Prototyping in Business Model Innovation: Exploring the Role of Design Thinking in Business Model Development

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Abstract

This study proposes a theoretical framework for business model prototyping (BMP), one in which design thinking is applied as a means of facilitating business model innovation (BMI). The value of design-led approaches in the development/management of innovation have received increasing recognition in the past decade, as the concept of design thinking (e.g., Brown, 2008; Martin, 2009) has gained broader application and credibility. In parallel, the concept of BMI has been discussed increasingly in research on innovation, as business models have garnered enhanced acknowledgement as a fundamental aspect in innovation management (Schneider & Spieth, 2013). Although experimentation for BMI is argued to be of importance (e.g., Chesbrough, 2010), the ways in which design thinking might inform prototyping of BMI is less articulated. Thus, the research provides a framework for prototyping business models in the process of BMI, and a first theoretical foundation for the subject.

The framework is developed by combination of insights from a thoroughgoing literature review with expert interviews, multiple institution-level case studies, and a series of validation interviews. The literature review articulates the concept of prototyping in BMI and covers three topics in-depth: innovation, business models and design thinking. Expert interviews capture the perceptions and orientations of practitioners, and case studies explore various contexts of business model development in social enterprise, university division, governmental organisation and private company. The validation interviews use feedback from industrial experts to aid and revise the framework and combining theoretical and practical perspectives.

On the basis of integrated findings, the thesis contributes to knowledge in three ways. First, it aims to bridge design methodology research and innovation management

research by articulating prototyping in design with business model innovation. Second, it proposes a theoretical framework for business model prototyping that incorporates four dimensions — purpose, process, context and engagement. This framework provides a theoretical foundation for further research in the area. Third, the thesis reframes prototyping not as a method or a tool but as a methodology (i.e., a conceptual framework and mode of thinking) that supports the management of business model development and innovation.

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1. Introduction

This chapter shows an overview of this thesis and the contextual background of this research. The former clarifies how this thesis presents the argument, and the latter indicates how the research interest is spotted in the existing research.

1.1. Overview

This thesis is the outcome of my exploratory research for developing a potential theoretical framework of business model prototyping (BMP). Chapter 2 explores the theoretical landscape of relevant concepts such as innovation, business models and design thinking. Based on the theoretical setting, Chapter 3 describes the research methodology that operationalise this research. The methodology is based on the integrated retroductive-abductive research methodology and collects data from theoretical frameworks in the literature, expert interviews, a multiple-case studies, and validation interviews. Chapter 4 represents the findings from the fieldwork. Chapter 5 discusses a theoretical framework of BMP developed by the analysis of the findings. Chapter 6 concludes this research by proposing the contribution to knowledge of this research. The contribution is three-fold. First, this thesis introduces the role of design thinking in business model innovation (BMI) by developing the concept of business model prototyping. Secondly, it proposes a theoretical framework of business model prototyping as a theoretical foundation for future research on the subject. Thirdly, it reframes business model prototyping not as a method or tool but as a methodology for managing BMI.

1.2. Context Setting

This section clarifies the contextual background of this research to illustrate the importance of this study. The argument mainly focuses on three factors. The first one is the increasing uncertainty and complexity surrounding organisation to force them to find alternative business models. The second one is a growing interest in BMI in various fields. The third one is how innovation studies have expanded from a subject of technology policy to an interdisciplinary subject. Both business models and design thinking are relatively new topics in the context of innovation, and the argument clarifies the connections among innovation, business models and design thinking.

The interleaved concepts of uncertainty and complexity are key drivers of enhanced attention to BMI issues (Chesbrough, 2010). These concepts are also core to recent theorising about design thinking (Cross, 2011; Liedtka & Ogilvie, 2011). However, the application of design thinking to BMI is not well theorised. This research proposes a theoretical framework of BMP that demonstrates a means of applying design thinking for BMI. It does so to encourage and support effective efforts to deploy BMP and to underpin and encourage further research via the provision of a theoretical foundation for the concept.

1.2.1. Complex and uncertain business environment

This subsection describes contextual changes surrounding organisations in the last decades that have been forcing the organisations to explore alternative business models and managing business model innovation.

One of the key drivers to change is globalisation (Lee et al., 2012; Cao et al., 2018). Business competitions for organisations have become more global, and the resources around the world has also become more accessible (Friedman, 2005; Kuruvilla & Ranganathan, 2010; Intriligator, 2017). Globalisation have redefined the basic rules of the competitions and forced organisations to reconsider their existing business models even though they seem to follow the best practices in the industry (Casadesus-Masanell & Ricart, 2011; Schneider & Spieth, 2013).

Guy Julier (2017), researcher of design culture and economies, argues that globalisation has also driven the changes in capitalism, which is conceptualised as *neoliberalism*. identifies four key factors of neoliberalism that are reated to the context of design – deregulation, New Economy, financialisaton and austerity – and points out that following the economic changes, design have accumulated their roles to tackle the higher level of complexity and uncertainty (see also Vogel, 2010; Ignatius, 2015b). The changes in capitalism have expanded the territory of design from specific issues such as graphics and interiors to more complex issues such as services and strategies. It also affects the boundary between commercial organisations and non-commercial organisations and expands the role of design from corporate issues to social issues (see also Leavy, 2011; T. Brown et al., 2014).

Not only the economic changes have technological developments been also observed as a key driver that urges the organisations to pursue alternative business models, especially the advent of the Internet in 1990s (Amit & Zott, 2001; Osterwalder & Pigneur, 2002) and Web 2.0 (Wirtz et al., 2010). The technological change also affects globalisation, as digitalisation by emerging technologies has accelerated globalisation as well (Rachinger et al., 2018). The emerging technologies have made business competitions more intense by lowering the entry barriers to various industries (Michael, 2015; Wright-Whyte, 2016). However, such technologies can be opportunities rather than threats as they enable organisations to develop new competitive advantages. For utilising the benefit of such emerging technologies, realigning business models is crucial for organisations to survive (Wu et al., 2010; Bohnsack et al., 2014).

The growing interest in social issues such as sustainability also makes the problems organisations face more complex (Seelos & Mair, 2007; Yunus et al., 2010; Massa & Tucci, 2013). In addition, some scholars observe innovations facilitated in developing countries, which are usually less innovative as they tend to lack the knowledge and resources to make innovation (Prahalad & Hart, 2002; Seelos & Mair, 2007; Thompson & MacMillan, 2010). The findings increase the interest in opportunities for innovation from the 'bottom- of-the-pyramid' in emerging markets (Prahalad, 2006). While technologies have been still considered as the main source of innovation (Norman, 2010), such new findings made many organisations notice that there are various sources of innovation. Rather than focusing on one single element of a business, developing a right business model has been argued as a key driver of exploiting such opportunities in a holistic way (Zott & Amit, 2010; Massa & Tucci, 2013).

1.2.2. Widespread interest in business model innovation

Over the past decade, BMI has been acknowledged as an emerging subject and a new approach to innovation management in particular (Chesbrough, 2007; Baden-Fuller et al., 2010; Schneider & Spieth, 2013) and more broadly for management of organisations as a whole (Pohle & Chapman, 2006; Chesbrough, 2007; Amit & Zott, 2010; Teece, 2010; Lüttgens & Montemari, 2016). Furthermore, surveys of senior executives indicate the importance of BMI; for example, International Business Machines Corporation (IBM) published a report featuring BMI back in 2006 (IBM, 2006). Management consultancy, the Boston Consulting Group (BCG) also started to consider and examine the value of BMI at a relatively early stage (Lindgardt et al., 2009). BCG has published an annual survey of senior executive views on innovation since 2004, one that charts the growing interest in the field in the period. BCG's 2014 survey indicates that innovation is a top three priority for senior executives representing a diverse range of industries and regions (Andrew et al., 2010; Taylor et al., 2012; Wagner et al., 2013; Wagner et al., 2014). Of particular significance, the survey asserts that successful innovative companies more often than not engage in business model innovation (Lindgardt & Hendren, 2014). While the importance is growing among professionals, business model innovation has also become an important topic in academia. Special issues on business models and business model innovation have been published in journals of a wide range of research fields such as management (Baden-Fuller et al., 2010; Robins, 2013), product development (Björkdahl & Holmén, 2013a), innovation management (Spieth et al., 2013) and Research and Development (R&D) management (Spieth et al., 2014b).

1.2.3. The expanding domain of innovation studies

Part of the reason why the interest in BMI is growing is that the domain of innovation studies itself has extended from a subject focusing on competitiveness (at firm/sector/national levels) and technology policy to an interdisciplinary subject. As the dynamics and complexity surrounding our society are increasing (Wallner, 1999; DG MediaMind Research, 2013; Hausman et al., 2014), organisations come under further pressure of finding a way of managing innovation to survive (Dervitsiotis, 2012). Also, complexity is observed not only in the sociological discussion but also in innovation studies and management research as an obstacle for innovation (Tsai, 2014; Berger & Kuckertz, 2016). Thus, managing complexity is an issue faced by various organisations for initiating new activities and sustaining their growth. As approaches to complexity, business model innovation and design thinking have become emerging subjects in various research fields such as management, innovation studies and design methodology research. As gathering attention from a wide range of disciplines, innovation studies have expanded the practice focusing on policies for R&D management to the management of the complexity surrounding innovation (Martin, 2012; Fagerberg et al., 2013b). This expansion is also one of the important factors that lead many researchers to the concept of business models (e.g., Chesbrough, 2007; Teece, 2010) and also design thinking (e.g., Boland & Collopy, 2004; Martin, 2009; Lockwood, 2010), which are key concepts in this research.

As for business models, despite the growing interest, there is still little agreement on what business models are (Teece, 2010; Spieth et al., 2014a; Wirtz et al., 2016). Reflecting the diversity of the argument, researchers on business models Massa and Tucci (2013) suggest a broad definition of the concept: "the [business model] may be conceptualized as depicting the rationale of how an organization […] creates, delivers, and captures value […] in relationship with a network of exchange partners" (p.423; see Afuah & Tucci, 2003; Osterwalder et al., 2005; Zott et al., 2011).

The absence of a general or agreed definition is also highlighted with respect to design thinking (Liedtka, 2015), and there are several strands in the research on the subject (Kimbell, 2011; Johansson-Sköldberg et al., 2013). Thus, it is difficult to present concisely the characteristics of design thinking. However, former President of the Design Management Institute, Thomas Lockwood, offers a definition of design thinking in the following terms: "a human centered innovation process that emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping, and concurrent business analysis" (2010b, p.xi). This definition encompasses the key features of design thinking that are also conceptualised as applicable to managing the complexity of innovation (e.g., Neumeier, 2008b; Brown, 2009; Martin, 2009).

Although design thinking is a newly argued concept, the complex nature of design problems has been argued as 'wicked' problems at least since the 1970s in design methodology research (e.g., Rittel, 1972a; Buchanan, 1992). The differences in ways of thinking among science, humanities and design also support the argument that design as a methodology is also distinctive from science's and humanities' methodology as a discipline (Cross, 2001).

Ironically, the argument emerged from a backlash against the movement of "scientising" (Cross, 2007a) design methodology, the scientised form of which is hardly effective for managing complex design problems (Schön, 1983; Cross, 2001). It is asserted that design has a different way of thinking for tackling complex problems, and design methodology research turns to develop design as a discipline (Cross, 2007b) or a liberal art (Buchanan, 1992) inherently different from science and the humanities. From this perspective, design is not a subject in science or humanities, but a discipline with value for everyone to learn (Archer, 1979; Cross, 1982). The difference influences not only a way of thinking but also the terminology used in design, and the argument of design started to use their terminology. For instance, in the current argument of design thinking, instead of using a terminology of science such as experimentation, the concept of 'prototyping' is often used to represent a feature of the design methodology for managing the complexity of design problems (e.g., Brown, 2009; Lockwood, 2010b; Liedtka, 2015).

In the research on business model innovation, some researchers attempt to apply experimental approaches (e.g., Sosna et al., 2010; Hawryszkiewycz, 2014), but there is still little research on prototyping and exploration of new opportunities in designing business models (Osterwalder & Pigneur, 2013). Furthermore, the approaches are mainly labelled as 'experimentation' (Bucolo & Wrigley, 2012), and the terms, 'business model experimentation' and 'business model prototyping' are often used interchangeably (e.g., Girotra & Netessine, 2013), or prototyping is argued without articulation of its meaning (e.g., Chesbrough, 2010; McGrath, 2010). According to design methodology research, however, the application of the scientific approach to complex problems has been problematic (Rittel, 1972b; Schön, 1983; Buchanan, 1992; Cross, 2011). Thus, developing the theory of BMP will enable researchers and practitioners to understand the process of business model innovation further. Therefore, this research explores what a theoretical framework of BMP would be and suggests implications for further studies.

1.3. The target audience for this research

The previous section provides an examination and explanation of the context for the work. It clarifies the evolving interest in both business models and design thinking, and the relationship between core concepts and the approach adopted for the study.

Figure 1-1 identifies the target audiences for the study and plots these across two dimensions (practice-theory and design-business). One key audience is that of research, as the application of design thinking to innovation is discussed in various fields from design management research (e.g., Wylant, 2008; Hestad & Brassett, 2013; Liedtka, 2015) to innovation (e.g., Tschimmel, 2012; Vetterli et al., 2012; Seidel & Fixson, 2013; Leifer & Steinert, 2014) to business and management research (e.g., Beckman & Barry, 2007; Leavy, 2010; Kolko, 2015). Another sits at the level of theorisation. In this dimension, three types of target audiences can be identified: practitioners (e..g, IDEO, 2009; Liedtka & Ogilvie, 2011; Tschimmel, 2012; Cook & Ermoyan, 2016), educators (e.g., Angehrn et al., 2009; Carroll et al., 2010; Hestad & Brassett, 2013; IDEO, 2013; Glen et al., 2015) and researchers (e.g., Dorst, 2010; Thoring & Müller, 2011; Tjahja, 2017; Elsbach & Stigliani, 2018).

Figure 1-1: The map of the target audiences

The main target audience for the study is design researchers, (the vivid red circle in Figure 1-1). As mentioned above, there is some research on how to use design thinking for innovation, though the use prototyping for business model innovation remains only partially articulated and under-theorised (Seidenstricker et al., 2014). As the role of design is evolving (see 2.3.5), the design of intangibles (for example, services, strategies and business models) has become a new frontier in design management (Vogel, 2010; Erichsen & Christensen, 2013; Ignatius, 2015; Ceschin & Gaziulusoy, 2016; Whicher et al., 2016). As we will see in Section 2.3, prototyping is regarded as an important aspect in the design methodology and process (e.g., Buchenau & Suri, 2000; Brown, 2008; Lockwood, 2010; Dow et al., 2012; Liedtka, 2015). However, the ways in which prototyping might be deployed in a future ever more focused on intangibles is not well-eleaborated: research on the use of design thinking for the creation of value (outwith tangible products) remains at a nascent stage in the design management discipline (e.g., Bentham, 2017; Joyce, 2017; Buehring & Liedtka, 2018). Buehring & Liedtka (2018) assert that "architects build models, Product Designers construct prototypes […] – but prototyping a new future is more challenging to envision" (p.144). In innovation management, however, business models have become recognised as key tool in the transformation of business ideas into marketable/useful innovations (Chesbrough, 2010; Amit & Zott, 2012; Spieth et al., 2014; Foss & Saebi, 2017). As Chapter 2 will show, the principles of design thinking emphasise the importance of a holistic perspective (see also Micheli et al., 2019), and prototyping is one of the key activities to gain holistic perspectives (Buchenau & Suri, 2000; Brown, 2009; Blomkvist, 2011). This theoretical context suggests that prototyping of intangibles remains an important research area, and one in which further exploration is required. To engage with the research opportunity, the current study provides a theoretical framework for the application of prototyping in design thinking to business model innovation. The framework will aid the design research community in extending the possibilities provided by design methodologies to intangible subjects including business models.

Business researchers (the pale red circle in Figure 1-1) is a secondary target for the study. The research on design thinking is not limited to the design research community, indeed considerable research and theorisation activity is evident in the business and management research discipline (e.g., Beckman & Barry, 2007; Leavy, 2010; Kolko, 2015). However, arguments in the latter tend to deploy the concept of 'experimentation' rather than prototyping in relation to business model innovation (e.g., Chesbrough, 2010; Thomke & Manzi, 2014). Therefore, this research proposes prototyping as an alternative concept by articulating it in the context of business model innovation.

The circles in pale yellow indicate the sub audiences for the research. Whilst they are not a primary target, the theoretical framework can be used as a guideline for innovation practitioners and educators in communicating with learners/practitioners that may have a less detailed understanding of knowledge re: business model innovation (for example, colleagues and students with limited background in or familiarity with innovation practices). Further research will be needed to investigate the feasibility of this research for these sub-audiences.

1.4. Organisations relevant to the research findings

The research explores various types of organisation that have attempted to apply design thinking to business model development. Figure 1-2 shows the characteristics of the case study organisations in terms of the size (Table 1-1) and the level of commerciality/market orientation. The figure demonstrates the relevance of the research to a range of organisations including small commercial firms, social enterprises, and both medium-sized and larger non-commercial organisations.

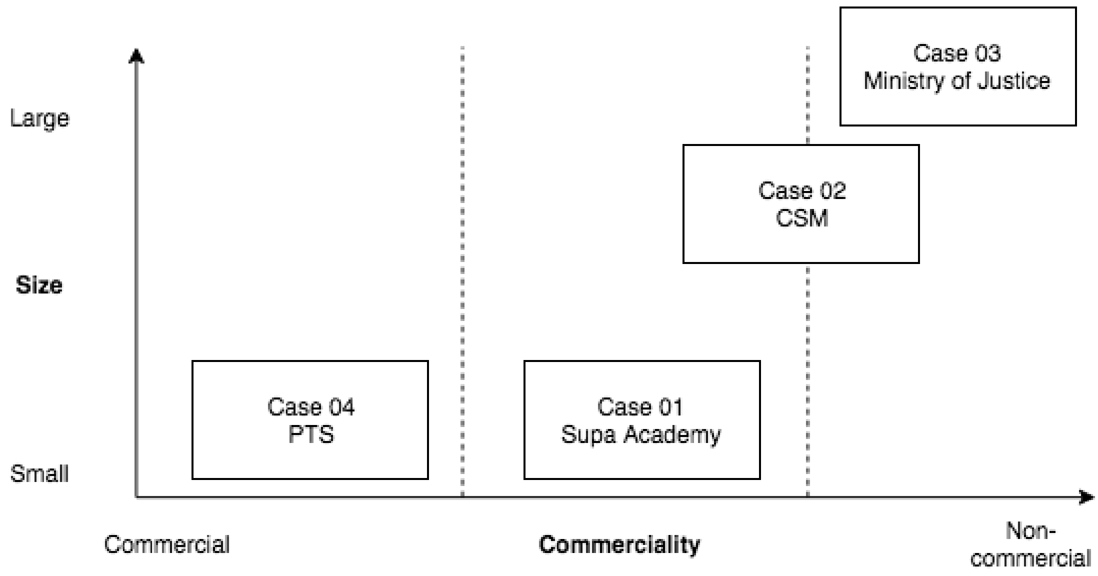

Figure 1-2: The characteristics of the cases

	Case 01	Case 02	Case 03	Case 04
Number of employees	2 (+ volunteers and part-time)	2,503 (University of the Arts London, 2016)	73,481 (National Audit Office, 2015)	3
Turnover	Confidential	£280.9m (University of the Arts London, 2016)	£1.7 billion (National Audit Office, 2015)	Confidential

Table 1-1: The criteria of the sizes

While categorising organisations by size is useful in terms of explaining the breadth of the study's relevance, recent research in innovation has argued that some approaches to innovation are effective in organisations of many different sizes where a high degree of uncertainty is present (e.g., Ries, 2011; O'Reilly & Tushman, 2016). Regarding commerciality, some researchers claim that design is currently increasingly used not only for issues of commercial organisations but also for non-commercial organisations (Yee et al., 2013; Julier, 2017).

This research also found that categorising organizations according to commerciality or otherwise is of less importance in business model innovation than the organisation's attitude to dealing with complex situations and uncertainty (see also Fixson & Rao, 2014; Ben Mahmoud-Jouini et al., 2016). This attitude is influenced by the mindsets of employees, including leaders and managers (Boland & Collopy, 2004b; Michlewski, 2008; Bojovic et al., 2018). Therefore, the findings will be useful for organisations that are experiencing the pressures of managing complexity and uncertainty, regardless of their size or market orientation. This point will be discussed further in 3.4.2.2.

2. Business Model Prototyping and Innovation: The State of the Art

This chapter introduces key debates on important topics of this research: innovation, business model innovation, and design thinking. As managing innovation is an overarching objective of conducting business model prototyping, it is essential to understand existing discussions on innovation to clarify the context of this research. Especially, business model innovation is an emerging subject in innovation research, and the argument on the concept is not settled yet. Thus, the second section reviews various debates about the concept to clarify the meaning of business model innovation. Finally, as prototyping – the main approach to business model innovation in this research – gathers attention as part of design thinking, the third section explores various arguments in design methodology research and design thinking to articulate the concept.

This literature review forms the theoretical foundation of business model prototyping in this research and sets the starting point of setting the methodology for the fieldwork.

2.1. Innovation

This section reviews the literature on innovation as part of the theoretical foundation of this research. First, it introduces an overview of innovation studies. Secondly, the position of design in innovation studies is clarified. Thirdly, as management research plays an important role in the debate of design thinking, this section also reviews the literature of innovation in management. Finally, it shows what innovation means in this research.

The major objective of this research is to propose a theoretical framework of prototyping in business model innovation to give researchers a theoretical foundation for further research on the subject, and support management practitioners to facilitate innovations through business model prototyping. One of the obstacles to achieving this objective is the lack of a unified and accepted definition of innovation (Adams et al., 2006). Researchers of innovation studies, as well as those of management research, assert that three factors are causing the difficulty. First, innovation is a complex phenomenon (Quintane et al., 2011). Second, the study of innovation is an interdisciplinary subject (Fagerberg, 2006; Martin, 2012). Third, the concept of innovation tends to be argued and defined in different ways across a variety of disciplines (Baregheh et al., 2009). Moreover, in academic research on design methodologies, Cruickshank (2010) claims that "the way innovation is used in design is more varied and contentious" (p.23) than in innovation studies.

Therefore, understanding the context surrounding the concept of innovation is a key step in clarifying the direction of this research. The following argument shows the background of important debates on innovation, especially in innovation studies, and identifies the position of design in innovation studies. Furthermore, as management scholars play the important roles in promoting the concept of design thinking (Boland & Collopy, 2004a; Martin, 2009), it also argues the current significance of innovation in management. After these arguments, the key operational definition of innovation in this research is set as “the successful exploitation of new ideas” (Cox, 2005, p.2).[1] This is the definition proposed in Cox Review by Sir George Cox, former director-general of the Institute of Directors. Although this definition is fairly basic (see Lawrence & Oliver, 2011), it captures the importance of design for making creative ideas happen for innovation (Bolton & Green, 2014; see also De Mozota, 2003; Press & Cooper, 2003; Bolton & Green, 2008; Brown, 2008).

2.1.1. The overview of innovation studies

According to Benoît Godin (2015), a researcher of Science Policy currently working on the history of the concept of innovation, innovation was a negative term from at least the seventeenth century to the nineteen century. It was in the twentieth century that innovation became a positive word, with the complete reversal of the connotation occurring after World War II. Recent historical research on innovation studies has also suggested that innovation research began to gain the traction around the 1950s (Martin, 2012; Fagerberg et al., 2013b)[2]. While these arguments indicate that the current research stream of innovation can be found to have originated during this time, it is also reported that some of the distinctive research on innovation can be found even at the turn of the twentieth century, such as a sociologist, Gabriel Tarde (1843-1904) (e.g., [1890] 1903) (Rogers, [1962] 2010; Kinnunen, 1996) and an economist, Joseph Schumpeter (1883-1950) (e.g., [1912, 1926] 1934)[3] (Fagerberg & Verspagen, 2009; Martin, 2012; Louçã, 2014).

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[1] Originally, Department of Trade and Industry (DTI) (2003, p.8) formulates the definition.
[2] See Martin (2012) about the detail of the research field. It should be emphasised that the view of innovation studies could not represent the whole historical background of innovation research, but the extensive research is conducted in the research field.
[3] Although the original German version was published in 1912, the English translated version in 1934 was based on the second German edition in 1926, which was arguably radically revised (Fagerberg et al., 2013).

Nevertheless, innovation studies did not instantly become a popular topic following the publication of their work. In the case of Tarde, his view on Sociology, which focused on 'imitation' by individuals, conflicted with the ontological view of Emile Durkheim (1858-1916) (see Lukes, 1973), who was then the leading scholar in the field and asserted that Sociology should study societies as a whole and not individuals (Kinnunen, 1996; Katz, 2006)[4]. As for Schumpeter, he became influential sooner than Tarde. However, neoclassical economics, a branch that views the economy as static and emphasises the equilibrium of the market, was flourishing at the time. His dynamic and evolutionary view of the market, from which disequilibrium produces values and profits, was followed only by a few scholars (Fagerberg & Verspagen, 2009). These examples suggest that their approaches to investigating innovation had conflicts with the main research streams in their disciplines at the time. The importance of innovation was recognised, yet the dynamics of innovation did not become a key subject in academia.

After World War II innovation studies had not yet flourished, however, the studies were being driven by policymakers, who became interested in the activities of research and development (R&D) mainly for military purposes. The tendency is particularly apparent in the US (and also for the civil sector but to a lesser extent) (Hounshell, 2000; Godin, 2006; Fagerberg et al., 2011). Meanwhile, in Britain, the Federation of British Industries started to research on R&D activities in British firms, and the Paris-based Organisation for Economic Co-operation and Development (OECD) began to assemble a framework for gathering data for statistics on R&D activities (Fagerberg et al., 2011).[5] From a historical point of view, Godin (2015) also asserts that 'technological' innovation

[4] Other explanations about the dismissal of his research were the popularity of communication study in Sociology, the lack of methodological tools (Kinnunen, 1996) and the usage of the less favourable term, 'imitation', which could have been labeled as 'influence' (Katz, 2006).
[5] The framework was published as the *Frascati Manual* (OECD, 1962).

was an emerging term and R&D became a new topic of discussion for managing innovation after World War II. With this interest in R&D from policy makers, scholars within different disciplines gradually began contributing to the area of innovation studies. This is particularly the case in economics (e.g., Nelson, 1959; Schmookler, 1966), management (e.g., Woodward, 1958; Burns & Stalker, 1961) and sociology (e.g, Rogers, [1962] 2010; Coleman et al., 1966) (Fagerberg et al., 2012; Martin, 2012). In the context of innovation studies, the turning point to a more interdisciplinary approach to innovation is characterised by the foundation of Science and Technology Policy Research Unit (SPRU) at the University of Sussex in 1965 (Fagerberg et al., 2013b), and subsequently Policy Research in Engineering, Science and Technology (PREST) at the University of Manchester in the mid-1970s. Although SPRU started simply as a department for science and technology policy, the SPRU not only cultivated the foundation of the field's interdisciplinary characteristics but also revealed that science is just one of the key elements necessary for successful innovations (Fagerberg, 2006).[6]

That said, the interactions among disciplines for innovation studies were still rare in the 1960s and 70s, and it was by the early 1980s that the research field of innovation studies clearly started to share its wealth of literature, methods and concepts, as well as conferences and journals[7] (Martin, 2012). It is thought that this transition of being an interdisciplinary subject was driven by a need to respond to the complexity surrounding innovation processes – a complexity that was gradually unravelled in the studies (Fagerberg, 2006). As the research fields expanded, the agenda of innovation studies also broadened its perspective (Fagerberg et al., 2013a). As we have seen, innovation research initially focused on internal R&D activities within an organisation. This is

[6] Godin (2015) asserts that the term science policy changed through technology policy to innovation policy as innovation became a positive term.
[7] Martin (2012) mentions *Research Policy*, *R&D Management* and *Technovation* as the examples.

something that continues to this day with technology as the most general topic in innovation studies (Nelson, 2013) and often considered the dominant source of innovation (e.g., Norman & Verganti, 2014), but it eventually shifted to a wider scope, including 'systems' of innovation (Lundvall, [1992] 2010; Nelson, 1993). The systemic view emphasises the importance of understanding interactions between the innovation activities of firms and the national, regional and sectoral environment surrounding it. Jan Fagerberg, Ben Martin and Esben Andersen (2013b), researchers of innovation policy, highlight three reasons for the shift. First, empirical research on innovation, surveys[8] in particular, revealed that some of the important roles in fostering innovations are not played only by firms but also users (e.g., Lundvall, 1985; Von Hippel, 1986). Secondly, R&D strategies of firms changed from solely relying on in-house R&D departments to also identifying and utilising externally distributed knowledge, resources and skills for innovation (e.g., Cohen & Levinthal, 1990; Chesbrough, 2003). Thirdly, it is also identified that the distributed knowledge, resources and skills are not only in private firms but also organisations in public sectors.

With this background, market demands have been recognised as another driving force for innovation as well as technology, and there have been debates on the advantages and disadvantages of the technology push and market pull (demand pull) approach (e.g., Mowery & Rosenberg, 1979; Dosi, 1982; Martin, 1994). One of the distinctive arguments on innovation from market demands is user innovation. A researcher of technological innovation, Eric von Hippel (1986; 2005) identified that some innovations were facilitated by 'lead users', who are deeply involved in the context of products and services by heavily using the product or service. Von Hippel's findings

[8] Fagerberg et al. (2013b) argue that surveys, such as *the Yale survey* (Levin et al., 1987) and later *the Community Innovation Survey* (CIS) (see Smith, 2006), contributed to providing new evidences for the innovation research.

reveal that there are different types of key actors in innovation, and the process of innovation is more complex than it has always been thought.

Another concept relevant here, especially to the change in the roles of internal R&Ds, is ‘open innovation’ as discussed first by a researcher of management of technology and innovation, Henry Chesbrough (2003). R&D is usually conducted in a closed environment with the internal resources of firms, but through a distinctive case study of Xerox Palo Alto Research Center (PARC), Chesbrough (2003) claims that the values of the research are occasionally captured by people or organisations that are not inside, but outside the company. Based on the findings, he proposes the concept of open innovation, in which firms utilise internal and external knowledge sources to commercialise new ideas to be profitable products and services, and also exploit internal and external routes to market. Because of this complexity, he argues, the roles of internal R&Ds, especially R&D managers, need to change; they have to consider not only technological matters but also how to commercialise the technologies, as “the economic value of a technology remains latent until it is commercialized in some way, and the same technology commercialized in two different ways will yield different returns” (p.64). In other words, the structure of how to capture values becomes as important as the development of technology itself. His argument suggests that organisations should recognise that the sources of innovation can flexibly come from both inside and outside the boundary of the organisation, and also there are various routes to market for commercialisation. Under this circumstance, the process of innovation is more dynamic than for what the closed R&D model is designed. This expansion also influences some researchers and practitioners to assert the importance of service innovation and public service innovation (e.g., Riel, 2005; Chesbrough, 2011; NESTA, 2011; Osborne & Brown, 2013; Carlborg et al., 2014).

This section has shown that the study of innovation has been shifting from an R&D centric research to an interdisciplinary subject with a perspective of capturing the broader contexts of innovation, as the research gradually reveals the complexity of managing innovation. The topics include the studies of the context (system) of innovation and the management of internal and external sources as well as routes to market.

Based on this understanding of the context of innovation studies, the next section clarifies the position of design in the context of innovation research for connecting this research stream of innovation with the research on design thinking.

2.1.2. Design in innovation studies

Although innovation studies are gradually becoming a more interdisciplinary subject as noted above, Cruickshank (2010) suggests that design is still relatively isolated from the research stream of innovation studies, by providing two pieces of evidence. One is that there are no references to design in the 650 page *The Oxford Handbook of* Innovation (see Fagerberg et al., 2006). The other is that no design journals are represented in the review of the top fifty technology and innovation management (TIM) journals in 2004 (see Linton & Thongpapanl, 2004). It has been over a decade that the pieces of evidence were published, but if we follow the same kind of reasoning, we can still find ourselves in a similar situation. In a more recent publication titled *Innovation Studies* (Fagerberg et al., 2013b), the role of design is still not clearly argued[9], and in a chapter of the book, Ben Martin (2013), scholar of innovation studies, admits that innovation studies have been still prone to concentrate on product and process

[9] As an exception, although it is not the main topic, Luc (2013) mentions the important role of design research for innovations facilitated in developing countries. About this type of innovations, see Prahalad (2006).

innovations and ignore other types of innovations, including ones based on design. In another paper, he introduces potential disciplines to contribute to innovation studies, but the list of examples also does not include design (2012).[10] On the evidence from the journal ranking, the updated ranking of the TIM journals is published in 2012and concludes that the TIM is turning to be more interdisciplinary[11] over time, but design journals are still not mentioned (see Thongpapanl, 2012).

The articles indicate that the awareness of the role of design is not greatly heightened among the research community. However, as Cruickshank (2010) himself claims, it cannot be simply concluded that deign has not contributed to managing innovation. He asserts that product design has been acknowledged as part of the activities of innovation management at least since the 1990s (see Utterback et al., 2006). Jeanne Liedtka (2015), management scholar recently arguing about design thinking, highlights that business researchers have been interested in product design for more than a decade, referring to the research by a marketing scholar, Peter Bloch (2011). Bloch (1995) claims that the academic marketing research was not aware of the importance of design by 1995, but his more recent research identifies that the body of research relevant to design in marketing has been growing since then (2011). Also, Cruickashank (2010) asserts that the third edition of *Oslo Manual* by OECD and Eurostat (2005) include the marketing category of innovation and it makes it easier to see design activities as an indicator of innovation. Indeed, compared to the previous editions of *Oslo Manual*, one of the characteristics of the third edition is the addition of marketing innovations and organisational innovations to the types of innovations, which were

[10] Hobday et al. (2011) also assert that design is absent from innovation studies, but also mention there are well-written innovation papers on design such as Walsh (1996) and Tether (2005).
[11] Thongpapanl (2012) interchangeably uses multidisciplinary and interdisciplinary, but this paper regards interdisciplinary as more engaged interactions among various disciplines than multidisciplinary.

previously only product innovations and process innovations. In the argument about the relationship between design and innovation, it is also acknowledged as the turning point for *Oslo Manual* to include non-R&D activities in the major aspects of innovation management (Hobday et al., 2011). In the third edition of the manual, OECD and Eurostat themselves also reflect that the focus of the first edition (1992) was on technological product and process (TPP) innovations in manufacturing, and the second edition (1997) attempted to include innovations in service sectors. However, they admit that, as the second edition still relied on the same TPP based definition of innovations as the first edition, it did not adequately capture the value of innovations in less R&D intensive sectors, such as services[12] and low-tech industries[13]. Recognising the growing importance of the sectors in the following years, they eventually modified the definitions of product and process innovations and proposed the concepts of marketing innovations and organisational innovations to include the less R&D intensive sectors.

The line of the argument shows that the new definition of innovations by OECD contribute to expanding the field of innovations, but what should be paid attention to here is that in this debate, design is still regarded as a supporting factor for marketing activities, and the strategic role is not clearly identified yet (also see Tether, 2005; Hobday et al., 2011). For instance, while being aware of the integral role of design for innovation, OECD and Eurostat (2005) conceptualise product design as part of marketing innovations as well as part of product innovations. They argue that “Marketing innovations involve the implementation of new marketing methods. These can include changes in product design and packaging, in product promotion and placement, and in

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[12] OECD was aware of a growing body of literature on innovation in services (e.g., Hauknes, 1998; De Jong et al., 2003; Howells et al., 2004; Miles, 2006)
[13] About low-tech industries, see, Von Tunzelmann & Acha (2006)

methods for pricing goods and services" (p.17). OECD and Eurostat describe that this idea is derived from the theory of marketing chiefly represented by the concept of 4 Ps in the marketing theory.[14] One of these Ps is products, and product design is regarded as an element of products (p.31). In this context, product design plays an important role in increasing the attractiveness and appeal of products to a new market or a target market segment. However, design is not considered as a key strategic aspect of managing innovation.

Overall, the revision of *Oslo Manual* is meaningful as it expands the scope of innovation, but it does not fully recognise the importance of design for innovation, especially the strategic side (see OECD & Eurostat, 2005). To argue the connection between innovation and design, the aforementioned *Cox Review* (2005) needs to be referred to. In the review, design is defined as "what links creativity and innovation", and it suggests that design is given a significant role in facilitating innovation. A parallel study by the Department of Trade and Industry (DTI) (2005) shows that the definition is based on a view from which design can be another or an alternative channel of making innovation at the same level as technological R&Ds, which are regarded as a typical channel of turning ideas (creativity) to be innovation.[15] Another point of this review regarding design is that the role of design is not limited to matters of aesthetics, such as style[16] and appearance. Cox admits that the considerations of aesthetics are important, but they are only a small part of creativity and design. Also, the paths of innovation through creativity and design are not only new products and services but also greater productivity. If we use the types of innovations provided by OECD and Eurostat here, it

[14] About 4Ps, see McCarthy (1960).
[15] For the diagrammatic model, see Swann & Birke (2005).
[16] These arguments are based on an assumption that design as styling is less important than the strategic role, and there is a contrary argument that the value of design as styling is neglected and should be discussed further (Tonkinwise, 2011; Brassett & O'Reilly, 2015).

suggests design can contribute to all the kinds of innovations including organisational innovations. Similarly, management scholars, Boland and Collopy (2004a) also assert that creativity itself does not facilitate innovation, and a design attitude is needed to turn the creativity to innovations. Although Boland and Collopy loosely define the design attitude as “the expectations and the orientations one brings a design project” (p.9), their perspective resonates with Cox’s view of design as a link between creativity and innovation. The concept of the design attitude will be discussed further in a later section.

In sum, design is not well integrated with the current stream of innovation studies yet, and even though the involvement of design activities in innovation are identified, the argument on the role of design is still limited. The new definition of innovations by OECD and Eurostat help the role of design in innovation to be acknowledged, but the role is still limited as a supporting part of marketing activities. However, as *Cox Review* exemplifies, the wider role of design in managing innovation is gradually recognised, and especially the strategic role becomes a prominent topic since the late 2000s in particular, which is argued and promoted as ‘design thinking’ (e.g., Brown, 2008; Martin, 2009; Lockwood, 2010a). Although there has been a research stream on how designers think in the academic design research community, It is advocated mainly by design practitioners and management scholars in the context of management (Johansson-Sköldberg et al., 2013). To make clear why it becomes a key topic not only for design practitioners but also in management research, the following section argues the discourse of innovation in the management research as the foundation of the concept of design thinking.

2.1.3. Innovation in management

As it is claimed that the research on innovation in management has existed at least since the late 1950s (Fagerberg et al., 2013; e.g., Woodward, 1958; Burns & Stalker, 1961), it is important to note that there is an increasing interest in innovation in management. Nevertheless, there is some research indicating the growing interest in innovation. For instance, the research above on TIM journals between 2006 and 2010 indicates growing involvement of traditional management and strategic journals in the subjects of innovation studies (Thongpapanl, 2012). Furthermore, in 2003, Boston Consulting Group (BCG) started senior executive surveys on innovation (Andrew & Sirkin, 2003b), which continues for more than a decade.[17].A key motivation for them to conduct the series of surveys was that through their consulting work for fifteen years they identified that many companies understood the importance of innovation, but most of them struggled with gaining the financial return from their effort to make innovation (Andrew & Sirkin, 2003a). This insight was supported by the result of their first survey in 2003; 69 percent of the executives ranked innovation as one of the top three priorities of their firm, but at the same time 57% of them were not satisfied with the financial return. The survey in 2005 reported that 87 percent of the participants agreed with the notion that organic growth through innovation is essential for the success of their business.

Although the last decade has seen a global economic downturn, the importance of innovation is still alive. BCG's 2014 survey (Wagner et al., 2014) claims that three-quarters of senior innovation executives reported that innovation is in their top three priorities of their business. Another survey by PricewaterhouseCoopers (PwC) in 2013 (Shelton & Percival, 2013) shows 83% of executives think innovation is important and the figure increases to 88% when they are asked about next five years. Furthermore, a survey on innovation by General Electric (GE) in 2014 shows that 64% of senior executives "are convinced that businesses have to encourage creative behaviors and

[17] For the report in 2014, see Wagner et al. (2014).

disrupt their processes more” (p.8). However, gaining the capability of managing innovation is still a difficult task for the majority of businesses. The same survey by GE indicates that 72% of them think they are not ready for the change (2014). To clarify the context behind the growing interest in innovation in management, the following paragraphs provide an overview of the arguments in management relevant to the argument of innovation in this research.

One of the key topics in the management study in the 1980s was how to gain a sustainable competitive advantage, which allows firms to outperform their competitors consistently (e.g., Porter, [1980] 2004b; Porter, [1985] 2004a)[18][19], and one of the traditional strategies to achieve it was building entry barriers[20] (Caves & Porter, 1977; Wernerfelt, 1984; e.g., Bain, 1954; Bain, 1956; Wenders, 1971; Needham, 1976). Based on this strategy, Michael Porter, the main proponent of competitive advantages, elaborated the concept of the barriers (Porter, 1976; Caves & Porter, 1977) and asserted the basic types of competitive advantages are low-cost and differentiation, which are attributes of products or services to set up the barriers (2004b).The approach assumes that the profitability of the attributes, or the effectiveness of the barriers, is mainly determined by the industry structure and the positioning of the products or services (Amit & Schoemaker, 1993). Thus, the approach emphasises the importance of industrial

[18] There was the study of corporate venturing (Burgelman, 1983) but it was in a relatively small scale

[19] Porter mentions innovation, but mostly it is not as a key source of growth, but as a possible factor of changing industrial structures. Also see Porter (1981). Initially, his attention was payed to criticise the view of the industrial organisation study to see industries as homogenous, and introduce the structures of industries (1979b). However, his theory would be criticised as it ignores the heterogeneity of firms (e.g., Barney, 1991; Teece et al., 1997). That said, it has to be admitted that the management approach based on competitive advantage can be compatible with more recent approaches such as dynamic capabilities.

[20] Entry barriers or barriers to entry are costs that new market entrants have to pay, while incumbents do not need to. For more details, see Porter (1976) and Caves and Porter (1977).

analyses and product positioning strategies. This approach is called in various ways such as the industrial analysis framework (Amit & Schoemaker, 1993) and five force approach (Teece et al., 1997), but this research uses the term, the "product based" view (see Wernerfelt, 1984)[21] to clarify the contrast with the resource based view, which the following paragraphs discuss.

Despite the dominance of the view, some scholars criticised the product based view as it sees the market in a static way and the focal point of the approach tends to be how to exploit the market power (Teece et al., 1997). It is argued that the product based view does not regard resources as the source of sustainable competitive advantage, or the barriers because the view rests on two assumptions. One is that firms in the same industry are identical and the other is that the resources are mobile and tradable in the market so that the internal resources are difficult to be distinctive from others in the long term (Barney, 1991). As a complementary or alternative view[22], some scholars began to develop the concept of 'Resource-based view' (Wernerfelt, 1984; Barney, 1991), which sees that resources are heterogeneity and difficult to trade so that the uniqueness of the resources can last long. Thus, the composure of the resources can be a sustainable competitive advantage (Barney, 1991). Moreover, the subsequent research identified capabilities as part of resources (Amit & Schoemaker, 1993), and how to develop the resources and capabilities to gain a sustainable competitive advantage became an important subject. Based on these arguments, management scholars, Teece et al. (1997) proposes the concept of 'dynamic capabilities', which is defined as "the firm's

[21] In the modern context of business, it is more precise when it is called the product and service based view or offering based view as Keeley et al. (2013) use the term, offerings, for indicating both products and services. However, as Wernerfelt (1984) develops the concept of the resource based view through the comparison between the characteristics of products and resources, this research uses the term, the product based view to clarify the contrast.

[22] While the two approaches are complementary to each other (Amit & Schoemaker, 1993), it is also asserted that the two are competitive (Teece et al., 1997).

ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (p.516).

As the concept of dynamic capabilities stems from the resource-based view, it shares the view on the difficulty in mobilising resources between organisations. However, it assumes that firms are surrounded by rapidly changing environments as the definition shows, while the resource based view sees the business environments as more static (e.g., Barney, 1991). Thus, the argument aims to understand resources as the sources of entry barriers for sustainable competitive advantages (Barney, 1991). Indeed, the initial argument by Wernerfelt (1984) proposes resources as another source of entry barriers as much as products. Therefore, the static view raises several questions about the effectiveness of the view for gaining a sustaining competitive advantage. For example, when resources are regarded as a key factor for the success of firms, it has to clarify how to acquire the resources in turn, and the change of market situations can potentially nullify the value of the resources (Porter, 1991). Furthermore, recent research has suggested that periods in which sustainable competitive advantages withstand become shorter over time (Wiggins & Ruefli, 2005), and also competitiveness relying on cost-effectiveness is no longer sustainable (e.g., Porter & Ketels, 2003; Neely, 2009). Therefore, some management scholars began to highlight the growing importance of innovation for management as the source of sustainable competitive advantage (e.g., Porter & Ketels, 2003; McAdam & Galloway, 2005; Neely, 2009). Moreover, it is even argued that gaining sustainable competitive advantages from core competencies itself is barely possible (Fiol, 2001).[23] In the argument of innovation management, Clay Christensen (2003) also identifies that the profitability is diminished not because the

[23] This rapidly changing environment is also argued as high velocity environments (Bourgeois III & Eisenhardt, 1988) and hypercompetition (D'Aveni, 1995).

company is beaten by the competitors, but the quality of the product overshoots the demand of the majority of the customers as the result of responding to the demand of their main customers. The theory indicates that the key issue for managers is not only competing with their peers but also constantly identifying new sources of innovation for sustainably serving new values to customers. Similarly, another criticism against strategy-based management is that it focuses on how to gain competitive advantages and compete with their rivals, and pays less attention to how to deliver and create new values for customers (Kim & Mauborgne, 1999)[24].

Therefore, the key subject in the argument of dynamic capabilities turns from how to build entry barriers and gain competitive advantages, to how to sustainably adapt themselves and develop the capabilities responding to rapidly changing market conditions (Teece et al., 1997; Barreto, 2010).[25] Dynamic capabilities can be skills for recognising the need for innovating existing business models (Leih et al., 2014). The concept of dynamic capabilities assumes that firms compete through innovations (Teece et al., 1997), and an essential element of capabilities is collective learning (Leih et al., 2014), but Teece (2014) claims that the functions relevant to the discovery of opportunities, learning and knowledge creation were almost neglected before the argument of dynamic capabilities began. In the debate of dynamic capabilities, innovative firms face the problems of gaining the competencies that are difficult for competitors to copy. One way of solving this problem, Teece et al. (1997) argues, is to strategically choose where the firm concentrates on and invest in to gain the competencies (Dierickx & Cool, 1989), but another problem is that the choices are

[24] They develop the concept of 'blue ocean strategy' from the point of view (Kim & Mauborgne, [2005] 2015).
[25] Porter (1998) asserts the importance of clusters for innovation more than internal activities of firms.

influenced by past choices, which means decisions in the past influence the competencies in the future. Therefore, firms need to not only exploit the current capabilities but also explore and develop new capabilities for the future. Teece et al. (1997) admit it is not the first argument to consider both the exploitation and exploration of capabilities in strategic management (e.g., Penrose, [1959] 2009), but the argument of dynamic capabilities initiate a more focused discussion on the subject. From the perspective of innovation, it can be summarised that the concept is developed for responding to rapidly changing environments, in which innovation is a key driver for competition and the capability for managing innovation to compete should be exploited and renewed constantly. In this context, how to manage innovation is regarded as an important aspect of management to survive in the fast-changing market.

Management scholar, Rita McGrath (2013) also elaborates the shift of the position of innovation in the research of strategic management from the perspective of the study of corporate venturing and innovation processes. Although the research on corporate venturing existed in the 80s and 90s (e.g., Burgelman, 1983; Eisenhardt & Tabrizi, 1995; Block & MacMillan, 1993), most of the research in strategic management dedicated to the long-term exploitation of competitive advantages, and innovation was treated as something apart from the core of corporate business activities. However, as some research reveals that competitive advantages last rather only tentatively (e.g., Ian C. MacMillan, 1982; Boisot, 1995; D’Aveni et al., 2010) and the market environments change rapidly (e.g., Bourgeois III & Eisenhardt, 1988; MacMillan, 1988; D’Aveni, 1995; Chen et al., 2010), the integration of corporate strategies and innovation management enters the mainstream of the management research (e.g., Christensen, [1997] 2003; Hamel, 2006; Nagji & Tuff, 2012).[26]

2.1.4. Innovation in this research

The subsections above have shown the context surrounding innovation in innovation studies, especially regarding the role of design, and management. Innovation studies expand the domain from being focused on R&D to capturing the complexity of the process of managing innovation. In the research stream, the role of design is not well argued yet, and the value of using design is limited to a supporting function for marketing. Meanwhile, in the management research, scholars argue that gaining a sustaining competitive advantage through industrial structure analyses and market positioning based on the product based view has become harder, as the business environment are changing more rapidly. In this condition, relying on market positioning and established resources seems to be less effective than having capabilities of sustainably creating and capturing values.

In this context, the definition of innovation by Cox, “the successful exploitation of new ideas” (2005, p.2), responds well to the demand in the current business situation. In order to understand the key points of this definition, the meanings of ‘new ideas’ and ‘exploitation’ in this definition should be articulated further. Regarding new ideas, he defines creativity as “the generation of new ideas – either new ways of looking at

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[26] It has to be stressed that these arguments might look like a linearly developing process but this simplified perspective on the discourse is possibly problematic. For example, more recently Porter also asserted that the model of competitiveness is dynamic and based on innovation (Porter & van der Linde, 1995). They clearly state that “internationally competitive companies are […] those with the capacity to improve and innovate continually. […] Competitive advantage, then, rests […] on the capacity for innovation and improvement that shift the constraints” (p.98). It can be considered that those concepts and arguments are organically directed towards the growing importance of innovation and the awareness of dynamism in the current business environment.

existing problems or of seeing new opportunities, perhaps by exploiting emerging technologies or changes in markets" (p.2). The emphasis on 'generation' indicates the contrast with 'exploitation' in the definition of innovation, but it can be understood that 'new ideas' mean reframing problems and finding new opportunities, through new perspectives not only on new technologies but also market changes. The important point here is that new ideas come from seeing problems and opportunities in new ways rather than incrementally adding new elements on existing problems or opportunities. As for exploitation, the full definition of innovation needs to be referred to. He rephrases innovation as "the process that carries [new ideas] through to new products, new services, new ways of running the business or even new ways of doing business" (p.2). Here, exploitation can be interpreted as turning new ideas into new actual outcomes including organisational changes. Based on this understanding, this research will use the definition, "the successful exploitation of new ideas" as the operational definition of innovation. However, this will also be critically reviewed in the following arguments about design thinking and business model innovation.

With regard to the relationship between innovation and design, another characteristic of Cox's argument is that it gives design an important role in managing innovation, which connects creativity and innovation. Other researchers also claim that the concept of design has been expanded from a part of product development to a more prominent role in managing innovation (Tether, 2005; Hobday et al., 2011), and the importance of design approach is argued across a broad range of contexts such as design management (e.g., von Stamm, 2004; Mozota, 2006; Bucolo & Matthews, 2010; Brown et al., 2014), management research (Boland & Collopy, 2004a; Utterback et al., 2006; Verganti, 2006; Jelinek et al., 2008) and policy making (e.g., Tether, 2005; NESTA, 2009). Particularly, the strategic role of design for managing innovation has been placed under the concept of ‘design thinking’ (e.g. Dunne & Martin, 2006; Beckman & Barry, 2007; Brown, 2008; Lockwood, 2010a). The term, design thinking was already used in 1987 as the title of a book written by Peter Rowe, professor of architecture and urban planning at Harvard’s School of Design ([1987] 1991). However, the focus was on architectural design rather than the application of design approach to businesses as currently argued (Liedtka, 2015). Moreover, a design scholar, Richard Buchanan (1992) used the term, design thinking to describe design as a liberal art to tackle ill-defined problems, but the key objective of the argument was to turn design as a new discipline different from natural, social and humanistic sciences. While the arguments about design thinking have existed at least since then, the concept is popularised by the more recent publications in business and management (e.g., Boland & Collopy, 2004b; Nussbaum, 2004; Utterback et al., 2006; Martin, 2009) as well as in design (e.g., Kelley & Littman, 2001; Brown, 2009; Lockwood, 2010a) (Johansson-Sköldberg et al., 2013; Liedtka, 2015). As a result, design thinking is widely discussed not only in the context of design (e.g., Rodgers, 2013; Brown et al., 2014) but various contexts such as Human-Computer Interaction (e.g., Klemmer & Carroll, 2014) and management (e.g., Ignatius, 2015).

While the popularity has provoked extensive arguments on the subject, it has been criticised for the lack of a solid theoretical foundation of the concept and the disconnection from existing research in the design research community (Kimbell, 2011; Johansson-Sköldberg et al., 2013). What’s more, the isolation from design practice is critically argued in the research communities of design and design management (McCullagh, 2010; Kimbell, 2011; 2012; Norman & Verganti, 2014).

This section has argued about the complexity of the contexts surrounding the concept of innovation and innovation studies. In Design and design thinking section, the context surrounding the concept of design thinking will be discussed to clarify the theoretical setting in this research. Before moving to the argument, the next section will argue another fundamental concept f this research, business model innovation to specify the context of the argument in this research.

2.2. Business model innovation

As the previous section shows, business model innovation has received attention from a variety of academic subjects as well as senior executives in various industries. Furthermore, only protecting resources cannot maintain competitive advantages, and organisations also need to constantly build capabilities[27] for facilitating innovation (Teece et al., 1997). Business model innovation is regarded as a potential source of sustainable competitive advantages as it can avoid imitation by competitors (Snihur & Zott, 2013). Also, Casadesus-Masanell & Ricart (2010) suggest that the factors driving the importance of business model innovation in the current business environment are globalisation, deregulation and technological changes as well as advances in information communication technology (ICT) and rising the significance of social enterprises. In addition, as the impact of business model innovation is significant, competitive threats could come from the outside of the industry, and it makes it difficult to survive by optimising an organisation for an established business model (Johnson et al., 2008). Therefore, this section will show how the concept of business model innovation has become a popular topic as an approach for innovation in the last several years. Before arguing business model innovation itself, the following subsections show the arguments surrounding the concept of business models, as business model

[27] Teece et al. (1997) define dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (p.516).

innovation is not well defined yet (Casadesus-Masanell & Zhu, 2013) and the cause of the fuzziness is the inconsistencies of the concept of business models themselves (Spieth et al., 2014a). The following sections show, with the concept of business models being articulated, the argument reveals that business model innovation should be conceived of as an approach to, not simply the outcome of, innovation by critically reviewing the literature.

2.2.1. Business models

Studying business models for over a decade, management scholars, Christ Zott, Rapha Amit and Lorenzo Massa (2010) assert that business models turned to be a major topic in the recent years and there had been 1170 academic papers since 1995.[28] They suggest three factors behind the growing interest in business models since the mid 1990s: the advent of the Internet (Amit & Zott, 2001; Osterwalder & Pigneur, 2002), increasing interest in "bottom- of-the-pyramid" issues in emerging markets (Prahalad & Hart, 2002; Seelos & Mair, 2007; Thompson & MacMillan, 2010), and the demand for new organisation forms dependent on post-industrial technologies (Perkmann & Spicer, 2010). Especially, it is claimed that the rise of the Internet produced new types of businesses based on the Internet technology called e-business, and the academic research of business models started from the study of e-business (e.g., Amit & Zott, 2001; Osterwalder, 2004). As the Innovation Section indicates, it is argued in the context of innovation studies that R&D and technology-oriented approaches for managing innovation have become less effective, and some scholars increasingly recognises the importance of business model development for capturing the values for fostering

[28] Osterwalder et al.(2005) assert that the term, business model was used in an academic paper at the first time in 1957 (see Bellman et al., 1957), and appeared in the title of a paper in 1960 (see Jones, 1960), although it did not rise as a key subject until the end of the 1990s.

innovation (e.g., Calia et al., 2007; Chesbrough, 2007). Furthermore, in the research of entrepreneurship, business models gather an increasing attention to as an alternative approach, or at least something complementary, to business plans (Osterwalder & Pigneur, 2010; Blank & Dorf, 2012).

The importance of developing a proper business plan has been emphasised in the practice of entrepreneurship, and the skills of making a detailed business plan before setting up a company is regarded as one of the most significant capabilities of entrepreneurs (e.g., Mason & Stark, 2004; Shane & Delmar, 2004; Gruber, 2007). In addition, it is considered that business plan competitions are helpful for building new ventures (Dodt et al., 1999; Thomas et al., 2014). However, in the recent study of enterprise education the advantage of the business plan based approach has been questioned (Honig, 2004; Bridge & Hegarty, 2012; Jones et al., 2013). Researchers of enterprise education, Colin Jones and Andy Penaluna (2013) show their concern as "outside the boundaries of academia, the business plan would seem to be increasingly losing credibility" (p.805). Also, in the study of entrepreneurship, it is observed in a case study research that business plans are rarely updated or referred to once they are developed, and the actual operation tends to become dissimilar to the plan as time goes by (Karlsson & Honig, 2009). Furthermore, the benefit of business planning, especially for new small firms, is reduced (Brinckmann et al., 2010) as the high degree of uncertainty surrounding firms makes the planning difficult (Forbes, 2007). Moreover, practitioners in entrepreneurship criticise the business plan based approach, as it takes time to develop and most of them do not work when they are implemented (e.g., Mullins & Komisar, 2009; Blank, 2010; Maurya, 2012). Therefore, Blank (2013) argues that business models are more suitable for developing new businesses than business plans, and asserts that entrepreneurs should use a more agile approach to developing businesses, and the holistic perspective provided by business models is preferable to the details required in business plans (see also Osterwalder & Pigneur, 2010; Blank & Dorf, 2012).

2.2.1.1. The key elements of business models

While attention to business models is growing and some scholars attempt to formulate a unified definition (e.g., Osterwalder et al., 2005; Zott et al., 2011; Wirtz et al., 2016), there is little agreement on what business models are (Kallio et al., 2006; Al-Debei et al., 2008; Teece, 2010; Girotra & Netessine, 2013; Spieth et al., 2014a; Gerasymenko et al., 2015; Wirtz et al., 2016). The concept of business models is argued in various ways (Linder & Cantrell, 2000), and it is even asserted that the research is still at an early stage (Wirtz et al., 2016).[29]

Nonetheless, a commonality in the arguments is perceiving business models as models, which is a simplified representation of business in reality (Baden-Fuller & Morgan, 2010; Massa & Tucci, 2013). In line with simplicity, clarity is regarded as a key

[29] There are similar concepts to business models in management research and some scholars attempt to clarify the concept of business models by dividing from the existing concepts such as strategy, organization theory or business planning (Wirtz et al., 2016; e.g., Mansfield & Fourie, 2004; Seddon et al., 2004; Al-Debei et al., 2008; Casadesus-Masanell & Ricart, 2010). One of the distinctive examples is strategy. For instance, comparing strategy with business models, Casadesus-Masanell and Ricart define strategy as “the choice of business model through which the firm will compete in the marketplace” (2010, p.196), but they also assert that “much more than the mere selection of a business model; it is a contingent plan as to how the business model should be configured, depending on contingencies that might occur” (p. 205). An interesting point of their argument is that strategy and business models are identical without contingencies. However, they argue that business models have to be modified to respond to contingencies, and such strategic modification is very complex. Magretta (2002) also argues about the difference between strategy and business models, and the key element in her argument is competition. Porter (1996) difines that “[s]trategy is the creation of a unique and valuable position, involving a different set of activities. […] The essence of strategic positioning is to choose activities that are different from rivals” (p.68). Here, a key issue is also how to be different from competitors. When competition is seen as a contingency, the definitions resonate with the assertion of Casadesus-Masanell and Ricart. The definition of strategy, however, is also not coherent. For instance, Wirtz et al. (2016, p.38) conclude that “the business model can thus be understood as a link between future planning (strategy), and the operative implementation (process management)". In this argument, strategy is not differentiation for competition but future planning.

advantage of business models to support communication with actors and employees (Magretta, 2002). Furthermore, a holistic perspective is also asserted as a key factor of business models (Vecchi & Brennan, 2014). For instance, through the literature review of business models, management scholars, Christoph Zott, Raphael Amit and Lorenzo Massa (2011) argue that "business models emphasize a system-level, holistic approach to explaining how firms 'do business'" (p. 2). Business models, in their argument, show not only what to do in the business, but also how to do it in a holistic way. Similarly, through literature review, Wirtz et al. (2016, p.41) define it as "a business model is a simplified and aggregated representation of the relevant activities of a company. It describes how marketable information, products and services are generated by means of a company's value-added component". Here, the characteristics of business models are described as 'simplified and aggregated'. The two things are contradictory, but business models need to be concise to achieve both simplicity and inclusivity. In other words, business models should be expressed in a simple way but at the same time it needs to comprehensively include the core of the business.

When business models are regarded as a simplified and inclusive representation of business, the following question is what should be included in the model. [30] An early definition of business models in academic research by Chesbrough and Rosenbloom (2002) is business models as a medium between technical domain and economic domain. This argument derives from criticism against approaches to innovation focusing too much on technological development and acknowledges the importance of success in the market. Amit and Zott (2001) give a slightly different perspective. They argue that "a business model depicts the content, structure, and governance of

[30] Osterwalder et al. (2005) suggest that concepts, especially business model, evolves from a definition to taxonomies to instances.

transactions designed so as to create value through the exploitation of business opportunities" (p.511). This definition suggests that not only what is developed as the content, but what actors are involved and how they are linked (structure), and how the content and structure are put in control (governance) are also important for business models. Similarly, Johnson (2010) describes that a business model "defines the way the company delivers value to a set of customers at a profit". Osterwalder and Pigneur (2010) also assert that "a business model describes the rationale of how an organization creates, delivers, and captures value".[31] In addition to the creation of values, these definitions suggest the importance of the delivery of values to customers with financial profit as a key element of business. By reviewing these definitions, Massa and Tucci (2013) suggest "the [business model] may be conceptualized as depicting the rationale of how an organization [...] creates, delivers, and captures value [...] in relationship with a network of exchange partners" (p.423; see Afuah & Tucci, 2003; Osterwalder et al., 2005; Zott et al., 2011). The creation, delivery and capture of values are repeatedly mentioned components of business models. This indicates the importance of marketability of the business ideas.

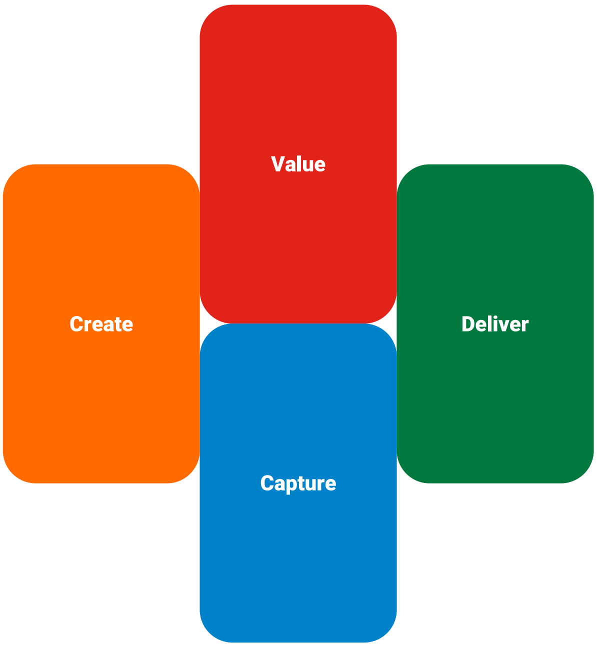
This review identifies two key points to consider regarding the key elements of business model:

1. It needs to include the marketability of the business ness.
2. The model needs to be simple but comprehensive.

[31] As a more detailed definition, Osterwalder et al. (2005) propose the following definition:
A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams. (pp. 17-18)

The learning point from the first one is that business models should not represent only how to create products, which the technology-driven point of view emphasises, or how to monetise the business (or capture values), which the finance-driven point of view tend to prioritise. This point resonates the argument of innovation driven by design (see Cox, 2005; Brown, 2008; Lockwood, 2010b). Based on this understanding, including the three aspects of creating, delivering and capturing values is considered as the crucial aspects of business models. In addition, what the value itself is or value proposition is another key element of business models, as the models including only the operational aspects tend to be too generic and abstract and not to direct any activities and business patterns to follow (Abdelkafi et al., 2013; Carayannis et al., 2015). Therefore, this research sets four elements, value, creation, delivery and capture, as the key components of business models. Each element can be represented in the following questions respectively: 'What is the value proposition of the business?', 'How do you create the value?', 'How to deliver the value?' and 'How to capture the value'?

When the second point is considered, however, it needs to be considered as a framework for the operational purpose. The reason is that fixing business models in a certain framework can be problematic as some extensive reviews on visual representations of business models find various forms of business model frame works.



- 'What is the value proposition of the business?'
- 'How do you create the value?'
- 'How to deliver the value?'
- 'How to capture the value'?

Figure 2-1: The operational framework of business models

2.2.1.2. The various forms of business model frameworks

There is some research reviewing the sets of business model's key components and how they are visualised (Osterwalder et al., 2005; Sundelin, 2010; Beha et al., 2015; Täuscher & Abdelkafi, 2017). There are many arguments on the key components, but what is interesting is that the numbers of key elements in each model are diverse. Even some models do not have a set of key elements but rather represent the value network or causal relationship among key elements and stakeholders. For instance, by reviewing 45 visual representations from academic sources and 50 visual representations from commercial sources, Täuscher & Abdelkafi (2017) suggest that three types of views to classify business models: elements view, transactional view and causal view. In their argument, the frameworks with the elements view have a set of predefined elements to be filled in by users. The ones with the transactional view represent the flows of cash or resources by boxes (usually representing actors) and arrows. The ones with the causal view represent causal relations between different actions and decisions by arrows. There are some frameworks to have both the elements view and the transactional view or the elements view and causal view, but there is no framework to have three views.

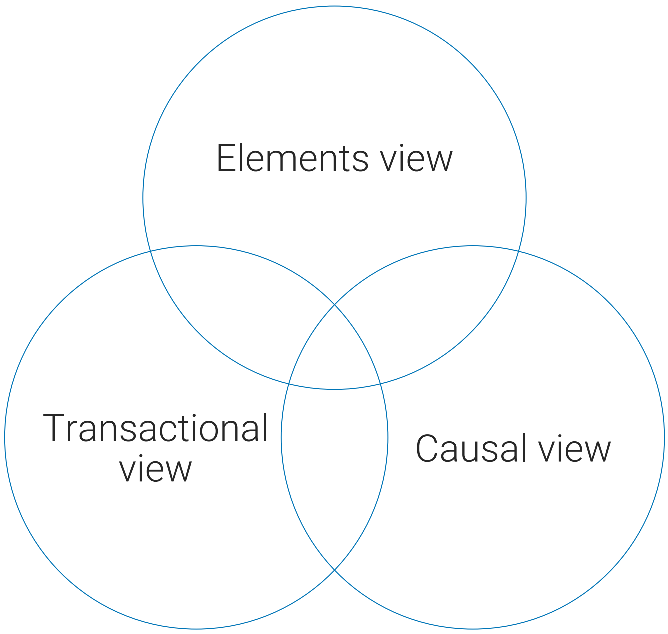


Figure 2-2: The three views of business model representation (adopted from Täuscher & Abdelkafi (2017))

This suggests that identifying key elements of business models is important, but the set of key elements might represent the business model only from one of various views. However, if the key point of using business models is to represent the business by a simple but holistic way, it is logical that there exist many variations, because the balance between simplicity and comprehensiveness of the representation depends on how much agility the users need.

If the key objective of using business model is to quickly respond to the dynamics of the market (see Blank, 2010; Bridge & Hegarty, 2013), controlling the level of abstraction of the representation following the context is essential. The reason is that as the speed of exploring the possible opportunities is crucial, simpler models have an advantage over more complex ones, which can be useful for analysing business model in turn. Therefore, as Massa and Tucci (2013) suggest, this research consider business models have various ways of representing business in a form of models with different level of abstraction (Figure 2-3).

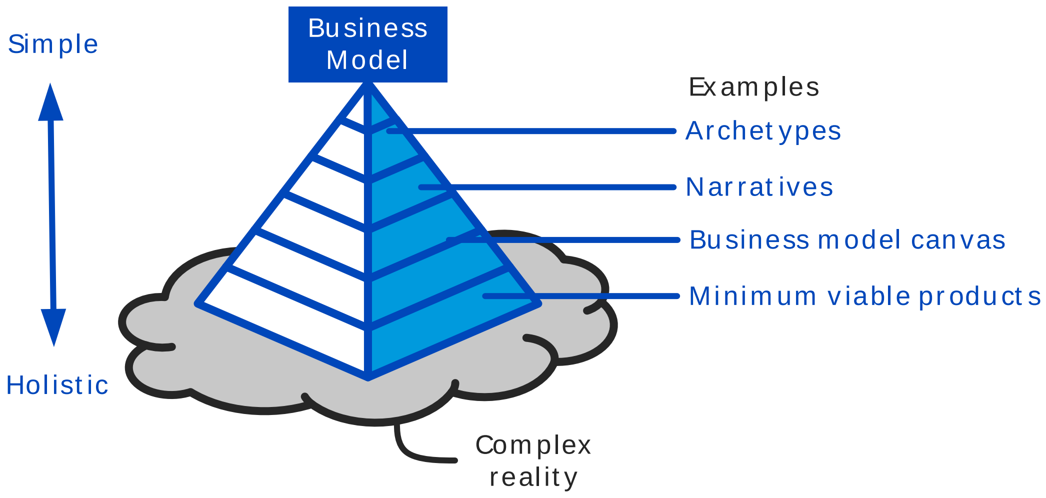


Figure 2-3: The level of abstraction of Business Models (adopted from Massa and Tucci (2013) and modified by the author)

At the most abstract level, business models can be simple architypes (e.g., 'feemium' (Pujol, 2010)). On the other hand, at a more concrete level, business models can be detailed meta models[32]. When business model prototypes are regarded as concretised representations of a business model, the range of the level of abstraction can be wide as Massa and Tucci suggest. Although acknowledging the importance of both the analysis and the exploration of business models, this research prioritises the value of business model for exploration, as it is one of the key advantages of design approach for innovation (Berardino, 2016). Thus, the business model framework with four key elements – value, create, deliver and capture – is suitable for this research for

[32] Massa and Tucci borrow the term meta model from the literature of system engineering, which regards meta-modelling is "the analysis, construction, and development of the frames, rules, constraints, models, and theories applicable and useful for modelling a pre-defined class of problems" (p.438). In other words, it is a model for analysing, constructing, developing a model.

the operational purpose. However, as mentioned above, complex models are useful to capture what the business is in detail. Rather than rigorously defining the framework, it is important to condense and expand the elements and the complexity of business models in order to align the agility with for matching the role of models with the objectives of using the models.

2.2.1.3. The multiplicity of business models

Another point of business models is that a business can have multiple business models, as business models do not only represent what the business is but also what the business should be (Massa & Tucci, 2013), which can guide actors to actions as a ‘recipe’ of the business (Baden-Fuller & Morgan, 2010; Perkmann & Spicer, 2010). Thus, business models play various roles for business. For instance, Burden-Fuller and Morgan (2010) suggest that business models can act as a means to describe businesses, an instrument to analyse businesses and a recipe for implementing new businesses.[33] From the literature review of business models, Spieth et al. (2014a) also identify three roles of business models: explaining, running, and developing the business. As possible directions of business in the future are varied and open-ended, business models can be a hypothetical model of a business which does not exist yet, and possible business models as a recipe are not just one but can be many. Based on the arguments above, this research regards business models as simplified and inclusive representations of business. Business models do not only show what the business is but what it should be. Thus, a business can have multiple business models.

[33] Barden-Fuller and Morgan assert that business models have "different roles for different firms and for different purposes: and will often play multiple roles at the same time" (2010, p.168).

2.2.2. Definitions of Business Model Innovation

This subsection argues definitions of business model innovation to identify the definition for this research. There are two distinct directions to consider the definition of business model innovation. One way is to see business model innovation as innovations of business models themselves. The other is to see it as innovations through business models. This research supports the latter, business model innovation as an approach for making innovation. The following sections show the arguments of the both directions, and clarify the standpoint of this research.

One way of defining business model innovation is as inventions of new types of business models, which are "not just new to the firm" (Vecchi & Brennan, 2014, p.134; e.g., Birkinshaw et al., 2008; see also Markides, 2006) or at least new also to the industry or market (Johnson et al., 2008). For instance, Markides defines that "business-model innovation is the discovery of a fundamentally different business model in an existing business" (2006, p.20). In this definition, the discovery of a radically new business model is emphasised. Johnson (2010) defines it as the act of innovating "something more core than the core, to innovate the very theory of the business itself". He also asserts that a radically new business model can drastically change the landscape of an industry. In the argument, business models are perceived as a representation of a business. As we have seen in a previous section, business models can be not only a representation of a business but a tool for exploring possible directions and developing a business towards innovation. Indeed, it is also suggested that even a subtle change of a business model can trigger business model innovation (Zott & Amit, 2010; Vecchi & Brennan, 2014). From this point of view, business model innovation can be conceptualised in another way as innovation through business models, which the next section explores.

When business models are considered as a tool for exploring opportunities and developing a business, business model innovation can be conceptualised not as inventions of novel business models, but innovation facilitated by using business models. From this perspective, acknowledging characteristics of business models is important. As argued in Business models subsection, main features of business models are simplicity and inclusivity. The reason why inclusivity and simplicity are important for business model innovation is that these characteristics provide business model-based approaches with agility (Doz & Kosonen, 2008; Doz & Kosonen, 2010). This point is clarified through the comparison with business plans. Blank (2010) argues that, in an uncertain situation, business models should be used rather than business plans to seek for potential business opportunities. Business plans are useful when many important facts are validated, but the problem is that it takes a lot of time and effort to develop it. Especially, in uncertain situations, the reliability of the plan tends to be low as the plan has to be developed based on many assumptions. On the other hand, business models do not show the detail of business ideas as much as business plans do, but business models enable the users to quickly response to the situation. Thus, utilising the elements, simplicity and inclusivity, for managing innovation is the essence of business model innovation to be agile. This approach potentially produces a radically new business model which drastically changes the market situation. However, some of the arguments on business model innovation emphasise identifying opportunities from the context through business models is important rather than inventing a new business model (e.g., Zott & Amit, 2010; Vecchi & Brennan, 2014). Similarly, in an argument of strategic entrepreneurship, Luis Martins, Violina Rindova and Bruce Greenbaum (2015) claim “a defining characteristic of business model innovation through conceptual combination is the strategic identification of differences between a modifier concept and the existing business model schema" (p.112). In this definition, a fundamental aspect of business model innovation is regarded as an identification of the gap between the current business model and a possible business model. Zott and Amit (2015, p.395) propose a definition of business model innovation as "the design and implementation of an activity system that is new to the focal firm or new to the product - market space in which the focal firm competes". They regard business models as activity systems, and the key point of this definition is to regard the innovation as designing and implementing it to a certain context surrounding an organisation.[34]

This research follows the arguments seeing business model innovation as innovations through business models. It does not need to invent a radically new business model but identifies the opportunities for innovation through designing and implementing business models. The following section overviews the argument about types of innovation, in which the innovation makes a change, to clarify what kind of innovations business model innovation deals with.

2.2.3. Types of innovation

There are various ways to categorise innovations based on the impact made by innovation. One of the conventional categorisations is a dichotomous categorisation of innovation (Meyers & Tucker, 1989; Song & Montoya-Weiss, 1998; Veryzer, 1998a; Chandy & Tellis, 2000). One category is for innovation with a high degree of change, and the other is one with a more frequent but minor impact. Although the dichotomous typology is the same, the discussion is set up in various contexts. Thus, the terminology for dichotomised models of innovation is still not completely settled (Garcia & Calantone,

[34] Amit and Zott (2001) also assert that efficiency, complementarities, lock-in and novelty as potential sources of value creation, and Chesbrough (2010) see them as key aspects of business model innovation.

2003; Hang et al., 2006; Linton, 2009). The former, for instance, is referred to as radical innovation (Ettlie et al., 1984; Leifer et al., 2000), discontinuous innovation (Veryzer, 1998b; Reid & De Brentani, 2004), breakthrough innovation (Zhou et al., 2005) and disruptive innovation (Christensen, 2003). The latter is argued as incremental innovation (Ettlie et al., 1984; Norman & Verganti, 2014), continuous innovation (Kassicieh et al., 2002; Hang et al., 2006; Vuola & Hameri, 2006) and sustaining innovation (Christensen, 2003).[35]

The argument of architectural innovation suggests the possibility of another approach to formulating innovation. Henderson and Clark (1990) theoretically divide a product into components and the architecture, which shows how the components are integrated into the products. They assert that innovation can be made, even without modifying components, by only changing the architecture, and conceptualise that sort of innovations as architectural innovations. Regarding innovations with a high degree of change, the term discontinuous innovation tends to be used as the umbrella term, under which radical innovation is regarded as discontinuous innovations through a technology-oriented approach (e.g., Henderson & Clark, 1990; Christensen, 2003).The term, incremental innovation is used as the opposite concept of radical innovation representing technology-driven innovations, which more frequently happen but only

[35] Although this research mainly follows this dichotomised scheme of innovation, it has to be mentioned that there are also arguments about the differences between all of these terms of innovation (Garcia & Calantone, 2003; Hang et al., 2006). Marketing and product innovation scholars, Rosanna Garcia & Roger Calantone (2003) assert that the dichotomous categorisation is too simplistic and propose 'really new innovations' (p.122) as the third category for categorising innovations with a moderate degree of change that the innovation makes. They divide discontinuities on macro level into technological continuity and market discontinuity. Innovations should be classified as radical innovations when both discontinuities occur, and really new innovations are for when just one of them happens. The attempts to refine the category of innovation should be appreciated. However, they could not identify the clear boundary between radical innovations and really new innovations. Also, the fragmented terminology of innovation is criticised as it often produces confusion more than clarification (Hang et al., 2006; Linton, 2009). Thus, to avoid further complexity of the argument on innovation, this research uses the dichotomised view of the categorisation for further discussion.

make an additional change. On the other hand, disruptive innovation is argued as also discontinuous innovation but rather through a market-oriented approach (e.g., Zhou et al., 2005; Hang et al., 2006). In the terminologies, business model innovation is treated as the source of discontinuous innovation. For instance, although business model innovation is not clearly defined in their argument, Bessant et al. (2005) claim it as a source of discontinuity. Markides (2006) also regards business model innovation as a subcategory of disruptive innovation. As we have seen, the popularity of business model innovation partly derives from the criticism against technology focused approaches for managing innovation. Thus, understanding the connection between disruptive innovation and business model innovation is important to articulate what business model innovation is. The next section articulates the concept of disruptive innovation.

Regarding technological discontinuity (or radically new technology), although technology-driven innovation has been argued, technology itself is not regarded as innovations unless they are successfully brought to the market when we follow the definition of innovation, "the successful exploitation of new ideas" (Cox, 2005, p.2). In other words, radically new technology without commercialisation should be regarded as not as innovations but inventions in this context. From this point of view, the categorisation of innovations by Christensen fits with the argument of business model innovation. Disruptive innovation attracts a considerable interest as a threat against incumbent firms (Christensen & Rosenbloom, 1995; Christensen, 2003; 2006).

As for innovations with a low degree of change, Christensen (2003) asserts that the concept of sustaining innovations[36] is different from incremental innovations, which is conceptualised in comparison with radical innovation. Also, he claims that sustaining

[36] Christensen initially calls it sustaining technologies.

innovation can be discontinuous or radical innovation as well as incremental. The key element of sustaining innovation in his argument is whether the customer segment served by innovation is the segment of existing main customers or not. In other words, whether the change is incremental or radical does not matter as long as it follows the value appreciated by existing main customers. An interesting point about the concept of disruptive innovation is that solutions provided by new technologies can be suitable for low-end users and non-users (or new market)[37], not only for high-end customers (Christensen, 2003).[38]

Based on this categorisation of innovations, business model innovation can be thought of as innovation dealing with disruptive innovations as it aims at not only technological development but a viable configuration of business components to capture new market opportunities. As Christensen emphasises, disruptive innovations are not always facilitated by a radically advanced technology, but the key point is to aim at underserved markets different from the current main markets (Christensen & Raynor, 2003). Also, it is asserted that gaining new markets often requires new business models (Chesbrough, 2010).

Historically, innovation with a radical change was not always praised, and some asserted incremental innovation was more important, especially in the late 80s to the early 90s in US (Gomory, 1989; Florida and Kenney, [1990] 1992; Womack et al., [1990] 2007), as Japanese manufacturers, especially in the automobile industry, became successful through incremental innovation, in which US manufacturers were inferior

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[37] It is argued that disruptive innovation can be 'low-end' innovations for overserved customers, 'new-market' innovations for non-served customers, or combinations of the two (Christensen & Raynor, 2003; Christensen et al., 2004; see also Ansari et al., 2015).
[38] In contrast, for instance, Porter (1979a) suggests that technological innovation can increase the fixed costs so that the entry barriers can be higher and the competition be fiercer.

(Dertouzos et al., 1989; Kash, 1990; Kano, 1993).[39] More recently, Bessant (2003) also asserts the importance of incremental innovation for exploiting the opportunities provided by breakthrough innovation. However, Management scholars, Gary Lynn, Joseph Morone and Albert Paulson (1996) criticise that the overemphasis on incremental improvements in the 80s and 90s in the US resulted in a decline in some markets in the following years.

In the discussion of sustaining and disruptive innovations, the two types of innovations are not completely divided. Rather, the theory of disruptive innovation describes the trajectory of innovations at the entry phase, and the trajectory of sustaining innovation explains the late phase of innovation. In other words, disruptive innovations gradually become sustaining innovations when it enters the phase of exploiting the value of innovation. As the concept of disruptive innovation gets popular from incumbents' perspective, most of the arguments focus on what problems incumbent firms confront (Hill & Rothaermel, 2003; Danneels, 2004; 2011; Christensen, 2006) and how they can tackle the problems (Christensen & Raynor, 2003; Ansari & Krop, 2012; Wessel & Christensen, 2012). However, how to manage disruptive innovation is a less researched area (Yu & Hang, 2010). Although the advantage of business model innovation is not limited in disruptive innovation, business model innovation can make a more significant impact on a business when it applies to making disruptive innovations.

2.2.4. Alignment of innovation strategies with types of innovation

The type of innovation is an important issue because the selection of types of innovation to manage affects the selection of the strategy for managing innovation

[39] In these arguments, the term incremental improvement is often used rather than incremental innovation. As an overview of the argument, see Lynn et al. (1996).

(McGrath & MacMillan, 1995; Bower & Christensen, 1995). The argument is in line with an argument in the theory of organisational learning that organisations need to engage two types of activities for sustainable growth, most commonly referred to as the exploitation of old certainties and 'exploration' of new possibilities (March, 1991). Exploitation is activities to improve and utilise existing competencies to facilitate incremental innovations and exploration is activities to search and develop new competencies to make radical innovation (Atuahene-Gima, 2005; Andriopoulos & Lewis, 2008). Although the two activities tend to conflict with each other when the resource is scarce, it is asserted that taking a balance between the two is inevitable for the long term success for organisations (March, 1991). The capability of organisations to deal with the two activities is discussed as 'organisational ambidexterity' (Duncan, 1976; O'Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008). However, it is argued that the conventional strategies of management and product development often fail to manage innovation as they are optimised for exploiting opportunities that are already identified rather than exploring new ones (MacGrath, 2000; Christensen, 2003; Martin, 2009; Ries, 2011). Thus, how to develop and retain the capability of exploration is a key topic in management, and design has been argued as providing an efficient strategy for exploring innovative opportunities (e.g., Boland & Collopy, 2004b; Martin, 2009).

From these arguments, it has to be clarified that this research is based on some assumptions.

- Radically new technology without commercialisation (a viable business model) is not innovation yet
- Technology and commercialisation are both important components of innovation

- A better combination of commercialisation and technology can beat a better technology or a better commercialisation itself

Based on these assumptions, business model innovation is to seek opportunities for innovation by connecting various components (including technology and commercialisation) through implementing business models. Although this section has shown the importance of business model innovation, the argument on how to manage business model innovation is still at a nascent stage, and there are some difficulties identified in the literature. The next section argues the challenges for making business model innovation.

2.2.5. Challenges for business model innovation[40]

This section argues challenges in business model innovation to understand why business model prototyping is needed and can be effective for business model innovation, and clarify what should be considered when prototyping is applied to business model innovation.

At a fundamental level, Johnson, Christensen and Kagermann (2008) point out that lack of clear understanding about the current business model in an organisation causes difficulty in managing business model innovation, as well as the fact that there is little research on the dynamics and processes of business model development. Furthermore, even if organisations understand their existing business models, the

[40] Magretta (2002) asserts that having business models themselves are not sufficient enough and an effective strategy is required to be successful. While business models are not for coping with competition, and strategy is needed to perform better than competitors. As 'being better' is 'being different' in her definition, strategy can be understood as the plan for differentiation. As a way of testing the viability of business models, Magretta (2002) proposes 'narrative test' and 'number test'.

conflict between existing models and new models can prevent organisations from exploiting the value of new business models (Amit & Zott, 2001; Christensen, 2003; Johnson et al., 2008; Chesbrough, 2010). Also, Chesbrough (2010) argues that as the perception of organisations tends to be influenced by 'dominant logic' (see Bettis & Prahalad, 1995), even what the right business model should be may not be clear for the organisation. Thus, he asserts that "business model innovation is not a matter of superior foresight *ex ante* - rather, it requires significant trial and error, and quite a bit of adaptation *ex post*" (2010, p.356).[41] Therefore, it can be considered that uncertainty or unpredictability of business model innovation is a key issue for managing it.[42]

Another issue of business model development is complexity among business model components as each component is interdependent with each other (Mayo & Brown, 1999; Morris et al., 2005; Zott & Amit, 2010; Zott & Amit, 2009; see also Siggelkow, 2001). Thus, changing a part of it can influence the viability of the entire business models. This causes difficulty in testing a component separately. Although some research recommends focusing on one aspect of business models to evaluate (e.g., Sinfield et al., 2012), the perspective of the approach is positivistic[43], which ignores the interdependence among components. The positivistic perception is criticised by the existing research on complex problems. In other words, it can stay in the same

[41] Massa & Tucci (2013) distinguish the development of business models in new firms from that in incumbent firms, which usually already have an existing business model. They label the former 'business model design' and the latter 'business model reconfiguration'. Calia et al. (2007) also use the term, business model configuration.

[42] Uncertainty is also regarded as a key issue in modern societies that can turn to both a danger or/and an opportunity {Citation}

[43] In an attempt to integrate positivstic and interpretive research approaches, organisation researcher, Allen Lee (1991) describes postivistic approaches as "those associated with inferential statistics, hypothesis testing, mathematical analysis, and experimental and quasi-experimental design" (p.342).

epistemology as the one that the design methodology research used to be caught in (see Rittel, 1972b; Schön, 1983; Cross, 2007a).

Based on the argument above from the existing literature, there are two types of key challenges identified for this research: uncertainty and complexity. They create different types of difficulties.

- Uncertainty - difficulty in identifying viable business models in advance
- Complexity - difficulty in managing problems by formalised procedures

The uncertainty and complexity do not allow business managers to identify right business models by foresight research or a simple trial-and-error process. Uncertainty and complexity are experienced in design and design thinking, and prototyping is proposed as a way to manage uncertainty (e.g., Gerber, 2009) and complexity (e.g., Jobst & Meinel, 2014). Problems in design are recognised as ill-defined and conceptualised as 'wicked' problems (Rittel & Webber, 1973; Buchanan, 1992). In other words, the advantage of design approaches for uncertainty and complexity has been recognised in the design methodology research.

2.2.6. The summary of the section

This section has reviewed the literature relevant to business model innovation in the context of this research. Initially, it clarified the concept of business models in the literature and how business model innovation is defined based on the understanding. This section also explored various types of innovation to identify the position of business model innovation. Different from other types of innovation such as product innovations and marketing innovations, business model innovation does not simply mean innovations of business models but innovation through business models. Innovations can be categorised into two types: sustaining innovation and disruptive innovation.

Business model innovation often manages disruptive innovation, which needs to mange complexity and uncertainty. The issues are identified also in design problems and the design approach can be applied for business model innovation. Especially, as we will see, prototyping is a key element of managing complexity and uncertainty in design. To clarify the theoretical context of prototyping in design and design thinking, the next section reviews the theoretical background of design and design thinking, followed by debates on prototyping.

2.3. Design and design thinking

Innovation section has reviewed the trajectory of how innovation studies move from a technology-oriented subject to an interdisciplinary subject to tackle the complexity of managing innovation. The argument is followed by examining the context of innovation in management research, whose scholars play an important role in advocating design thinking. Business model innovation section has reviewed the literature on business model innovation to elaborate the theoretical context of the concept.

Following these augments of the key concepts, this section demonstrates how the design methodology research shifts from establishing design as science, to identifying design as a distinctively different matter from science. This distinction is important to theoretically support the characteristics of the concept of prototyping. Therefore, the following sections show the argument.

2.3.1. The diversity of 'design thinking' discourses

As the arguments about design thinking take various strands, this section shows the varied arguments to clarify the theoretical position of this research regarding design and design thinking. The arguments on design thinking is mainly promoted by design practitioners, particularly design innovation consultancy, IDEO (e.g., Brown, 2008; Brown, 2009; Brown & Wyatt, 2010) and management scholars, notably Roger Martin, former Dean of Rotman School of Management (e.g., Dunne & Martin, 2006; Martin, 2009) (Kimbell, 2011; Johansson-Sköldberg et al., 2013). Meanwhile, there have been extensive studies on design practices and methodologies in the design research community (e.g., Cross, [1982] 2006; Buchanan, 1992), which include prominent events such as the

Conference on Design Methods of 1962 (Jones & Thornley, 1963) and the inaugural Design Thinking Research Symposium in 1991 (Cross et al., 1992) (see Cross, 1993; Cross, 2007). In this context, 'design research' does not mean research for design but research about design itself (Archer, 1981; Bayazit, 2004). This is also claimed as 'design methodology' (Cross, 1984; 1993b).[44]

Many scholars assert that there is the discontinuity between the two discussions (Badke-Schaub et al., 2010; Cross, 2010; Dorst, 2010; Tonkinwise, 2011; Kimbell, 2011; Johansson-Sköldberg et al., 2013), which adds more complexity to the argument. In order to clarify the concept of design thinking, the following argument attempts to re-connect the different discourses of design research and design thinking.

As key references, the theoretical landscape of the argument on design thinking in this research is mainly based on two reviews on the concept. One review is done by a researcher of design research, Lucy Kimbell (2011; 2012), and the other is by scholars of design management, Ulla Johansson-Sköldberg, Jill Woodilla and Mehves Çetinkaya (2013). First, we will overview the critique by Kimbell, then move to that by Johansson-Sköldberg et al. (2013). Then it will argue what research streams should be reviewed.

Kimbell initially clarifies the position of the current arguments of design thinking in the research of design practice by classifying the discourses of design thinking into three types: a cognitive style (e.g., ; Lawson, [1980] 2006; Cross, 1982; Schön, 1983; Rowe, [1987] 1991; Cross, 2006; Dorst, 2006), a general theory of design (Buchanan, 1992) and a resource for organisations (e.g., Dunne & Martin, 2006; Bauer & Eagen, 2008; Brown, 2009; Martin, 2009).

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[44] Design researcher, L. Bruce Archer (1981) starts the argument with 'Design Research' with capital D and R, but the followers argues design research without the capital letters (Bayazit, 2004; Cross, 2006). Thus, this thesis also uses the term 'design research' for meaning research about design.

Regarding the key sources of each type, the first one, design thinking as a cognitive style, derives from how (successful) designers individually think and do in the process of design so that it mostly relies on protocol analysis, which is useful for tracking what they do and think during a project. While the first discourse is mostly about the practice of designers, the second one, design thinking as a general theory of design, theoretically removes the traditional practice in craft and product development from the design theory in order to develop a more general theory of design applicable to other fields and practices. The third strand, design thinking as a resource for organisations, originates from a different root from research in the design community, which is mainly from management research and the publication by design practitioners.[45]

She claims, however, all of those discussions are incomplete because of the following three reasons. First, the arguments assume that thinking and doing are something separate from each other so that designers and the world in which they do design activities are also conceptually divided. Because of this assumption, design thinking, as a resource for organisations, in particular, is considered as if it could be easily transferred to other disciplines. In addition, because the discourse is mainly generated from the perspective of management, they may not recognise the importance of the relationship between thinking and doing in design practice.

Secondly, design thinking ignores the diversity of the practices of designers. She argues that there are various types of design disciplines and practices, as well as cultural and sociological aspects playing important roles in design practice. Additionally, she

[45] A distinct example is CEO of IDEO, Tim Brown. He asserts that "a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" (Brown 2008, p.86).

claims that understanding the diverse contexts of design – especially by non-designers such as engineering and service design - will help scholars who look for a way of applying design to other fields, rather than simply identifying the commonality.

Finally, in the discourse of design thinking, designers are located in the centre of the design process even though they appeal the importance of human-centredness and collaboration. Other fields of research such as anthropology, sociology and consumption studies, however, have identified design as a distributed social activity. From this point of view, designers should not be a definite factor in the practice, and artefacts and other actors in design should be paid attention to as much as designers.

Johansson-Sköldberg et al. (2013) also critically examine the design thinking discourse through an extensive literature review and categorise the arguments at two levels. First, based on another research by Johannson and Woodilla (2010), they distinguish the recent argument of design thinking in the recently accessible business media, from the debate in the design research community since the 1960s. The authors label the arguments from the traditional research community 'designerly thinking' and the newly emerging discourse 'design thinking'. In order to keep the argument coherent, this section will follow the same terminology. At the second level, they further divide the two categories into more specific topics. Designerly thinking is categorised into five types, and design thinking into three types. This suggests that, although the design research community is a long-established community, even the research on designerly thinking is not a single stream. Some of them are profoundly connected, but some of them are not. For instance, while Simon's argument ([1969] 1996) is referred to in most of the categories of designerly thinking, Cross (2006) and Buchanan (1992) do not directly mention each other, despite the fact that they discuss similar issues. While Cross argues about the design discipline as the third discipline distinctive from science and humanities, Buchanan asserts design as a new liberal art, which is different from science and arts. In addition, the emergence of the discourse of deign thinking makes this situation more complicated.

The two reviews do not propose a unified definition of design thinking but indicate the discourses that should be taken into consideration when design thinking is discussed (Table 2-1). To articulate the discourses, the next sections will argue on some of the key texts in their analyses, if not thoroughly but as needed.

Author	Key concepts	Variations	Key reference
Johansson-Sköldberg et al. (2013)	Designerly Thinking	The creation of artefacts	Simon (1996)
		A reflexive practice	Schön (1983)
		A way of reasoning	Lawson (2006), Cross (1982)
		A problem-solving activity	Buchanan (1992) based on Rittel and Webber (1973)
		Creation of meaning	Krippendorff (2006)
	Design thinking	IDEO's way of working with design and innovation	Brown (2008; 2009)
		A way to approach indeterminate Organizational problems, and a necessary skill for practising managers	Martin (2009)
		part of management theory	Boland and Collopy (2004b)
Kimbell (2011; 2012)	Design thinking	A cognitive style	Cross (1982), Schön (1983), Lawson (2006)
		A general theory of design	Buchanan (1992) based on Rittel and Webber (1973)
		An organizational resource	Brown (2008; 2009), Martin (2009)
Hestad and Brassett (2013)	Design thinking	An innovation process and methods	Lockwood (2010b)
		A particular design approach	Vogel (2010), Neumeier (2008b)
		Interplay between rationality and intuition	Martin (2009)
		A way of thinking ("think like a designer")	Neumeier (2008b), Brown (2008)
Dong (2015)	Design-led innovation	Outcome	Verganti (2003; 2006; 2008; 2009) (Design-driven innovation), Utterback et al. (2006) (Design-inspired innovation)
		Process	Wrigley and Bucolo (2012) (Design-led innovation)
		Dominant logic (Culture)	Beverland and Farrelly (2007)

Table 2-1: The arguments on design and design thinking

2.3.2. Design methodology research

The roots of design methodology research can be found within the activities and philosophy of Bauhaus founded by Walter Gropius in 1919 (Margolin & Buchanan, 1996;

Bayazit, 2004). Also, the attempts of turning design to be a more rigorous and scientific subject can be seen in the twentieth-century modern movement of design, such as De Stijl in the early 1920s (Cross, 2001; Bayazit, 2004). While the arguments of then thought leaders in design such as Walter Gropius, Adolf Loos and Edgar Kaufmann, Jr. are mainly about the physical object or artefact (Margolin & Buchanan, 1996), the aim of setting objectivity and rationality as the foundation of design can be found in the philosophies of a prominent architect, Le Courbisuer and the De Stijl protagonist, Theo van Doesburg already in 1920s (2001).

It is considered that the argument becomes important again in the 1960s (Cross, 2007a), and *the Conference on Design Methods* in London in 1962 (Jones & Thornley, 1963) is considered as the crucial moment for the foundation of the design research community (Cross, 2001; Bayazit, 2004; Kimbell, 2011). The key reason is the influences of World War II and the subsequent technological competition in Cold War between the United States and the Soviet Union (Rittel, 1972b; Cross, 1993a; Bayazit, 2004). Cross (2001) asserts that comparing the argument in the 1920s, which was mainly concerned with how to develop scientific design products, the focal point of the arguments in the 1960s is on scientific design 'process'. In the argument of design research, Cross (2001) also identifies three strands of the argument about the relationship between science and design: scientific design, design science, and a science of design. The argument of scientific design is based on scientific methods, as the design methods movement in the 1960s tried to acquire the scientific methods into design. This was also influenced by the transition from craft-based design to industrial design, and also there was the rapid growth of sciences, such as materials science and engineering science, supporting various types of design. Therefore, design was conducted based on scientific knowledge and the industrialised design activities seemed distinctively different from traditional craft-based design. To put it another way, it asserts that design is, and should be, based on scientific knowledge, but it does not critically argue what design is. Thus, Cross concludes, the concept of scientific design was not controversial, but on the other hand, it simply described how design was conducted in the industrial society.

Another argument in the 1960s was ‘design science’, the term of which was coined by Buckminster Fuller (Cross, 2001; Bayazit, 2004; see Fuller & McHale, 1963), and adapted by Sidney Gregory into the context of the design research for the 1965 conference on ‘The Design Method’ (Cross, 2001; see Gregory, 1966). Under this term, Scholars of Engineering Design, Vladimir Hubka and W. Ernst Eder (1987; 1996) also argue how design can be turned to be a more scientific process. Therefore, compared with the fundamental essence of scientific design, which was that design is based not only on intuitive methods but also on scientific methods and knowledge, Cross characterises that the argument of design science asserts that design itself can be a scientific activity.

The third strand, a science of design, treats design as a subject of a scientific study; instead of regarding design itself as a scientific process, it investigates the activity of design by scientific methods (e.g., Grant, 1979). For Cross, this difference is of importance as it opens the possibility of investigating “the *nature* of design” (Cross, 2001, p.53). The existing research on design methodology, Cross asserts, focuses on founding design science or a science of design to examining the nature of design.

2.3.2.1. The science of design

For this strand, *The Sciences of the Artificial* (Simon, [1969] 1996) is often referred to as the starting point of the discussion about the nature of design (e.g. Cross, 1982; Schön, 1983; Buchanan, 1992; Kimbell, 2011; Johansson-Sköldberg et al., 2013). With this book, Simon attempts to establish the sciences of the artificial that complement the sciences of the natural (natural science), as the latter is so dominant in academia that the sciences of artificial are undervalued despite the importance. The difference between the natural and the artificial in this context is more complex than the usual usage of the terms. Being made from natural materials does not automatically mean it is natural. For example, a forest can be natural, but a farm is not. Whether "they are adapted to human goals and purposes" (1996, p.3) divides the artificial from the natural. The artificial (artefacts) obeys the natural laws as much as the natural does, but at the same time, the artificial embodies a human purpose as well. The sciences of artificial, he argues, deal with these subjects and phenomena, and connect the natural laws and human purposes.

For Simon, "how to make artifacts that have desired properties and how to design" (p.111) is primarily the task of engineering, but "engineers are not the only professional designers. Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (1996, p.111). Thus, he calls the study of the creation of the artificial "the science of design" (p.111). Compared to natural science concerned with how things are, he asserts that "design […] is concerned with how things ought to be, with devising artifacts to attain goals" (p.114). In this context, design is regarded as a core and common subject of all professions relevant to the sciences of the artificial, including architecture and business. Furthermore, he regards the science of design "not only as the professional component of a technical education but as a core discipline for every liberally educated person" (p.138). This argument suggests that Simon considers design is not only for professionals but a discipline for all the educated people.[46]

However, in the 1970s, there was a backlash against the pursuit of the rigour for design methodologies (Cross, 2001), and the scientific approach is also regarded as the first generation of design methodology research (Rittel, 1972b; Bayazit, 2004). It is partly because the attempts of making design more scientific rather reveal the difference between science and design (Cross, 1993). As the argument of the science of design is not about making the design process scientific but understanding design through scientific investigations, the criticism cannot be directly applied to the argument. However, how to perceive the state of design problems is problematic for the following researchers. One of the distinctive critiques was Donald Schön, who advocates the concept of reflective practitioners.

2.3.2.2. Reflection-in-action and wicked problems

One of the direct critiques of Simon's notion ([1969] 1996) is one by a researcher of urban planning, Donald Schön (1983). He argues that professionals in practice have a different scheme of the way of thinking from science, and conceptualises the approach

[46] His argument is based on the concept of 'bounded rationality' (Simon, 1957; 1996), which suggests that in reality an available information and time are limed when decision is made so that rationality for decision making is also limited. In this situation, what decision makers seek is not optimal but satisfactory solutions, which are shaped for responding to how things ought to be. Cross (2006) points out that this approach has been observed in the study of decision making in the various subjects of design, such as in engineering design (Marples, 1961), urban design (Levin, 1966) and architecture (Eastman, 1971). Therefore, the characteristics of the sciences of the artificial is different from the traditional natural science, but, Simon asserts that it does not mean the sciences of the artificial are less important than natural science. Thus, he asserts the need for founding "a science of design, a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process" (1996, p.113). Because of this statement, Simon's argument is regarded as the foundation of 'a science of design' (Cross, 2007a).

as "reflection-in-action". On the one hand, he praises the argument of design by Simon ([1969] 1996) as he criticises the Positivist approach to understanding professional knowledge and practice in the natural science, and proposes a science of design, in which the condition ought to be changed to a more preferred one, as the concept for filling the gap between natural science and design practice. On the other hand, he criticises Simon as his epistemology is still in Positivism.[47] The argument of Simon is an attempt to raise the importance of the professional schools and the knowledge area, but the concept of the professional schools is formulated in the Positivist perspective. Therefore, Schön criticises that what he calls design itself is the thing that those schools do not teach, and “his science can be applied only to well-formed problems already extracted from situations of practice” (p.47). In other words, establishing a science of design means that changing design to be an analytic and formalised subject, and the statement itself contradicts with the inherent characteristics of design, which he instead proposes as the concept of "reflection-in-action" (p.49).

This argument is in line with the concept of ‘wicked problems’, which is formulated by design theorist and scholar, Horst Rittel (1972a). Based on a conversation with Rittel, systems scientist, C. West Churchman (1967, p.141) introduces wicked problems as a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing”. Rittel criticises the phase-based linear model of design processes as it only works when problems are well-defined, which he calls “tame” problems (Rittel & Webber,

[47] There is a contrary argument (Chua Soo Meng, 2009), asserting that Simon’s epistemology is rather constructivist.

1973).[48] However, he argues, most of the problems for designers – and all the other professionals dealing with a variety of social problems – are the ill-defined “wicked” problems, and they have to take a different approach from the one in science to solve them (Rittel, 1971; Rittel & Webber, 1973).

To clarify the characteristics of wicked problems, Rittel and Professor of City Planning, Melvin Webber (Rittel & Webber, 1973) introduce ten properties of wicked problems.[49] In their argument, design is not merely providing a solution to a problem, but should be an argumentative process (Rittel & Webber, 1973). This shares the theoretical foundation about design processes with Schön’s.

Furthermore, Rittel’s critique is against not specifically Simon’s argument but against the whole argument applying a scientific thought process to design. Rather their argument does not directly criticise Simon’s argument, and some of wicked problems’ properties even suggest similar points to the argument of Simon’s. As we have seen, Simon asserts that the key point of design is not to provide the best solution, but turn the situation to be preferred. This argument has a similar characteristic of designing to the

[48] This is a modified paper that was originally presented in the Panel on Policy Sciences, American Association for the Advancement of Science, Boston in December of 1969.
[49] The properties (Rittel & Webber, 1973) are:

1. There is no definitive formulation of a wicked problem.
2. Wicked problems have no stopping rule.
3. Solutions to wicked problems are not true-or-false, but good or bad.
4. There is no immediate and no ultimate test of a solution to a wicked problem.
5. Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial and error, every attempt counts significantly.
6. Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.
7. Every wicked problem is essentially unique.
8. Every wicked problem can be considered to be a symptom of another problem.
9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.
10. The social planner has no right to be wrong.

third property in wicked problems: "Solutions to wicked problems are not true-or-false, but good or bad" (Rittel & Webber, 1973, p.162).

The argument of design in the early stage was not specifically about deign but the value of the practice conducted by professionals, which was undervalued as it was believed that science is more rational and rigid (e.g., Schön, 1983). Professionals tend to be regarded as a job at a lower level than occupations which deal with more rigid subjects such as science tackling well-defined problems. However, professional practitioners, such as designers, conduct their practice in a different, not lesser, way. Without well-framed problems given, the professionals figure out problems and develop solutions through reflections from the interaction with their clients and the situations surrounding them. He calls those practitioners 'reflective practitioners', and designers are one of the examples he introduces.

2.3.2.3. Design as a discipline (Designerly ways of knowing)

The arguments of a science of design reveal the limitation of articulating design as a scientific process to solve complex problems design faces. Rather, Cross investigates how designers think, and asserts design as a 'discipline' (e.g., Cross, 1982). He identifies the lack of the sound foundation for design as a discipline at the end of the 1970s, and the finding makes him conduct extensive research for developing the concept of 'designerly ways of knowing'[50] to prove design as the third discipline, complementing science and humanities. His paper, 'Designerly ways of knowing' (Cross, 1982) is a part of a series on 'Design as a Discipline' in *Design Studies*. This is his response to the first contribution to the series by Bruce Archer, which claims that design

[50] This is based on 'designerly ways of thinking' by Bruce Archer (1979)

is the third area of general education (Archer, 1979). Cross claims that there are many arguments attempting to connect design methods to scientific methods, but the arguments rather reveal the difference between two of them (Cross et al., 1981). He also asserts that 'technology' is regarded as taking a different approach from science (e.g., Whitehead, [1929] 1967; Ferguson, 1977), and re-maps design onto the concept of technology, which he defines as "the application of scientific and other organized knowledge to practical tasks by social systems involving people and machines" (Cross et al., 1981, p.198).

Part of the argument is about how to shift the education of design from specialist education to general education, as at the time design became a subject taught in secondary schools in the UK. In his understanding, although design education is aimed at acquiring extrinsic skills to be a professional, general education must have intrinsic values. He claims that there is a particular way of thinking in design, which is different from science and humanities. Referring to the research by Lawson (1979), he argues that, while the scientific approach takes a problem-oriented approach to solving problems, the designerly approach is solution-focused. In the experiments by Lawson, this difference is not observed in junior students in universities. Thus, he concludes that designerly ways of knowing can be taught and should be cultivated through design education.[51]

2.3.2.4. Design as a liberal art

Similarly, Richard Buchanan argues design as a "liberal art of technological culture" (1992, p.5), referring to a philosopher, John Dewey ([1929] 1960; [1929] 1998; 1944). Buchanan emphasises that 'technology' for Dewey be different from the meaning

[51] Cross also asserts that "*design is rhetorical*" and "persuasive" (Cross, 2006, p.31).

of technology in the modern society, which is knowledge about the development and use of artefacts or the artefacts themselves. Instead, he defines technology is "an art of experimental thinking" (p.8). In addition, he sets out a liberal art as "a discipline of thinking that may be shared to some extent by all men and women in their daily lives and is, in turn, mastered by a few people who practice the discipline with distinctive insight and sometimes advance it to new areas of innovative application" (pp.8-9). Kimbell (2011) characterises his argument as taking the concept of design away from the tradition of crafts and industrial production in order to formulate a more generalised and widely applicable concept of design thinking.

Buchanan points out that, as our knowledge was accumulated, the subjects in academia were specialised and divided into more detailed categories. The specialisation was useful for advancing knowledge, but it also caused the fragmentation of our knowledge. He argues, therefore, we need to search for a way of thinking to combine them again and establish the integrative discipline, and it can be design as a liberal art.

The subjects of design such as graphic design and industrial design are set up by the result of the design subjects, as graphic design produces graphics, and industrial design produces industrial products. However, Buchanan asserts that design should be perceived as a liberal art, and developed as a concept applicable to anyone. He identifies four areas of design and concisely expresses the outcomes of each area as signs, things, actions and thought. Instead of being stuck in one area, experienced designers rather explore the different areas to provide innovative outcomes. He also emphasises that the areas are not only interconnected but they "interpenetrate and merge in contemporary design thinking" (p.10). This suggests that what designers design should not be bounded by the type of the outcomes expected in the subject of design, but the whole context surrounding signs, things, actions and thought should be considered to provide a better solution.

In addition to the integrative aspects of ‘design thinking’, he points out the communication gap between the scientific community and the design community. The gap derives from the types of problems, as the problems designers face do not fit in the boundaries of subjects in the scientific community. He connects those problems with the concept of ‘wicked problems’ (Rittel, 1972a) mentioned above, and raises a question: why all the design problems are wicked problems. His response is that it is because design does not have a clear subject matter. This fact theoretically allows the scope of design to be universal and holistic, although designers usually “invent a *particular* subject” (p.16) in the course of solving the problems. The interesting point here is that, in his argument, design is different from other sciences because design regenerates the subject matter whenever designers face problems. This absence of a specific subject matter in design also causes the difficulty in communication with other sciences.

Then, he turns to the concept of technology, by looking back to the historical sense, as “discipline of thinking” (p.19). He continues that “design also has a *technologia* [or a discipline of thinking] and it is manifested in the plan for every new product. The plan is an argument, reflecting the deliberation of designers and their efforts to integrate knowledge in new ways, suited to specific circumstances and needs” (p.19). This indicates that the key aspect of design is the thought process to solve a particular problem and the way of thinking is holistic and integrative.

Finally, he points out the differences between the modes of argumentation by different design practitioners and asserts that the modality of the new liberal arts of design thinking is ‘impossibility’ (p.20). He argues that something “impossible” is impossible only when there is a lack of imagination. Design tackles the impossibility by the holistic and integrative thinking.

2.3.2.5. Design as making sense

From the etymology of 'design', researcher of communication, Klaus Krippendorf defines design as "making sense (of things)" (1989, p.9). One of the key points of this definition is what is designed is not physical materials. As he uses the term, *the semantic turn* in his book title (2006), this argument suggests that design should shift from design of objects to design of meanings. Johansson-Sköldberg et al. (2013) argue that his concept reverses the core of design from artefacts to meanings, which Simon's ([1969] 1996) concept of design would have treated as only an attribute of artefacts.[52]

A characteristic of this argument is that the concept of design derives from the etymology not the actual practice of design. Thus, while he is aware of the importance of understanding the practice of design, his argument is critical against traditional practices of design, compared to other research developing designers' ways of thinking from their practice (e.g., Rowe, 1991; Lawson, 2006). Design, he argues, was originally a broader concept intending the creation of meanings, but the unprecedented growth of industrial technologies turned design into 'industrial' design. His claim is, therefore, in the more complexed society in the modern world, the original sense of design should be regained.[53]

[52] Later, Simon (1996) also redefines artefacts as things with purposes.
[53] He also asserts the need for a science for design (see Krippendorff, 1995; 2006). Design science is describing design activities through rigorous and systematic ways. A science of design deals with design activities as a scientific subject, and it is a high affinity with established scientific disciplines. Thus, it contributes to generating knowledge for existing subjects such as psychology and sociology but not for design practice. Instead of these theorisations, he asserts we need to set up a science 'for' design, which is a study and conceptualisation of successful practices of design and practically supports design activities.

Interestingly, his argument is not often referred to in the other strands of design research such as Cross and Buchanan, but his definition of design is adapted by Verganti for the concept of design-driven innovation, which is argued in a later section. The possible explanation of this is that his concept has a relatively larger distance from design practice in regard to the conceptualisation of design. Thus, it may be more suitable for management scholars to absorb the benefit of design to their theory. As a result, Vertganti asserts the importance of a cluster surrounding a firm to reinterpret or 'innovate' the meaning of products. In his theory, designers can be a part of the cluster, but it is not necessary to involve designers, as the interpreters of the meanings of products can be other actors and professions such as suppliers and artists.

2.3.3. Design thinking

As we have seen, there has been the research relevant to designers' ways of thinking at least since the 1960s in the design research community, but the current argument of design thinking has emerged apart from the existing strands in the design methodology research (Johansson-Sköldberg et al., 2013; Liedtka, 2015). In order to avoid a confusion of the terms between the argument of designers' ways of thinking in the design research community and the current argument of design thinking, this thesis calls the former 'the designerly way of thinking' and the latter 'design thinking'.

The concept of Design Thinking gained popularity through the 2000s, as Kevin McCullagh, a thought leader of design practice and Founder and Director of Plan, London-based design consultancy, reflects that a climactic moment was when Tim Brown, CEO of IDEO, was invited to and participated in the World Economic Forum in Davos in 2006 (McCullagh, 2010) As we have seen, the mid-2000s was also the time when the importance of managing innovation gained more attention in management.

Innovation is conventionally regarded as a matter of technology (Christensen, 2003; Miles, 2006; Goffin & Mitchell, 2010; Norman & Verganti, 2014). However, Sir George Cox, a former Chairman of Design Council, highlighted the importance of design for innovation and creativity for business in his review for the Department of Trade & Industry (Cox, 2005). He defines innovation as “the successful exploitation of new ideas” and explains that “it is the process that carries them through to new products, new services, new ways of running the business or even new ways of doing business” (p.2). Based on this awareness of the importance of innovation, he provides his definition of design as “’Design’ is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end” (p.2). This implies that delivering new ideas is as important as generating them, and one of the key elements of it is design. At least since then, the strategic role of design for managing innovation has been more widely acknowledged. This argument has been reinforced with the concept of ‘design thinking’, which usually includes the method of prototyping as one of the key aspects along with human-centredness and collaboration (e.g. Brown, 2009; Lockwood, 2010b).

As the previous sections look through, the argument about design methodology has existed since the 1960s at the latest. As widely criticised, why the concept of design thinking’ in the 2000s looks new is because they do not clearly refer to the existing research on the designers’ way of thinking, and the concept is delivered to a new audience, management executives, as a new practice for innovation. Despite the lack of academic rigour, the concept is argued and promoted by some design practitioners and design scholars (Kimbell, 2011; Johansson-Sköldberg et al., 2013). Both Kimbell (2011) and Johansson-Sköldberg et al. (2013) recognise that IDEO and Roger Martin are the key advocates of ‘design thinking’ in the recent arguments. Even Johansson-Sköldberg et al.

(2013) regard IDEO's way of designing as one of the distinct discourses of design thinking. Therefore, as we have already seen the arguments of designers' ways of thinking, the following sections overview the supporting arguments of design thinking to clarify the theoretical foundation of the concept.

2.3.3.1. Supporting arguments on Design Thinking

2.3.3.1.1. Design Thinking as the design attitude

One of the characteristics of the argument of 'design thinking' in the 2000s is the involvement of management scholars (e.g., Boland & Collopy, 2004b; Martin, 2009) (Kimbell, 2011). In a relatively early phase of the argument of Design Thinking, management scholars, Richard J. Boland Jr. and Fred Collopy, publish a book titled *Managing as Designing* (2004b), arguing about the connection between management and design. This is based on inspirations from the experience of working with a notable architect, Franck Gehry, for their new building of Weatherhead School of Management in Cleveland, and the book includes essays by scholars participating the following workshop.

They propose the concept of 'design attitude', which is compared with 'decision attitude' business managers usually take. The decision attitude assumes that finding options is not difficult, but the selection of the best option is hard. By contrast, the design attitude assumes that designing a good option is difficult, but once an excellent option is designed the selection is not an issue. When this attitude is taken, the risk of making mistakes is less considered than the risk of failing to develop a better option than options that are already identified in order to avoid a wrong selection. In their concepts, the selection of ideas is the key issue for business people, and the development of a better solution is the main concern for designers, and they argue this design mindset is essential also for business managers to tackle complex problems.

2.3.3.1.2. Design Thinking as the practice in IDEO

Although the case of Boland and Collopy, the key source of inspiration for developing the concept of the design attitude is Frank Gehry, a frequently mentioned example by management scholars is the practice of IDEO, a leading design innovation consultancy (Johansson-Sköldberg et al., 2013). For example, management scholars, Michel Schrage (2000) and Stefan Thomke (2003) mention IDEO as one of the best practices of fostering an experimental culture for innovation. Also, the success of P&G, supported by IDEO, in applying the design approach to innovating is regarded as a typical example of innovation by Design Thinking (Lafley & Charan, 2008; Martin, 2009). The value of design asserted by IDEO is supported by not only management academics but also more general management publications such as BusinessWeek (e.g., Nussbaum, 2004; Myerson, 2004).

IDEO themselves also promote their methodology. In the early 2000s, Tom Kelley, then General Manager of IDEO, published 'The Art of Innovation', which introduces the methodology of managing innovation in IDEO to readers in management (Kelley & Littman, 2001). More recently, Tim Brown (2008), CEO of IDEO, published an article, 'Design Thinking' in Harvard Business Review. The two publications by IDEO being compared, their practice and attention seemingly changed through the 2000s. In Kelley's book, most of the examples are about new product development. By contrast, the main example in Brown's article is a project of redesigning the procedure of nurses in a hospital. This suggests that design in IDEO is no longer only about designing physical objects but the whole context surrounding products or services. The example of Thomas Edison as a Design Thinker, introduced by Brown, suggests that the approach for innovation should be holistic, and the holistic approach to problems is even regarded as a key element of design thinking. Brown points out that Edison not only invented light bulbs but also developed the system of generating and supplying electric power. The development of the entire system, from design thinking's point view, was the key factor for Edison to be innovative.

Brown mentions that designers were traditionally only in charge of styling so that they were assigned in the late stage of product development and only provided an additional value.[54] However, he claims that nowadays there are three key aspects that designers have to consider for making innovation: technical feasibility, financial viability and emotional desirability.

In his later book, 'Change by Design' (2009), he introduces Isambard Kingdom Brunel as another example of a design thinker. The railway system he built is still an icon of the industrial revolution, but also he did not only consider the technological side of the railway system. His desire was to provide a well-designed end-to-end experience of a journey to the passengers. This implies that the concept of design thinking does not necessarily derive from design in the traditional sense. Rather, having a more holistic view is a key element of design thinking.

Despite the popularity of their methodology, as the authors at IDEO heavily rely on the examples of their own projects as a member of IDEO, it raises a question whether their concepts represent the practice of designers in general (Kimbell, 2011). However, part of the discourse of design thinking can be seen as an argument only about their own practice (Johansson-Sköldberg et al., 2013), and there are still some essential conceptual elements they provide for this research. One is how Brown describes their

[54] The value of styling in design is an unsettled subject. For further arguments, see Tonkinwise (2011), Brassett & O'Reilly (2015).

design process. While he divides the process into three phases of inspiration, ideation and implementation, he makes the boundaries blurred by using the analogy of space to describe the design process. This indicates that the design process is highly dynamic and iterative, or even chaotic. Another key aspect of their argument is the holistic perspective used in Design Thinking to see problems and the solutions. This is from criticism against more approach-specific strategies for innovation such as technology-centric and marketing-centric approach. Instead of focusing on only one dimension of possible solutions, he claims that design approach takes a balance among the three aspects to provide an optimal solution.

These characteristics can be found in the argument of business model innovation. The common points are argued in 'The evolution of design and design thinking

The previous subsections reviewed the connections between design methodology and design thinking. This subsection clarifies how design and design thinking have been evolving from designing tangible things to designing intangible things such as business models.

There are some researchers arguing the evolution of design. Analysing a corpus of literature relevant to design, Findeli and Bousbaci (2005) find three types of the design concepts: the object- or product-centred model, the process-centred model and the actor- or stakeholder-centred models. They argue that the object-centred model was the dominant model by the middle of the twentieth century. The process-centred model appeared only after the 1960s, and the emergence of the actor-centred model was in the late 1990s or in the 2000s. The authors also analyse this change from the use's perspective and identify the steps historically corresponding to the former models. For users, the shift moves from objects to functions to experience or their way of life. This evolutional, typological model indicates that the focal point of design moves from tangible things to intangible things.

Another framework showing the evolution of design is The Design Ladder (Dansk Design Center, 2001; Ramlau, 2004; Whicher et al., 2016). This framework consists of four stages of adopting design in organisation. The first step is 'No use of design'. This indicates that the organisation does not systematically utilise design for their business. The second is 'Design as styling'. At this stage, design is used for styling of a product or a service at the end of product or service development. The third is 'Design as process'. Design is integrated in the entire design process as a work method involving various discipline. The final stage is 'Design as strategy'. Design is one of the strategic aspects of the organisation's business. Although it is not directly related to the historical transition of design's role, it suggests that design deals with more strategic and intangible matters at the higher level of design capability.

Through the analysis of the relationship between neoliberalism and design, Julier (2017) points out that the roles of design have accumulated the complexity as a subject providing a specific solution to one tackling more intangible and contextual matters. According to his argument, before neoliberalism emerged design was treated as a subject to specific outcomes such as interior and graphics. In this phase, problems themselves were clear and what design needed to provide was solutions for those issues. As the complexity and uncertainty in the society increased, the role of design moved from mere problem solving to problem defining or problem finding (see also Kruger & Cross, 2006; Dew, 2007; Brassett & Marenko, 2015). Identifying what needs to be solved itself turned to be the main issue for many organisations. Therefore, the methods for a deeper understanding of people such as ethnography and interdisciplinary approach became popular methods among design communities (see also Salvador et al., 1999; Hanington, 2003).

While such deep learning of the current context is useful to define problems and improve the situations, the demands of organisations gradually shifted from the current issues to potential issues and opportunities for the future (e.g., Bentham, 2017; Joyce, 2017; Buehring & Liedtka, 2018). This trend requires design and design thinking to deal with value creation for the future. It does not necessarily derive from problems but demand organisations to provide holistic solutions to change the system itself to produce new values (Ceschin & Gaziulusoy, 2016). Such contexts lead the shift of design management from one for product design to more integrated concepts of design management including design thinking and designing business models (Erichsen & Christensen, 2013) A similar change can be observed in innovation management, which is from product focused activities to more comprehensive approaches such as business model innovation (Foss & Saebi, 2017).

This subsection has reviewed some arguments and frameworks to clarify how design and design thinking has evolved from problem solving to problem defining to value creation. I also indicates that design expands the subjects from tangible things to intangible things including business models. The next subsection will initiate the argument on how business model innovation and design thinking work together.

Business model innovation and design thinking' section.

2.3.3.1.3. Design thinking as integrative thinking

Roger Martin, a management scholar in University of Toronto, is another key proponent of Design Thinking from management discipline (Kimbell, 2011; Johansson-Sköldberg et al., 2013). He published a book 'The Design of Business' in 2009 as well as many articles in commercial and academic journals since the mid-2000s including interviews (e.g. Dunne & Martin, 2006; Martin, 2007; Leavy, 2011; T. Brown et al., 2014). He explains that the advantage of Design Thinking is to integrate the different modes of reasoning. He argues that there are two types of thinking, which are analytical thinking and intuitive thinking. Design thinking, he asserts, is taking a balance between two of them. Analytical thinking is based on inductive and deductive reasoning; intuitive thinking deals with another form of logic, abductive reasoning. The first two modes of reasoning are for declaring that a statement is true or false. On the other hand, abductive reasoning is for indicating what could be true. While design practitioners build the concept of Design Thinking mainly from their practices (e.g., Brown, 2009; Lockwood, 2010b), Martin's conception is from the analysis of the reasoning styles.

He also introduces the concept of the knowledge funnel that describes the process of business development. It starts from mystery to heuristic to algorithm. These analogies represent the degree of uncertainty contained in each phase. In the earlier stage, there are many possibilities for the shape of business. As moving to the later stage, the possibilities are gradually eliminated, but the business becomes more structured and formalised. This ends up with leading greater opportunities for the business to be scalable. While the key issue in the early phase of business is the validation of business ideas, the challenge in the later phase is increasing the reliability of the business. He criticises that established organisations tend to favour reliability over validity in any phase. As a result, they underestimate the importance of abductive reasoning, and use a wrong way of thinking in a wrong stage.

He suggests that corporations should use the integrated approach of 'exploration' and 'exploitation', which are originally conceptualised by March (1991). According to the theory, organisations generally engage the two activities. The former is for discovering new opportunities and the latter is for maximising the value of the learned knowledge through exploration. A key issue is that devoting to only one of the activities is harmful for the organisation in the long term (March, 1991). Martin claims, however, established companies tend to focus on exploitation of knowledge that they already acquired. Instead, the two approaches should be organically integrated. He says "the most successful business in the years to come will balance analytical mastery and intuitive originality in a dynamic interplay that I call *design thinking*" (2009, p.6).

Those two advocates of design thinking, IDEO and Roger Martin, play important roles in promoting the concept of design thinking. However, they are not only advocates arguing the importance. Therefore, the following sections will also look into other discourses of design thinking to capture the argument more holistically.

2.3.3.1.4. Design thinking in design management

From the perspective of design management, Thomas Lockwood, a former director of the Design Management Institute, edited a book titled 'Design Thinking' (2010a). The Design Management Institute is a leading organisation of researching the practice of designers, and they also assert their concepts about Design Thinking. In Lockwood's argument, Design Thinking is nothing new, and it is just design practice. Because of this perception to design thinking, he does not strongly emphasise the current demand for firms to be more innovative but rather describes the key aspects of the practice of Design Thinking from his experience.

He proposes five tenets of Design Thinking: a deep understanding of the customer; collaboration; rapid prototypes; visualisation; and concurrent business analysis. This provides a comprehensive framework of what designers do and think in the context of Design Thinking. Although his framework uses a different terminology, it is similar to the core elements of Design Thinking promoted by IDEO. For instance, as he emphasises the importance of rapid prototypes and visualisation, prototyping is regarded as a key characteristic of Design Thinking in the practice of IDEO (Schrage, 2000; Thomke, 2003; Rodriguez & Jacoby, 2007; Brown, 2009).

Also, this partly resonates with the concept of Martin, as it mentions business analysis as part of Design Thinking. Lockwood even uses the term 'integrative thinking' in his explanation about concurrent business analysis. In detail, however, they are not the same concept. Lockwood claims the key point of the integration of creative ideas with strategic business analyses is to "learn from a more complete and diverse point of view" (p.xii). Here, the main argument is the importance of broadening the perspective. By contrast, Martin's argument is that there are two activities in business and they require a different way of thinking from each other. Although Martin claims the two way of thinking should be integrated, it does not clearly indicate that they should happen at the same time. However, the commonality is that both of them acknowledge the benefit of utilising the different types of thinking from various disciplines.

Marty Neumeier, Director of Transformation for Liquid Agency, a branding agency based in San Jose, is another advocate of expanding the strategic role of design from the design industry into other fields, notably business, and also claiming the importance of brand strategy. He published *The Designful Company* in 2008, and an article describing the essence of his argument was also published in the Design Management Institute Review (Neumeier, 2008a; Neumeier, 2008b). He starts his argument by drawing attention to the fact that the traditional management methods such as total quality management and Six Sigma have already become the norm and no longer work as a competitive advantage.

He explains that our modern society is surrounded by problems which seem to be too complex to solve, and he applies the concept of 'wicked problems' to describe these problems. He also conducts a quantitative research with Stanford University about what the top ten wicked problems the senior managers currently face. Neumeier argues design as a discipline having the ability to tackle such wicked problems and also claims that we need to utilise the value of design to address those problems.

He asserts that, in the fast changing business environment, differentiation is a key to survive and innovation provides the differentiation for it. Then, in his claim, what drives innovation is design. Neumeier claims: "Design contains the skills to identify possible futures, invent exciting products, build bridges to customers, crack wicked problems, and more" (2008a, p.12). Compared to the argument of IDEO, although his background is based on the experience as a design practitioner, what he claims is seemingly an overview of the transition from the traditional business approach to a more design-centric approach for innovation. He mentions design as building a bridge to customers, and this point also resonates with Cox's definition of design as connecting creativity and innovation (2005).

Neumeier also asserts the need for shifting from ownership to agility for surviving in the fast changing market. In the past, he argues, it was effective to build barriers to competition by owning facilities, property rights and so on. However, by introducing the case of Kodak, he asserts that sticking to their existing assets and culture could lead the organisation to a disaster. This sounds similar to what Christensen describes as 'The Innovator's Dilemma' (2003) and the argument of dynamic capabilities (e.g., Teece et al., 1997), but what is interesting is that he proposes the concept of agility for solving the problem. He emphasises that agility is an emergent property from embedding the right mindset, the right skills and the ability of collaboration for exploiting them to the culture of the organisation. In his argument, this is not a functional problem but an organisational problem. To resolve this issue, he claims that it is not sufficient enough for organisations in non-design sectors to merely hire designers, but business people in the organisation themselves have to think and act like designers. In other words, it is not sufficient to just have design skills as a function but to embed the capability of design into the organisation as a culture to be a design-oriented firm. IDEO also argue the importance of culture for managing innovation, but it is basically about bringing their methodology and culture to the organisations of their clients through a deep engagement with IDEO (e.g., Brown, 2009). Neumeier, here, develops a more general description of the need for the design-based strategy from the senior management point of view.

Criticism against building barriers to competition by ownership is similar to the argument against the management approach based on the concept of competitive advantage by Porter (1979a; 2004a). Denning (2012) argues that the core feature of competitive advantage is the strategy for building “safe havens for business”, but the problem is that no competitive advantage is sustainable at least in the current economic situation.

For gaining agility to solve wicked problems, Neumeier argues, the way of thinking taught in business school does not provide a strong advantage, because it is honed to address well-defined problems. On the other hand, design thinking provides the skills for dealing with ill-defined problems in the situation. Therefore, the importance of design thinking is getting increased.

These are the positive arguments about Design Thinking, and they introduce the significance of a holistic approach to engage our dynamic business environment as well as provide the methods of practising ‘design thinking’. Martin also emphasises there are two activities in developing and sustaining businesses, and organisations need to take a balance and integrate two of them. Martin’s concept does not highlight the change of business environment, but Neumeier highlights that quality management is no longer competitive, and organisations need to adapt the design-based strategy and culture to survive.

2.3.3.2. Critiques of design thinking

2.3.3.2.1. Design thinking for design practitioners

The practice and the 'doing' aspect of deign cannot be separated from the way of thinking of design (Kimbell, 2011). Some design practitioners also caution that the concept of design thinking can mislead designers about the advantages of design approach (McCullagh, 2010). McCullagh (2010; 2013) critically analyses 'design thinking' from design managers' point of view.

Through the critique, he proposes three hidden opportunities for design managers behind the fad of 'design thinking': the tacit side of designers' knowledge, the integration of analytical and intuitive thinking, and the ability to be visionary. Behind this proposal, there is his belief that design managers should focus on the point where the following three elements of design management cross over: process, talent and context.

His concern on the fad of 'design thinking' is the narrow focus only on process in the three factors, and it leads to underestimate the design challenges in the complex situation of the real world.

Although 'design thinking' wins popularity in general and the management community, he finds many design managers respond negatively to the trend. From this observation, he raises a question where this gap between the responses of the two communities come from.

While McCullagh praises Martin's 'design thinking' as integrative thinking, he also points out a problem in the concept. The integrated way of thinking is called 'design thinking', but it arguably does not have a clear connection with the actual practice of designers. This point resonates with the critique by Kimbell (2011).

He also identifies that IDEO is successful to promote their design methodology and methods as 'design thinking', to prove the value of their approach for managing innovation. However, he criticises that what they argue as 'design thinking' is not much different from the design process, which used to be discussed in the design community. A problem of those discussions on design process is that it looks as if there was a clear process that innovation can be intentionally managed when it is properly followed, but the design process in the real world tends to be chaotic that it is almost impossible to describe as a prescriptive process. Moreover, Walters (2009) suggests a new role of designers as facilitators of stakeholder involvement, but she concerns that while emphasising the importance of process and correctness of design, this idea undervalues the quality and effectiveness of the outcomes of design.

Instead, McCullagh asserts that we need to reassure the importance of talent and context in design management, which are relatively underrated in the argument of design thinking. On his concept of 'context', he emphasises the importance of vision. Referring to Verganti (2010a), he claims that getting closer to users like business people only makes designers less visionary.

Regarding the concept of 'talent', he asserts that the quality of designers cannot be built up just by one or even several workshops. It can be developed only in design practice, and the development takes time. By contrast, in IDEO's concept of 'design thinking', Kelley and Kelley (2013) emphasise everyone has the creative capability and encourage people to regain the confidence to exercise their untapped creativity. Kelley and Littman (2006) introduce ten characteristics for turning organisations to be more creative, but they clearly state that their official position in the organisation does not have to be innovation managers, and anyone can play the roles in the organisations. Also the argument of 'design thinking' highlight the significance of collaboration rather than the talent of individuals.

However, if carefully looking at what talent means in his context, the argument looks different. 'Talent' here apparently means people who survive the harsh competitions in design school and the job market in the design industry, and it implies that the competitive environment nurtures highly-rated professional designers. Interestingly, to explain the value of those talented people, he highlights the importance of the aesthetic aspect of crafts and denounces that design thinkers tend to underrate the aesthetic values. He continues that, because of the aesthetic aspect of design, senior managers can hardly acquire an essential design skill only in a couple of workshops. Here seems to be confusion about thinking like a designer and being a professional designer.

Curiously, although IDEO is a distinctive promoter of 'design thinking', IDEO arguably hire many talented designers in the sense of McCullagh. Also, they hire talented experts in other fields such as ethnography, psychology and even management. There is a possible hypothesis that 'design thinking' might not be a competitive edge for IDEO in the traditional sense. This is why they publish their knowledge on their design process and design methods. Rather, as McCullagh asserts, those talented professionals in IDEO might provide their competitiveness in the design consulting industry, which even can compete with management consultancies.

As McCullagh himself distinguishes, design correctness and design effectiveness are different matters. Crafting skills might be very useful for the improvement of design effectiveness, but for design correctness, the skills seem to be less important. The problem is that, even if designers create high-quality products, it can be a waste of their time and effort if customers do not want the products at the end.

In the context of the traditional design industry and discipline, design correctness and effectiveness are equally important, or the latter can be more important, as what to design is clearer in the context. On the other hand, in the context of innovation, design correctness is often more important than effectiveness as what to design is not evident. When firms enter a new market, what to produce is highly uncertain. This point resonates with the assertion in the entrepreneurship community. The highest risk for entrepreneurs is making what customers do not want (Blank, 2005; Ries, 2011).

McCullagh's argument reveals, if not intentionally, that the situation surrounding design managers are changing. It makes them have to consider not only design effectiveness but also design correctness. A problem for design managers is that the traditional design skills are for the former, and new skills have to be acquired for the latter.

This concern is similar to the relationship between exploration and exploitation in management, or validity and reliability in the terminology of Martin (2009). As mentioned before, Martin asserts there are two modes in business. Compared to the two modes, the counterpart of design correctness is validity, and that is design effectiveness is reliability. In both of management and design, there are two types of activities and the skill set required for each type is different from each other.

'Design thinking' promotes the strategic role of design to solve complex problems and challenges, often categorised as wicked problems (Buchanan, 1992), and this shift probably changed the balance between the importance of design correctness and that of effectiveness. His argument can be read as a warning about the disadvantage by dismissing the importance of design effectiveness.

As we have already seen, Simon (1996 [1969]) is often referred to as a person formulating one of the distinctive definitions of design. He argues that design is to make a situation preferred, but it sounds like what should be made preferred is obvious. However, in the current condition of the business world, what problem should be solved is not clear. From this point of view, the domain of design is expanded from mere problem solving to a domain including problem finding and reframing.

2.3.3.2.2. Critiques of human-centredness

2.3.3.2.2.1. Confusion in the argument of human-centredness

McCullagh's argument criticises not only the entire concept of 'design thinking' but also human-centredness more specifically. He refers to Donald Norman and Roberto Verganti as the key authors of criticising the movement of 'design thinking', especially human-centredness (Verganti, 2009; Norman, 2010; Norman & Verganti, 2014). They claim that human-centred approach is effective only for incremental innovation, but not for radical innovation.

Norman was originally a supporter of human-centred approach (e.g. Norman, 1998; Norman, 2004), but more recently he has claimed the importance of technological development for innovation. Verganti criticises human-centredness from a different point of view, from which innovation is formulated by changing the meaning of products. For making the change, only following customers is not sufficient enough, and it requires 'interpreters' of the cultural meaning, which can be designers.

Regarding Norman's claim, the importance of technology and invention for innovation has been rather acknowledged. One of the problems in innovation management is that there are already many established technologies, but most of them are not adequately commercialised (Cox, 2005). That is why, for example, Moore (1991) argues the importance of the transition from a technology-oriented company to a market-oriented one for crossing the chasm in the process of the diffusion of innovation.

However, Norman's concern implies that the opposite problem happens when we focus only on the market side of the business. Simply returning to technology-centric approaches for innovation is problematic, but there can be a risk in undoubtedly following the methodology of 'design thinking', and a more holistic perspective is rather required for managing innovation.

Regarding Verganti's argument, what he criticises is intriguingly the same point as what 'design thinking' criticises. Verganti illustrates the case of Nintendo's Wii as a contrasting example of the user-centred approach. Here, the term 'user-centred' is intentionally used as a different term from 'human-centred', as the vagueness of the difference often causes confusion about the advantage of human-centred approach. His concern is that if firms observe users too closely, they would simply produce a better version of what customers use, such as faster cars and faster game consoles.

Interestingly, this concern is also the concern of the promoters of 'design thinking'. Why they promote the method of observation for innovation is to avoid the exactly same issue. Traditional marketing methods such as surveys and focus groups are convincing, but they tend to conclude that what they want is simply a better version of the solutions they have currently adopted.

Because of this issue, the subject of observation is even not 'main' users of the products. The method is named extreme user research in the context of 'design thinking', and the subject of the research tends to be heavy users or non-users of a product or service (Brown, 2008).

In the case of Wii, Verganti illustrates, the developers of Wii researched on mothers, who are entirely different from the usual target users for game consoles (Hall, 2006). This approach is similar to the extreme user research in 'design thinking'. The point of this argument is not to support the argument of 'design thinking', but the human-centred approach is seemingly not the same as a user-centred approach that Verganti disputes.

The human-centred approach is often compared with technology-oriented approaches or the approach driven by suppliers such as manufacturers and designers. However, as the cases of Verganti and the advocates of 'design thinking', the target of the criticism is often market research based on data and statistics. From this point of view, the opposite concept of 'human' in the term, 'human-centred' seems to be statistics or data. The important point of human-centred approach in this context is to see customers not as numbers, but as humans.

The reason why people should be seen as humans, in the argument of 'design thinking', is to get out of logical assumptions that dominate the standards of the industry. This is the key point of human-centred approach. While Brown (2008) proposes using insights, observation and empathy for it, Verganti (2009) suggests partnering with interpreters of cultural meanings such as designers, artists and even technology suppliers.

Based on this understanding, the two concepts do not completely conflict each other. Rather, while the alternative approaches they propose are different, both of them criticise the same thing, which is the approach towards innovation overly relying on the statistical model of human beings and cultures.

A fundamental aspect of design methodology is to avoid being trapped by what customers say they want and identify what they really need. However, the emphasis on human-centredness causes misunderstanding about the design approach as if it merely cared about what customers say they want. This misconception provokes a similar criticism against user innovation, which is that human-centredness can only facilitate incremental innovation (Bucolo & Matthews, 2011; Norman & Verganti, 2014). However, as we have seen, the key argument of design thinking is rather opposite. Managing innovation is a ‘wicked problem’, and for instance, Buchanan (1992) asserts that design thinking is solving wicked problems.

2.3.3.2.2.2. The importance and risk of being visionary

Another criticism is a lack of vision in design thinking. Verganti emphasises the importance of vision, but the interpreters in the concept of Verganti do not need to be designers. As McCullagh points out, even Verganti claims designers became less visionary (2010a). Why he calls his concept design-driven innovation is not because he refers to the practice of designers, but the word ‘design’ can be etymologically understood to mean “making sense of things”, which is originally proposed by Krippendorff (2006).

Back to the argument of McCullagh, he also mentions the role of vision discusses the importance of envisioning the future and articulating a vision of how things should be (McCullagh, 2008). The importance of vision for facilitating radical innovation is difficult to deny, but what seems to be missing in this discussion is the argument about the risk of being visionary (Dong, 2015).

In the research on innovation, the unpredictability and risk of addressing a new market have been acknowledged (Christensen, 2003). Also in the research of entrepreneurship, it is pointed out that most of the entrepreneurs more or less have their vision but often fail because they stick to the vision too much and could not adjust their assumption to the market (Blank, 2005).

Comparing visions with ideas, Verganti (2010b) stresses the need for "visionaries who will build the arenas to unleash the power of ideas and transform them into actions". He claims the importance of the implementation of ideas as part of the key characteristics of visionaries. In other words, being visionary is not only conceiving new ideas for the future but also implementing the ideas to the real world. This suggests a value of examining how prototyping is conducted in the design process, as prototyping is a way for designers to implement ideas and embracing the risk to turn it to be opportunities.

This section has reviewed the arguments of criticising design thinking. The review reveals, however, the criticisms are not directly against what the arguments of design thinking suggest. Rather, some parts are in common to criticise the problems of analytical approaches that business minds prefer.

2.3.4. Designerly thinking and design thinking

2.3.4.1. Design thinking and a science of the artificial

Despite the discontinuity of the debate, a similar argument to integrative thinking can be found in the debate of designerly thinking. For instance, Simon (1996) argues the sciences of the artificial require a fundamentally different mode of thinking from the sciences of the natural; while the latter is based on analytical modes of thinking, the former needs to use more synthetic modes of thinking.

Although Simon does not use the term design thinking, his argument is regarded as a source of the argument on design thinking (e.g., Boland & Collopy, 2004a; Kimbell, 2011). This is because, although the core of the argument is design of artefacts, his concept of design does not strongly emphasise the physical aspect of design, but the subject of design is courses of action. Kimbell (2011) points this out through the comparison with another definition of design in the same period, which is proposed by architect, Christopher Alexander (1964): design as giving a form.

A possible reason for this difference is that Simon himself is not particularly a designer. His background has a broad range from Economics to Psychology to the research on artificial intelligence. Because of his background, his argument of design is also not based on the practice of design, but engineering, and from his point of view, design is part of engineering. The key point of his argument is that the origin of design thinking is from the outside of design, even though it is cited as the starting point of the argument on designerly thinking in the design research community. Moreover, his concept of design is referred to in some argument of design thinking in management as Simon suggests that management should be treated as not natural science but a science of the artificial, which should be based on design (Boland & Collopy, 2004a; Dunne & Martin, 2006).[55]

The validity of his argument is not the main topic here, but the important point for this research is that theorising designers' way of thinking, in general, raises the possibility of applying the value of design to other fields outside design. His argument already clarified the difference between the role of the analytical approach and the synthetic one. Although Simon does not argue the need for integrating two approaches, this clearly resonates with the concept of 'design thinking' or more specifically 'integrative' thinking by Martin (2009).

[55] Management scholars, Boland and Collopy (2004a) develop the concept of the design attitude based on his argument. Also, it is claimed that his argument suggests the applicability of design approach to managerial problems (Dunne & Martin, 2006), as he includes both design and business (management) in the sciences of the artificial.

2.3.4.2. Constructive thinking and integrative thinking

Similarly, Cross asserts that the designerly way of thinking is ‘constructive’ thinking (1982). Constructive thinking in Cross’s argument is the same kind of reasoning as abductive thinking. A key advocator of design thinking, Roger Martin also regards abductive thinking as a fundamental aspect of design thinking.

This similarity in the two arguments makes the criticism by McCullagh more sense. McCullagh argues that the model of ‘design thinking’ proposed by Martin is seemingly not connected with the design practice from the design management’s point of view. One of the key objectives of Cross’s argument is to identify the intrinsic values of design apart from design education as specialist education providing extrinsic skills. For Cross, therefore, it inherently should be possible for anyone to learn and adopt. For McCullagh, on the other hand, the key subject of his argument in the article is to suggest there should be the opportunities for design managers, and ‘design thinking’ should give an advantage to designers. When design or design thinking is regarded as something anyone can learn, there is an unavoidable conflict with the industry that is founded on extrinsic skills. The arguments of designerly thinking and design thinking have a similar tendency to the conflict.

Cross acknowledges, however, that designers have to cope with real problems surrounding many constraints, and the characteristics of the problems require the way of thinking to be distinct from academic thinking. The reason seems to be partly because his argument is based on the comparison between design and traditional academic disciplines. He describes that main objectives of the academic research are to identify the best answer in a condition assuming that all the information is available and the problem is completely understood. Cross highlights, therefore, academic research in the traditional disciplines “legitimately conclude that further research is needed” (2006, p.7). By contrast, designers need to propose a solution that is apparently the ‘best’ solution within limitations of time, resources and all other factors, even though the solution is not the best option.

Interestingly, his concept is very similar to the concept of ‘design thinking’ which is currently popularised despite the fact that the current advocates do not clearly refer to his concept. What is different at least is the context surrounding the arguments. The objective of Cross’s argument is to verify the possibility of design as a discipline and extract the general aspects of design, which can be applied to the education for everyone. On the other hand, the current argument involves the management scholars, and ‘design thinking’ is already regarded as something applicable to non-designers. This suggests that design is possibly established as a discipline already and the problem has been shifted to how to integrate the discipline with the traditional disciplines.

2.3.4.3. The commonality between designerly thinking and design thinking

We have seen the arguments on design methodology, or designerly thinking, and design thinking in the recent debate including some critiques against it. The arguments are mostly based on the assumption that designerly thinking and design thinking are theoretically divided. Nevertheless, the literature review in this thesis suggests the continuity between two of them. Also, while the arguments of designerly thinking and design thinking are diverse and controversial, there are some key aspects that are repeatedly argued. This section discusses some of the key aspects relevant to this research as the summary of this topic.

The key aspects of design thinking for this research are:

1. The holistic approach
2. The importance of implementation
3. Agility

One of the key aspects is the holistic approach to innovation. Although it is called 'design thinking', it is not merely focusing on the design-based approach. Rather, the key feature is to take a balance among the major elements of new solutions (Brown, 2009) and ways of thinking (Martin, 2009). In business development, there are at least two types of activities, exploration and exploitation, and the effective integration is required for fostering innovation and building sustainable businesses. From the review of the key texts, the priority of the activities mainly depends on the phase of the business. The argument of design thinking tend to focus on the exploration phase of business, but also, as Martin argues, firms need to take a balance between them. For identifying new opportunities, one of the key points is to take a holistic view covering technical, financial and emotional aspects of products and services.

Secondly, some of the arguments identify the importance of implementation of ideas. This resonates with the argument on innovation management. In the context of innovation management, the importance of invention had been acknowledged, but how to deliver the technologies to market has been an obstacle for facilitating innovation. One of the key aspects of the design-oriented approach is that it takes the implementation phase into consideration as part of the innovation process. 'Build to learn' is used as a catch phrase to represent the ethos. The argument of designerly thinking also suggests that the design approach is not problem-focused but solution-focused, which pay less attention to analysing problems but spend more time and effort to generate solutions.

The third point is agility. Neumeier (2008a) uses this term for explaining the newly required capability of organisations for tackling ‘wicked problems’ they face. The concept does not only mean the speed of change but also implies the flexibility and adaptability of organisations. Martin points out that large organisations tend to rely on ideas that are already verified but argues the importance of constantly validating new ideas to sustainably innovate their business. As the methodology and methods to be agile, some scholars and practitioners introduce prototyping as a key element of ‘design thinking’ (e.g. Brown, 2008; Lockwood, 2010a).

2.3.5. The evolution of design and design thinking

The previous subsections reviewed the connections between design methodology and design thinking. This subsection clarifies how design and design thinking have been evolving from designing tangible things to designing intangible things such as business models.

There are some researchers arguing the evolution of design. Analysing a corpus of literature relevant to design, Findeli and Bousbaci (2005) find three types of the design concepts: the object- or product-centred model, the process-centred model and the actor- or stakeholder-centred models. They argue that the object-centred model was the dominant model by the middle of the twentieth century. The process-centred model appeared only after the 1960s, and the emergence of the actor-centred model was in the late 1990s or in the 2000s. The authors also analyse this change from the use’s perspective and identify the steps historically corresponding to the former models. For users, the shift moves from objects to functions to experience or their way of life. This evolutional, typological model indicates that the focal point of design moves from tangible things to intangible things.

Another framework showing the evolution of design is The Design Ladder (Dansk Design Center, 2001; Ramlau, 2004; Whicher et al., 2016). This framework consists of four stages of adopting design in organisation. The first step is 'No use of design'. This indicates that the organisation does not systematically utilise design for their business. The second is 'Design as styling'. At this stage, design is used for styling of a product or a service at the end of product or service development. The third is 'Design as process'. Design is integrated in the entire design process as a work method involving various discipline. The final stage is 'Design as strategy'. Design is one of the strategic aspects of the organisation's business. Although it is not directly related to the historical transition of design's role, it suggests that design deals with more strategic and intangible matters at the higher level of design capability.

Through the analysis of the relationship between neoliberalism and design, Julier (2017) points out that the roles of design have accumulated the complexity as a subject providing a specific solution to one tackling more intangible and contextual matters. According to his argument, before neoliberalism emerged design was treated as a subject to specific outcomes such as interior and graphics. In this phase, problems themselves were clear and what design needed to provide was solutions for those issues. As the complexity and uncertainty in the society increased, the role of design moved from mere problem solving to problem defining or problem finding (see also Kruger & Cross, 2006; Dew, 2007; Brassett & Marenko, 2015). Identifying what needs to be solved itself turned to be the main issue for many organisations. Therefore, the methods for a deeper understanding of people such as ethnography and interdisciplinary approach became popular methods among design communities (see also Salvador et al., 1999; Hanington, 2003).

While such deep learning of the current context is useful to define problems and improve the situations, the demands of organisations gradually shifted from the current issues to potential issues and opportunities for the future (e.g., Bentham, 2017; Joyce, 2017; Buehring & Liedtka, 2018). This trend requires design and design thinking to deal with value creation for the future. It does not necessarily derive from problems but demand organisations to provide holistic solutions to change the system itself to produce new values (Ceschin & Gaziulusoy, 2016). Such contexts lead the shift of design management from one for product design to more integrated concepts of design management including design thinking and designing business models (Erichsen & Christensen, 2013) A similar change can be observed in innovation management, which is from product focused activities to more comprehensive approaches such as business model innovation (Foss & Saebi, 2017).

This subsection has reviewed some arguments and frameworks to clarify how design and design thinking has evolved from problem solving to problem defining to value creation. I also indicates that design expands the subjects from tangible things to intangible things including business models. The next subsection will initiate the argument on how business model innovation and design thinking work together.

2.3.6. Business model innovation and design thinking

The two approaches, design thinking and business model innovation, also have some characteristics in common. The similarity suggests the possibility and usefulness of applying the design methodology to business model innovation. Also, at the practical level, in both the management consulting and design consulting industry, the distance between business and design is seemingly getting closer. For example, design for business and innovation consultancy Doblin was acquired by a global business strategy firm, Monitor in 2007 (and both by Deloitte in 2013), and it was a rare case of the acquisition of a design agency by a management consultancy at that time. Recently leading design agencies have been acquired by organisations in other sectors such as management consulting and finance (Accenture, 2013; Adaptive Path, 2014; McKinsey & Company, 2015; EY, 2015). This could only mean the integration of business and design at the division level, but at least this suggests the interest in the capability of design from management and other sectors.

One of the key characteristics of design thinking is the holistic point of view. CEO of design and innovation consultancy IDEO Tim Brown (2009) claims the importance of taking balance among technological viability, financial feasibility and emotional desirability. Design consultant and ex-president of the Design Management Institute, Tom Lockwood (2010b) emphasises the concurrency with business analyses is a tenet of design thinking. A key characteristic of business model innovation is also to avoid focusing on a certain aspect of a business, especially products and technologies, and holistically to capture an overview of a business to identify potential opportunities that exist in business components that are possibly ignored. For instance, Osterwalder & Pigneur (2010) produce a tool of quickly capturing a business model called Business Model Canvas[56], and the distinct advantage is to enable the users to have a swift snapshot of their business situation. The canvas can help them to see the problems and assumptions in their business from a relatively objective and holistic point of view. This approach assumes that there might be opportunities for innovation in blind spots in the

[56] Some scholars point out the similarity of business model canvas to balanced scorecard (e.g., Trimi & Berbegal-Mirabent, 2012; Pedersen et al., 2016). About balanced scorecard, see Kaplan and Norton (1992).

business. This common aspect suggests there are similarities between the ‘design thinking’ approach and the business model approach to managing innovation.

A space model of design processes (Brown, 2008) also can be seen as an indicator of the similarity of design thinking to business model innovation. The design process as space can be associated with the concept of minimum viable product (MVP) in the study of business model development in entrepreneurship (Ries, 2011; Moogk, 2012; Blank, 2013; Münch et al., 2013). MVP is defined as a “version of a new product which allows a team to collect the maximum amount of validated learning about customers with the least effort” (Ries, 2009, para. 3). One of the key aspects of MVP as a method is to implement a product for gaining feedback as quickly as possible even if the product has been developed only at the minimum level for learning. In a sense, this is an attempt to remove the boundaries among inspiration, ideation and implementation, and take advantage of the learning from implementation in the earlier phases than the traditional product development model (Blank, 2005).

The origins of the two approaches are apparently different, but both of them seek a way of identifying problems and solving the problems through a more holistic perspective. Connecting the two approaches can develop a more comprehensive understanding and framework for managing innovation.

2.3.7. Prototyping

The previous subsection has shown the potential connection between the concept of business model innovation and that of design thinking. There are some key points in common, and the commonality suggests that the application of the design methodology can be effective also for business model innovation. Prototyping is regarded as an important aspect of the design methodology and process (e.g., Thomke, 1998; Buchenau & Suri, 2000; Terwiesch & Loch, 2004; Hartmann, 2009) as well as a key element of innovation processes in management (Leonard & Rayport, 1997; Mascitelli, 2000; Schrage, 2000; Thomke, 2008). As relevant terms to prototyping are varied, however, this subsection clarifies the terminology of the terms relevant to prototyping this thesis. As this research uses the literature as a data sources, an overview of existing frameworks of prototyping is discussed in subsection in Discussion chapter.

This thesis regards prototyping as a broad concept gaining feedback, although here are some terms used as variations of prototyping such as piloting and mock-ups. Thus, this research includes these variations as part of prototyping as long as they are conducted for building to learn and gaining feedback.

To reduce confusion in the argument, the difference between prototyping and prototypes in this research should be clarified. It is claimed that ‘prototyping’ as action and ‘prototypes’ as objects are not clearly divided in most of the literature on prototyping, and it causes confusion about what the actual topic is in the argument (Blomkvist, 2011). Similarly, it is pointed out that this confusion can also be seen in the debate on business model prototyping (Bucolo & Wrigley, 2012; Seidenstricker et al., 2014). Therefore, the two terms, prototyping and prototypes, is intentionally distinguished in this thesis. Lim et al. (2008) clarify the difference between the two. They define that “prototyping is the activity of making and utilizing prototypes in design”, and also “prototypes are representative and manifested forms of design ideas” (p. 10). The definitions clearly divide prototyping as an activity and prototypes as a representation. Furthermore, Sanders (2013) asserts that as fields that design contributes to expand, the role of prototyping also changes. The focus of using prototyping was “to *help us see* what it could be” (p.63), but in the expanded design fields, the focus also expands “to help us […] to make *sense of the future*” (p.64). For this type of prototyping, prototypes are not simply representations of objects but need to be tools for collectively exploring, expressing and testing hypotheses about future ways of living in the world" (p.64). As prototyping in this thesis is for making business model innovation, which is a new area for the design methodology, the argument in this thesis follows the distinction between prototyping and prototypes and the definitions of the concepts above.

Distinctions of prototypes from other concepts are argued in some literature. For instance, interaction design scholar, Lars Erik Holmquist (2005) distinguishes prototypes from mock-ups and representations. In his theoretical framework, prototypes embody functionality, mock-ups show appearances and representations have both of the attributes. In this thesis, prototypes are not strictly limited to the embodiment of functions for two reasons. One is to avoid turning the terminology to be too complex. The other is that this research rather regards prototypes as "learning tools" (Coughlan et al., 2007, p.124). As for piloting, in the context of design thinking, the main objective of prototyping is to get feedback and learn from building and implementing a product or service (Brown, 2008; Lockwood, 2010). This point is sometimes argued as a notable difference between prototyping and piloting, which aims at evaluating the feasibility of the product or service (NESTA, 2011). Therefore, as long as mock-ups and representations are used for learning, they are perceived as 'prototypes' in this research.

2.3.7.1. Prototyping as an umbrella concept

This part clarifies where prototyping is theoretically located among other kinds of organisational experimentations. As discussed in the previous section, this research treats prototyping as a broad concept of learning form feedback including mock-ups and piloting, which are argued as a different concept in some arguments.

Prototyping is not the only way to learn from trials and errors. More scientific approaches such as randomised control trials and A/B testing are also argued as effective methods for innovation or even thought of as the most rigid approach (e.g., Ries, 2011; Bravo-Biosca, 2016; Phipps, 2017; Ripsas et al., 2018). Despite the rigidity, however, some scholars and researchers also critically reflect that they are not always a perfect solution and seek for alternative approaches (e.g., Edovald, 2016a; Pham et al., 2016). Edovald (2016b) introduces a table showing the differences between prototyping and RCTs made by Lucy Kimbell, Director, Innovation Insights Hub, University of the Arts London (see Table 2-2). There are various differences, but one of the key differences emphasised in their argument is the difference in the inference logic (see also Kimbell, 2015). While RCTs tend to use the inductive/deductive logic, prototyping follows the abductive logic. As the research methodology section discussed, the inductive/deductive logic is the preferable logic in the traditional research methodology. A question raised from acknowledging the differences is that how to effectively use the two types of approaches together. This point will be discussed after the following paragraphs argue the different types of prototyping.

	Prototyping	Piloting	Random Controlled Trials (RCTs)	A/B Testing
Logic	Abductive	Deductive/Inductive	Deductive/Inductive	Deductive/Inductive
What it does	Builds confidence in direction of travel, generates new insights (proto-theories), opens up new possibilities	Check the feasibility of theoretical assumptions	Confirms or disproves hypothesis, informed by existing evidence/ theory	Confirms or disproves hypothesis, informed by existing evidence/ theory
Complexity	Many variables / High	Few variables / High	Few variables	2 variables
Focus	Holistic – people's experience in context	Few, important details in a holistic setting	Few, important details	One important detail
Critical success factor	Selecting the right mix of participants to be involved	The similarity to the real setting	Selecting the right variables	Selecting the right variables
Expertise required	Participatory design expertise to design exploratory prototyping	The skills to develop the final outcomes	Experimental social science expertise to design the trial	The skills to develop the final outcomes
Investment required	Low investment in time and resources	Higher investment in time and resources	Higher investment in time and resources	Low investment in time

Table 2-2 The key differences between prototyping and other methods (adopted from Kimbel's table in Edovald (2016b) and modified by the author)

Although the general definition of prototyping for this research is 'learning form feedback', the characteristics of prototyping can be categorised by the objectives of prototyping. A repeatedly used taxonomy of prototyping has three variations, which is originally asserted by a computer scientist, Christiane Floyd (1984). The variations are exploratory prototyping (Floyd, 1984; Bischofberger & Pomberger, 1992; Budde et al., 1992b; Lichter et al., 1994; Bäumer et al., 1996; Carr & Verner, 1997; Gedenryd, 1998; Hartmann, 2009; Nacheva, 2017), experimental prototyping (Floyd, 1984; Bischofberger & Pomberger, 1992; Budde et al., 1992b; Lichter et al., 1994; Bäumer et al., 1996; Carr & Verner, 1997; Gedenryd, 1998; Hartmann, 2009; Nacheva, 2017), evolutionary prototyping (Floyd, 1984; Crinnion, 1991; Bersoff & Davis, 1991; Bischofberger & Pomberger, 1992; Budde et al., 1992b; Davis, 1992; Lichter et al., 1994; Pape & Thoresen, 1992; Bäumer et al., 1996; Carr & Verner, 1997; De Santis et al., 1997; Nacheva, 2017).

Nacheva (2017) summarises the characteristics of each approach of prototyping (Table 2-3).

	Exploratory	Experimental	Evolutionary
Goal	Study	Evaluation	Changes adaptation
Object of research	System Requirements	Partially realised solutions	Detailed system requirements
Fidelity	Low	Medium	High
Orientation	Horizontal	Horizontal or Vertical	Vertical
Result	Rapid (representation) prototype	Rapid (representation) prototype or components (functional prototype)	Pilot system or final system

Table 2-3: A comparison of prototyping approaches (adopted from Nacheva (2017) and modified by the author)

She points out that the key feature in these characteristics is generally argued as fidelity. Each approach has a different level of fidelity from each other (see also 5.6.1). Orientation indicates that whether the prototypes is made for representing broad aspects or specific aspects. They are conceptualised as horizontal prototyping (Floyd, 1984; Budde et al., 1992b; Beaudouin-Lafon & Mackay, 2012; Singaram & Jain, 2018) and vertical prototyping (Floyd, 1984; Budde et al., 1992b; Beaudouin-Lafon & Mackay, 2012; Singaram & Jain, 2018)[57]. The former is prototyping representing broad aspects of the subject, and the latter is prototyping for a specific aspect (see also 5.6.2).

As piloting is categorisd in evolutionary prototyping, this view of prototyping can include different types of learning activities in the concept of prototyping. From this point of view, more experimental approaches such as RCTs and A/B testing can be regarded as a part of experimental or evolutionary prototyping. This research follows this broad scope of prototyping to capture how such different types of learning activities interact each other. However, as we have seen above, the abductive logic is a key characteristic of prototyping, and the attitude of actors using prototyping is important to learn from feedback (Boland & Collopy, 2004b; Michlewski, 2008; Kelley & Kelley, 2013). This point will be further discussed in 5.5.1.3.

2.4. Summary: key findings for business model prototyping

The literature review found that the research on business model prototyping is still in a nascent phase. Also, the discussion on innovation, business model innovation and design thinking - the key concepts surrounding business model prototyping - are diverse and not fully agreed. Thus, this literature review has initially attempted theoretically to ground the key concepts.

There is an early debate on business model prototyping, but this tends to focus on discussion on validation of ideas and mapping tools of business models (e.g., Osterwalder & Pigneur, 2010). As literature reviews on innovation reveal, one of the

[57] Singaram and Jain (2018) use the term as prototyping for checking the back end of a product.

biggest problems in managing innovation is how to manage the complexity in innovation processes (Dervitsiotis, 2012; Fagerberg et al., 2013b; see also Neumeier, 2008b). The complexity requires innovation researchers and managers to take a holistic approach to innovation rather than element-specific approaches such as technology-push and market-pull (Chesbrough, 2010).

In this context, business model innovation and design thinking have become new topics in innovation management. A reason why business models have become an important concept for managing innovation is that it is effective to gain a simple but inclusive view of a business in a rapidly changing market environment (Feller et al., 2008; Doz & Kosonen, 2010; Blank & Dorf, 2012). Innovation has been regarded as a technological matter, but it is claimed that mere inventions do not successfully capture the value, and the importance of commercialisation is gradually revealed (Chesbrough, 2010). In other words, innovation management expands from technological development to identifying a successful composition of business components (Chesbrough, 2010). To fulfil this purpose, the simplicity and inclusivity of business models are sufficient, and the approach of utilising business models for innovation is conceptualised as business model innovation.

Meanwhile, management scholars, as well as design practitioners, began to argue the application of the design methodology to innovation management under the concept of 'design thinking'. Design methodology research has acknowledged the complexity of design problems at least since the 1970s, but the argument tends to focus on developing the educational foundation of design rather than managerial applications of the approach. On the other hand, the newly emerging argument of design thinking clarified the connection between the design methodology and innovation management.

Design thinking is characterised in various ways, and one of the key elements is represented by the concept of prototyping. Prototyping is not a new practice in design and engineering. However, as the domain of design expands, the meaning and role of prototyping also expand. It traditionally means an activity using a physical representation of design outcomes called prototypes, and the main objective is verification of ideas and persuasion of stakeholders (Sanders, 2013). Yet, in the current context of design, prototypes are not necessarily physical, and the main objective is exploration.

The debate on business model innovation also identifies the importance of exploring potentially viable business models, and it is argued mainly as business model experimentation. Nevertheless, the argument of business model prototyping is still scarce, and the argument tends to focus on verification of ideas and mapping tools of business components.

There is no doubt that how to represent businesses and business models is an important subject for business model prototyping, but it is only part of the entire activity. Also, while the verification of ideas is significant for business management, the design methodology research suggests that an inherent issue of managing complex problems is the inability of verifying the effectiveness of solutions. This confusion can be caused by the vague boundary between business model experimentation and business model prototyping. Examining the activity through the perspective of prototyping will enhance the understanding of business model innovation.

There is a high degree of uncertainty in the early stage of a business, compared to the later stage to scale (Abernathy & Utterback, 1978; Tushman & Anderson, 1986;

Klepper, 1997; Blank, 2005)[58], and the need for purposeful experimentation for managing uncertainty in the early stage of business is identified (Murray & Tripsas, 2004).

Also, in the context of business model innovation, the importance of experimentation and prototyping has been acknowledged (e.g., Chesbrough, 2010; Brunswicker et al., 2013; Girotra & Netessine, 2013; Halecker et al., 2014; Seidenstricker et al., 2014). While it is mainly labelled as 'experimentation' (Bucolo & Wrigley, 2012), Halecker et al. (2014) conduct a literature review and case studies about the drivers (and the cause of failure) of business model innovation and assert the importance of prototyping in business model development.[59]

The theory of 'wicked' problems suggests that, for complex problems, trial-and-error approaches may not lead the situation to be desirable as every trial influences following actions and every solution is 'one shot operation' (Rittel & Webber, 1973, p.163). In other words, each experimentation is unique due to the complexity of the context so that it does not 'guarantee' the success of the solution in the real situation even after certain times of iteration.

This research regards managing business model innovation as 'wicked' problems (see also Neumeier, 2008b). As we saw in the argument of design research, the use of the methodology and the analogy of science is possibly problematic for understanding the process of dealing with ill-structured or wicked problems (Simon,

[58] Abernathy & Utterback (1978) argue that there are target uncertainty and technological uncertainty, and the former makes it difficult to invest in formal research and development. Tushman and Anderson (1986) identify that there are competence-destroying technology discontinuities and competence enhancing-technological discontinuities, and the former generates more uncertainty and tends to be initiated by new firms.

[59] The whole list of implications is (p.8):

- clearly identify current and future customer needs
- ensure a sufficiently future-oriented evaluation
- attach great importance to prototypes and pilot phases
- consider existing business models (cannibalization), resources, and brands

1996; Rittel, 1972a; Cross et al., 1981; Schön, 1983) and even it could cause confusion in the development of the design methodology (Bayazit, 2004; Cross, 2007a; Alexander, 1971; Jones, 1977). Nevertheless, the terms, 'business model experimentation' and 'business model prototyping' are often interchangeably used (e.g., Girotra & Netessine, 2013), or business model experimentation is argued without the articulation of the meaning (e.g., Chesbrough, 2010; McGrath, 2010).

Even in the argument of design management, the application of prototyping to business model innovation is not often argued, but one of the exceptions is the argument of business model prototyping in design-led innovation (e.g., Brunswicker et al., 2012; Johnson et al., 2013; Brunswicker et al., 2013). Different from most of the arguments in innovation studies and management, it emphasises the difference between 'experimentation' and 'prototyping' (Bucolo & Wrigley, 2012; Brunswicker et al., 2013).

It is claimed that the term 'experimentation' tends to emphasise the aspect of validation of ideas more than exploration (Brunswicker et al., 2013). By contrast, the term 'prototyping' suggests the explorative side of iterative processes as well as utilising a tangible medium of supporting communication to gain feedback (Bucolo & Wrigley, 2012). Furthermore, business model experimentation emphasises that it is through "thought experiments" (Sinfield et al., 2012, p.85) to reduce the cost, and regards a business model as a set of variables (e.g., Sinfield et al., 2012). When cost reduction is considered as the benefit of business model experimentation, the process tends to be rather linear from the diversification of ideas to the selection of the best ideas (e.g., Sinfield et al., 2012). The lack of the articulation of the concepts causes the explorative aspect of prototyping tends to be less emphasised when the process is argued as business model 'experimentation' (Bucolo & Wrigley, 2012; Brunswicker et al., 2013).

Some researchers attempt to apply design thinking to business model innovation (e.g., Sosna et al., 2010; Gilbert et al., 2012; Hawryszkiewycz, 2014). However, it is also pointed out that there is still little research on how to explore the possible business models through experimentation and prototyping (Chesbrough, 2010; Brunswicker et al., 2013; Osterwalder & Pigneur, 2013), and the strategic role of design is not fully argued in the research on business models and the experimentation in innovation studies and the management research (Verganti, 2011; Brunswicker et al., 2013).

Although the argument indicates that the design approach may enhance the capability of firms to explore and prototype potentially viable business models, it does not develop a clear definition of business model prototyping and claims that the further examination of business model prototyping is needed (e.g., Brunswicker et al., 2013; Wrigley & Straker, 2016).

3. Operationalisation of the Study: Aims and Approaches

This chapter describes the methodology used in this research. The first section shows how the research question and research purposes of this research are formulated. It clarifies that the key research question is “what dimensions/elements constitute an adequate theoretical framework for prototyping in business model innovation?” Following the question, the research purpose is to explore possible theoretical frameworks of business model prototyping. The following sections will show the theoretical foundation of the methodology applied to this research.[60] Sociologist Norman Blaikie (2009) regards research strategies as logics of inquiry and suggests that they should help researchers to identify the starting point of research and the steps for answering research questions. The first section, therefore, takes an overview of the theoretical background of research strategies and argues the selection of a research strategy for this research in the following section.

This research includes a literature review and a discussion of fieldwork that has consisted of expert interviews, a multiple case studies and validation interviews. Relevant ideas from the literature review and findings from the fieldwork are combined to generate an enhanced and more coherent theory (Dubois & Gadde, 2002; Dubois &

[60] Scholars of Educational Psychology, Paul D. Leedy and Jeanne Ellis Ormrod (2010) assert that there are two key functions of research methodology:
- To dictate and control the acquisition of data
- To corral the data after their acquisition and extract meaning from them

They rephrase the second part as the interpretation of data, and in sum the two of them can be understood that the role of research methodology is to clarify how to gather and interpret data.

Gadde, 2014), one that is crystallised in the form of a theoretical framework. An ‘abductive approach’ – a key characteristic of design practice and design thinking (Neumeier, 2008a; Martin, 2009), and distinguished by an ability to make creative sideways connections – has also been deployed in the development of our framework. Also, the study has employed dimension-based models of prototyping, synthesising these to map the four dimensions (purpose, process, context, and engagement) that constitute what we will show as the core vectors of the business model prototyping framework. This basic version has been elaborated via the use of fieldwork findings (from the expert interview and case studies) to create a more nuanced model, one that is reflective of both theory and practice. We contend that this business model prototyping framework is a substantive contribution to BMI theory and practice, which we will detail further below.

3.1. The research question

The research question of this thesis is what a theoretical framework of business model prototyping can be. This chapter describes the background of the question. Behind the question, this research aims to contribute to the knowledge of how to manage innovation through the design methodology that has been developed through academic research and design practices.[61] For designing research, it is suggested that

[61] Björkdahl & Holmén (2013b) claim that there are seven challenges that research on business model innovation has to engage:

1. Definition and characterisation of business model innovation
2. Managing business model innovation (in established firms)
3. Experimenting, testing and implementing new business models (Murray & Tripsas, 2004; McGrath, 2010; Blank & Dorf, 2012)
4. Business model scalability
5. Profiting from business model innovation
6. Business model innovation and changes in the eco-system
7. The role of capabilities for business model innovation

They also assert that key questions about experimenting business models are:

clarifying the formulation of research questions is helpful as the starting point of research (Creswell, 2012; Fink, 2013) and the questions work as a guideline for the selection of methodology (Blaikie, 2009).

This research was initiated with a research interest, 'how might it be possible to manage business model prototyping?'. As this research progressed, however, the search for cases gradually revealed that business model prototyping did not clearly exist as an intentional practice. Thus, the direction of the research moved from 'how might it be possible to manage business model prototyping?' to 'what would a theoretical framework of business model prototyping be?'. This kind of redirection in research is argued as a characteristic of research on the abductive logic (Dubois & Gadde, 2002). The research problem (Blaikie, 2009) behind the research question for this research has been argued as the context setting in Introduction chapter. The study of research methodologies suggests that the type of questions influences the selection of methodologies. Research questions are also regarded as connected with research purposes. Therefore, the next section overviews the argument on types of research questions and purposes.

3.1.1. Research questions and research purposes

In the argument of research methodologies, it is identified that there are three major types of questions identified: 'what', 'how' and 'why' (Blaikie, 2009).[62] There are

---

- How do firms experiment with new business models? What are the "best" processes?
- How can firms test new business models in an efficient and cost effective manner?
- Are there patterns to business model innovation?
- How should firms implement changes in their current business model?
- What is the role of users in business model experimentation?

[62] "Why questions ask for either the causes of, or the reasons for, the existence of characteristics or regularities in a particular phenomenon. They seek an understanding or explanation of the relationships between events, or within social activities and processes" (Blaikie, 2007, p.7)

other types of questions such as ‘who’, ‘where’, ‘how many’ and ‘how much’, but they can be categorised in the ‘what’ type of questions (Blaxter et al., 2010; Yin, 2013). The type of questions is regarded as sequentially connected, from ‘what’ through ‘why’ to ‘how’ (Blaikie, 2009). What it is has to be understood before it can be explained why it happens, and why it happens should be understood for intervening to make a change. Therefore, for answering the ‘why’ question, ‘what prototyping is’ should be answered.[63]

In this research, the research question was redirected from a ‘how’ to a ‘what’ question, as the data collection process revealed the practice of business model prototyping is not clear in a social context as it was expected. Moreover, as the application of prototyping in design thinking to business model innovation has yet received little research attention, the research subject can be considered to be in a nascent stage of the research (Edmondson & Mcmanus, 2007). Types of questions are connected with research purposes (Blaikie, 2009; Yin, 2013), and it is argued that ‘what’ questions are mainly for the purpose of exploration and description (Blaikie, 2009).

At an early stage of researching on a subject, exploratory and qualitative research are recommended to develop the theoretical foundation of the research subject (Edmondson & Mcmanus, 2007; Easterby-Smith et al., 2012; Bryman & Bell, 2015). From this perspective, the objective of responding the key question is to build a theoretical framework (Eisenhardt, 1989; Eisenhardt & Graebner, 2007) of prototyping in business

[63] Reflectively, this sequential relationship among research questions is based on the assumption that something already exists in a social context, and the objective of social research is to reveal the phenomenon. This research, however, explores possibility of a new practice that even social actors may not notice or exercise, and some part of a theoretical framework needs to be developed through exploration. In this situation, what it is needs to be justify why it works, and the identification of what it is may be done after realising why it works. For this research, it is difficult to formulate what business model prototyping is without considering why it works or happens. In this case, why it works is the complexity surrounding the process of managing innovation. Without recognising the complexity, it is difficult to justify what business model prototyping would be.

model innovation, rather than to test it. In other words, the research purpose is exploration rather than evaluation. Therefore, this research is designed to use an exploratory and qualitative approach to data collection and focuses on finding emerging patterns of business model prototyping and identifying potentially significant research streams for future studies. More specifically, the research purpose is to develop an appropriate theoretical framework of prototyping to business model development. Hence, one of the key tasks is to reveal the mechanism beneath the process of business model development.

In sum, the purpose of this research is not to prove, disprove or compare existing events but rather to discover the underlying mechanisms of the nascent research domain. For responding to the research question discussed above, this research takes the view of a critical realism paradigm with a combined retroductive-abductive research strategy. While exploring the notions of social actors, this research also relies on existing theoretical foundations in relevant subjects such as innovation, business models and design.

This research considers theoretical frameworks of prototyping in design and design thinking in the literature as part of the sources to develop the theoretical framework. However, it is also cautious about other possible forms of prototyping in business model innovation or 'business model prototyping', as there is a concern that this research could need to modify the theoretical framework to fit with the context of business model innovation. By developing the framework, this research contributes to knowledge in two ways. One is for researchers of business model innovation and design methodology; there is no firm theoretical ground for researching business model prototyping yet, and this the framework works as the theoretical foundation for further development of the concept. The framework is useful to explore answers to a question, ‘how prototyping, as used in design practice and valued in design thinking discourses, can be used to facilitate business model innovation’. Future directions section in Conclusion chapter will suggest possible directions for ‘how’ questions. The other is for practitioners of developing business models and of applying design methodology for it; the framework helps the practitioners as a guideline to coordinate the activities to prototype business models.

3.2. The theoretical background of the research strategy

This section reviews the theoretical background of the research startegy of this research. One of the methodological challenges of this research is to apply an abductive approach — a characteristic of design thinking (Neumeier, 2008b; Martin, 2009) — to a subject in innovation management. However, the methodological argument on abdicative thinking in design thinking is still not well grounded. Thus, the following argument articulates the methodological role of abduction in this research.

3.2.1. Abduction - Forms of logical inference

Blaikie (2009) asserts that in natural science there are three major research strategies, which are also applicable to social sciences. They are labelled as the inductive, deductive and retroductive research strategy (2007, p.56). As the names suggest, the forms of logical inference for these strategies are induction, deduction and retroduction[64] respectively. The first two forms contain two types of statements:

[64] Retroduction is defined as a “mode of inference in which events are explained by postulating (and identifying) mechanisms which are capable of producing them” (Sayer, 2010, p.72).

“singular statements” and “general statements” (p.57). [65] The former states a particular event in a particular condition, and the latter states all events of a certain kind in any conditions. Induction starts with many singular statements to devise a general statement, and deduction is vice versa. The main purpose of the two inference types is to produce generalised knowledge.

Retroduction is chiefly advocated by a philosopher, Charles Sanders Peirce (1839-1914) (1934), as the third form of inference. However, as he interchangeably uses the terms, retroduction, abduction and even ‘hypothesis’ (Blaikie, 2007), his terminology of retroduction is confusing in academia (Chiasson, 2005). To clarify the difference between retroduction and abduction, a researcher of Peirce, Phyllis Chiasson (2005) argues that while abduction is the style of logical inference, retroduction is “the form of a deliberate and overarching logical method” (p.223). Based on the Latin derivations, she claims, abduction means “leading away from” (p.227) and retroduction means “deliberately leading backward” (p.227). “The operation of adopting an explanatory hypothesis’" (Niiniluoto, 1999, p.436) is regarded as one of the characteristics of abduction, which is explained as the following (Pierce, 1934, p.189):

> The surprising fact, C, is observed;
>
> But if A were true, C would be a matter of course,
>
> Hence, there is reason to suspect that A is true.

This shows that the inference proposes a hypothesis before it is observed (Blaikie, 2007). For generating the hypothesis, it has to use a hunch or guess (Niiniluoto, 1999; Chiasson, 2005). Also, while the process of induction and deduction is “linear in the

[65] Blaikie initially introduces these two, and then divides general statements to general and universal statements (see 2007, pp.57–58).

nature" (Blaikie, 2007, p.57), the process of retroduction/abduction needs to be recursive to generate and prove the hypothesis (Chiasson, 2005; Blaikie, 2007). Thus, although Peirce does not clearly divide the two terms 'abduction' and 'retroduction', 'abduction' should represent the aspect of moving away from a certain course of logic when facing an anomaly or a surprising fact to get a hunch or make a guess (Chiasson, 2005). In contrast, 'retroduction' should be the term indicating the cyclic aspect of Peirce's retroduction/abduction. Moreover, the cyclic process of retroduction utilises induction, deduction and abduction for generating and proving hypotheses (Chiasson, 2005). In this understanding, the forms of logical inferences are three types: induction, deduction and abduction. Also, retroduction is an overarching logical process using the three types of inferences. Thus, although Blaikie (2007) asserts the differences among inductive, deductive and retroductive research strategy are based on the differences of the inference forms, retroductive research strategy follows abduction as an inference form. Additionally, however, Blaikie (2007) also introduces the abductive strategy, which is only appropriate for the social sciences. From the perspective of inference forms, the retroductive strategy and the abductive strategy are confusing, as Blaikie (2007) admits that both of them are greatly influenced by abduction. As this research adopts the integrated version of the retroductive and abductive strategies, next subsection argues the characteristics of research strategies proposed by Blaikie (2007).[66]

[66] The ontological and epistemological stance of this research is the following. For generating new knowledge, it is necessary to acknowledge the logic of the research process, its underlying assumptions and research approaches. Blakie (2007) asserts that the selection of research strategies should be aligned with the type of research questions to answer, but researchers also have to consider the philosophical assumptions about the nature of existence or reality (ontology) and how the knowledge on the reality can be acquired (epistemology). These assumptions are combined in research paradigms and establish the foundation for the paradigms (Guba et al., 1994). Research paradigms are a set of philosophical perspectives or worldviews (Guba et al., 1994; Creswell, 2013) that guide the actions and the activities of researchers throughout the research process (Denzin & Lincoln, 2005) as well as it gives the validity to the research (Myers,

3.2.2. The combined retroductive-abductive research strategy

As the etymological meaning of retroduction is “deliberately leading backward” (Chiasson, 2005, p.226), retroduction is considered as a logic asking ‘what must be true in order to make this event possible?’” (Easton, 2010, p.123). This may sound like the inductive approach, but Economist, Tony Lawson (Lawson, 1997, p.236) clarifies the difference:

1997). There are diverse ways of categorising paradigms, but the common pattern of the structures is that there are two classical extreme paradigms and the critical versions of paradigms between the two (e.g., Chua, 1986; Orlikowski & Baroudi, 1991; Sayer, 2000; Blaikie, 2007). Positioned as the extreme paradigms are positivism and interpretivism (Proctor, 1998; Sayer, 2000; Blaikie, 2007; Farquhar, 2012).
The positivist paradigm derives from natural sciences. The ontological assumption is that reality objectively exists (*shallow realist*) (Blaikie, 2007), and it is epistemologically believed that it can be captured by independent observers and their instruments (*empiricism*) (Orlikowski & Baroudi, 1991; Blaikie, 2007). The general approach of the research is testing theories for improving the capability of predicting measurable phenomena (Myers, 1997). Positivists tend to collect data at an observable level, and look for regularities and causal relationships in the data to generalise the findings into laws (Gill & Johnson, 2010). On the other hand, in the interpretive paradigm, the ontological assumption is that the reality does not neutrally exist and is socially constructed. People subjectively generate meanings through the interaction with factors surrounding them (*idealist*) (Blaikie, 2007). Thus, as for the epistemological assumption, the neutral stance of researchers does not exist, and researchers are always involved in the situation to be studied, in which beliefs, values, and interests of the researchers always influence their investigations (*constructionism*) (Orlikowski & Baroudi, 1991; Blaikie, 2007). The critical version of paradigms takes a critical stance to these extreme paradigms to be more realistic. Blaikie asserts the retroductive research strategy fits with the research paradigm of social realism or critical realism (Harré & Secord, 1972; Bhaskar, 2008). Critical realism is positioned as one of the key research paradigms for social research alternative to the positivist and interpretivist paradigms (Wynn & Williams, 2012). In critical realism, reality is constituted by not only the events experienced by the researcher, but also events that happens even if it is not experienced by the researcher, and the paradigm assumes structures and mechanisms producing the events exit beneath the events (Blaikie, 2009). Critical realism acknowledges the value of subjective knowledge of social actors as well as independent structures limiting and also helping the social actors’ action (Wynn & Williams, 2012). Based on critical realism researchers can develop a detailed explanation about a particular phenomenon in a certain setting. Methodologically, compared to positivism and interpretivism, critical realism enables researchers to take a relatively wide range of research methods, although the selection should follow the nature of the object of study and the learning objectives (Sayer, 2000, p.19). Based on this understanding of the research paradigm, the next section argues the theoretical background of research strategies and the selection in this research. There are two versions of critical realism, one of which assumes that the structure exists without the influence of social actors, and the other assumes that activities of social actors rather construct the structure (Blaikie, 2007).

Whereas [induction and deduction] are concerned with movements at the level of events from the particular to the general and vice versa, retroduction involves moving from a conception of some phenomenon of interest to a conception of a different kind of thing (power, mechanism) that could have generated the given phenomenon.

The reasoning style builds theories from phenomena, but it is not for identifying general statements from particular incidents. Rather, the aim is to discover structures or mechanisms to produce the phenomena (Blaikie, 2007). This reflects a characteristic of retroduction as reasoning "from effect to cause" (Niiniluoto, 1999).

To discover unknown structures or mechanisms, it is considered that the researchers start with formulating a theoretical model of the structures or mechanisms (Blaikie, 2007). As this point is similar to deduction, the retroductive research strategy is regarded as including both the aspects of deductive and inductive research (Downward & Mearman, 2007; Sæther, 1998; Ragin, 1994). However, it is also claimed that it is not only an iterative process between induction and deduction but also "the process of discovery" (Ragin & Amoroso, 2010, p.231), which relies on abduction.

Similarly, as a difference between deduction and retroduction, although deductive inferences are used for the analysis of theory-based qualitative research, the inference of deduction requires researchers to compare the initial theoretical framework with data, and the researchers often ignore the aspects missed in the initial theoretical framework. In contrast, retroductive and abductive research strategies treat the missing parts as important subjects of the discussion of the findings (Meyer & Lunnay, 2012; Wynn & Williams, 2012).[67] The strategy, therefore, uses an iterative approach to organically developing explanations.

[67] "Within critical realism, a single incident of a finding contrary to expectations would not necessarily be the basis for falsifying a proposed causal mechanism. While this may be the case,

As the origin of the terms suggests, the reasoning style on which abductive research strategy is based is similar to the style for retroductive research strategy. Therefore, the difference is characterised by not the reasoning style, but the sources for developing technical descriptions of social phenomena (Blaikie, 2007). While the aim of the retroductive research strategy is to reveal mechanisms beneath social phenomena, the abductive research strategy seeks to turn lay concepts and vocabulary of social actors to technical descriptions for scientists (Proctor, 1998; Blaikie, 2007). To put it another way, it is an investigation of the relationship between "everyday language and concepts"(Dubois & Gadde, 2002, p.555), which is similar to induction. It is argued that "an abductive approach is fruitful if the researcher's objective is to discover new things - other variables and other relationships. […] our main concern is related to the generation of new concepts and development of theoretical models, rather than confirmation of existing theory" (Dubois & Gadde, 2002). This research is mainly based on the retroductive research strategy, but also it appreciates the value of social actors' notions as a source of interrogating existing theories to develop a theoretical framework that is not fully articulated in the literature yet. The next section argues the combined approach of retroductive and abductive strategy.

Blaikie (2009) asserts that the abductive research strategy can apply to answer both 'what' and 'why' types of questions. Moreover, the combination with the 'constructionist' version of the retroductive research strategy is suitable for responding to the research purpose of 'understanding' (Blaikie, 2007). This research will adopt a combination of the abductive and retroductive strategies. This section argues the brief

contrary findings would possibly lead to further explication of events, structure and context, as well as additional retroduction to identify a mechanism acting to counter or nullify the proposed explanation" (Wynn & Williams, 2012, p.801).

background of the combined research strategy, followed by the section argues the connection of the strategies with this research.

The retroductive research strategy is usually used in the paradigm of 'critical realism' (Harré & Secord, 1972; Bhaskar, [1979] 1998), which ontologically assumes that reality consists of three layers: 'empirical', 'actual' and 'real'. The 'empirical' level is constructed by what is observed. Beyond the observation, the paradigm assumes that events and phenomena exist even though they are not directly observed, and constitute the 'actual' level. Beneath the actual level are structures and mechanisms that make the events or phenomena happen. These structures and mechanisms are regarded as in the level of 'real'. Thus, the purpose of the retroductive strategy is to reveal the structure or mechanism under events or phenomena through research.

In the argument of critical realism, however, the origin of the social structure is not agreed. Philosopher, Roy Bhaskar (1998; 2008) considers that the social structure shapes the actions of social actors, not vice versa. Philosopher and psychologist, Rom Harré (Harré & Secord, 1972; 2002), by contrast, argues that social actors considerably influence the social structure so that the perceptions of social actors are a major source of social research. As this difference influences the methodology of the retroductive research strategy, Blaike (2007) divides it into the 'structuralist' version and the 'constructionist' version. The versions follow Bhaskar's realism and Harré's realism respectively.

The abductive strategy shares some characteristics with the retroductive strategy (see Peirce, 1934; Chiasson, 2005). However, while the retroductive strategy seeks for structures and mechanisms, the fundamental concern of the abductive strategy is turning knowledge of laypeople to scientific knowledge of researchers (Blaikie, 2007). It focuses on gathering the knowledge of social actors to generate scientific knowledge, which can be used for further refinement of the knowledge by the same research strategy or forming a theory for other research strategies such as retroductive strategy (Blaikie, 2007). Thus, the abductive strategy is generally based on interpretivist paradigm, but it is argued that it can be applied for various paradigms and work together with the constructionist version of the retroductive research strategy (Blaikie, 2009). Based on this understanding of methodology and research strategies, the next section argues the research strategy selection and the research design for this research.

3.3. The research strategy and design

One of the difficulties in research on business model prototyping is that the concept is emerging and there is not an explicitly shared understanding of the concept. Also, the practice of design is expanding to untraditional design fields (Yee et al., 2013). Thus, there is little literature directly arguing the subject, and on the other hand, it is concerned that simply asking experts about what business model prototyping would be might not produce a clear answer to the question, as different experts have a different theoretical understanding of the concept. This research, therefore, takes an approach of the combined retroductive and abductive research strategy, which is reviewed in the previous section. The combined strategy allows researchers to take into consideration both the theoretical foundation and the notion of social actors.

The combination of the two strategies are argued as fitting with the research purpose of understanding a structure or mechanism considering social actors' perspectives (Blaikie, 2009), and it is also argued that including different perspective is effective for triangulation (see Proctor, 1998; Haig, 2005; Blaikie, 2007; 2009; Abulof, 2015). Thus, the combination supports using the theoretical ground of prototyping in design thinking and integrating the knowledge of practitioners to examine the applicability of the theoretical framework to a new field, which in this research is the development of business models. Hence, this research uses this strategy not only for 'understanding' the structure and mechanism beneath empirical findings but exploring and developing a possible theoretical framework of business model prototyping. The strategy takes an iterative and reflexive process moving between theories and findings from the fieldwork. The iterative process is theoretically articulated as 'systematic combining' by business scholars, Anna Dubois and Lars-Erik Gadde (Dubois & Gadde, 2002; 2014). As this thesis borrows the theoretical framework to clarify the research methodology, the next section argues the concept.

3.3.1. Systematic combining as a template of research design

A methodological concept, 'systematic combining& describes the process of combining theoretical knowledge and empirical findings based on iteration and abductive logic (Dubois & Gadde, 2002; 2014; see also Juho-Petteri Huhtala et al., 2014). The approach relies on both theories and empirical data, and also uses abduction. Thus, this approach can be well coordinated with the philosophical foundation argued in the integrated retroductive-abductive research strategy. Key advocators of the concept, Dubois and Gadde (2002) define systematic combining as "a non-linear, path dependent process of combining efforts with the ultimate objective of matching theory and reality" (p.556). They develop this methodological scheme for case studies, as they consider that difficulty in case studies is to handle and combine various interconnected elements found during the research process and the standardised, phase-based process does not resolve the issue.

The research process starts with a preliminary analytical framework, but it is assumed that the framework evolves through an iterative and flexible process moving around the theoretical framework, data collection and data analysis. During the process, researchers might find unanticipated factors that could redirect the research to be a new direction and eventually theories and empirical findings are matched to generate a more robust framework. Figure 3-1 shows the key ingredients of systematic combining.

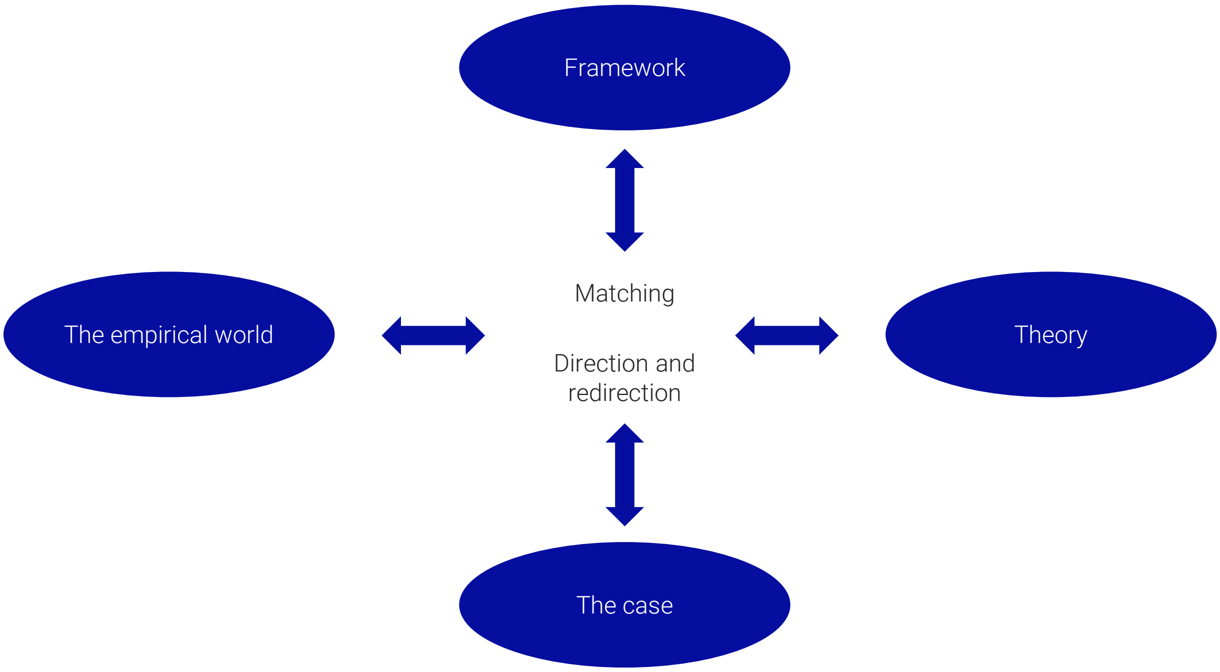

Figure 3-1 The theoretical framework of systematic combining (adapted from Dubois and Gadde (2002))

One of the characteristics of this approach is the usage of a tight and emerging theoretical framework (Dubois & Gadde, 2002; 2014). Compared to a dichotomised categories of frameworks, tight or loose frameworks (Miles & Huberman, 1994), tight and emerging frameworks are expected to show the preconceptions of researchers on the subject as well as to allow the framework to evolve during the research. While the dichotomy of tight and loose frameworks fits with deductive and inductive research respectively, tight and emerging frameworks can work well the retroductive-abductive research based on the abductive logic.

Blaike (2009) also suggests that developing an experimental theoretical model may be needed at the beginning, especially for deductive and retrouctive research strategy. It is conceptualised as ‘analytic frames’ by Sociology scholars, Charles H. Ragin and Lisa M. Amoroso (2010). It is also suggested that the hypothetical frames are often formulated through literature review (Blaikie, 2009; Ragin & Amoroso, 2010). Therefore, research with the retroductive research strategy starts from developing a document and a model of patterns. Then, it moves to describe the context and possible mechanisms of the phenomena. Finally, it identifies a temporary best mechanism explaining the phenomenon. The abductive strategy starts from finding concepts and meanings of social actors. Based on the findings, it moves to develop more scientific accounts that turn to be a theory through an iterative development.

It is argued that a phenomenon to be investigated should be conceptually and theoretically understood in the early stage of the research, as it allows the researchers to set significant questions (Haverkamp & Young, 2007; Creswell, 2013; Brinkmann & Kvale, 2014). Yin (2013) also argues that theory development prior to data collection is one of the characteristics of case study research different from other qualitative methods such as ethnography and grounded theory.

Thus, the starting point was to identify issues in the practice of business model innovation. Therefore, the exploration began from reviewing the literature on innovation, business models, design and design thinking. The aim of the review is to develop an initial operational framework of prototyping in business model innovation, as these key concepts themselves are contested, and it is clear that the concept of prototyping in business model innovation has to be theoretically settled for further investigation.

Through the review, this research develops a theoretical framework of prototyping in design and design thinking, consisting of four dimensions, which are: purpose, process, context and engagement. This framework provides the preliminary propositions for this research.

Thus, after arguing the theoretical landscape of this research, theoretical dimensions of prototyping in design and design thinking are argued as an initial framework for further investigation. The dimensions are used for framing the learning outcomes of interviews and case studies, and the details of the dimensions are argued in the discussion chapter.

Similarly, in systematic combining, theory and literature play a different role from inductive and deductive research, in which the review of existing theories and literature is used for finding research gap in existing knowledge. However, the systematic combining approach takes a stance that theories cannot be developed without empirical findings, and empirical findings cannot be understood without theories. Thus, it assumes that all the relevant theories and literature might not be thoroughly reviewed before collecting data as the process of collecting data and analysis could reveal the relevant theoretical area of the research (Corbin & Strauss, 2015). Therefore, the attention is rather paid to matching the theories with the reality and vice versa (Dubois & Gadde, 2002).

3.3.2. The research journey developing a theoretical framework

In this research, literature plays an important role not only as a source for clarifying the theoretical landscape of the research subject, but also as data sets (see Dubois & Gadde, 2002) to explore various fields of studies from innovation studies to management to design methodology. As case study research needs to rely on replication logic or analytical inference, it is recognised that enfolding literature is an important part of supporting the intellectual credibility of findings (Eisenhardt, 1989). Furthermore, key concepts for this research of business models and design thinking do not have widely agreed-upon definitions (Johansson-Sköldberg et al., 2013; Täuscher & Abdelkafi, 2017) relying only on social actors' notions may result in incoherent conclusions. Therefore, this research uses literature not only as a foundation for clarifying its specific research contexts, but also as an important source for developing the theoretical framework proposed by this research. As a result, the theoretical framework evolved through matching theories evaluated from the literature with data from primary research. Based on this understanding of the methodology, this research started by developing an initial framework with literature and synthesised it with findings from empirical research.

Through a brief initial review of literature relevant to design thinking, a preliminary theoretical framework of business model prototyping was developed, which consists of key elements: agility (e.g., Doz & Kosonen, 2010), tangibility (e.g., Hornecker & Buur, 2006), complexity (e.g., Thackara, 2005) and synthesis (e.g., Kolko, 2009). During the research, the framework evolved to one that consists of purpose, process, context and engagement, representing more the question of 'what is business model prototyping' rather than 'how it might be possible to manage it'. This shift happened as it was identified that the initial question was rather premature than expected during the sampling process. To find suitable cases, I had meetings with experts and consultants in the relevant areas such as product design and service design. Some of the responses, however, indicated that even the experts and consultants were looking for ways to prototype business models and it was difficult for them to identify suitable cases to give the answer to 'how to prototype business models'. From these interactions with the industry, I shifted my research focus from 'how to manage' to 'what business model prototyping might be', as the absence of an explicit framework of business model prototyping was observed.

Such a shift had been expected, as this research evolved through reflections on each phase and explored three areas of activities: problem definition, data collection and theorisation (Figure 3-2). The research was initiated by my previous learning and experience and started from understanding the contextual setting. After the context was captured not only through my experience but also the literature review, a research question, 'how might it be possible to manage business model prototyping?' was set as a provisional question for anchoring the starting point of the expert interviews. Through the expert interviews, it was identified that a theoretical foundation of business model prototyping itself was not widely shared.

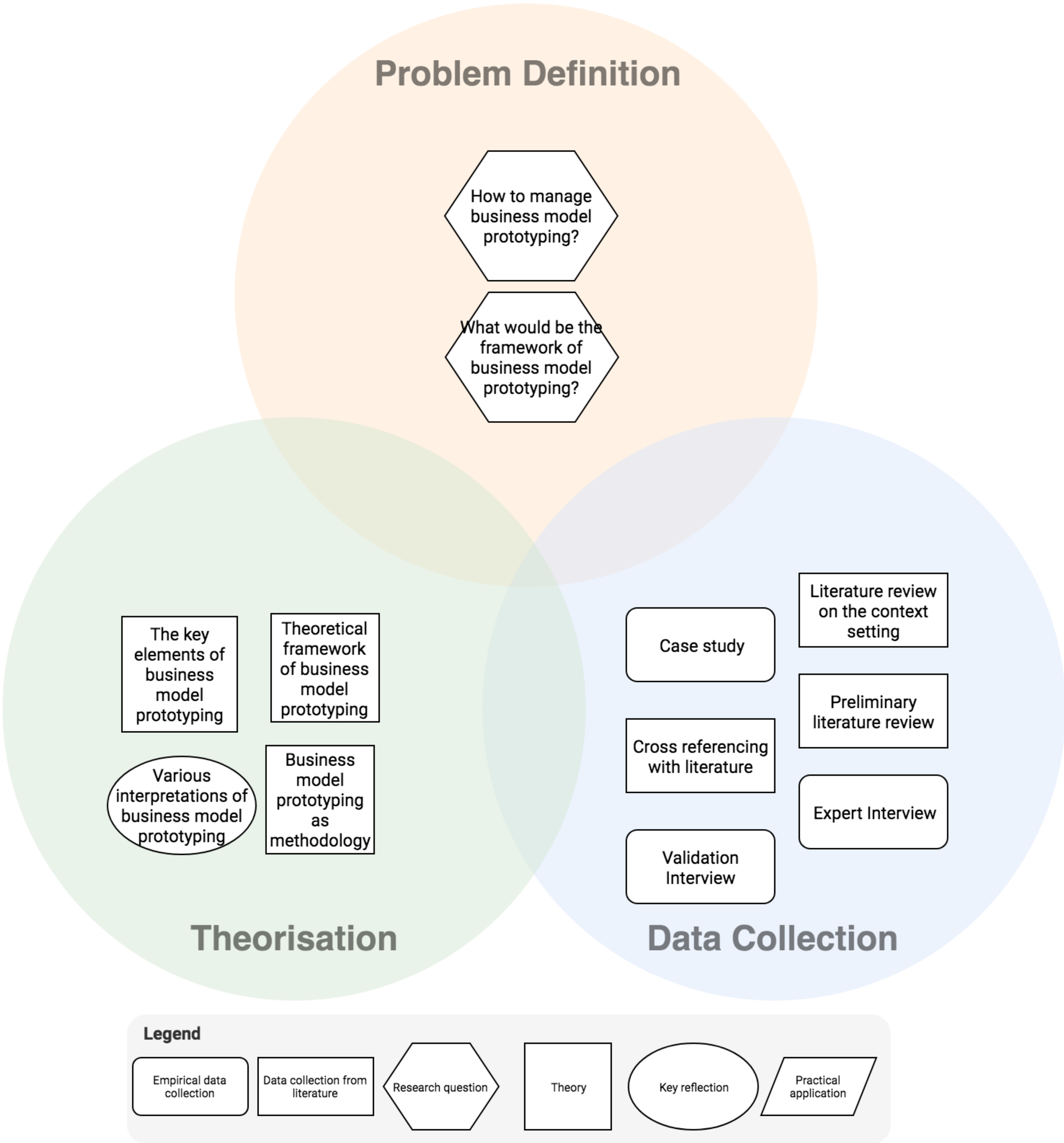

Figure 3-2: The research activities

The expert interviews followed a semi-structured interview protocol (Whiting, 2008; Harrell & Bradley, 2009), and the content was used for gaining insights through reflection (Schön, 1983; Bolton, 2010; Johns, 2013). The reflection led this research to redefine the research questions, which strengthened the connection between this research and the contextual issues on business model prototyping research (see Dubois

& Gadde, 2002). With the redefined question, this research further explored actual practices through case studies and the theories supporting the practices through literature review.

The findings from the empirical exploration were used as sources for developing the theoretical framework of business model prototyping. Validation interviews were also conducted to strengthen the validity of the framework, and this research suggests that business model prototyping is not a single method but a methodology for facilitating business model innovation (Figure 3-3). The author's stake in the research will be clarified in the next subsection.

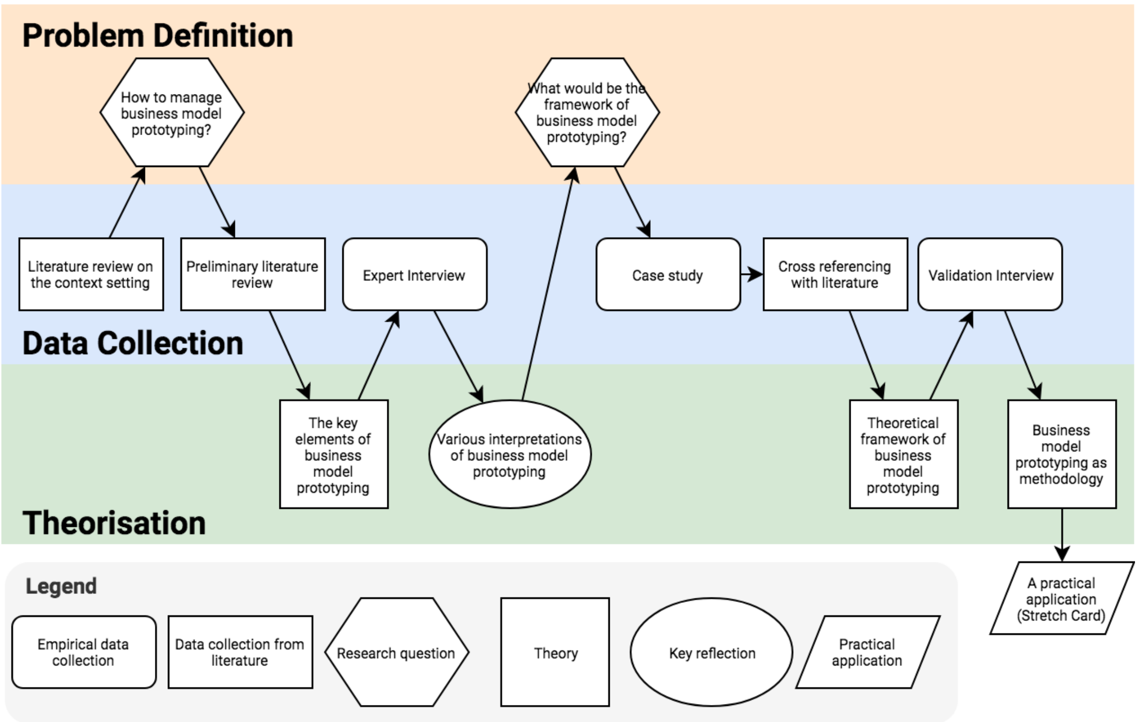

Figure 3-3: The research journey map

3.3.3. The author's stake in the research

I located myself as a researcher as a creative practitioner who combines existing relevant theories and practices to build the theoretical framework of business model prototyping (Dubois & Gadde, 2002; Dubois & Gadde, 2014). As my research interest sits between the contexts of business and design, using the network of my university for setting the sites and finding cases was an effective catalyst to find the starting point of my research (Blaikie, 2009).

Through the training in the master degree in Innovation Management, I understood the importance of immersive learning of the subjects through qualitative research, and my expertise and the position as a researcher had been directed to qualitative data gathering and analysis on the basis of reflective practices (Schön, 1983; Johns, 2013). As the research journey map (Figure 3-3) shows, such reflections led the research to move back and forth among problem definition, data collection and theorisation. Brassett and O'relly (2018) point out that collisions and swerves - changing directions – are the key activities in creative practices. From this point of view, it is easier to understand my position in this research not as a social science researcher but as a creative practitioner, especially following the design thinking approach (e.g., Boland & Collopy, 2004b; Rodriguez & Jacoby, 2007; Brown, 2008; Lockwood, 2010a; Kolko, 2011; Kelley & Kelley, 2013).

While this research borrows the structure of social research using case studies (e.g., Blaikie, 2009; Farquhar, 2012; Yin, 2013), the process contained various collisions and swerves. The main reason is that the research subject, business model prototyping, does not exist as solid cases as case study approach expects, but it was rather a process of creatively generating a theoretical framework by synthesising findings from theories and randomness that collisions and swerves provided. As the theoretical foundation of this approach, I selected 'systematic combining' (Dubois & Gadde, 2002; Dubois & Gadde, 2014), which iteratively develop the theoretical framework through data gathering.

The first large iteration was after the expert interviews. The reflection indicated that the question of what the practice of business model prototyping is itself is not clear. Coming back to the literature for research methodologies, I found that Blakie (2009) asserts that the research should move from what question to how question. In the initial plan of this research, what business model prototyping was supposed to be more explicit than I found in expert interviews. While their knowledge is insightful such as the importance of agility, the involvement of earlier adopters and the importance of impressiveness to the context. However, those learning points were not well structured but still anecdotal. Therefore, I redirected this research question from a 'how' question to a 'what' question. In the design process, redefining problems is a common practice to open up the possibilities to provide more suitable solutions (Dorst & Cross, 2001; Adams et al., 2011).

Regarding the case studies, as discussed in the methodology section, it is not used as a strict methodology but rather a part of data set as Blaikie (2009) suggests. Thus, the findings from the case studies is also used for the insights for developing the framework of business model prototyping.

The key learnings are:

- Case Study 01 – There is no clear boundary between prototypes and a final outcome
- Case Study 02 – Proposing new projects to real clients is one of the biggest opportunities to learn from feedback (i.e. prototyping)
- Case Study 03 – Visualisation moderates the complexity of the contexts
- Case Study 04 – Maximising the value of the incomplete information by action is important (see also Sarasvathy, 2008)

The findings are synthetically combined with the existing frameworks of prototyping to the four element-based business model prototyping framework (see Kolko, 2014). As a part of the technique, for instance, this research used affinity diagram to synthesise finding and gaining insights (see Tate et al., 2009; Hanington & Martin, 2012) (Figure 3-4). The process followed the divergent and convergent thinking process proposed by Brown (2009) (Figure 3-5).

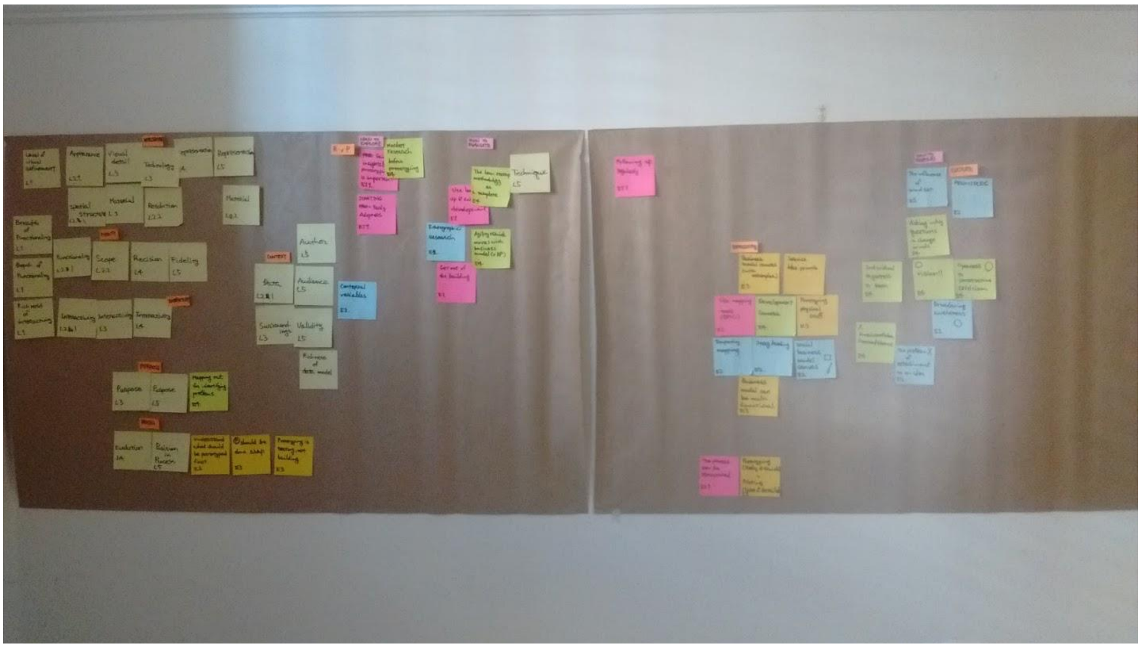

Figure 3-4: An exmaple of affinity diagram (taken by the author)

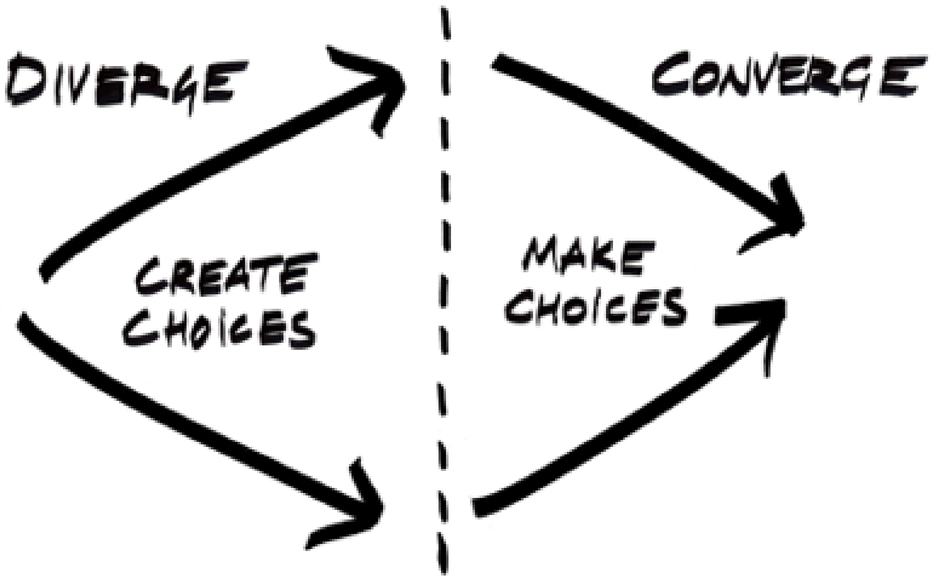

Figure 3-5: The divergent and convergent thinking process (adopted from Brown (2009))

The case studies and the framework development was followed by validation interviews. The main purpose was to validate the framework, but the findings were also used for the further development of the framework through the same divergent and convergent process of findings as the case studies.

By reviewing the whole process, it is clear that the research was not simply gathering data to verify the framework but rather an iterative and creative activity to generate a possible framework. In the process, my role and stake was not a researcher who merely listen to the practitioner's notions but actively engage with the creative process as a create practitioner.

One of the outcomes from the attitude as a creative practitioner in this research is *Stretch*, a card game for exploring possible business models (see in 8.1.1.2 the appendices) (Figure 3-6). The card game is made based on the findings and insights from this research.

Figure 3-6: An image of Stretch (taken by the author)

3.3.4. Matching through an iterative and flexible process[68]

The systematic combining approach uses matching between theories and data (Dubois & Gadde, 2002). While data collection and data analysis tend to be argued as a separate subject in some of the guidelines for case study research (e.g., Eisenhardt, 1989; Farquhar, 2012; Yin, 2013), it is asserted that social research should be regarded as a cyclical and iterative process rather than a linear process, and the research design should consider the room for flexibly adapting to the findings in the later stages of the research (Blaikie, 2009). However, for the retroductive-abductive approach, a literature

[68] For theory building through case study, Kathleen M. Eisenhardt (1989, p.533) suggests the following steps:

1. Getting Started
2. Selecting Cases
3. Crafting Instruments and Protocols
4. Entering the Field
5. Analysing Data
6. Shaping Hypotheses
7. Enfolding Literature
8. Reaching Closure

review is necessary to show the connection of cases with existent theories and knowledge (Eisenhardt, 1989).

Especially, case study research tends to be iterative when the purpose is theory building (Eisenhardt, 1989), and the data analysis is based on explanation building (Yin, 2013).[69] Thus, the need for adapting iteration is acknowledged, as flexibility is important in qualitative research to develop a theory (Eisenhardt, 1989; Dubois & Gadde, 2002; Blaikie, 2009; Yin, 2013). Furthermore, the importance of matching theory and reality is claimed (Glaser, 1978; Dubois & Gadde, 2002) and the process of matching needs to take a non-linear and path-dependent process (Dubois & Gadde, 2002). In the process, data collection and data analysis frequently overlap each other (Eisenhardt, 1989). Corbin and Strauss (2015) assert that the process is moving among data collection, hypothesis generation and comparisons. In the matching process between theory and reality, data collection and a search for complementary theories can be conducted in parallel (Dubois & Gadde, 2002).

For this research, the data collection was initiated with the major elements of business model prototyping from literature in mind, but the concurrent literature review for finding more suitable theories gradually revealed that the dimensional model of prototyping was more useful to describe the characteristics of business model prototyping. This process is in line with the matching process mentioned above. The

[69] Yin (2013) suggests that the possible iterative steps for explanation building are following (p.149):

- Making an initial theoretical statement or an initial explanatory proposition
- Comparing the findings of *an initial case* against such a statement or proposition
- Revising the statement or proposition
- Comparing other details of the case against the revision
- Comparing the revision to the findings from *a second, third, or more cases*
- Repeating this process as many times as is needed.

reflectivity during the data collection is regarded as important to avoid to forcibly fit findings with a framework developed in advance (Glaser, 1978; Dubois & Gadde, 2002).

3.3.5. The process of this research

Based on the methodological foundation of the integrated retroductive-abductive research strategy and systematic combining, the key methodological aspect of this research is the following:

- Using an initial framework to evolve
- Using a parallel literature review with data collection and analysis to match theories and findings

It starts with building a theory from literature clarifying the theoretical background of this research relevant to innovation, business models and design thinking as well as constructing an analytical framework of prototyping to be the theoretical foundation of business model prototyping. The abductive approach supports the development of business model prototyping by exploring a possible theoretical framework from the notion of social actors, through fieldwork such as expert interviews and case studies in particular. Eventually, this research takes a combined abductive-retroductive research strategy to respond the research question and develop a theoretical framework of business model prototyping. Findings from the fieldwork are integrated with theories and frameworks from initial and parallel literature review. The actual process is an iterative process as the research journey map (Figure 3-3) shows.

3.4. Data collection

Although the importance of literature in this research is emphasised in the previous section, it is also not reliable to use only literature as a source of data as the theoretical argument of business model prototyping is still at an early stage. Therefore, this research undertakes fieldwork to collect empirical evidence. The data collection activities can be categorised into three types, which are initial expert interviews in the relevant industries, multiple case studies of related activities and validation interviews with experts. The following subsections describe the further detail.

3.4.1. Expert interviews

Expert interviews are conducted for collecting the notions of practitioners relevant to business model or service development as part of the abductive strategy in this research. As this research is explorative, the samples of interview candidates are chosen on the basis of reputation and body of work in fields relevant to business model prototyping, such as business model design and service design. Additionally, a snowball sampling method of interviewee selection is employed, in which interviewees are asked about potential candidates for further data collection. With the permission of the interviewees, the interviews are audio-recoded and transcribed. One interview is conducted on Skype, but other three interviews are face-to-face meetings.

	Background	Location	Type of meeting
01	Business model design consultant	The Netherlands	Skype meeting
02	Social innovation consultant	UK	Face-to-face meeting
03	Service design consultant	UK	Face-to-face meeting
04	Social enterprise consultant	UK	Face-to-face meeting

Table 3-1: The interviewees of expert interviews

The initial purpose of the interviews was finding cases for the case studies, and the questions were directed to understand how it might be possible to manage business model prototyping more than what the framework of business model prototyping would be. After the theoretical framework had been developed, the findings were re-analysed to match the theories with the findings.

Key questions were set as:

- How to test/explore possible business models?
- How to evaluate the result of the test/exploration?
- How to respond to the results (how to synthesise them)?

However, the importance of flexibility in qualitative research is pointed out for discovering new concepts to develop (Gioia et al., 2013). The interviews follow the principles of convergent interviewing, which conducts data collection and analysis in parallel. Thus, the interviews also follows the flows of interviewees to reveal their practice in the interviews when the conversation moves to an unintended direction to find unexpected aspects of their practices.

3.4.2. Case studies

This research treats case studies not as a particular research methodology but research with cases as a type of data. In social research, 'case studies' are understood in various ways such as a research design, a research methodology (e.g., Perry, 1998) or a data collection method (Blaikie, 2009). [70] This variety of the interpretations causes confusion about theorising what case studies are. However, it is reasonable to think that case studies are not a particular type of research design nor that of collecting data, but a way of selecting research units to study, as the way of collecting and analysing data can be flexible to illustrate cases (Hammersley, 1992; Hammersley & Gomm, 2000; Stake, 2005; Blaikie, 2009; Miles et al., 2013). Thus, this research regards case studies as not a research strategy but a type of data bounded by predetermined criteria. Also, case studies are suggested to fit with the retroductive and abductive research strategy

[70] For instance, Perry (1998) defines case study research as "a research methodology based on interviews that is used in a postgraduate thesis involving a body of knowledge".

(Dubois & Gadde, 2002; Blaikie, 2009).[71] This research relies on critical realism as the research paradigm, and case studies are well-matched with critical realism for developing a theory of complex events (Dobson, 2001; Harrison & Easton, 2004; Easton, 2010; Wynn & Williams, 2012). Research with case studies "investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2013, p.16). Therefore, using cases as a type of data in this research is well coordinated with the research strategy and the research paradigm.

Moreover, some researchers regard using case studies as an effective approach when the research purpose is exploration, and understanding contexts plays a major role in the research (Eisenhardt, 1989; Leonard-Barton, 1990; Dubois & Gadde, 2002; Voss et al., 2002). A key advantage of using case studies is to enable researchers to get closer to theoretical constructs and illustrating causal relationships from a more direct data collection than quantitative research with large samples (Siggelkow, 2007).

3.4.2.1. The number of cases

It is asserted that multiple-case studies are preferable to single-case studies if researchers have a choice, as multiple-case studies can have analytical benefits and a single-case design can be vulnerable because all the resources turn to be one case and it is hard to distinguish a phenomenon from the context (Yin, 2013). There is no ideal number of cases for qualitative research, but Eisenhardt (1989) suggests the reasonable number of cases is four to ten. If the number is too small, generating a convincing theory

[71] It is considered that case studies are based on the inductive research strategy based on inductive logic (Eisenhardt, 1989; Svengren, 1993; Farquhar, 2012), when only deductive and inductive research strategies are considered. In this broad framework containing only deductive and inductive strategies, retroducitve and abductive resaerch strategies are closer to the inductive research methodology than the deductive one.

from complexity, and if the number is too large, the complexity tends to expel the capability of the researchers to handle it.

3.4.2.2. The selection of the cases

The cases are selected from broad contexts, and it does not focus only on business model development. The main reason is that soon after starting to search for cases I realised that business model canvas and the lean startup methodology are so popular in the business development community that the findings can be easily biased to support the tool and methodology if the cases are collected only from business model development, in particular for startups. The overview of the lean startup methodology will be in the Discussion section. Moreover, as the concept of business model prototyping is still not fairly developed as a solid practical approach, it is hard to collect a plausible number of cases in which business model prototyping is intentionally used. Thus, the case studies of this research aim to understand the practice of producing complex outcomes through an iterative approach. Then, the findings are integrated with the learning outcomes from literature review and interviews to generate a theoretical framework of business model prototyping.

As prototyping processes for business models are not explicitly acknowledged, the cases were identified through snowball sampling (Blaikie, 2009), which allowed me to utilise the university's network to find cases. Each case represents a different context to capture various situations of business model prototyping (Table 3-2).

	Type	Sector	Size	Stage	Interviews	Other documents
01	Social Enterprise	Education	Small	Design	3 (co-founder, co-founder, investor/mentor)	Maps of business components Images of the events
02	University	Education	Large	Reconfiguration	3 (director, project manager, facility manager)	Pictures of the events Promotional materials

03	Policy Maker	Government / Legal service	Large	Reconfiguration	2 (project manager / external designer)	Stakeholder maps
04	Private company	Trading agency / Sock manufacturer	Small	Design	3 (director, external researcher, external researcher)	Corporate Introduction Business model maps

Table 3-2: The characteristics of the cases

Although the difference of sizes and commerciality of organisations is important, as we have seen in 1.3, the attitude to uncertainty and complexity is identified through this research as the key criteria of the cases regarding business model prototyping and innovation. Therefore, while it might look inconsistent to include the case of Ministry of Justice and not to include large commercial organisations, the level of uncertainty and complexity of their issues they faced was in common with other cases.

	Case 01	Case 02	Case 03	Case 04
Uncertainty	The company needed to find a feasible business model as a startup.	The university looked for new types of revenue stream that is different from the existing sources.	The mission of the team was to implement more agile processes for making policies that was usually highly institutionalised.	The company needed to find a way for the clients to penetrate a foreign market.
Complexity	As a social enterprise, they needed to not only satisfy financial requirements but also provide social values.	It needed to involve various departments in their own organisations as well as their clients.	There are multiple stakeholders in the policy making process, and the process itself tends to be complex.	They needed to find a solution to satisfy the new market itself and also the client.

Table 3-3: Uncertainty and complexity in the cases

Case 01 was the case of a newly set up social enterprise and they needed to validate their business model or modify it with the market demand (Tootill, 2014). As a social enterprise, they needed to seek how to produce social values and it added another layer of complexity in searching their viable business models.

Case 02 was a university looking for a new revenue stream different from their core business, which is providing higher education (University of the Arts London, 2012).

Although their core business is stable, finding new revenues streams for them were complex and uncertain processes as they had to deal with new types of clients and produce new values for them.

Case 03 was a project team in Ministry of Justice, whose mission is to implement more digital and agile processes to make policies (Takwale, 2015). As they traditionally used more rigid, phase-based processes to make new policies, the implementation process contained the high degree of uncertainty. Furthermore, the policy making process tends to have various stakeholders, and it brought high complexity in the process.

Case 04 was a private company seeking a new business model for a client company that planned to enter a new market. The client had a certain brand awareness in their own country, but there was no presence in the UK. While the client was successful in the existing market, they had to manage the uncertainty of entering a new market.

3.4.2.3. The unit of analysis

The unit of analysis is organisations attempting developing business models with prototypes. The organisations were chosen from the different fields in order to explore various contexts of business model development: a social enterprise, a university, a governmental organisation, and a private company. Although the industries and sizes are varied, all the cases are using a prototyping approach to identify opportunities with new business models. Although this research acknowledges the importance of sizes and industries for the selection of cases, it prioritises capturing various contexts as an explorative research.

For the first case, small and even large events worked as prototypes to identify possible new business models. In the second case, pitches to clients and actual project management were prototypes for figuring out the viability of new businesses and cultivating capability of realising the new businesses. The third case includes a map visualising a complex process and relationship of actors in a service, which worked as a prototype extracting feedback from various actors. In the final case, business model canvases were used as prototypes representing business models and encouraging discussions among actors. To reveal the detail of the cases, the data were collected through multiple sources such as documents, semi-structured interviews and other materials, including visualisation tools for prototyping business models.

3.4.2.3.1. Interviews

The interviews are semi-structured and open-ended for focusing on key aspects of the research and also keep the space for exploring unexpected insights through the interviews (Yin, 2013). The questions are focused on understanding interviewees' views of the business model development. The duration of interviews is between 30 minutes and one hour, and are audio-recorded. Most of the interviews were face-to-face, with a few conducted over Skype or the telephone.

The key interviewees are the core members of the process such as co-founders and project managers. Also, external actors such as consultants are included. For finding interviews, gatekeepers were found, and an initial interview with them was conducted.

For the first case, the key interviewees were two co-founders, and a mentor of the accelerator program they were involved was interviewed. The second case includes interviews with project manager, studio manager and the director of the division. In the third case, the project manager and external designer were interviewed. For the fourth case, the founder had an interview with a prototype of a business model on Business Model Canvas, and also two external research consultants were interviewed.

The process is designed as an iterative process, and the data collection are dynamically conducted for being flexibly responding to new knowledge that can be immediately applied to further data collection. An advantage of open-ended questions is to be adaptive to newly identified interesting subjects and adjusting the direction of data collection with accumulative knowledge and insights (Edmondson & Mcmanus, 2007).

The interviewees include mainly two types of people. One is people who are in charge of managing the iterative process, such as founders and project managers. The other is those who are in a supportive position, such as mentors and designers, providing an alternative perspective on processes.

3.4.2.3.2. Documents and images

In some cases, business models are described in a document and depicted in a map or a drawing. Therefore, this research treats these materials as an important source of data. When documentation (internal documentation, articles in press and multimedia contents) is accessible, it is used for underpinning findings and gaining further insights about how business models (or business ideas) are developed and refined. Also, published sources such as websites and magazine articles are collected when they are accessible. In addition, for cast studies, multiple sources are preferable to strengthen the argument (Yin, 2013). This benefit of multiple sources is argued as triangulation to verify the accuracy of data (Denzin, 1971; Yin, 2013). Furthermore, multiple sources are useful for researchers to reveal unknown aspects of the research subjects (Dubois & Gadde, 2002). Thus, this research uses the data to complement findings from interviews, but also key sources of getting insight into the cases.

3.4.3. Validation interviews

After conducting the case studies, findings and the theoretical framework are combined. A summary document of the theoretical framework with diagrams is developed, and the document is used for sharing the proposed theoretical framework of business model prototyping. The development of the framework is based on the abductive logic. Thus, the proposed framework is tentative, and it is reviewed by experts from relevant practical fields to strengthen the external validity of findings. The backgrounds of the interviewees is shown in Table 3-4.

	Location	Type of meeting
Design thinking consultant	UK	Face-to-face
Service design consultant	UK	Face-to-face
Business design consultant	UK	Skype
Business consultant	UK	Face-to-face

Table 3-4: The interviewees of validation interviews

The interviewer shares the slide in advance and also described key points during the interview. As the objective of the interviews is not collecting answers to specific questions but clarify the gap between the practices, questions are not set up for the interviews to keep their questions intentionally guided. Instead, the interviewer asks the interviewees to raise questions if they do not understand some part or feel a gap between theories and their practice.

3.5. Data analysis

The collected data is analysed through building a more comprehensive explanation fitting with findings from the fieldwork (see Yin, 2013), as the objective of this research is not confirming an existing theory but developing a possible theoretical framework. It is also asserted that an abductive approach is suitable for "*theory development*, rather than *theory generation*" (emphases in original) (Dubois & Gadde, 2002, p.559). This thesis follows the approach as the main goal of the analysis is to emergently construct or develop a theoretical framework of business model prototyping (Farquhar, 2012). Another reason for choosing this approach for the data analysis is that it is hard to set up rigid propositions prior to data collection, as the subject of the research is a new application of a design approach to external matters, and so were not fully theorised in advance. For such research topics, iteratively developing an explanation is theoretically more suitable than strictly comparing preliminary propositions with empirical findings (Yin, 2013). The analysis of data is conducted by taking notes after interviews, clarifying what was and what was not argued (Farquhar, 2012). The findings from the fieldwork are reflectively compared and combined with the findings from the literature review, which is also continuously conducted during the data collection. The key findings are holistically generated from the data and sorted into a table of the theoretical dimensions of business model prototyping to synthesise the findings. The summarised findings are integrated with theoretical findings from literature to revise and develop a theoretical framework.

4. Fieldwork

This chapter shows findings from the fieldwork. The fieldwork has three activities: expert interviews, case studies and validation interviews. Each section has subsections of overview and findings. Overview describes the background and context of each activity. Findings show key learning points from the data collection. In Case Studies, each case has a summary to synthesise findings for this research.

4.1. Expert Interviews

4.1.1. Overview

The objectives of expert interviews were to find potentially suitable cases for the case studies and understand how they perceive the concept of business model prototyping in their practice and how they manage it. The expertise of interviewees is business model design, social innovation, social enterprise and service design (see Table 3-1 for the detail of the interviewees).

The interviews were designed as semi-structured interviews (Whiting, 2008; Harrell & Bradley, 2009), and the following table shows the protocol:

	Questions
Introduction (5 minutes)	The main objective of this research is to theorise business model prototyping, and I would like to know your experience and perspective on the subject through this interview. Would you have any questions about this research and this interview?
Topic 1 (15 minutes)	Topic 1: How to prototype business models How do you test business models?
Topic 2 (15 minutes)	Topic 2: How to evaluate the result How do you evaluate the result of prototyping business models?
Topic 3 (15 minutes)	Topic 3: How to respond to the result How do you respond to the result and learning points from the prototyping?
Final thoughts (5 minutes)	Would you have any final thoughts on business model prototyping? Would you have any other topics you think we should discuss?

Recommendations of cases (5 minnutes)	Would you know any cases that you think it would be relevant to this research?

Table 4-1: The interview protocol of the expert interviews

The interviewer took notes during the interview and also audio-recorded the interview. The record was transcribed to review afterwards. Although the interviews were roughly structured to be consistent, the conversation also relied on a natural flow to explore key aspects of their approach without preventing by formality. The contents are holistically interpreted and matched with findings from the case studies and the literature review.

4.1.2. Findings

In the expert interviews, prototyping is perceived as a learning and explanatory activity (EI02, EI03, EI04). The perception is in line with the literature of design thinking regarding prototyping as exploration (e.g., Brown, 2009; Leifer & Meinel, 2011). An interviewee mentioned that a purpose of mapping out business models is to identify problems in the business models at an early stage rather than verifying ideas (EI03, EI04). While exposing business ideas to potential customers in an early stage is argued as significant in some literature (e.g., Blank, 2005), the importance of preliminary ethnographic research on customer insights before prototyping is also emphasised (EI01). Similarly, clarifying what should be prototyped is considered as important (EI4). This perspective suggests that further understanding of target customers can reduce the cost and loss of prototyping as well as prototyping is used for evaluating and validating findings from qualitative customer research. This resonates how prescriptive models of design perceive prototyping in the design process. Although prototyping is associated with building physical representations, it is also pointed out that the main purpose of prototyping is testing ideas and not necessarily include a physical development of prototypes (EI03). Whether it should involve a physical representation of ideas depends on the objective of prototyping. In literature, it is also cautioned that there is a risk that prototyping can make the developer of prototypes stuck in the idea represented in the prototype (Leonardi, 2011).

An interviewee asserts that the prototyping process can be structured (EI01). Also, the importance of gaining customer insight in advance is suggested (EI01). Similarly, as customer behaviours are diverse, the consideration of various components of prototyping before it is conducted is important to make prototyping effective (EI02, EI03). On the other hand, the importance of organisational culture is also emphasised in some interviews (EI02, EI04), and it is pointed out that prototyping is not a process but principles (EI02 – "we run workshops on the principles of prototyping to that hopefully when the organisations start to plan their prototype, they're using those principles keeping a little forefront to their mind to design an effective and a useful prototype"). This suggests that while a structured process is helpful for implementing prototyping in the business model development, merely following a structured process without setting a proper context might not have an impact on making an organisational change. While each interviewee has their own approach, the Lean Startup methodology was often mentioned as a template of an iterative and agile process in business and service development (EI01, EI02, EI04).

As for participants, finding early adopters is identified as a key activity for the innovation process. The diversity of participants is also argued (EI01). Although the variety of actors is acknowledged, the selection is highly contextual, and it is difficult to identify a normative set of participants for business model innovation in general. Rather, exploring the context supports the identification of main actors to involve in prototyping. Immersion to the customer's context is recommended to gain customer insights for developing viable business models (EI01). “Get out of the building” has become a keyword for business people to have direct interactions with customers to gain insight (see Blank, 2005). The value of ethnographic approach popular in design practice is also recognised (EI01). Variables are always different and understanding the clients’ context is a key activity for developing business models (EI02). Thus, applying one tool for all the cases is avoided or believed to be not sufficient (EI02 – “because they have such different projects and different types of work there's no use like one tool which encompasses them all and they all use in their work”). The interviews suggest that although there are various tools for exploring business models, it is recommended to integrate findings from the tools with insights from the exploration of the market or the exposure of the ideas to the market.

As one of the main objectives of prototyping is the exploration of new opportunities, the importance of openness to new things is suggested (EI02, EI04). Mindset and organisational culture are important factors to support the openness during prototyping. Thus, overconfidence (EI03) and attachment to initial ideas (EI02) are regarded as negative factors to prevent from conducting prototyping and gaining feedback from prototyping. From the interviewees’ point of view, organisational culture is an issue of preventing their clients from learning from the insights through prototyping. In an interview (EI03), the difference between prototyping and piloting is emphasised, and the difference is based on the fidelity of prototypes as well as when it is conducted. It suggests that the difference of fidelity influences the role of prototyping. In the argument, prototyping is conducted with less cost and effort, and possibly multiple prototypes are built at the same time. However, piloting usually uses one pilot as it requires more cost and effort. Thus, piloting could increase risk instead of reducing it if it is built without the verification of the idea. Moreover, it is asserted that prototypes are not necessarily 3D representation but can be sketches if they work for testing ideas (EI03 – “prototyping is not necessarily building something, but it could just be testing an idea. I seek analysis, sketch an idea or storyboarding and testing it as a way of articulating your idea”). From experts’ perspective, how and what to learn is a fundamental issue rather than how they are built. In the learning process, the perceptions of the main actors are important (EI02), and overconfidence could stifle the learning process (EI04). In the literature, it is also pointed out that participants who evaluate the result of prototyping tends to be attached to the initial ideas (Leonardi, 2011), and the same point was mentioned in the interviews (EI02, EI04).

4.2. Case Studies

4.2.1. Overview

The case studies include four cases from various contexts. The case studies were conducted in an explorative orientation, which brought sources of learning for developing a theoretical framework for a new practice that is business model prototyping.

4.2.2. Case Study 01 – Supa Academy (Social Enterprise)

4.2.2.1. Background and mission

Supa Academy is a London-based social enterprise founded in June 2014 by two co-founders. Their mission is "to provoke curiosity, build confidence and develop skills in teenagers and young adults taking their first steps in enterprise" (Dominguez, 2014; Supa Academy, 2016). One of the co-founders formally set up an enterprise education franchise in schools called 'Supa Tuck'. The other was a founding member of SB.TV online entertainment channel, mainly managing the movements of the youth culture.

The co-founders met each other through a Hackathon event, and after they had formed their friendship for a while, they set up the social enterprise together. The trigger was to apply for Bethnal Green Ventures, an accelerator program backed by Cabinet Office and NESTA (see Bethnal Green Ventures, n.d.). They started with an idea of developing a mobile app and a web platform for teaching practical business skills to teenagers. Statistical reports indicated that young people spend 69% of their time on mobiles and tablets. Also, regarding the competition in the market, although there were already some established services in enterprise education, such as Enabling Enterprise and InspireEngine, they did not fully utilise mobile devices for education.

Through observing the market situation and competition, they initially expected three revenue stream for the company: licensing with schools, paid online courses, and advertising and brand partnership.

However, through the interactions with thought leaders and potential customers, the co-founders gradually realised that the touch points of the services should be both online and offline. Based on this finding, they changed their key activity to hack events, providing hundreds of teenagers with opportunities to run their own business in a live working environment.

From 2015, Supa Academy began to be supported by TrueStart, which provides an accelerator program specialised for retail business. They scheduled 'the Supa Academy Hack' (Supa Hack) in July 2015 as their inaugural hack event, and also as the prototype of their business for the further development.

Based on these business models, they conducted their inaugural event, the Supa Academy Hack. The event consisted of a one-day training session and a two-day pop-up market to provide an immersive enterprise experiences for the 18-24-year-olds in tandem with various corporate partners. The three-day event saw hundreds of young people attending talks and workshops around retail and enterprise before building a series of market stalls - selling both established and independent products, an auction room, bar, food stalls, live music entertainment and an e-commerce platform - all facilitated by under the 24-year-olds. The event saw 5,000 members of the wider public attend across the two days and gained over 20,000 unique watchers over a live stream channel and even more impressively, gained an additional 20,000,000 reach, visibility and engagement on a variety of social media channels, printed and online news and media publications and a campaign on tube escalators (130+ stations London-wide) and London buses.

This case study investigates the prototyping process of their business.

4.2.2.1.1. The potential further directions

Supa Academy needs to find new partners and potential clients to verify the idea. A project with one of the key clients was planned to be a prototype of this scheme. They had a Human Resources partnership to provide talented young people in their community to the recruiting process of those companies. They also found 20 business leads for the service through the further conversations with their potential corporate partners within their network.

Through the first event, the founders understood what they need to do to run an event at the same scale. The integration of the recruitment business model into the rest of the company proposition is still uncertain, and they need to have a plan for how they iteratively develop the detail of their new business model.

4.2.2.1.2. The learning point from the prototyping

As for the financial aspect, CSR model was extensively successful. On the other hand, it was identified that Training Model and Partner Model needed to be reconfigured as business models in the future plan. However, as those business models are interconnected, the findings did not conclude dropping some of them.

One of the key findings to lead Supa Academy to a new direction was that there could be a business opportunity to help corporations find talented people with marketable digital skills. They discovered that a major corporate partner was struggling with finding people who are highly skilled for digital tasks for their technology department. Supa Academy observed that their corporate partners met the participants outside the event for interviewing, and identified the potential opportunity. Desk research convinced them further as they found it reported there would be the shortage of 745,000 people highly skilled for digital tasks in 2017.

4.2.2.1.2.1. The potential business models

A future business model could be an integration of the current business models with a recruitment service for corporations who need talented people and young people who need a job opportunity. One of the key aspects of their business models is whether they can be organically integrated rather than work separately, as the lack of resources is an obvious issue for them as a startup, and the efficacy of running multiple business models is a critical factor for developing their business.

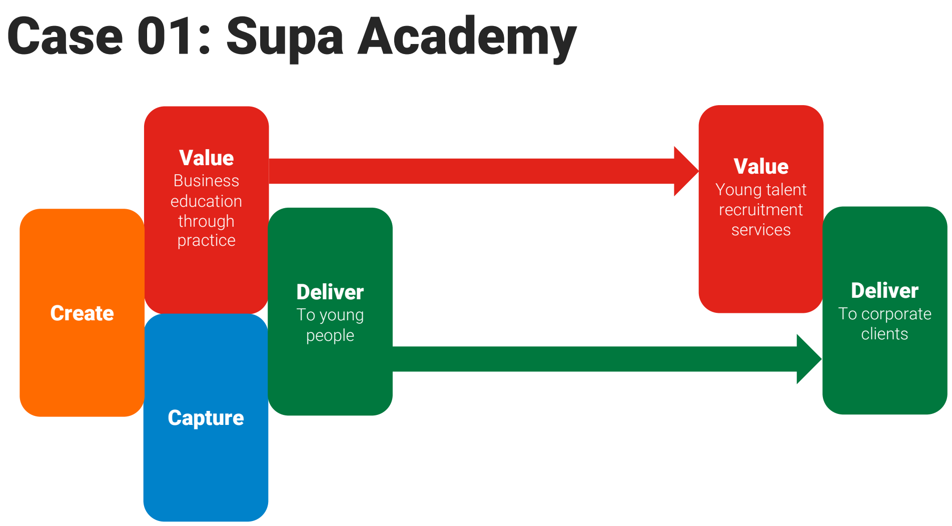

Figure 4-1: The findings through prototyping - Case 01

4.2.2.2. Findings

Initially, the objective of the prototyping was rather clear to be an evaluation of their business model, as they had a clear picture of their business model, which was based on events providing live experiences. There were some smaller-sized pre-events for the Supa Academy Hack, and they were partly regarded as prototypes to evaluate the feasibility of the main event. In hindsight, however, the main event, Supa Academy Hack, can be seen as a 'pilot' because the event was fully featured, but interestingly it worked as an explorative activity to identify possible opportunities for new business models. On the other hand, the smaller events in the early phases worked as improving the quality of the main event rather than identifying a possible radical change. Thus, it was difficult to divide exploration with other activities clearly. Rather, the opportunities for gaining new ideas seem to be all over the process.

Regarding the position of prototyping, small events for evaluating the feasibility was located in an early stage of the process. The main event as a pilot was at the end of the process. However, when the process of finding new business models is seen as an unstoppable process, the Supa Hack was an inaugural event, and it was still in the early stage of a long journey of the social enterprise itself. Thus, it is hard to articulate where the prototyping was located, but rather the learning opportunities for new business models were spread into the entire process of business development. When considering preliminary events as prototypes and the main event as a pilot, the process moved from low fidelity to high fidelity during the process. For evaluating the event, they set various metrics and plan to have multiple data sources:

- The financial result
- The number of the participants
- Reach on social media (by a social media analytics platform)
- Interviews with the participants

These metrics are useful to see the impact of the event, but it seemed to be difficult to interpret the data to be insightful findings unless there are already clear hypotheses before prototyping. Also, because the measurement of the impact is connected with promotional activities of the business, the interpretation of the data can be easily biased. Rather, one of the key insights from the event was identified with the interactions with the corporate clients and observations of how the participants and corporate clients behave. The insight led Supa Academy to develop a recruitment service to conect the corporate clients with young people, which is described in a later section. This suggests that describing prototyping as merely an iterative process is problematic. It might not be able to be observed that the iterative process led a major change of the direction. It is simply because the main event was already scheduled before those events, and the mindset of the company was already set towards the success of the main event. However, it could also be assumed that knowledge and experience were accumulated to end up directing the organisation to a new direction when the mindset are properly aligned to change. As the Lean Startup methodology introduces the concept of 'pivot' to describe the moment of a major change of direction in the iterative tests of business ideas (Eisenmann, 2011; Ries, 2011), it can be assumed that the iteration in the prototyping process also does not evenly happened. The moment of the alignment of the mindset rather happened after the main event. The theory of 'windows of opportunity' (Tyre & Orlikowski, 1994) suggests that the window of opportunity to change gets narrowed during the implementation process and an adaptation period could follow. In this case, the learning points through the implementation were acknowledged as a source of identifying possible new business models. 'Emergence' may be a potential analogical concept for the phenomenon, but the further investigation between the concept of prototyping and emergence will be needed.

Supa Academy identified the opportunity of the recruitment service model through interactions with and observations of their key clients. As the co-founders seem to have 'discovered' the opportunity rather than generated it, their approach may fit better with the concept of 'serendipity' in entrepreneurship (Dew, 2009; Austin et al., 2012) than formally synthesising findings. Interestingly, also in the context of design, it is reported that experienced designers behave more intuitively in the synthesis process (Gumienny et al., 2015), although it is recognised that the understanding various perspectives is important in the process of design synthesis (Kolko, 2009a). In some arguments, collaboration for synthesising is limited in an internal design team, and a more structured approach is recommended (Kolko, 2010). However, when involving the customers for gaining feedback, it is concerned that the formality could reduce the quality of the feedback in the context of entrepreneurship (Fitzpatrick, 2013). Also, it is believed that the involvement of decision makers in the process of getting feedback is preferable to delegating the tasks to others as the report to the decision makers can be easily biased to be positive (Maurya, 2012). In business model prototyping, the serendipitous aspect seems to be unavoidable in the synthesis of the learning points, as it requires rich feedback from customers and clients. Synthesis and serendipity are both related to sense making, and the formality of the process can influence the quality of the sense making. Theorising the relationship between the two concepts can reveal how the formality should be managed to gain the best result. This will be an opportunity for the further research.

The co-founders were main decision makers, but mentors were also influential regarding Supa Academy's strategic decision, especially as some of them were also investors. The co-founders also regularly shared their directions with external experts in a good relationship in the industry and the start-up community to gain feedback and inspiration for finding new opportunities. The organisation was still small and sharing the business ideas with those experts complemented a lack of diversity in internal resources. The young people participating in the event were the main target of business as a social enterprise, but in the situation at the time, the revenue stream from the participants was still relatively small. Therefore, the influence of their voices seemed to be smaller than the corporate clients. This can be rationalised as it is because Supa Academy was still in the initial phase of operation and they need to secure the fundamental level of revenue to survive rather than exploring new opportunities. However, the process of securing the investment from corporate partners also worked as an opportunity of exploring the market situation and gaining insight.

Through the interaction with young people through the hack, it was identified that they were keen on getting opportunities through experience and there was a gap between what they want and what the current education system provides. As Supa Academy was still small, the co-founders had plenty of opportunities to interact directly with their main customers, and it encouraged them to drive their business, and profoundly understand customer needs.

This prototyping effectively used actual business situation through small events and the implementation of the main events. The approach helped them to gain rich feedbacks from their clients and partners. There were three business models in one prototype, and it seemed that the profitability of the models influenced the further decision for the future business models. In the prototype, the most successful model in finance was CSR Model, and eventually, the voices of corporate partners led the company to a new direction. Another possible account of this situation could be explained by their strength. As the capability of the co-founders to develop firm connections with big brands is presumably their advantage, they could understand the potential demand of corporations more easily.

One of the key factors of change is their vision. Their main goal is to develop a comprehensive platform for teaching young people business skills, and the business models are a means to build a financially sustainable business. Although starting from a mobile app, Supa Academy realised that it could be harder for them to achieve the mission by developing an app. Rather, they gradually realised that the app is a mean to achieve their goal and not the core of the business. In other words, as they have a bigger vision than just making an app, they were able to change direction to another potential business activity. Also, while the inaugural event was successful, one of the key factors driving the further development of their business model is the fact that there is still a gap with their vision. CSR model could be sustainable, and a potential opportunity was behind it. More comprehensive supports for young people are their goal as a social enterprise, and from this point of view their business does not fully exploit the market opportunity.

As a full-featured event was organised, it enabled the participants to feel the whole experience of the event. This can be perceived as a prototype with very high fidelity. As some scholars and practitioners claim, the extensively high fidelity of the prototype could cause a positive bias about the quality of the event. On the other hand, exposing the actual service to the real customers and partners also helped the company to observe how customers and partners actually behave with their service.

As mentioned, the hack events became Supa Academy's main activity, and the major value proposition was to teach young people business skills through immersive experiences in a live work environment. At the narrative level (Magretta, 2002), this has been the core of their business models. At the level of archetypes and graphical frameworks, their business can be modelled as three ways. In a simple framework, there are three key actors in their business: the company itself (Supa Academy), young people and corporate partners. One of the business models casts young people as customers. In the model, the young people are trainees in their service, and they pay the registration fee for the service. Another model is for young people as partners. In this model, customers are public people to visit their pop-up events, and they pay for the products and services sold and served in the events. In the third model, the customers are their corporate partners, and Supa Academy provides them with opportunities for corporate social responsibility (CSR) activities and PR through the events supporting young people in the community.

The following sections labelled the models Training Model, Partner Model and CSR Model respectively. At the lower level of abstraction of business, the business models were interconnected, and it is difficult to separate. For instance, Training Model is supposed to improve the skills obtained by young people, and the improvement will influence the performance of Partner Model.

Their prototype, the Supa Academy Hack, can be regarded as an 'integration' prototype in the categories of Houde and Hill (1997), as it represents a whole business model as an event. Nevertheless, this does not mean it covers the whole of the business, as it only represents part of the business when you see the bigger picture of the business. Therefore, when the hack event is seen as a comprehensive business model, the prototype seems to embrace the complexity of the business model. In contrast, when seen as part of the bigger picture of their business, it appears a simplified version of their business. The prototype is not as minimal as the Lean Startup methodology asserts (Ries, 2011), but it is doubtful whether they could gain the same quality of feedback from a more minimal prototype due to the complexity of what they are doing. Obviously, there was a risk that the event could end up a complete failure for the business, and it may be difficult to generalise every case of new business, as the co-founders already had the entrepreneurial experience before this particular social enterprise. However, this suggests that managing the degree of simplicity/complexity suitable for different situations can be a theme of further research, rather than simply saying prototypes should be minimal in a Lean way.

4.2.3. Case Study 02 – Central Saint Martins (University)

4.2.3.1. Background and mission[72]

Central Saint Martins (CSM) is one of the leading art and design colleges in London, which was founded in 1854. Despite the long history of art and design education, since the early 2000s, the college explored the possibility of exercising the underutilised capability of art and design for managing innovation. In 2012, CSM moved their main campus from Holborn to King's Cross. The new venue had a potential opportunity for a space hiring service. One of the challenges of this case was to integrate collaborative projects involving students with venue hiring, as partly because the involvement of educational activities is a requirement of the financial return scheme from Higher Education Funding Council for England (HEFCE). Thus, integrating education aspects with the venue hiring service was an important factor in this business model development. Also, adding a creative essence was supposed to increase the value created by the venue hire service for the clients as well as their students.

Regarding their standard business model as an educational institution, the key value proposition of CSM is to provide education of art and design for students. To give students opportunities of working with various industries, CSM had provided not only conventional education based on lectures and tutorials, but also live collaborative projects with external firms. The venue hire service could have been a mere space hiring service, which is called 'cold' or 'dry' hire, as the new venue seemed to be attractive enough to gather potential clients. However, one of the concerns for the business was

[72] Here is the background of participants for the research. This case study resulted mainly from three interviews with the senior director, the project manager and the creative director. The senior director was in charge of developing business for CSM in the area of innovation.

that the value mainly relied on the novelty of the venue, and additional values were needed to sustainably create values. One of the challenges for this case was to combine these business models to be an integrated business model to provide an incremental value for their clients and educational value for students. Thorough iteratively upselling projects, the business changed from a mere venue hire service to be a more integrated event service with contents. One of the interviewees, however, still concerned that the novelty of the space was attractive only for a short term, and the business model should evolve to be workable without relying on the novelty of the space.

4.2.3.2. Findings

The overall objective was to find and develop a viable business model for the new venue. Instead of using an extensive time for exploration, however, the project team effectively used the opportunities of persuading clients for gaining feedback. Their upselling process was effective for validating ideas as a business deal, and the outcome of the projects expanded the customer values provided by their project. When a client accepted a new project, the activity moved to implement the project, and the implementation process worked as a learning opportunity of the feasibility of the new offerings. This approach was enabled by their robust client base from past projects and the brand value of the university. However, even with the stable business foundation, it was difficult to propose a radical project from the early stage, and it took time to build a relationship with clients as well as internal actors through running projects. The process established the foundation for event production and student collaboration service as one of the revenue streams for the college (University of the Arts London, 2014).

As their business model development included various projects, it took a long time to develop their project from space hiring to collaborative projects. It is also still an ongoing development, and it is an open-ended process unless the business or section itself is shut down. They used the persuasion process as part of a learning process, and the implementation process was also a key activity of understanding the viability of business models. Although the process of convincing clients worked as a learning process, the implementation process allowed the team members to learn and identify further opportunities in more concrete ways. In this process, it looks like persuasion is at the front end of the process, and it is followed by the development of the capability of running business model. This cannot fit with the typical normative process model of design (e.g., Liedtka, 2015), and it is difficult to identify where the prototyping part was located in the process of business model development. As exposing their ideas to their clients in an early stage, the process rather fits with the process of minimum viable product.

One of the interesting points of this case is that a fire happened in the very early stage of the space hiring service on the site. Although it could be regarded as a failure, the experience also became an opportunity for learning how to manage the operational issues. One of the interviewees emphasised how this accidental learning opportunity was beneficial for further development of the projects. Obviously, there could have been a risk damaging a commercial image of the site, but fortunately, as there was another fire in London on the same date, the risk was mitigated enough not to prevent from gaining following business deals after the fire.

The prototyping process gradually revealed the feasibility of more complex projects from a simple space hire to a space-based content (exhibition) to a time-based content (performance) through an iterative process with multiple projects. Also, the level of involvement of other actors such as clients became higher in the later projects, involving various actors such as clients and students. Moreover, in an early co-creation projects, the project brief was given from the clients, as the co-creation of the project concept from an early stage was supposed to increase the complexity of project management and required a high degree of mutual trust. However, a late co-creation project achieved the co-creation from an early stage of the project, as the degree of the mutual trust between the project team and clients were increased and the knowledge of managing collaborative projects were also improved through the iterative process.

Although the project members did not have formal sessions of synthesising learning outcomes, frequent informal communication among project members played an important role of synthesising learning outcomes from previous projects. It developed a new offer for next projects. Also, as offering new projects to potential clients worked as prototyping, the process of gaining resources was also verifying business ideas. In other words, when the prototypes can gain resources, the feasibility of the business is seemingly higher. As the prototyping process took advantage of recurring opportunities for upselling, there were not many constraints of offering the deal to customers. Rather, although the projects were confirmed as a business deal, implementation of the projects was complex and uncertain until each project finished.

Additionally, it was recognised by an interviewee that post event PR materials were useful for gaining feedback from potential customers. This point was connected to the fact that the proposals of projects to potential customers work as a learning opportunity for evaluating the feasibility of the business ideas.

One of the projects they conducted was a replication of the same scheme for the same clients. It was supposed to be easier to deliver, but it turned to be a less effective as the team members became overconfident about their mutual understanding of each other. This caused less effective communication among the team members. In the argument of design thinking, iteration was supposed to reduce the complexity of problems (International Organization for Standardization, 2010). On the contrary, however, the theory of wicked problems asserts that it is impossible to solve the problems through trials and errors as the complexity turns the problems to be always new, and the result of a trial can influence the next trial (Rittel & Webber, 1973). This finding suggests that, at least in the case of developing a business, the validation of business models is not easily confirmed just because the business model worked before, as the context surrounding the business model might be changed already.

Case 02 can be seen an extension of business models, but it still required several iterations to figure out a viable coordination of business components. The real business is not simply a model but including many actors in it. Thus, introducing new actors in a business needed the designer to build trust among them and could require further resources to be viable. For the business model development, the internal project members played important roles as they mainly handled the direction of the projects. Also, clients, students and academics were considered as important actors in developing their business models. As the organisation primarily devoted themselves to education, there were additional key actors such as students and academics, compared to a business model only for profit. Students can be regarded as customers as they usually pay tuition fees for education. However, for the space hire service, the main source of the revenue was corporate clients. Thus, students can be seen external actors for the business model. Furthermore, as the implementation of the projects were important, staff in charge of operation such as production were also key actors in the process.

As the prototyping was based on the process offering new projects and upselling, it is important to find clients who pay for the new proposal. The project members utilised the feedback from clients by offering projects to learn. In this regard, the prototype was developed as an actual offer to customers. Why it was possible is that

CSM already had resources to provide the services and had an established client base from existing businesses. One of the interviewees emphasised that clients also need to be imaginative to accept unprecedented projects. This requires that not only the project team but also the clients needed to have a positive attitude for new trials. Finding potential clients and costumers is a difficult task, but thanks to the existing customer base of the university, the project team was able to manage to find clients who were willing to try new projects. As a result, CSM used the opportunities to test the feasibility of new business models in actual business deals.

It was claimed by an interviewee that the college had a tendency to take risks for new things, and it was helpful to explore new business models. Moreover, the mindset of project members also influenced the quality of the project. Although tentatively there was another project manager, the manager's mindset did not fit with the role of exploring opportunities. As mentioned above, the mindset of clients can also influence the process of prototyping.

Key learning activities, in this case, were mainly two types. One was proposals of new projects to potential clients. The other was the implementation process of the projects. The former was not detailed compared to the project itself, but it was developed enough to convince clients to take a project. The latter can be seen a fully developed business. Thus, in this case, the fidelity of prototypes was mixed following the objectives. In the normative model of design, the process moves from exploration to persuasion, but in this case, the order was the other way around. However, the fidelity of prototypes or ideas moved from low to high. Different from products, collaborative projects are difficult to produce before it is sold. Thus, in a sense, the order needs to be naturally changed. Also, the implementation process of each project worked as a prototype for learning the feasibility of the business model as well as establishing a foundation for developing next projects. Each prototype was an attempt of offering new projects or upselling, which generated a gradually increased complexity for the implementation from a project to a project. Therefore, the implementation process itself was an important element for understanding the complexity of each project.

This case utilised sales activities for gaining feedback from actual clients, and also the process of implementing projects was a key source of understanding the viability of the projects and developing the capability of managing projects. Thus, the scope can be seen as wide and holistic. On the other hand, how to capture the value or how to sell was not much questionable as it was based on commissions for a project from clients. Thus, the representation of prototypes mainly focused on projects themselves rather than the background of the projects.

Initially, there was no evidence of collaborative projects in the venue, and the business ideas were represented in a verbal form. It was difficult for clients to understand the value of the service, and it required clients to be imaginative as well as the project team. After running some projects, visual materials such as images and videos were produced, and they were used as promotional materials for gaining further opportunities. The materials did not represent the entire business model, but it was helpful for gaining feedback from potential clients.

Case 02: Central Saint Martins

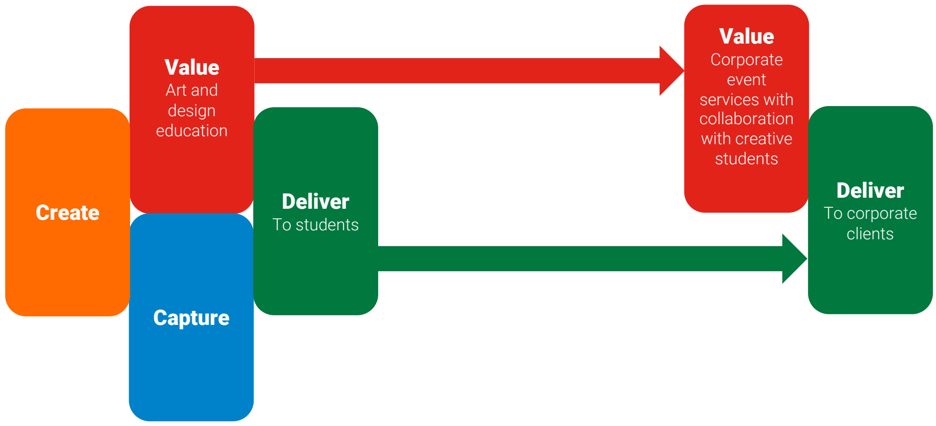

Figure 4-2: The change through prototyping - Case 02

4.2.3.3. Summary

This case study described how the venue hiring service was developed through various projects. Although they did not intentionally conduct business model prototyping, the iterative learning process for business development demonstrates potential patterns for understanding the process of business model prototyping. Different from small firms and startups, the organisation had a robust customer base. The existing customer base was successfully exploited for consecutively running incrementally modified projects. However, even it was an incremental modification or even running the same type of events, there were a certain amount of uncertainty during the process. The organisational culture was acknowledged as an important aspect of managing the process, and frequent informal interactions among the small project team worked for absorbing and digesting learning outcomes from projects.

4.2.4. Case Study 03 – Justice Lab (A Governmental Organisation)

4.2.4.1. Background and mission

Ministry of Justice Digital and Technology (MOJ Digital and Technology) was set up to improve the experience when people access and use justice services. They conducted a project, 'The Digital Capability' for defining and implementing digital capability in Ministry of Justice. In this context, "digital capability" does not only mean information technology (IT) skills for how to use computers and software but also the capability of utilising digital resources online. They claim "'Digital' is an umbrella term. It's about having an **innovative mindset** and a **fast-paced, user-focused style of working**" (bold in original) (Ministry of Justice, 2014). The concept follows five principles (Ministry of Justice, 2014):

1. Put user needs ahead of process
2. Start small, and improve from there
3. Make the most of digital tools
4. Manage risk, don't be blocked by it
5. Feel empowered to innovate

For implementing the capability, the project included various activities such as workshops, lectures and the daily-based implementation of the process.

As part of this initiative, The Justice Lab was founded as an internal project team in Ministry of Justice. The main objective was to revise the policy making process and introduce an agile approach for accelerating the process. This case does not directly handle business model development. However, implementation of the agile process, in this case, shows similar patterns to the process of business model development through prototyping. Thus, this case is included as a source of inspiration for further understanding of prototyping for business model innovation.

Notably, UK government is acknowledged as a governmental organisation successfully implementing a design thinking approach (Gruber et al., 2015).

4.2.4.2. Findings

The main purpose of this research was exploration and implementation of the agile process in policy making. The policy making process usually follows linear processes called "Policy Wheel", and it takes 2-4 years to change. Thus, one of the objectives of this project was to implement a more dynamic approach based on agile development and design thinking (Takwale, 2015). Another challenge was the improvement of the process of Family Law, as the usability of the service was low and the service users needed to hustle when they used the service. Also, the cost structure was unclear so that optimising the running cost for the service was another objective. To tackle these problems, one of the key activities was to visualise the complex relationship among actors and the process of the service. Thus, visualisation tools were often used for making a complex situation understandable. In the project with the family law team, the team members had numerous interviews with actors to visualise the complex process of using the legal services. This visualised material was used as a communication tool to gain feedback from actors as well as a source of inspiration for further development of ideas and prototypes. In this regard, the map was used for exploring and understanding the context of the service.

As this project was planned for a six-week project, the process was well structured. Although prototyping was at the final stage, a mapping tool was used for understanding the context surrounding the service. The map was a useful tool to gain feedback and learn from the actors. From business model prototyping’s point of view, the initial stage can also be seen as part of prototyping. Thus, prototyping can be identified in various phases of the design process.

The project aimed at improving process called ‘civil processes’ relevant to divorces and marriages. One of the problems in the process was that the current situation was not clearly understood. The project team used an iterative process based on a format moving through four steps: discovery, alpha, beta and live (see Waterworth, 2014). In this case, the project was planned as a six-week project and took steps of context, discovery, design and prototyping. Thus, the project team started from mapping out the service process through the interaction with the actors of the service. As the service involved various actors from service users to legal staff, the project members had numerous interviews with each actor. Also, the project members conducted various review workshops with the actors to confirm the findings from the interviews. Based on the learning points from the interviews and workshops, the map was iteratively revised to depict more detail of the context.

During the process, the policy-making team identified that some of their assumptions were unproven. For instance, the team initially expected that what service users needed was a comprehensive on-line system to respond to various requirements to improve the usability of the service. However, soon after they started to have conversations with the key actors, they realised that it was not necessarily a full-featured online system to simplify the service. Through the iterative process, they realised the gap between what they think to do and what the users actually needs.

In this project, various qualitative research was conducted, and the learning points were reflected in the visualisation of the context, such as scenario planning and persona methods. Also, after the process of deeply understanding the context of the service, the project team developed prototypes of their possible new services. For the evaluation of the prototypes, the approach was divided depending on the characteristics of the service. For instance, for the prototype of on-line forms for testing were actually built up. However, some of the ideas were represented by storyboards and role playing, and the results were rather difficult to evaluate by KPI. Instead of analysing measurable metrics, the learning points and inspirations are used for further development of other prototypes or revised prototypes.

A contextual issue for this project was a diversity of the actors. The service involved not only users of the services but also from judges to lawyers to social workers to the tech department. Especially, judges were most influenced by the change of the service process. Therefore, their involvement was inevitable. Also, Legal Aid Agency (LAA) was the key department involved in this project. The diversity of the actors influenced the process of this project, as the process needed to be heavily iterative to involve various actors and understand the highly complex context.

The visualised map of the context is a virtual representation of the complexity. However, the information sources underpinning the map was mainly from actual actors. Thus, the validity of the map was considered as high. Regarding the prototypes of the potential services, some ideas such as an online form were relatively easy to represent in a situation close to reality. However, some ideas were difficult to set in a real situation and needed to use indirect methods such as role playing and storyboarding. Additionally, it also had various external constraints such as budgets, time and politics. Especially, political contexts are influential in this case as the key actors were in governmental organisations.

As the approach was new for the organisation, the project members did not only implement the process but also gave training sessions to have a mindset suitable for the approach. One of the problems of this project was that as the project was evolved, it gradually revealed that the implementation of the agile process required internal staff fully committing the deployment of agility. However, it was difficult to identify a right person for that position. This suggests that implementing an agile approach is a cultural issue and required a firm commitment to cultivating the culture of using agile processes.

In this case, there were two levels of prototypes. One is a map representing the complexity of the context surrounding the service. The other is the representations of new service ideas. The former was represented on a two-dimensional map, and the latter was various forms.

One of the important prototypes in the project was a visualised map of the process and actors. For managing the complexity, the visualised map was used for representing the complex context. The development of the map included numerous interviews with each actor and review sessions with the interviewees. The visualisation map was gradually developed, and it supported the participants to get engaged. The key point is that the visualised map of service absorbed the complexity of the service and the simplicity encouraged the participants to interact.

Also, they developed various prototypes for different elements of the process. Some ideas were able to be represented as an on-line form, and prototypes were actual on-line forms. In another part such as the meeting point between judges and the service users, it was contextual and difficult to represent in as actual form. As an alternative approach, they used illustration to make the process tangible to gain feedback. The map helped the participants to realise challenges they face in the process and also successful points in the process. Policy making processes tend to rely on documents, and it caused difficulty in communication among various actors. To avoid this problem, a key characteristic of this project was to use visualisation rather than focusing on documentation.

Based on the research with the actors, the project team visualised a possible pathway to access the private family law service. To gain further feedback, they pick up key touch points of the service and developed prototypes specific for the touch points.

They made various prototypes:

1. Smart Answer
2. A universal self-diagnosis tool (Online Guide)
3. Online Questionnaire
4. D.I.Y tools for separated parents (parenting tools)
5. Internal information sharing

The prototypes were used for getting feedback from the actors.

The visualised map is not functionally interactive, but it was a useful tool for the participants to engage with the project team to give their ideas and feedback. In this sense, the prototype was highly interactive. For the prototypes of new service ideas, the prototyped online form was technically interactive and was helpful to gain highly trustworthy feedback as it was similar to the actual outcome. Overall, technical interactivity, in this case, is not significant. Rather, non-interactive representations were also helpful for improving the engagement of the participants and target audience.

Case 03: Ministry of Justice

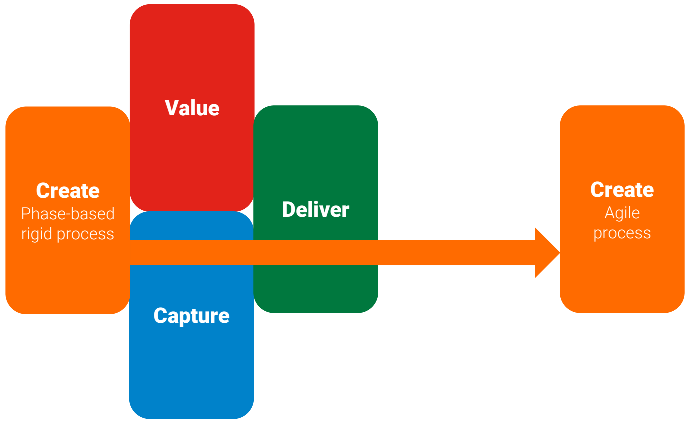

Figure 4-3: The change through prototyping - Case 03

4.2.4.3. Summary

Although this case did not directly deal with business models, visualisation was used for managing the complexity of the context based on numerous interviews with various actors. The visualisation in the map helped the project team to manage the complexity of the context surrounding the legal service. It also enabled the participants of the process to engage to give feedback. Interestingly, the map was also used to absorb the learning outcomes from the iterative interactions with the actors by revising the map.

One of the issues was how to evaluate the learning outcomes of the iterative process. The project team responded to the rich learning outcomes from the process by using the feedback as the source of making renewed representation of complex contexts surrounding the policy, rather than directly producing conclusions.

In this case, the prototypes can be categorised into two types. One is a map capturing the complexity of the context. The project used their own format, but this approach is similar to other mapping tools such as business model canvas for business model development, and service blueprint and customer journey for service design. The map was a useful tool for achieving to capture the complexity of the service in a simple but inclusive way.

Finally, implementing an agile process required an organisational change, and a deep commitment to turn the change to be sustainable. Although the project involved a project team and external partners, the importance of an internal leader was gradually revealed.

4.2.5. Case Study 04 – Pinnacle Trading Service (Private Company)

4.2.5.1. Background and mission

Pinnacle Trading Services Ltd (PTS), founded in 2005, is a trading company mainly specialising in supporting foreign companies to enter the UK market. The director has a diverse business experience both in Poland and the UK. Therefore, their service is diverse from supports for distribution to the consultations on marketing. Especially, the company has an advantage of dealing with international business and aims at developing the capability to be more multinational. Not only geographical diversity but also industries the director has worked in span a wide range from the housing industry to the car industry.

PTS have a partnership with a sock manufacturer in Poland, which has an over forty-year history and extensive capability of producing socks. The UK market was an unfamiliar market for the manufacturer, and PTS was the exclusive distributor for the brand in the UK. Thus, finding viable business models for the manufacturer in the UK market was a key business mission for PTS.

Although the fundamental target market was the UK, PTS also considered scaling the business globally in the long term, and reinventing the whole brand for internationalising the business is another target for the future. As marketing activities, PTS attended a trade show of products for children in the UK, and also set up a showroom for the manufacturer's products. However, to identify further opportunities for socks, PTS used design approaches with design research consultancy, Studio INTO. INTO conducted an intense visual market research and facilitated an idea generation session. Based on the findings from the research and the session, INTO proposed several business model ideas and PTS selected an idea to explore further. The following sections analysed the case with each dimension of prototyping.

4.2.5.2. Findings

In this case, the overall purpose of prototyping was to find viable business models for the sock manufacturer in the UK. Exploration of possible business models was done through the market and customer research by INTO. After the market and customer research, the design agency organised a workshop participated in the employees of PTS and INTO to synthesise the findings from the research. INTO developed a document presenting three possible directions of the business models to allow PTS to evaluate which direction would be potentially most successful. Thus, in this process, the main purpose of prototyping was evaluation. Once the founder gained confident about a business model, he arranged a meeting with the supplier (the manufacturer of socks). As the founder of the company had a good relationship with the supplier, it was not difficult for the company to gain feedback from suggesting a further plan for the future. When activities of learning from feedback are regarded as prototyping, the process of this prototyping can be seen as for persuading the manufacturer.

The initial business model was a distribution model to the consumer market as the manufacturer had their own brand and various product lines successful in Poland, and using the asset was a less problematic approach. PTS started from joining a tradeshow and setting up a showroom for the products in the UK. Soon after PTS engaged with the UK market through the activities, however, they realised mismatch between the market demand and the fashion design of the products. The realisation urged them to explore new business models different from the current model for the manufacturer in the UK. As a key research partner, PTS involved INTO at this point. INTO conducted a broad visual and brand research on the sock industry in the UK, which was followed by a workshop with internal staff and experts to generate ideas for possible directions for the sock manufacturer. To evaluate possible business models generated by the visual customer research, INTO summarised the output from the idea generation workshop and identified three opportunities for PTS and the sock manufacturer. In the review meeting, PTS showed their interest in a business model of working as an agent for clients that need to have a small-batch production as the sock supplier had a capability of flexibly producing socks with diverse colours and designs. Although the members of PTS had various experiences of setting up new businesses, the fashion industry, especially in the UK, was still new for PTS. Thus, their attention was paid to the formation of alliances with key partners such as market experts and fashion designers, as expertise in the fashion market was acknowledged as a lacked skill for supporting the sock manufacturer. Especially, the director was well-experienced in establishing partnerships, and the advantage influenced the focus of their business activities. Through design research by the partnership with INTO, potential business models were identified. However, the proposed business models were still abstract and needed to be verified. For instance, one of the identified value proposition was a flexible production allowing customers to produce a small amount, as the manufacturer can handle a relatively small amount of production. However, the interviews with small fashion labels revealed that the ideal amount of minimum orders is smaller than the standard of the manufacturer. Thus, there is a gap between the identification of business models and the confirmation of the feasibility of the business model.

The internal staff in PTS mainly managed the process. As the director was an experienced serial entrepreneur, he played an important role in decision making in the prototyping process. Also, the other manager had a connection with the fashion industry and influenced the learning sources for prototyping. INTO supported the process for the preliminary visual research and organising a workshop and sessions. Also, Syntex, the sock manufacturer, was a key partner and their decisions influenced the direction of the business in the UK. Therefore, the director took care of the communication with the partner and also used the opportunity to measure the viability of the business direction, while he was determined to pursue the opportunity even if the response would not be much positive.

In this case, the supplier of the socks had their own brand, and their business model based on the brand was successful in Poland, but the replication of the business model did not work in the UK. For instance, PTS joined a tradeshow in the UK with the product lines in Poland, and the reception from the buyers was not all negative but not as positive as in Poland. The feedback was gained from actual potential buyers. In this sense, the environment was close to the real setting, and it made the company turn to an exploration of alternative business models. As another approach to identifying potential business opportunities in the UK, a visual trend research and an idea generation workshop were conducted, and three potential business models were developed in diagrammatic maps. The map was developed by the internal members among PTS and

INTO, and the diagrammatic maps were simplified representations of their business model. Thus, the environment can be seen as virtually set up, and the simplicity allowed the project members to quickly explore three types of potential business models. The business model was still identified as a diagrammatic map based on the business model canvas format, and further exploration was needed to confirm the viability of the business model. Eventually, PTS was convinced with one of the business models to confirm the viability. As the director had confidence and skill sets to establish partnerships with various partners through his business background, he intended to use the activities of creating the partnership as an opportunity to explore further and understand the viability of the business model.

PTS consists of a few members with their speciality and expertise. Therefore, the influence of each member's mindset was relatively significant. In an interview with business model canvas, the researcher discussed the director of PTS about further steps to develop the business model. The director had a plan to talk with the suppliers and develop the partnership among various actors behind their services before contacting potential customers. The director considered that he could gain further information and knowledge through activities to formulate partnerships with supplier rather than continuing customer research. This action-oriented attitude resonates with the concept of 'effectuation' in entrepreneurship. The attitude influenced the direction of PTS for developing business models (Sarasvathy, 2008).

As the director was a seasoned serial entrepreneur, he showed the tendency of 'effectuation' (Sarasvathy, 2008). During the process, the researcher suggested that researching on the connection between value propositions and customer demands should be done before starting to make partnerships with key external partners. However, the director also suggested that after making the alliances with key partners, they would understand better the market condition. In other words, the process of making alliances works as a learning opportunity for developing the business model. Based on the theory of effectuation, the attitude of learning through doing is a key trait for entrepreneurship. On the other hand, the importance of customer research before implementing businesses are also asserted. Therefore, the decision of whether moving on the business model development or verifying the feasibility of the business model cannot be simply made with a single principle. There seems to be a dilemma in the decision-making process.

The representation of business models was used for the internal communication for exploring possible business models and also negotiations with key partners including the sock manufacturer.

The prototypes were developed mainly as narratives and business model canvas. Thus, the fidelity was relatively low as a representation, but the simplicity was suitable for quickly gaining feedback and responding to the learning outcomes. The director had a good relationship with the sock manufacturer as a key partner, and the director recognised that gaining a further support from the partner was an important milestone for the development of the business. Thus, he did not heavily rely on the quality of prototypes for the engagement with the partner, but rather agility of gaining the feedback from the partner was an important issue in the process.

In this case, an overview of the agent business model was quickly captured through an archetype and a business model diagram without articulating details of each component of the business model. In this sense, the scope was not deep but wide. The activities of articulating business components were used as opportunities to evaluate the viability of the business model.

In this case, business models were represented mostly in two levels. One way was archetypes such as 'agent' business and 'brand' business. Using archetypes as a tool for representing a business model is also acknowledged in literature as it is effective to quickly share the outline of a business model (Massa & Tucci, 2013; e.g., Johnson et al., 2008). Another way was a mapping of business components based on business model canvas. The researcher had an opportunity to have a conversation with the company with a business model canvas showing their potential business model. The conversation revealed that which part of the business model needed to be articulated, and it guided the following action. The director clearly understood the importance of partnerships with key actors in the industry.

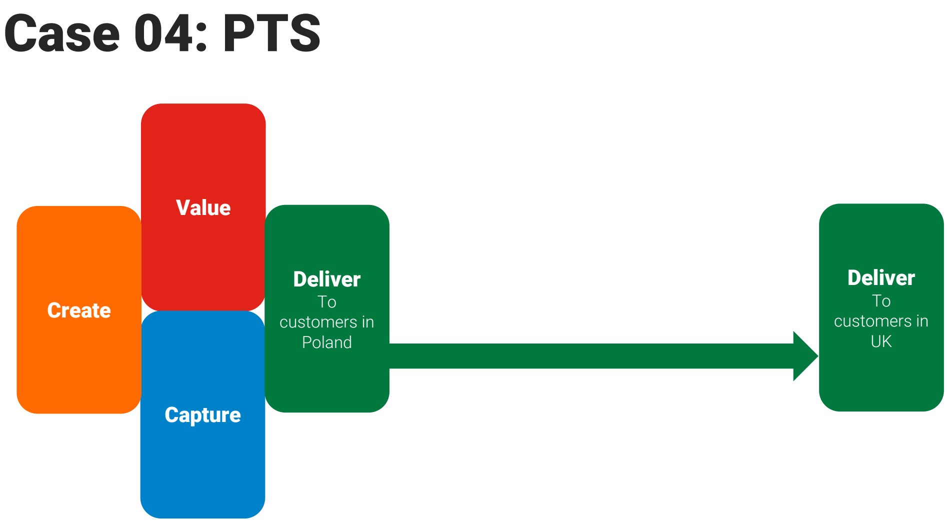

Figure 4-4: The findings through prototyping - Case 04

4.2.5.3. Summary

The interviews included the senior manager, the project manager and the creative director to clarify how they manage the iterative process of developing business models. This case study showed how PTS explored possible business models for a business based on the partnership with a sock manufacturer in Poland. Although PTS started with a traditional distribution model, they identified other opportunities from a creative workshop. They focused on a model from variously identified models and moved to the negotiation with potential partners to formulate a partnership for value creations. The process also worked as a process of evaluating the business ideas. The director was aware of the fact that some part of the business model was uncertain, but it would be clarified after the negotiations with potential partners.

4.2.6. The summary of the cases studies

Table 4-2 shows the connections of the cases with design thinking. Row A is what was the key issues on making innovations for the organisations. Row B is what the actions relevant to design thinking in the case is. Row C indicates how familiar with design thinking the organisations are. Row D shows which part of the business model prototyping framework the case contributed to.

	Case 01	Case 02	Case 03	Case 04
A. Existing business model activities against potential new innovations	Focus on incremental improvement	Fixation to the current main revenue stream	Institutionalised process of implementing new laws	Lack of the variety of perspectives to capture the opportunities of potential innovations
B. The connection points for design thinking	Experience prototyping	Engaging with clients from an early sage	Visualisation	Visualisation
C. The capability and experience of using design thinking	Middle	Low	The project team: High Other departments: Low	Client: Low Trading Agency: Low Design research Agency: High
D. The emergent components to the business model prototyping framework	Context, Engagement	Purpose, Context	Process, Engagement	Context, Engagement

Table 4-2: The connections of the cases with design thinking

Although each case has a different connection to design thinking, the useful insights for developing the framework were gathered. The key learning points from each case are the following:

- Case Study 01 – There is no clear boundary between prototypes and a final outcome
- Case Study 02 – Proposing new projects to real clients is one of the biggest opportunities to learn from feedback (i.e. prototyping)
- Case Study 03 – Visualisation moderates the complexity of the contexts
- Case Study 04 – Maximising the value of the incomplete information by action is important (see also Sarasvathy, 2008)

Surely, this connection is important to clarify the consistency of the cases. The other key element that is identified is the attitude to uncertainty and complexity. As discussed in the subsection for the criteria of the case selections, despite the inconsistency of the size and the commerciality of the organisations for the cases, the similar patterns were observed in how to face uncertainty and complexity. This aspect can be used for selecting cases for the further case study research in business model innovation and business model prototyping.

4.3. Validation Interviews

4.3.1. Overview

After the theoretical framework had been developed, validation interviews were conducted. In the interview, a visualised model of business model prototyping was displayed, and key topics suggested by the interviewee were discussed.

As the expert interviews, this interview was also designed as semi-structured interviews (Whiting, 2008; Harrell & Bradley, 2009) to be consistent, and the following table shows the protocol:

	Questions
Introduction (5 minutes)	The main objective of this research is to theorise business model prototyping, and I have developed a provisional theoretical framework of business model prototyping. Through this interview, I would like to validate findings and improve the framework from your feedback as a practitioner and an expert.
Topic 1 (15 minutes)	Topic 1 Matching the framework with practice How does the framework align with your experience as an expert?
Topic 2 (15 minutes)	Topic 2 Gap with the interviewee's practice What part of the framework would you not agree with?
Topic 3 (15 minutes)	Topic 3 Improving points What change would you think makes the framework better?
Final thoughts (10 minutes)	What would you have any final thoughts on business model prototyping? Would you have any suggestions for further research?

Table 4-3: The interview protocol of the validation interviews

The interviewer took notes during the interview and also audio-recorded the interview. The record was transcribed to review afterwards. As one of the objectives of this interview is also gaining insights, the interviewees were allowed to freely talk even though it does not follow the pre-defined topics. The framework was not shared before the interview, and the interviewer (the author) described what they were to see their reactions.

4.3.2. Findings

Although the framework of the purpose consisting exploration, evaluation and persuasion were accepted by the interviewees, some points were discussed. One thing is the importance of the awareness of what is going to be tested (VI01 - “Establishing criteria about what you are testing [is important]”). This point was also suggested in the expert interviews (EI01, EI03). There is, however, literature suggesting different types of prototyping with different levels of clarification of preliminary hypotheses (e.g., Blomkvist & Holmlid, 2011a). Another point is that there can be a purpose of 'creation' (VI04). While exploration can be seen as a purpose including creation, it may simply imply exploring the existing context not developing and proposing new things. The purpose, creation, may require a different approach to conducting prototyping.

There can be seen advantages and disadvantages of developing a formal process model. An interviewee pointed out that using a formal process model was seemingly problematic for a dynamic process such as design and prototyping (VI03). On the other hand, another interviewee suggested that further articulation of the relationship between different dimensions may be useful for the practical use to guide the process (VI02). In the argument of this dimension, this research suggests that prototyping is not part of one phase in the design process, but a philosophy and culture of design are spreading into all the phases of the design process. If so, prototyping used in a different phase may be a different type of prototyping methods (VI02). Thus, clarifying the relationship between the phase and the type of prototyping methods is useful for practice as a guideline. Although this research identifies two levels of prototyping process (e.g., Case 01, Case 02) as also Bogers and Horst (2014) suggest in literature, the division of the prototyping process between 'managerial level' and 'designer level' is confusing or questionable in the interviews. One reason is that reflection is not necessarily only for designers but all the participants (VI04). The other is that although reflection is a key activity for design, it seems to be an embedded part of each phase rather than another level (VI02).

It is pointed out that, as business models can be regarded as a social construct (VI03), different actors have a different view on what the business model is and it is difficult to reach a consensus in an organisation. It suggests that diversity of participants is required to understand and prototype business models. Especially, who is in charge of prototyping is influential (VI01 - “who will decide in a company” that we are prototyping with a business model”). Regarding the environment, it is suggested that the difference between real settings and virtual settings is less clear when the target of prototyping is about future, as it does not exist yet (VI03). In the situation, the environment might be virtual, but it can be set up as a representation of ‘real’ situations. Also, although, in literature, multiple parallel prototypes are useful to avoid the fixation of ideas (e.g., Dow, Fortuna, et al., 2012), a question about how many prototypes should be suitable for business model prototyping as a practical suggestion is raised (VI02). Problems of organisational culture and mindset are raised again (VI01 - “Propensity of experimenting” , VI04) as in the expert interviews (EI02, EI04). Examples of typical patterns are the conflict between using a business model and organisational culture preferring planning (VI04), and lack of tendency of experimenting that allows learning from failure (VI01). Another issue on context mentioned in the interviews is epistemological issues in organisations to cause further complexity of prototyping business models (VI04), and the discussion suggests the exploration of the literature by Nonaka and Takeuchi (e.g., Takeuchi & Nonaka, 1986; Nonaka & Takeuchi, 1995; Nonaka et al., 1996) and complexity theory.[73]

It is suggested that as the components of business models are interdependent, only being aware of the interdependency can help organisations to avoid sticking to a certain aspect of a business (VI01). Also, further clarification of the relationship between the context and the engagement (or what types of prototypes should be built in which context) is practically useful (VI02). While the selection of fidelity depends on the context

[73] About the relationship between complexity theory and organisational science, see Anderson (1999).

and the phase of the design process (VI04) as the literature also suggests (see Design and design thinking subsection), it is also pointed out that “any product can be a prototype in the long run” (VI04) as also identified in Case 01. This suggests that in business model prototyping, the boundary between prototypes and final outcomes is less distinct than prototyping for product design (e.g., Moggridge, 2007). While the vagueness, it is cautioned that prototyping for business models and prototyping for products and services should be clearly distinguished as it causes confusion on the purpose of prototyping (VI01). Moreover, business models can be seen as part of prototyping following a rough sketch of ideas and followed by the development of products and services as minimum viable products (VI04; about minimum viable product see Reis (2009)). As this point is controversial with findings from other sources, it is further discussed in the Discussion session.

5. Discussion: a theoretical framework of business model prototyping

This chapter will re-address the research question and reflect the findings to discuss the important contributions of this research. This research proposes business model prototyping as a methodology for identifying viable business models.

First, following the dimensions of prototyping, this section discusses the theoretical framework of business model prototyping developed from this research. The discussion reflects findings from the expert interviews and case studies with existing theory from literature (see Dubois & Gadde, 2002; 2014), and uses the research paradigm of critical realism, considering "reality is 'real' but only imperfectly and probabilistically apprehensible, and so triangulation from many sources is required to try to know it" (Sobh & Perry, 2006, p.1195). Thus, rather than examining the difference between theories and empirical findings, this section aims to interweave theories and findings to create a new theoretical framework. This section does not only discuss findings from the fieldwork but also provides theoretical arguments that proposes business model prototyping as a methodology for managing business model innovation. This chapter uses some abbreviations. LR, EI, CS and VI indicate Literature Review, Expert Interviews, Case Studies and Validation Interviews respectively.

The collected data from fieldwork revealed that prototyping is not clearly applied in the practice of business model development. The focus of the research moved from understanding how business prototyping is managed to what would be a possible theoretical framework in business model prototyping.

To identify what the key dimensions of the business model prototyping framework, the existing frameworks of prototyping (Table 5-1) are reviewed and synthesised as Figure 5-1 shows.

Authors	Blomkvist and Holmlid (2011)	Beaudouin-Lafon and Mackay (2007)	Jensen et al. (2015)	Lim et al. (2008)	McCurdy et al. (2006)
Discipline	Service design	Interactive design	Engineering design	Human-Computer Interaction	Human-Computer Interaction
List of dimensions	• Purpose • Position in the entire process • Author • Audience • Validity • Technique • Fidelity • Representation	• Representation • Precision • Interactivity • Evolution	• Material • Interactivity • Visual detail • Purpose • Surroundings • Technology	Filtering • Appearance • Data • Functionality • Interactivity • Spatial structure Manifestation • Material • Resolution • Scope •	• The level of visual refinement • The breadth of functionality • The depth of functionality • The richness of interactivity • The richness of data model

Table 5-1: Lists of prototyping dimensions

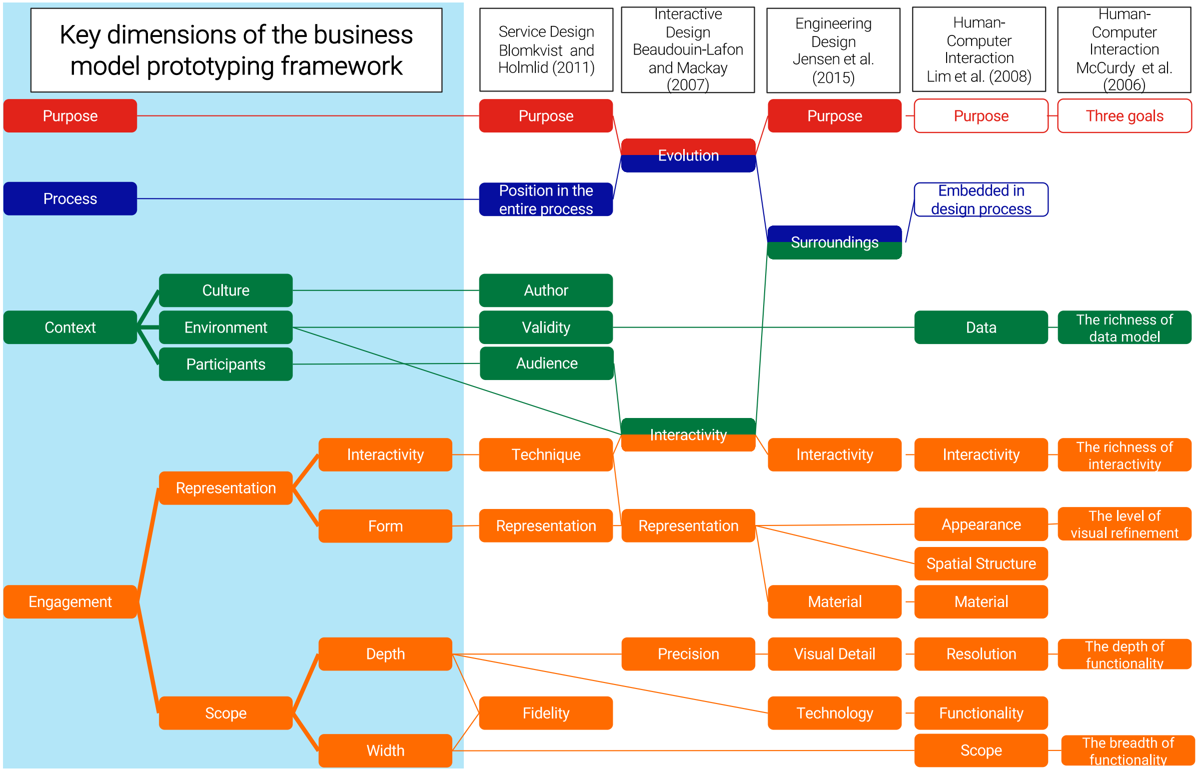

Figure 5-1: The frameworks behind the business model prototyping framework

While the existing theory provides the foundation of the framework, the findings and insights from the case studies and the interviews contribute to the selection of key dimensions and subdimensions. For instance, if you look at only the items in the lists of prototyping dimensions (Table 5-1), there seems to be a lot of items relevant to what the prototype is such as fidelity, interactivity and material. The insights from the case studies and the interviews, however, rather emphasise the importance of other factors such as contexts and process. Therefore, the dimensions related to prototypes themselves are aggregated to one dimension, engagement, in the proposed framework.

Through this analysis and synthesis of data from the literature and the empirical data collection, this research proposes a business model prototyping framework with four dimensions purpose, process, context and engagement (Figure 5-2).

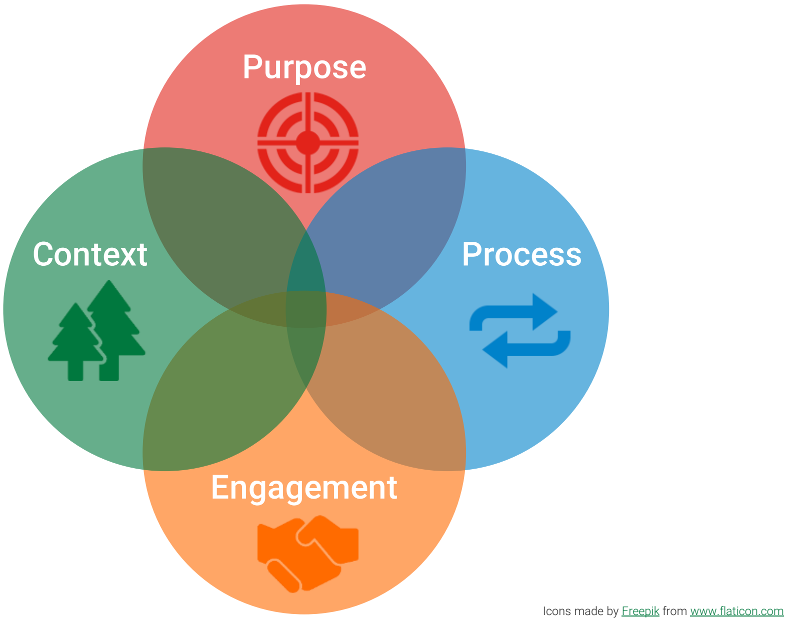

Figure 5-2: The four dimensions of business model prototyping

The 'purpose' of business model prototyping can be categorised as exploration, evaluation, and persuasion. The findings show that exploration is undervalued but is considered as a highly important aspect in prototyping. While the 'process' in which prototyping is used is often regarded as phase-based (e.g., Seidel & Fixson, 2013; Liedtka, 2015; Zott & Amit, 2015) – i.e. that it fits within clear set of goods or services development processes – the results show how much impact an organisational culture and philosophy have in the process of prototyping (Schrage, 1993; Thomke & Nimgade, 2000; Pering, 2002; Brown, 2005). 'Context' influences learning through prototyping. The key components of context in business model prototyping are participants, environment, and organisational culture. Another key dimension of prototyping is to learn from feedback. 'Engagement' with users and other actors in prototyping is a crucial factor in improving the learning outcome (Beaudouin-Lafon & Mackay, 2007; Han, 2009; Rizzo & Cantù, 2013; Bogers & Horst, 2014; Jensen et al., 2015). It is managed by fidelity, scope and representation of prototypes. Business model prototyping as learning from feedback can be done through various methods and processes. Thus, business model prototyping is a methodology, rather than a method.

As discussed in 1.3, the main contribution to knowledge is to provide a theoretical foundation to the design research community to expand the capability of the design methodology to intangible things, especially business models. As the comparison of the existing frameworks shows, which will be argued more detail in the next section, the theoretical grounds for prototyping are still mostly product-based concepts. This research will propose a theoretical foundation of prototyping intangible things and enable design researchers to explore the new research area.

5.1. Review of existing frameworks

This section reviews five conceptual frameworks of prototyping in existing literature. As various frameworks coexist, there are also various ways to select and synthesise the key dimensions of prototyping. However, the main objective here is not to represent what prototyping is but to provide a conceptual foundation for understanding business model prototyping. Thus, the selection and synthesis of the key dimensions are based on the assumption that prototyping applies to something intangible and complex problems (e.g., Brown, 2009; Lockwood, 2010b; Jobst & Meinel, 2014; Almahmoud et al., 2016). Table 5-1 displays selected lists of prototyping dimensions from Human Computer Interaction, Engineering design, Interactive design and service design.

Human-computer interaction (HCI) researchers, McCurdy et al. (2006) assert that measuring prototypes only by whether they are low fidelity or high fidelity is too simple, and propose five dimensions for investigation: the level of visual refinement, the breadth of functionality, the depth of functionality, the richness of interactivity and the richness of data models. As their main concern is on an interaction between computers and users, the set dimensions emphasises on how prototypes can be interactive.

Similarly, in the argument of prototyping for interactive systems, computer scientists, Michel Beaudouin-Lafon and Wendy Mackay (2007) propose a set of key elements to prototyping for interactive design (p.1018):

- representation – the type of the prototype and how it is represented
- precision – how much detail is represented in the prototype
- interactivity - the degree of the capacity for users to interact with the prototype
- evolution – the role of the prototype in the whole expected life cycle

While Beaudouin-Lafon and Mackey see HCI as an interdisciplinary subject among science, engineering, and design, they claim that "prototyping is primarily a design activity" (2007, p.1018).

Other researchers in HCI, Youn-Kyung Lim, Erik Stolterman and Josh Tenenberg (2008) propose a theoretical framework of prototyping consisting of dimensions of 'filters' and 'manifestations of idea' as parts of prototyping. Filtering dimensions are the focus of design ideas that designers choose to prototype, and manifestation dimensions are how to represent the ideas. In the framework, both filters and manifestations have sub-attributes. The former's sub-attributes are:

- Appearance
- Data
- Functionality
- Interactivity
- Spatial structure

The latter's three sub-attributes are defined as (p. 11):

- Material - Medium (either visible or invisible) used to form a prototype
- Resolution - Level of detail or sophistication of what is manifested (corresponding to fidelity)
- Scope - Range of what is covered to be manifested

In this framework, what to prototype and how to prototype are considered as two key metrics of arguing types of prototyping.

From a service design perspective, Blomkvist and Homlid (2011) formulate a framework of service prototyping based on expert interviews and literature review. Dimensions in the framework contain purpose, position in the process, author, audience, validity, technique, fidelity and representation. While the frameworks from HCI and interactive design tend to focus on how prototypes are developed, this framework pays more attention to the context surrounding prototyping processes.

More recently, engineering design academics, Matilde Jensen, Stephanie Balters and Martin Steinert (2015) re-evaluates the literature of theoretical prototyping frameworks to formulate a general model of prototyping. Through a statistic analysis of the literature, they identified important themes of prototyping: material, interactivity, visual detail, purpose, surroundings and technology. Although the work focuses on engineering design, their review also recognises Blomkvist and Homlid's study from above on the the importance of context-setting in prototyping.

Through the review and comparison of the frameworks, this research develops a theoretical framework of prototyping consisting of key four dimensions: purpose, process, context and engagement.

‘Purpose’ is what prototyping is done for, ‘process’ is how prototyping is conducted. ‘context’ is in what circumstance prototyping is carried out and ‘engagement’ is how prototyping encourages the participants to engage. Context includes participants, environment and culture as the sub-dimensions. ‘Engagement’ is usually argued as representation, interactivity or fidelity of prototypes. However, the selection of those attributes depends on how to make the participants engage with prototypes and prototyping processes. Thus, this research uses the term, engagement as a dimension relevant to representation, interactivity and fidelity of prototypes.

Also, as these key dimensions influence each other (Blomkvist & Holmlid, 2011a), they do not stand independently on its own. Thus, this research asserts business model prototyping as a methodology as the result of reflection on the framework.

5.2. Overview of the dimensions

The previous subsections have theorised prototyping with four dimensions, purpose, process, context and engagement, from the synthesis of frameworks of the existing literature. This subsection summarises the key points of the dimensions.

From the literature, the fundamental purposes of prototyping are mainly exploration, evaluation and persuasion. The purposes move from exploration to evaluation to persuasion.

The process can be discussed into two parts. One is the position on prototyping in the design process. The other is the prototyping process itself. Regarding the position of prototyping, there are three types of arguments. In normative process models of design, prototyping is located in a late stage of the design process. Nevertheless, it is asserted that prototyping should be conducted as soon as possible. Furthermore, prototyping is argued as the culture or philosophy of design that can be applied in all processes.

The process of prototyping is theorised as a circular model, consisting of designing, building, running and evaluating phases. Circular models also can be seen in other fields dealing with uncertainty and complexity, such as innovation and entrepreneurship.

Context is divided into three sub-dimensions: participants, environment and culture. Desirable participants involve a wide range from internal actors to external actors, although the participants need to be selected on the basis of time and resources limitations. It is also argued that contextual environments surrounding prototyping influence the validity and authenticity of learning through prototyping. In addition, multiple prototypes are preferable to avoid the fixation of ideas. Culture refers to organisational culture and individual mindset which influence learning and decision making during and after a prototyping phase. This is a rather meta-level context compared to participants and environment. Even if prototyping is conducted with right participants in an appropriate environment, a lack of open-minded culture can deter the experience/opportunity of identifying potential business models.

For engagement, managing the fidelity of prototypes is important. Low-fidelity prototypes are relatively more recommended in the context of design thinking, but the advantage of high-fidelity prototypes are also recognised. Prototypes can represent a part or a whole of an idea with a certain depth in the detail. How ideas are communicated through a prototype also influences the quality of a feedback. These are determined by a form, medium and interactivity of a prototype.

5.3. Purpose

5.3.1. Three purposes: exploration, evaluation and communication

In the argument of design, especially of design thinking, an overarching objective of prototyping is considered as gaining feedback and learning from building and implementing a product or service (Rodriguez & Jacoby, 2007; Lande & Leifer, 2009; Jensen et al., 2015), or as simply expressed, 'build to learn' (Kelley & Littman, 2006; Gerber, 2009).[74]

However, it is also argued that prototyping has multiple functions and play different roles in different contexts (Beaudouin-Lafon & Mackay, 2007). In literature,

[74] Rodriguez and Jacoby (2007) assert that prototyping is "[a] process of accelerating feedback and failure" (p.57).

general purposes of prototyping are identified in three ways: exploration, evaluation and communication (Blomkvist & Holmlid, 2011a; e.g., Schneider, 1996; Buchenau & Suri, 2000; Smith & Dunckley, 2002; Voss & Zomerdijk, 2007) (Figure 5-3). [75]

Figure 5-3: The framework of purpose

Before moving to the argument of each type of purposes, this subsection discusses the context of prototyping in design thinking and clarify the reasons to the shifting purposes in prototyping. Prototyping has been widely used as a method of translating ideas in a tangible form in engineering and design practice (Carleton & Cockayne, 2009; Sanders, 2013; Liedtka, 2015). Prototyping is also discussed in various areas such as engineering design (Yang, 2005; Gerber & Carroll, 2012), software engineering (Budde et al., 1984; Law, 1985; Mayhew & Dearnley, 1987), Computer-

[75] This is not the only way to categorise purposes of prototyping. For instance, researchers of Human-Computer Interaction, Youn-Kyuung Lim, Erik Stolterman and Josh Tenenberg (2008) assert that “prototypes are the means by which designers organically and evolutionarily learn, discover, generate, and refine designs” (p.2).

Human Interaction (Lim et al., 2008), product design (Buchenau & Suri, 2000; Kelley & Littman, 2001; Moggridge, 2007), and management (Schrage, 2000; Thomke, 2003).

Because of this diverse arguments, the definitions of prototyping are also varied (Beaudouin-Lafon & Mackay, 2007; Lim et al., 2008). Despite the lack of a widely accepted definition, prototyping is also regarded as an important element of design thinking (Brown & Wyatt, 2010; Dow, Fortuna, et al., 2012; Lockwood, 2010b; Jobst & Meinel, 2014; Liedtka, 2015). As the role of design expands to be more strategic, the key features of prototyping also extend to be more strategic and contextual (Sanders, 2013; Liedtka, 2015).

Design researcher and scholar, Sanders (2013) reflects on the historical transition of design practice and claims that the main usage of prototyping is shifting from persuasion to evaluation and exploration. She points out that when persuasion was the main purpose of prototyping, handcraft skills were crucial as digital technologies for prototyping was emerging but not yet widely distributed. In the 1990s, however, the development of digital modelling tools enabled designers to see the designed outcomes in a much earlier phase of the design process (see also Schrage, 2000; Thomke, 2003). This change brought the research part of design to the front end of design projects (Carleton & Cockayne, 2009; Sanders, 2013), and prototyping moved from an earlier stage to a later stage to evaluate ideas (Carleton & Cockayne, 2009; Sanders, 2013). With the advent of interaction design, the role of prototyping shifted from a persuasion tool to a learning device for interaction with various actors. Interestingly, it is acknowledged that low-fidelity of prototypes can have the advantage to get a constructive feedback (Rudd et al., 1996). Furthermore, Sanders (2013) argues that prototyping has focused on the physical representation of ideas as the traditional domains of design has been developed around objects. However, she recommends keeping in mind a broader definition of prototypes as “the first or preliminary model of something” (2013, p.63), as the domain of design expands. In the context of human-computer interactions, Michel Beaudouin-Lafon and Wendy Mackey (2007, p.1018) also define a prototype as “a concrete representation of part or all of an interactive system”. In these definitions, prototypes are no longer limited to physical forms but are regarded as any types of representation. This implies that prototyping is no longer a matter of physical objects, but a representation of an intangible outcome.

The main interest of this study is precisely on the prototyping of intangible outcomes such as software, human-computer interactions and services. Interestingly, however, even in the context of product design, the form of prototypes also extends to abstract forms. Buchenau and Suri (2000), then researchers in IDEO, propose a concept of ‘experience prototyping' as design no longer only deal with physical objects but also experiences. They define that “an Experience Prototype is any kinds of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing” (p.2). They also claim that experience prototyping is “a form of prototyping that enables design team members, users and clients to gain a first-hand appreciation of existing or future conditions through active engagement with prototypes” (p.1). Based on this shift, the focus on prototypes as abstract forms can be useful for this research. On the other hand, this focus could miss the benefit of prototyping from using a physically tangible medium. Therefore, the advantage of being physically tangible will be discussed in the section of Engagement.

This subsection has shown the expansion of the meaning of prototyping and prototypes for business model innovation. The following argues each purpose.

5.3.2. Communication for persuasion

Although the three purposes are widely supported by literature, this research replaces the term, communication with 'persuasion' (e.g., Sanders, 2013) as communication is important also for exploration and evaluation. Blomkvist and Homlid (2011a) describe that prototyping for communication tends to be used for presenting ideas to and persuading audiences (see also Buchenau & Suri, 2000). The term is used to emphasise the communication between external actors such as clients to persuade to purchase or invest in the final outcomes represented by prototypes or as a further exploration in finding potential opportunities. As the purpose of communication in this context is persuasion, prototyping for communication is conducted after exploration and evaluation (Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2011a).

Thus, 'persuasion' as Sanders (2013) uses in her argument, is a less confusing term to represent the purpose of prototyping than communication. [76] Instead, communication is regarded as a key activity underlying the achievement of the purposes.

The overarching importance of communication is in line with an argument in business models. Massa and Tucci (2013) argue that business models play an important role in representing key elements of business and business model tools to provide the following three functions:

- A reference language (Amit & Zott, 2012)
- Virtual experimentation with business model innovation (Osterwalder & Pigneur, 2010)

[76] In some literature, the difference of purposes are emphasised in the terminology, piloting and prototyping, as the former mainly works for exploration and the latter for persuasion (e.g., NESTA, 2011).

- The involvement of external audiences through the articulation and instantiation of the value of the business (Perkmann & Spicer, 2010)

All of the functions are relevant to communication. Business model tools seem to work as media helping the communication among actors. The importance of communication in prototyping is discussed in the Engagement subsection.

While the meaning of persuasion is relatively straightforward and less important in the current design practice (see Sanders, 2013), the role of evaluation and exploration turns to be more significant, but the difference between the two are not fully articulated.

5.3.3. Evaluation

A purpose-oriented classification of prototyping is proposed by software engineering scholar, Christiane Floyd (1984). A conference on prototyping was held in 1980's in the study of software engineering, and the papers in the conference were published as 'Approaches to Prototyping' (Budde et al., 1984). In the conference paper, Floyd (1984) categorises prototyping into three types: exploratory, experimental and evolutionary prototyping. While the last one is about the process, the first two categorisations are based on the purpose of prototyping.[77]

For Floyd, Exploratory prototyping is for clarifying requirements and desired features to explore possible alternatives. By contrast, experimental prototyping is for examining the appropriateness of solutions for large-scale implementation.[78] In other

[77] Also, in the context of prototyping for public services, NESTA (2011) divides prototyping into exploratory and developmental prototyping.
[78] The two objectives are further examined by other researchers (e.g., Law, 1985; Mayhew & Dearnley, 1987; Budde et al., 1992). Consultant for computing, David Law (1985) additionally proposes performance prototyping and organisational prototyping, which are variations of experimental prototyping. The former is also referred to as "synthetic" (Hughes, 1985). Law also identifies three pre-requisites for successful prototyping: suitable tools, change in attitudes and a methodology (Mayhew et al., 1989). By reviewing the categorisation of Floyd's and Law's, Mayhew and Dearnley (1987) proposes a framework of prototyping.

words, it is for evaluating ideas for further deployment. Houde and Hill (1997) also state that “prototypes provide the means for examining design problems and evaluating solutions” (p.368). The difference between exploration and evaluation is not always clear, but Blomkvist and Holmlid (2011a, p.4) argue that, compared to exploration based on hunches and intuitions, prototyping for evaluation is "based on more elaborate design ideas, and generally envision a more explicit hypothesis, encompassed by assumptions about what it should achieve”. In this understanding, evaluation requires business model designers to have clear hypotheses before prototyping is conducted.

Additionally, one of the key functions of prototyping is dealing with uncertainty (Gerber, 2009) and complexity surrounding wicked problems (Jobst & Meinel, 2014). In management research, prototyping tends to be regarded as a way of risk management to reduce the uncertainty and complexity. For instance, Schrage (2000) indicates prototyping as simulating and modelling reality. The key point of his claim is that technological development for simulating new businesses makes it easy to reduce the risks for facilitating innovation. Prototyping is even described as a process to ‘guarantee’ successful exploitation of creative ideas through incremental improvement (International Organization for Standardization, 2010; see Norman & Verganti, 2014).

In the study of business models, however, it has been argued that identifying a right business model in advance is challenging. Chesbrough (2010, p.356) claims that “business model innovation is not a matter of superior foresight *ex ante*. Rather, it requires significant trial and error, and quite a bit of adaptation *ex post*”. Similarly, management scholar, Rita McGrath asserts that “business models often cannot be fully anticipated in advance. Rather, they must be learned over time, which emphasizes the centrality of experimentation in the discovery and development of new business models”

(2010, p.248). These assertions assume that right business models can be identified through trials and errors, even though business models cannot be predicted in advance.

Another theoretical problem is the concept of wicked problems. Although the management scholars use the terms, ‘trial and error’ and experimentation, the concept of wicked problems assert that there is no opportunity for learning by trials and errors for complex problems (Rittel & Webber, 1973). This is because the situation is too complex to be the same all the time and it suggests that it is difficult to validate ideas in a test environment without exposing businesses in real situations. This theory suggests that evaluation needs to be complemented by exploration to search for opportunities that cannot be foreseen before prototyping is conducted.

5.3.4. Exploration

In the argument of design thinking, the key role of prototyping is to explore possible design outcomes to facilitate innovation (Brown, 2008; Holloway, 2009).[79] Evaluation is for narrowing down options, but exploration aims to broaden the perspective to capture more possibilities. While management research argues how to mitigate risks, an advantage of design thinking is claimed as ‘embracing’, rather than avoiding risks (Rodriguez & Jacoby, 2007). This suggests that designers do not perceive constraints as risks but rather as a source of identifying new opportunities. Schrage (1993, p.59) also emphasises that “prototypes are as much a medium for managing risks as for exploring opportunities”. Thus, although reducing risks is undoubtedly a key element of prototyping, understanding of prototyping in management dismisses the explorative possibilities of its use.

[79] The explorative role of prototyping was already identified at least in 1980s in software engineering (e.g., Floyd, 1984), but it is not connected with the context of innovation.

Brown and Wyatt (2010) claim that prototyping in design thinking is not for the validation of finished ideas but part of the creative process, but rather an exploratory activity to gain new insights.[80] Furthermore, Brown introduces a case of Kaiser Permanente, in which "using the insights gleaned from observing these important times of transition, the innovation teams explored potential solutions through brainstorming and rapid prototyping" (Brown, 2008, p.87).

Moreover, one of the main purposes of prototyping is to receive feedback and learn from building and implementing a product or service (Kelley & Littman, 2001; Martin, 2009). Furthermore, Liedtka (2015) claims that one of the characteristics of the current argument of design thinking is:

> [The] emphasis on the concrete and the visual to highlight the key role of visualization and prototyping. Certainly, prototyping has long been a central feature in fields such as architecture and product development, but design thinking's view of prototyping is somewhat different: the function of prototyping in design thinking is to drive real world experimentation in service to learning rather than to display, persuade, or test" (p.927)

Prototyping as learning is also emphasised here. Also, referring to Schrage (1999), she suggests that "these prototypes act as […] 'playgrounds' for conversation rather than 'dress rehearsals' for new products" (p.927). In Management Education, it is also argued that while prototyping in engineering focuses on the process of product development, prototyping in design thinking is for gaining feedback and learning (Glen et al., 2015).

The roles of prototyping, however, is not always exploration-centric. As we have seen, there is an expansion of design's role in the shift. Lim et al. (2008) claim that the

[80] They state that "a vibrant design thinking culture will encourage prototyping - quick, cheap, and dirty - as part of the creative process and not just as a way of validating finished idea" (p.43).

traditional research on prototyping focuses on the roles of prototyping for validation, not exploration. Sanders also points out that traditionally, prototyping is "to *help us see* what it could be" (p.63), but in emerging design practices prototyping is "to help us, all of us, to *make sense of the future*" (p.64).[81]

5.3.5. Overlapped exploration in business model prototyping

It should be clarified that business model innovation is not about inventing a radically new business model. The invention may happen as a result of prototyping, but business model innovation itself does not generate a completely new business model. Instead, it occurs through designing and implementing a new business model in a certain context (Zott & Amit, 2015). Additionally, even inventing a new business model may not be innovation as innovation has to be implemented to exploit the value of business (Cox, 2005).

Furthermore, business models themselves are not final outcomes but tools (Osterwalder et al., 2005) and models (Baden-Fuller & Morgan, 2010) to support business development. In this sense, business models themselves work like prototypes as a tool for learning. However, business models themselves are abstract, and turning them into prototypes is helpful for managing uncertainty and complexity of business model innovation. This point can be seen as a characteristic of the design methodology (VI01; see also Lockwood (2010b)). For tackling complexity, business model innovation requires exploration of possible business models (e.g., Chesbrough, 2010; McGrath,

[81] Sanders further suggests other methods of prototyping for exploration such as empathy probes (Mattelmäki & Battarbee, 2002), primes/sensitizing tools (Visser et al., 2005), and video prototypes (Westerlund, 2009).In addition, she mentions new types of prototyping in speculative design such as Critical design objects (Dunne & Raby, 2001), cultural probes (Gaver et al., 1999; Gaver et al., 2004) and provotypes (Mogensen, 1992; Boer & Donovan, 2012).

2010). However, it does not mean exploration solves all the problems surrounding business model innovation. Rather, exploration exists in all aspects of the activities (Case 01, Case 02).

In the literature of management, the difference between learning processes and implementation processes is conceptualised as exploration and exploitation (March, 1991; Benner & Tushman, 2003; Andriopoulos & Lewis, 2008). However, by facing the complexity of business environments, the boundary between exploration and exploitation is rather blurred, and the vague boundary is also identified as 'overlapping development' (Takeuchi & Nonaka, 1986) in management. With this vague boundary, exploration in a real situation is potentially useful to manage the overlapped activity and gain rich feedback from the actual market.

Thus, it is preferable that the business development process includes implementation rather than only testing business models in a virtual setting. Exploitation of values or even prototyping for persuasion can be used as exploration (see Case 02). Even if prototyping is done as an evaluation of pre-defined ideas, new findings may exist outside of pre-acquired assumptions and hypotheses (see also Case 01, Case 02).

In the case studies, the boundary among exploration, evaluation and persuasion were seemingly vague. A finding from this analysis is that the three purposes, exploration, evaluation and persuasion, are not completely separate but only move in different directions. While exploration potentially increases acknowledged possible options, evaluation tends to reduce the options to identify the best option. Persuasion is used for involving actors to certain ideas to gain more resources including payments and investment.

When prototypes are regarded as 'learning tools' (Jensen et al., 2015), even the process of persuading customers works as an exploration for new business models (see

Case 02). This is partly because new ideas tend to lack a substantial support in implementing the ideas. In agile development, it is also recognised that budget is not always allocated in advance but "arrives in increments" (Kelly, 2011, p.17). In other words, resources including budget, skills and knowledge must be gained throughout the iterative process. Thus, promotional materials such as pictures and videos are regarded as important to attract further resources as well as a key tool for gaining feedback (Case 01, Case 02). These findings also suggest that evaluation and persuasion can work for exploration, and prototyping for complex things such as business is inherently for exploration. Due to its vagueness, however, lack of understanding in building a prototype could hinder new learning opportunities (EI02, EI03, VI01). Therefore, the vagueness of the boundary does not simply mean a complete flexibility in prototype learning. Rather, a careful balance between deliberate learning and open mindset is vital in exploring for new opportunities.

5.4. Process

The previous subsection explores the purpose of prototyping: exploration, evaluation and persuasion. As discussed above, however, findings in the fieldwork suggest that the purposes of prototyping are not completely exclusive of each other and the exploratory aspect of business model prototyping overlaps prototyping for evaluation and persuasion. In the literature, the purposes and position of prototyping are related to each other (e.g., Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2011a; Sanders, 2013), and the process of business model prototyping should be consiered with the purposes.

This subsection argues the process of business model prototyping as a key dimension. As we will see, the process of prototyping, as well as the design process, is argued in various ways. While normative process models of both design and business model innovation suggest that prototyping is located in the late stage of the process, the importance of conducting prototyping as early as possible is also acknowledged. This section clarifies the position of prototyping in business model prototyping and discusses the business model prototyping process in two aspects. One is where prototyping positions in the entire design process, and the other is what the process of prototyping is. Figure 5-4 shows an overview of the dimension.

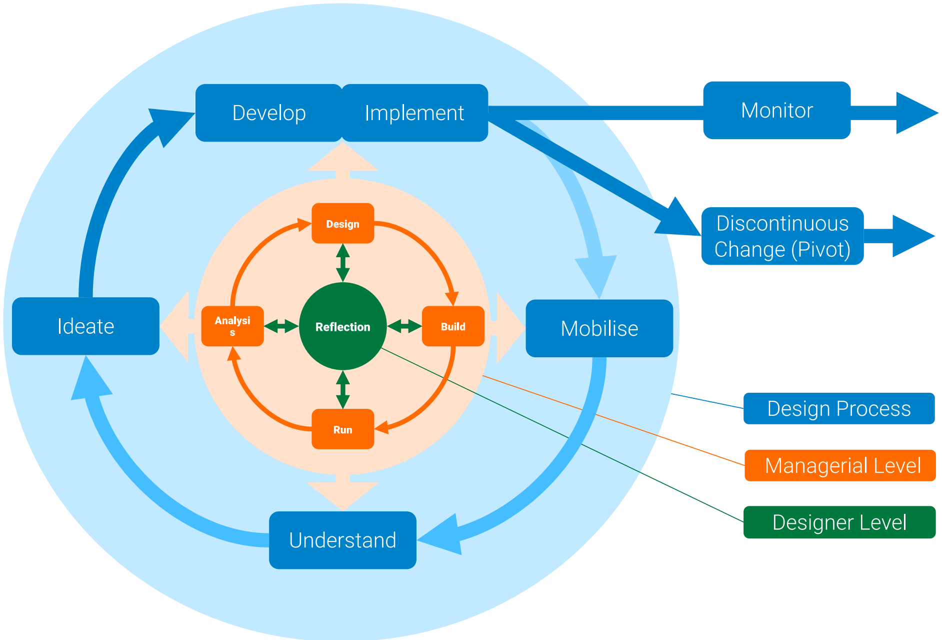

Figure 5-4: The framework of process

5.4.1. Position of prototyping in design and design thinking

The following reviews the arguments with the consideration of the relationships with purposes and fidelity.

By integrating seminal frameworks of the process of design thinking (IDEO, Continuum, Stanford Design School, Rotman Business School, Darden Business School), Liedtka (2015) proposes three sequential stages in the design process: exploring stage, idea generation stage and testing stage. Prototyping is included in the testing stage. She also mentions the similarity of the steps to the key methods of design thinking proposed by Seidel & Fixton (2013): need finding, brainstorming and prototyping. Glen et al. (2015) argue the importance of applying design thinking to the curriculum of business schools, and propose simple steps to achieving this practice. Here, ‘prototyping and testing’ appears at the fifth stage out of an entire six steps. These models commonly locate prototyping at a later stage in the process. This section follows the three-step models - Stage 1: Data Gathering, Stage 2: Idea Generation, Stage 3: Testing - to keep the simplicity of the design process based on the synthesis of various process models (The Hasso Plattner Institute of Design at Stanford, 2010; Liedtka & Ogilvie, 2011; IDEO, 2013; Seidel & Fixson, 2013; Continuum, 2014; Rotman School of Management, 2014; Glen et al., 2015; Liedtka, 2015).

Although the importance of business model innovation has been recognised, there exists little academic research on the process of business model design, let alone business model innovation (Bucherer et al., 2012; Zott & Amit, 2015). Due to difficulty in finding normative process models for business model innovation from literature in management, Zott and Amit (2015) explore process models in the design literature (e.g., Beckman & Barry, 2007; Bhavani & Sosa, 2008; Brown, 2008) and propose a five-step process model for business model innovation: observe, synthesise, generate, refine and implement. Following a notion by Owen (1993), they assert that the first two steps are in the analytical stage, and the last three steps are in the synthetic stage. From the study of entrepreneurship, Osterwalder and Pigneur (2010) also propose a five-step model of business model design: mobilise, understand, design, implement and manage. One of the characteristics of this model is that it starts from ‘mobilise’, which other models do not often include. Combining the five steps by Osterwalder and Pigneur with knowledge from their experience, Bucherer et al. (2012) offer a similar process model: analysis, design, implementation and control. In the study of product development, Frankenberger et al. (2013) propose four phases of business model innovation based on innovation management literature and their case studies: initiation, ideation, integration and implementation. The first three phases are for designing business models, and the last one is for realising it. By synthesising the models in the literature (Fritscher & Pigneur, 2009; Osterwalder & Pigneur, 2010; Bucherer et al., 2012; Frankenberger et al., 2013; Zott & Amit, 2015), this research theorises the process of business model innovation with the stages of 'mobilise', understand, innovate, develop and implement.

It is also claimed that prototyping in design thinking should be conducted in an early stage (Jobst & Meinel, 2014). In engineering design, Yang claims a "prototype is an early embodiment of a design concept" (2005, p.650). Also, in the argument of social service development, NESTA (2011) defines "prototyping is an approach to developing and testing ideas at an early stage before large-scale resources are committed to implementation" (p. 6). Benefits of prototyping at an early stage involve saving costs and time in product and service development (Houde & Hill, 1997; McCurdy et al., 2006; Coughlan et al., 2007). These arguments suggest the importance of embodying ideas in 'an early stage' of the process.

It is argued that the position of prototyping in the design process is connected with the purpose of prototyping (Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2011a; Sanders, 2013). From this perspective, prototyping for exploration tends to be located at an early stage of the design process. As prototyping for evaluation needs to have more specified ideas, it needs to be located at a later stage than exploration (Blomkvist & Holmlid, 2011a). Moreover, prototyping for persuasion is located later than evaluation

(Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2011a) or at the end of the process (Sanders, 2013).

Another pattern of the process models of design is that high-fidelity prototypes are used at a later phase, while low-fidelity prototypes are used at an earlier phase. For instance, Skogstad (2009), Vetterli et al. (2012) propose four milestones of prototyping processes following the requirements of prototypes: Critical Function Prototype, Dark Horse Prototype, Functional Prototype and Final Prototype. In this model, prototyping moves from conceptual prototypes to more concrete prototypes. Similarly, Ullman (2009) proposes four classes of prototypes based on the difference of the purposes: proof-of-concept prototypes, proof-of-product prototypes, proof-of-process prototypes and proof-of-production prototypes. In this process model, prototypes in later stages need to prove more specific issues using higher-fidelity prototypes. Both models indicate the increase of fidelity during the iterative prototyping process. Also, it is argued that "the level of precision usually increases as successive prototypes are developed and more and more details are set" (Beaudouin-Lafon & Mackay, 2007, p.1019). Similarly, Sommerville ([1995] 2010) and Yang (2005) suggest that there are three stages of prototyping in software engineering: throwaway, evolutionary and incremental. In this process, prototypes in an early stage should be designed to be thrown away, and changes in a late stage are supposed not to be radical but only incremental. In these process models, the purpose and the stage of prototypes are connected through fidelity of prototypes, and the categorisation of prototypes is based on the level of an embodiment of ideas. The process models are based on the assumption that ideas represented in prototypes are gradually verified through iteration. This assumption could be controversial when design problems are seen as wicked problems, as the concept of wicked problems asserts that verifying the viability of solutions through trials and errors is questionable because of the complexity in the context surrounding problems (see Rittel & Webber, 1973). In addition, the process model moving from low-fidelity prototypes to high-fidelity prototypes does not explain radical changes of the direction in new business, such as 'pivot' in entrepreneurship (e.g., Ries, 2011; Blank & Dorf, 2012).

The relationship between the purpose and position of prototyping can also be seen in the argument on the relationship between prototyping and piloting. In the context of social service development, NESTA (2011) describes the difference between prototyping and piloting based on the purpose and the position in the design process. Prototyping is in an earlier phase than piloting, and the main purpose is to develop services. On the other hand, piloting is located at a later stage of the design process than prototyping for exploration, and the purpose is the refinement of well-verified services essentially for rolling out and scaling the service. Additionally, service designer working with NESTA, Aviv Katz (2011) argues that the difference between prototyping and piloting is "exploratory (done in early stages of insight and idea generation) and developmental (done after the service has been specified and you know what you're designing). The former is quick and cheap; the latter requires more planning". Here, also, the purpose and position of prototyping are interconnected, and even fidelity of prototypes is influenced by the purposes. From this point of view, prototyping can be placed at both an early stage and a late stage, but the purpose of prototyping needs to shift from exploration to evaluation to persuasion.

Learning through iterative processes is also frequently mentioned as a characteristic of prototyping (e.g., Hartmann et al., 2006; Brown, 2008; Leifer & Meinel, 2011). This iterative aspect is characterised as 'agility' (e.g., Neumeier, 2008b; Mootee, 2013). Agility is a widely used concept as a key element of design thinking for managing uncertainty in facilitating disruptive types of innovation (e.g., Brown, 2008; Neumeier, 2008a; Lockwood, 2010b). Agility is also recognised as an effective element for managing innovation as well as business processes to manage uncertainty surrounding innovation (e.g., Thomke & Reinertsen, 1998; Bessant et al., 2005).[82] In regards to uncertainty in managing innovation, Christensen (2003) claims that a new market cannot be analysed even by market experts. In order to tackle uncertainty, designers build product or service to learn, not to complete it. Production processes should be flawless, but production processes are viewed as part of learning activities, even failure can be used as a learning opportunity (see Rodriguez & Jacoby, 2007).

Despite the growing awareness on the importance of agility, the meaning of agility in design is not clearly articulated (see Lindberg et al., 2011). Iterative processes are in common with other practices dealing with uncertainty such as agile development in IT and the Lean Startup methodology in entrepreneurship. The concept of agility was originally formulated in the study of software development (Abbas et al., 2008).[83] As Larman and Basili (2003) claim in the historical review of iterative and incremental development (IID), using iteration for managing uncertainty is not a new approach for software development. Not only in IT and design, but there is also a methodology for developing business models to a viable business through iteration called 'Lean Startup' methodology in entrepreneurship (Blank, 2005; Ries, 2011; Blank & Dorf, 2012; Maurya, 2012). The methodology encourages entrepreneurs to expect business development as not a linear but an iterative process (Ries, 2011). In the Lean Startup methodology, the concept of 'pivot' and Minimum Viable Product (MVP) that characterise the methodology. Similar to prototyping in design, the lean startup methodology usually

[82] For instance, Bessant et al. (2005) assert that organisational agility is required to seize opportunities for discontinuous innovation.
[83] See Royce (1970) about 'Waterfall' development that the argument of agile development criticises.

goes through an iterative process. The methodology relies on a launch of a product that is minimally developed to gain feedback from the market, which is conceptualised Minimum Viable Product. After each iteration, the user of the approach needs to interpret the feedback from the market and decide whether to keep improving the current product (persevere) or change the direction of the business (pivot). Pivot is defined as “structured course correction designed to test a new fundamental hypothesis about the product, strategy, and engine of growth" (Ries, 2011, p.149).

In contrast to other approaches for tackling uncertainty, researchers of design thinking, Tilmann Lindberg, Christoph Meinel and Ralf Wagner (2011) argue that, although a core feature of design thinking is described as “iterative learning and development processes” (p.11), agility in design thinking is different from agility in IT development. First, agile development tends to reduce options, but the iterative process of design thinking is for diversifying ideas. Secondly, agility in IT development is less collaborative than that in design thinking. From this understanding, iteration in the design approach is not only for mitigating risks but exploring potential opportunities and supporting collaboration with involved actors. When prototyping is regarded as an exploration, iteration or agility is not only for incremental improvement but can be a source of discontinuous changes.

5.4.2. Position of business model prototyping

The literature review suggests that there are two levels to consider for understanding the business model prototyping process. One is the position of business model prototyping in business model design processes. The other is the process of business model prototyping. However, while some normative process models locate prototyping in a certain phase of a design process, prototyping is also a culture and philosophy of design approaches as well as the agile aspect of design. Findings from fieldwork also could not settle the position of business model prototyping. Rather, this research faces difficulty in clearly separating the design process and the prototyping process. In this regard, this research supports the arguments asserting prototyping as a culture and philosophy of design, and the notion can be applied to business model innovation.

In some frameworks of prototyping for business model innovation, the idea generation phase is set before the prototyping phase. For example, Seidenstricker et al. (2014) suggest a systematic idea generation and selection phases for business model prototyping should be conducted before prototypes are developed. One of the expert interviewees also asserts the importance of understanding customer insights before conducting prototyping (EI01). This point is in line with the process models of design thinking (see Liedtka, 2015).

It is considered that prototyping is conducted before the implementation and the release of the final product (e.g., Moggridge & Smith, 2007). In product design, Moggridge and Smith (2007, p.685) clearly state that prototypes are "made before the final solution exists". However, from business model's point view, final solutions can also be a prototype in the long term (VI04). Also, prototyping is identified as the core of implementation in social innovation (Brown & Wyatt, 2010), and one of the findings of this research is that implementation is also an opportunity for learning about the feasibility of business that makes it difficult to clearly divide the development and the implementation of a business (e.g., Case 01, Case 02, VI04). In this process, business models can be seen as fundamental tools for supporting the development of a new business. Therefore, the difference between the development and implementation phases rather derive from the level of exposure of porotypes to external actors such as customers and clients. Feedback gained from the exposure can be a key source of learning for developing business models. Thus, implementation can be seen part of business model development. An expert interviewee (EI03) also suggests that prototyping should be conducted as soon as possible to maximise the benefit of learning. This point is rather close to the concept of ‘effectuation’, which is an attitude of learning through doing rather than planning (Sarasvathy, 2001; also see Case 04). Moreover, for business model prototyping, prototyping for evaluation or persuasion can provide also learning opportunities for exploration due to the complexity of business model development (Case 01, Case 02). Thus, it is difficult to identify where the position of business model prototyping should be in the entire process of business model development in advance. Rather, learning opportunities seem to exist at any point of business model development processes. Although this argument undermines the value of normative process models, such models are useful for convincing actors unfamiliar with the process (VI01, VI02). For the purpose, the process of design and business model innovation is simplified to clarify the benefits of applying a design approach to complex problems by people outside of the design discipline. This simplification and formalisation, however, also causes confusion of the position of prototyping in the process. Furthermore, it is asserted by an interviewee that in reality, the dynamic process does not have static steps but a set of core activities (VI03). Thus, articulating the position of prototyping in the design process as a phase-based model may not be suitable to represent a dynamic process. By contrast to the arguments supporting formal models, some researchers point out that prototyping is part of the philosophy and culture of design (Kauber, 1985; Schrage, 1993; Schrage, 1996; Thomke & Nimgade, 2000; Pering, 2002; Brown, 2005), which also suggests that prototyping is part of the design process from the beginning to the end. An expert interviewee also highlights that prototyping is not a set of tools but rather a principle (EI02). This resonates with the space model of the design thinking process proposed by Brown (2008). The space model suggests the interconnections among inspiration, ideation and implementation phases. In this model, prototyping can be conducted throughout the design process. Overall, while various process models indicate that prototyping is an activity in a late stage of the whole process, some theories suggest that prototyping can be effective at an early stage if the position of prototyping is correctly aligned with the purpose of prototyping and the fidelity of prototypes. Furthermore, prototyping can work as a philosophy and culture of the design process. The process of business model prototyping can also be considered as not only iterative but also overlapped over the entire design process. This understanding of prototyping in design is in line with the notion that design is an agile approach (e.g., Neumeier, 2008; Lindberg et al., 2011; Leifer & Meinel, 2011; Mootee, 2013). While agility is argued as a characteristic of processes, it is also considered as an organisational property or "competence" (e.g., Neumeier, 2008a). When prototyping is regarded as philosophy or culture of design, agility can be regarded as part of the philosophy or culture. Although the iterative process characterises agility, it does not explain well about the discontinuity in the prototyping process. The following sections will argue it with the concept of evolution and emergence.

While iteration is an important characteristic of the innovation process, it is reported by practitioners that some businesses go through a major change of direction of businesses during the iterative business development process (e.g., Blank, 2005; Ries, 2011). Likewise, it is also asserted that while iterations are useful for incremental innovation, 'windows of opportunity' to change gets narrowed in quick iterations unless there are interruptions such as unexpected events or new discoveries (Tyre & Orlikowski, 1994).[84] This point suggests that an iterative approach is effective to manage uncertainty, but at the same time how to manage discontinuity in the process has to be considered to successfully exploit the value of the prototyping process as exploration. In practice, the difficulty is in making a decision in the conflict between improving the current solution and exploring new possibilities. It is asserted that “there is a tension between evolving toward the final solution and exploring an unexpected design direction, which may be adopted or thrown away completely” (Beaudouin-Lafon & Mackay, 2007, p.1020). When regarding design problems as complex problems, each iteration in the prototyping process should include the reconfiguration of prototypes as the business situation dynamically changes and each iteration affects the next iteration (Rittel & Webber, 1973; see also Case 02). In other words, each iteration is not the same as it affects the mindset and the knowledge of project members is accumulated through the iteration. Thus, the analogy of tornado or a spring shape is more suitable than a horizontally-recurred circle. Similarly, Lim et al. (2008) assert that the process of prototyping is organic and evolutional. [85] Although the differences among iteration, increment and evolution are not often argued, software developer, Allan Kelly (2011) divides agile development into three types, which are iterative, incremental and evolutionary development. Iterative development turns large requirements to be small sized requirements that can be managed by short-term iterations. In iterative development, predetermined tasks and goals are assumed to be well defined and correct. Thus, even though it uses an iterative approach, all the effort is made for a big product launch, and changing requirements is perceived negatively. Incremental

[84] This point can be linked with Lewin’s there-step change model (Lewin, [1951] 1964; see also Schein, 1996).
[85] “Prototypes are the means by which designers organically and evolutionarily learn, discover, generate, and refine designs” (p.2).

development is similar to and based on incremental development, but the product release cycle is shorter than iterative development to gain users' feedback. Therefore, changes are a positive move and reducing tasks is regarded as saving, although it still starts with predetermined requirements. By contrast, evolutionary development starts with a loose set of requirements, as it assumes that it is hardly possible to identify all the requirements in advance. Not only in software development, specifying required features before prototyping is also questioned in product development (e.g., Boehm et al., 1984; Rudd et al., 1996; Thomke & Bell, 2001). The process is goal-oriented, and through the process, new requirements and opportunities are emerged and identified. The development has to be measured by how much progress is achieved towards the goal rather than by how many pre-set tasks are done. An important point for this research is that evolutionary development is a parallel process of creating solutions and discovering new requirements and opportunities. From this perspective, the findings of this research suggest that the term, evolution should be intentionally chosen to describe the process of business model prototyping. It is also argued that business models are a subject to evolve rather than something staying in the same state (Chesbrough & Rosenbloom, 2002; Mitchell & Coles, 2003; Gerasymenko et al., 2015). Thus, at least in the context of business model prototyping, the process can be seen as an evolutionary process as the development of prototypes works as an exploratory process for new opportunities.

Following the argument of the evolutionary process, another question is raised; how the emergence of new requirements and opportunities occurs. Some arguments suggest that iterations gradually improve a solution. For instance, Fixton and Rao (2014) claim that "emergent strategy is an iterative process, one experiment leads to another, and to another, in each case closing in on a workable solution" (p.49). As they apparently regard the iterations as experiments, this might not be exactly the case of prototyping, but an issue in emergent processes is that it is uncertain about whether the direction is right or wrong, and the accumulation of knowledge through iteration is more likely to lead to a fairly radical change of direction (Tyre & Orlikowski, 1994; Ries, 2011; Bogers & Horst, 2014). Emergence requires a deep understanding of the context of innovation opportunities. Peschl and Fundeider (2015, p.142) introduce the concept of emergent innovation and suggest that the realisation of potential opportunities requires an exploration for a profound understanding of the key contexts.[86] The aim of business model prototyping ca be to gain this level of understanding of a new business, and it is expected to lead the emergence of innovation through new business models. In the case studies (especially in Case 01and Case 04), the learning opportunities were distributed over the whole process of business development, and it was more chaotic than gradually mitigating the uncertainty of new businesses. Rather, the advantage of the iteration may be to generate the dynamics in the power structure for decision making to widen a window of opportunity to change (see Tyre & Orlikowski, 1994). In other words, iteration is not for gradually validating the parts of business models, but deconstructing and rebuilding the organisational situation for identifying new opportunities for business model innovation. Also, as the importance of principles and cultures is asserted, simply following the process may not result in intended outcomes.

[86] The full description is “only, if one has achieved a profound understanding of the core/deep meaning (of the innovation object, the organization, and its context), it is possible that one can explore its potentials. By “core” we refer to the very essence, the heart, the very meaning, the substance of an organization, of a product, service, business model, or, more generally speaking, of any phenomenon. This exploration on the level of the core (beliefs and assumptions) might lead to insights concerning the potentials and the emergence of new meanings, which are both completely new and at the same time fit into the existing contexts, as they are rooted in the core of the phenomenon and not in some imagination, projection, or wish of the observer” (p.142).

5.4.3. Process within prototyping: a circular process

The previous paragraphs overview the position of prototyping in the design process, and it suggests there are contradictory notions on the position of prototyping. This section will discuss how the process of prototyping is conceptualised in the existing literature.

In the argument of the design process, the concept of prototyping is often used to indicate agility of the process (see Design and design thinking subsection). Similarly, there is some literature indicating that the prototyping process itself is cyclic, even though the number of steps is varied (e.g., Simon, 1996; Wheelwright & Clark, 1994; Thomke, 1998). For instance, as a simple model of design processes, Simon ([1969] 1996) suggests a generator-test cycle model. This model simply includes two phases. The generator phase produces a solution, and it is tested in the later test phase. Although this model is developed as a model of design processes, it is also regarded as a foundation of process models of prototyping (e.g., Thomke, 1998). In software development, Floyd (1984) suggests the four steps of prototyping: functional selection, construction, evaluation and further use. In this process model, it is assumed that prototyping is to test a set of selected functions.

Wheelwright and Clark (1992; 1994) introduce the design-build-test cycle of prototyping. They do not include the evaluation phase in the model, but they acknowledge these three steps are followed by evaluation of the results deciding whether to launch the solution or to go back to the design phase. Similarly, Thomke (1998) introduces four steps of the prototyping cycle that divide the test phase into ‘run’ and ‘analysis’ (see also Von Hippel, 2005; Bogers & Horst, 2014). Moreover, cyclic process models are found not only in design. In the study of innovation management, Cole (2002) suggests an iterative approach repeating a cycle of prove-and-learn for managing innovation. In entrepreneurship, the Lean Startup methodology also proposes a cyclic process is going through the steps of build, measure and learn (Ries, 2011). These models are designed for managing uncertainty and complexity as prototyping is expected to do.

5.4.4. Process within business model prototyping

While the process model within prototyping is understandable through review interviews, learning was conducted through informal interaction through the process in the case studies (Case 01, Case 02).

Learning throughout the process resonates the concept of 'reflection-in-action' (Schön, 1983) and "thinking through prototyping" (Klemmer et al., 2006), and the concepts support the unstructured nature of the synthesising process. Bogers and Horst (2014) advocate that the prototyping process happens on two levels. One is a formal or 'managerial' prototyping process, and the other is an informal or 'designer' prototyping process. While the former takes time, the latter could happen in seconds.

In review interviews, however, it was pointed out that reflection did not seem to be at a different level but embedded in each phase for decision making for the next step (VI03, VI04). Also, reflection is not limited to designers but all the participants in prototyping (VI04).

Rather, serendipity can be a more suitable concept to describe instant informal learning in prototyping (VI01). It is argued that serendipity is not a simple hunch but an outcome from an accumulation of learning knowledge (see Dew, 2009). The importance of informality might not be limited to the interactions among internal actors. This research suggests that external actors play an important role in the learning process, and it is also suggested that formality in the communication with clients can deteriorate the quality of learning (Fitzpatrick, 2013).

5.5. Context

Although the importance of context in prototyping has been acknowledged (e.g., Nielsen, 1993; Snyder, 2003), it is not so well regarded as the attributes of prototypes themselves such as fidelity (e.g., Virzi et al., 1996; Nilsson & Siponen, 2006), or materials (e.g., Sefelin et al., 2003; Akaoka et al., 2010). Recently, however, some researchers have started to afford greater attention to the context surrounding prototyping – including factors such as participants, environment and organisational culture – as an influential factor in their outcomes (e.g., Lim et al., 2006; Sauer et al., 2010). This subsection discusses the role of contexts in prototyping. As context is a theoretically broad concept, this section argues the concept based on the three aspects identified through the synthesis of the frameworks in literature: participants, environment and culture. 'Participants' is relevant to who are involved in prototyping. 'Environment' is how prototyping is set up, and culture is organisational culture and individual mindset influencing decision making through prototyping (Figure 5-5).

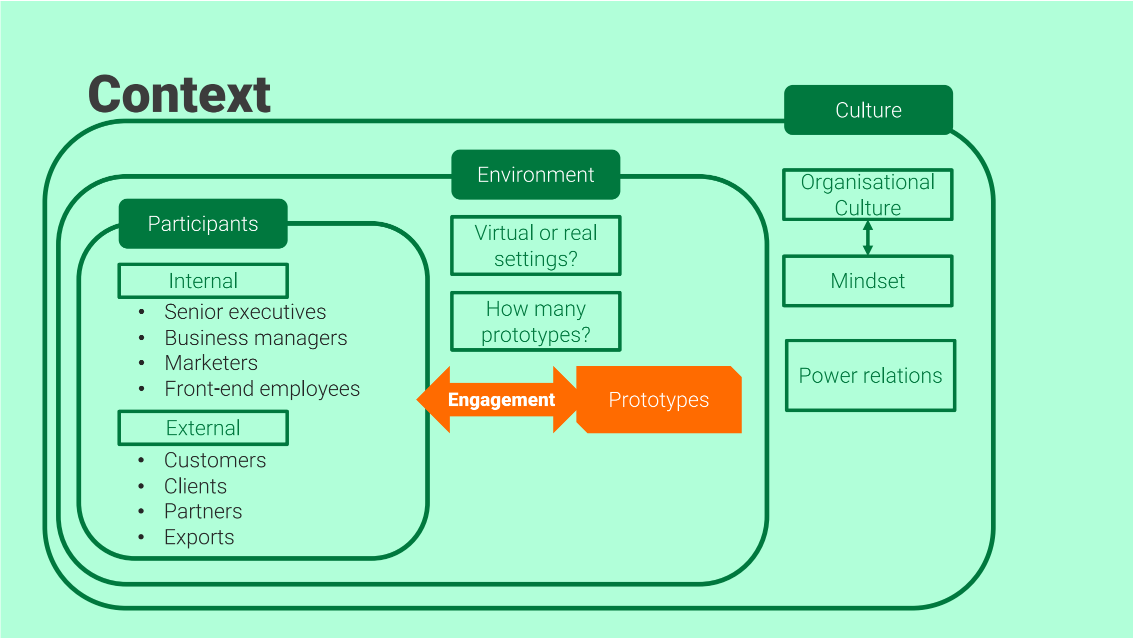

Figure 5-5: The framework of context

5.5.1. Key elements of context

5.5.1.1. Participants

The involvement of various actors is important in prototyping as learning from feedback and understanding the complex contexts (Buchenau & Suri, 2000; Mascitelli, 2000; Terwiesch & Loch, 2004; Bogers & Horst, 2014). The diversity of actors involved in the process is relevant to the quality of the outcomes of the process. To put it another way, not only how to build prototypes but also who is involved in the prototyping process is an important aspect as it influences the quality of learning outcomes through business model prototyping.

Ideally, all the actors should be involved in the prototyping process (Blomkvist & Holmlid, 2011a), but practically only a limited number of actors can be involved in the process so that the selection of actors involved in prototyping is important (Vink et al., 2008; Blomkvist & Holmlid, 2011b). One of the aspects to influence the actor selection is the purpose of prototyping. For instance, while prototyping for persuasion usually needs to involve clients (Blomkvist & Holmlid, 2011a), prototyping for evaluation usually requires customers and end users to be involved in (Blomkvist & Holmlid, 2011a).

Participants of prototyping is not limited to the design team and can be internal and external actors of the focal organisation (Blomkvist & Holmlid, 2011a; Bogers & Horst, 2014). In interaction design, common actors are interaction designers and usability experts, but marketers, managers and users are also reported as involved actors in prototyping for collaboration (Bogers & Horst, 2014).For service design, internal actors can be colleagues including business strategists, brand consultants, usability experts, project managers, business managers and designers (Blomkvist & Holmlid, 2011a). In new product development (NPD), it is identified that involving internal actors from various functions and hierarchical levels is significant, especially for R&D, production, and management (Adler, 1995; Song et al., 1997; Song et al., 1998; Buur & Matthews, 2008; Atuahene-Gima & Wei, 2011). Potential external actors are clients (Buchenau & Suri, 2000; Blomkvist & Holmlid, 2011a) and end users (customers) (Terwiesch & Loch, 2004; Bogers et al., 2010; Poetz & Schreier, 2012) as well as external suppliers (Bozdogan et al., 1998; Van Echtelt et al., 2008; Henke & Zhang, 2010).

Also, in the cases of commercial organisations, the influence of investors cannot be ignored. For small organisations, as they do not have a plenty of internal resources, external advisors and mentors tend to be influential in decision making for business model prototyping. Thus, communication among actors is an important source for identifying potential opportunities. Additionally, it is suggested that the professional backgrounds and skill sets of participants are also influential (Jensen et al., 2015).

Throughout this research, it is identified that the diversity of actors is an issue to embrace in business model prototyping (Case 01, Case 02, Case 03, VI04). For exploration in business model prototyping, gaining feedback is a key objective and communication among actors is an important activity to learn potentially viable business models. Although even the importance of actor engagement or involvement is recognised in the argument of prototyping in general, it is distinctively important for business model prototyping due to the complexity of the contexts surrounding business model development.[87] Part of the reason is that business models themselves are a social construct (VI04).

Moreover, an issue of finding key actors is that the actors may not be identified before prototyping is conducted (Case 01). Thus, the reflection on the selection of actors during the prototyping process is also helpful for context setting.

5.5.1.2. Environment

The environmental setting is regarded as important as participants themselves, as it influences validity and authenticity of learning outcomes from prototyping (Blomkvist & Holmlid, 2011a; Jensen et al., 2015) as well as the quality of learning (Lim et al., 2008). In HCI research, for example, Mackay (2002) claims that users show different behavioural patterns in a different context of use. Thus, the contextual environment surrounding participants in prototyping should not be dismissed (see also Beaudouin-Lafon, 2004; Appert et al., 2005). There are mainly two ways to manage the environment: closeness to reality and multiplicity of business model prototypes.

5.5.1.2.1. Closeness to reality

To make sure the learning points from prototyping are valid, the contextual environment should be close to the actual context in which products or services are used (Blomkvist & Holmlid, 2011a). Therefore, in design literature, it is preferable for user research to be conducted in a real setting (e.g., Brown, 2008), or at least as close to a real situation as possible to maintain the reliability of feedback (Convertino et al., 2004).

[87] The same point is argued for service prototyping (Blomkvist & Holmlid, 2011a).

It is concerned especially when researchers or designers use indirect representations such as role playing (Blomkvist & Holmlid, 2011a) and 'personas'[88] (Turner & Turner, 2011), as the use of stereotypes could mislead design teams (Blomkvist & Holmlid, 2011a). The gap between a prototyping environment and the actual context could not only underestimate the value of design ideas but also potentially cause over-expectations or oversell the ideas prototypes represent (Alavi & Napier, 1984; Iivari & Karjalainen, 1989). Another problem is that if sources of learning are not authentic and the contextual setting is not appropriate, prototypes and learning outcomes could be used in a distorted way (Blomkvist & Holmlid, 2011a). Blomkvist and Holmlid (2011) describes the problem with an example in which actual users of prototypes pretend the prototype does not work as it is not for their benefit.

Regarding business model prototyping, setting up prototyping environment to be close to a real context is rather difficult than general prototyping as business situations tend to be too complex to represent in a virtual setting. It is asserted, therefore, that rather than virtually setting up a situation for prototyping, taking advantage of a real setting is effective to learn for business model development in literature (e.g., minimum viable product (Ries, 2011; Moogk, 2012; Blank, 2013; Münch et al., 2013)) and were also observed in the fieldwork (Case 01, Case 02). Furthermore, mobilising additional resources including financial supports during business model prototyping is significant; as the organisation needs to prepare for a significant change of business direction that usually requires unexpected, additional resources. Therefore, exposing ideas to external actors is a key activity during the prototyping process, and this may be difficult to achieve by prototyping in a closed setting.

[88] About a design research method using 'personas', see Cooper (2004).

5.5.1.2.2. Multiplicity of business model prototypes

Not only closeness of the situation to the actual context but the number of prototypes can influence the learning outcomes. In the literature, It is asserted that developing multiple prototypes in parallel can be more effective in the design process (Ward & Liker, 1995; Tohidi et al., 2006; Dow, Fortuna, et al., 2012). The same point is asserted by business modelling experts (Osterwalder, Founder Fabric). In the case studies, it was observed that a business could have multiple business models in a single context, and business models are not locked in one map (see Case 01). An expert interviewee also mentioned that a business is not necessarily limited to one business model but can have multiple business models. Although completely different prototypes of business models may be difficult to develop, it can be possible to include multiple models in a component, such as revenue streams, to explore the feasibility (see Case 01).

However, the number of prototypes for business models tends to be small in practice. It is because when it includes an implementation of prototypes in a real context it consumes time and costs, and also lacks rich evidence to convince supporters of ideas. That said, in the process of developing businesses, business models themselves can be represented at various levels of abstraction for communication.

5.5.1.3. Culture

In addition to participants and environment, organisational culture in the prototyping process plays an important role, especially when the decision-making process is influenced by the relationship between designers of prototypes and decision makers (Blomkvist & Holmlid, 2011a; Knapp et al., 2016). Although some frameworks of prototyping do not mention about culture, it is because those frameworks tend to focus on how to build prototypes rather than the entire context of prototyping. Although prototyping can be seen as a normative process of developing businesses from the positivistic point ofview, a step-by-step type of instructions for the process is not suitable for business model innovation as various contextual factors influence the process. [89] The consideration of the dynamics of organisational culture including mindset is required to utilise business model prototyping effectively. Also, the importance of mindset (Carlgren, 2013) or mentality (Hassi & Laakso, 2011) is pointed out for design thinking as well as innovation (Steiber & Alänge, 2013).

Although organisational culture and personal mindset are in different scales of views, the interdependency of the two factors is identified in business model experimentation in management (Chesbrough, 2010) and prototyping in engineering design (Gerber & Carroll, 2012). Organisational culture influences personal mindset of the members of the organisation and vice versa. Thus, they cannot be clearly separate. However, it would be worth noticing that there are different levels of factors in the culture of prototyping. Therefore, the following part separately argues the two concepts.

5.5.1.3.1. Organisational Culture

The influence of organisational culture and politics on prototyping is pointed out in both design and management research (e.g., Schrage, 1993; Kelley & Littman, 2001) as well as in sociology (Henderson, 1995). Existing corporate culture can be a barrier against conducting prototyping (Gerber & Carroll, 2012). Schrage (1993) anecdotally introduces a case of IBM PCjr, in which he asserts that the product was withdrawn due to a 'specification-driven' culture of the firm. However, the influence is not one way. For instance, it is asserted that prototypes, both three-dimensional and two-dimensional, can

[89] Similarly, Nussbaum (2011) criticises design thinking as a failed experiment, as it turns to be a linear, phase-based methodology (see also Hestad & Brassett, 2013).

be influential in politics in an organisation (Henderson, 1995). The relationship between the author of prototypes and decision makers is also important, as it influences how the learning outcomes are reflected in the decision-making process (Blomkvist & Holmlid, 2011a; Knapp et al., 2016). Thus, although stakeholder involvement is important for prototyping, it does not simply mean asking what they think can provide right answers. Schrage (2004) proposes the Prototyping Partnership Principle, suggesting that prototyping should not be made for, but with participants. Findings on culture in the fieldwork seem to be in line with the theories in literature, or the findings from the fieldwork emphasise the influence of culture in business model prototyping more than literature. In the fieldwork, the issues of organisational culture and mindset were acknowledged (EI02, EI04, VI01). Also, Case 03 suggests that implementing agility is not only a process but requires an organisational commitment to implement. In this case, the leading members of implementing the agile process was external project members, and hiring internal staff became an issue for keeping the agile process within the organisation. Review interviews also suggest that lack of prototyping culture accepting failure (VI01) and preference for business plans (VI04) can prevent the organisation from using prototyping approaches.

5.5.1.3.2. Mindset

In prototyping, not only an organisational level of culture but also the importance of mindset is identified, which is named 'low-fidelity (prototyping) mindset' (Buchenau & Suri, 2000; Gerber & Carroll, 2012). The mindset appreciates the value of low-fidelity prototyping and learning by doing. The overall objective of business model prototyping is learning, and the organisational mindset influences the learning process (Buchenau & Suri, 2000; Chesbrough, 2010; Gerber & Carroll, 2012). Also, Gerber and Carroll (2012) suggest that the practice using low-fidelity prototyping influences not only the result but also how people feel the process. In other words, the practice and the mindset influence each other. Gerber and Carroll (2012) further indicate the prototyping mindset influences in three ways. The practice "1. reframes failure as an opportunity for learning 2. supports a sense of forward progress, and 3. strengthens beliefs about creative ability" (p.70). Also, the psychological aspects of prototyping seem to be as important as the structure of the process. However, as Gerber and Carroll (2012) claim, the psychological experience of prototyping has not yet been fully investigated, and this suggests that understanding the psychological aspects will be beneficial also for business model prototyping. In the fieldwork, it is also pointed out that fixation to an idea and lack of openness to new ideas are issues when prototyping is conducted (EI02, EI04). Fixation is also a problem in the process (Cardoso & Badke-Schaub, 2009). Additionally, for trying new things, taking risks is important and the mindset is needed to prepare for taking risks (Rauth et al., 2010; Carroll, 2014 see also Case 02, VI01). Also, many findings from prototyping are outside of the assumptions and hypotheses formulated before prototyping is conducted. Thus, openness to new findings is required when prototyping is carried out. Mindset is connected with how to perceive and deal with the complexity, because the relationship with prototyping and final outcomes tends to be blurred in business model prototyping, and the mindset seems to influence the perspective. In other words, the main outcome in the short term can be a prototype in the long term.

5.6. Engagement

It is argued that engagement with users and other actors is an important aspect for prototyping (Beaudouin-Lafon & Mackay, 2007; Han, 2009; Rizzo & Cantù, 2013; Bogers & Horst, 2014; Jensen et al., 2015). Prototypes support the facilitation of communication within and across different actors in design processes (Erickson, 1995;

Kolodner & Wills, 1996; Schrage, 1996; Schrage, 2000; Kelley & Littman, 2001; Yang, 2005; Blomkvist & Holmlid, 2009). However, it is considered as a difficult activity (Voss & Zomerdijk, 2007), and the difficulty will be discussed with the concept of 'boundary objects'.

The traditional literature on prototyping coming from product design, however, discusses engagement largely regarding 'interactivity', and focusses upon only whether the prototype has an interactive function (e.g., Beaudouin-Lafon & Mackay, 2007; Lim et al., 2008). In addition to the interactivity of prototypes themselves, the proposed model in this thesis considers interaction among actors and situations through prototyping as a key factor in the value of prototyping (see Latour, 1996; Reckwitz, 2002; Kimbell, 2012).

Fidelity – either low-fidelity rough and dirty models, or high-fidelity almost finished products – is also a widely discussed subject regarding prototyping (e.g., Rudd et al., 1996; Virzi et al., 1996; Houde & Hill, 1997; Walker et al., 2002; Lim et al., 2006; McCurdy et al., 2006; Sauer & Sonderegger, 2009). However, as business models, prototypes are not necessarily physical, because the level of abstraction of business models is high in itself. Business models can be even narratives (Magretta, 2002; Massa & Tucci, 2013). For this thesis, fidelity in the dimension of engagement, in the argument of engagement, relates to how precise the prototype affects the engagement of actors in the design and development of business models. Thus, this thesis sees engagement as not interactivity or fidelity but embraces a wider definition of its possibilities.

While it is identified that engagement or involving various actors is a key for prototyping (Brown, 2008; Blomkvist & Holmlid, 2011a; Jensen et al., 2015), it is difficult to collaborate with people from different backgrounds as they tend to have a different view of their own businesses, let alone people outside the organisation such as partners and customers (Erickson, 1995; Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2009). To resolve the difficulty, prototypes can work as a medium of sharing the common understanding of their businesses and services (Star & Griesemer, 1989; Henderson, 1991; Carlile, 2002; Nicolini et al., 2012; Bogers & Horst, 2014). In other words, prototyping encourages actors to engage with the process. Kelley and Littman (2001) describe prototypes as "almost like a spokesperson for a particular point of view, crystalizing the group's feedback and keeping things moving" (p.112).

The function of supporting communication and engagement played by objects is argued as the concept of 'boundary objects' (Star & Griesemer, 1989; Henderson, 1991; Carlile, 2002).[90] By sociologists, Susan Star and James Griesemer (1989, p.393), boundary objects are defined as "objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use".[91]

Boundary objects exist between different social worlds and work as bridges between them (Nicolini et al., 2012) or a platform for communication among various perspectives (Bogers & Horst, 2014). This concept of boundary objects can explain a function of prototypes for supporting various actors to engage in the business model development.

[90] Carlgren (2013) asserts that design thinking itself can work as 'boundary objects'.
[91] The more extensive definition is that "objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. They may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is key in developing and maintaining coherence across intersecting social worlds" (Star & Griesemer, 1989, p.393).

This research identifies three key elements that support prototypes to work as boundary objects for encouraging engagement: fidelity, scope, and representation (Figure 5-6).

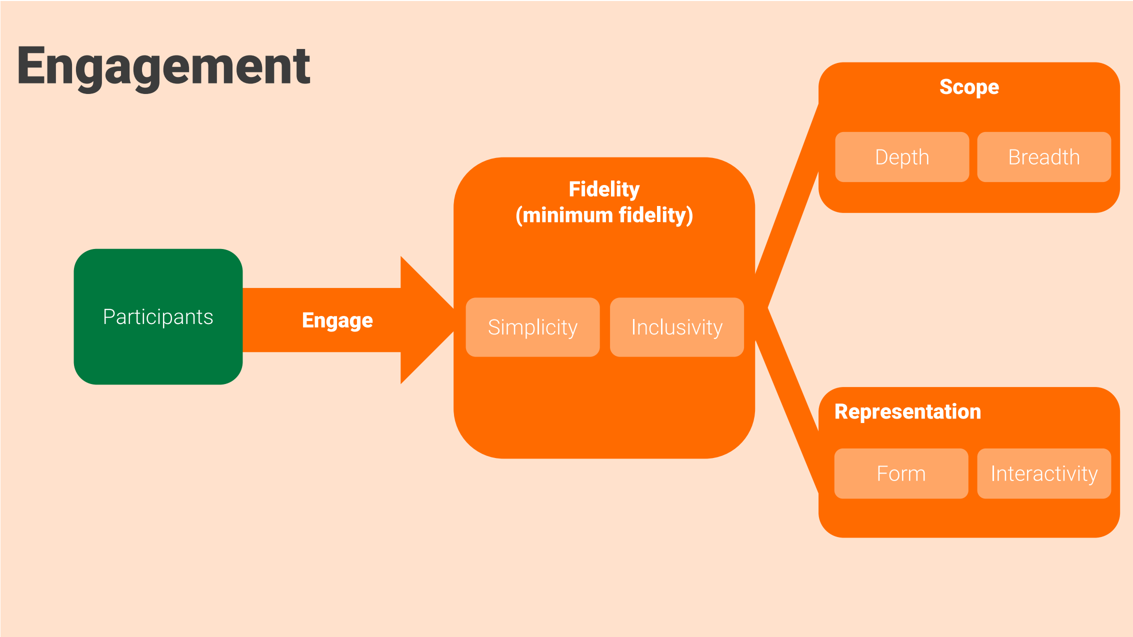

Figure 5-6: The framework of engagement

5.6.1. Fidelity

Fidelity of prototypes needs to be aligned with the ability of participants to correctly grasp the role and purpose of prototyping for enabling the participants to give a meaningful feedback (Bryan-Kinns & Hamilton, 2002; Markensten, 2005; Buxton, 2007; Samalionis, 2009; Blomkvist & Holmlid, 2011a).[92] Thus, it is important to set a proper fidelity of prototypes to help participants to engage.

There are extensive arguments in design practice about levels of fidelity of prototypes (e.g., Rudd et al., 1996; Virzi et al., 1996; Houde & Hill, 1997; Walker et al., 2002; Lim et al., 2006; McCurdy et al., 2006; Sauer & Sonderegger, 2009). In the

[92] Passera, Kärkkäinen and Maila (2012) call this fit 'plausibility', which they suggest is experiential.

argument of design, the advantage of low-fidelity, or ‘quick-and-dirty’, prototypes for exploration is emphasised (e.g., Dijk et al., 1998; Sefelin et al., 2003; Buxton, 2007; Brown, 2008; Gerber & Carroll, 2012; Hare et al., 2013). (e.g., Buchenau & Suri, 2000; Brown, 2009; Gerber & Carroll, 2012).

A reason why low-fidelity prototypes are preferable in design contexts is that designers can be open to the feedback when they spend less effort and time for the prototype and avoid the fixation with their initial idea (Brown, 2008; Gerber & Carroll, 2012). An expert interviewee also indicates that Industrial designers, Dijk et al. (1998) also assert that the experimentation with pilots is usually lengthy and expensive, and quick evaluations with abstract prototypes are more effective for exploration. Prototypes should be developed only enough to get valuable feedback and improve or generate ideas.

However, a value of high-fidelity prototypes is also indicated. For instance, ‘realistic’ impressions is also argued as important for gaining feedback (Holmquist, 2005). As both high-fidelity and low-fidelity prototypes have advantages and disadvantages, the selection of representations should be aligned with the purpose of prototyping (Rudd et al., 1996; Houde & Hill, 1997; McCurdy et al., 2006).

Interactive design researchers, Jim Rudd, Ken Stern and Scott Isensee (1996) compare low-fidelity and high-fidelity prototypes to clarify the advantages and disadvantages of both. One interesting claim of their research is that while prototyping with low-fidelity prototypes tends to be facilitator-driven, prototyping with high-fidelity prototypes is user-driven. As the involvement of external actors is an important factor for business model prototyping, the advantage of being user-driven can be considered as beneficial for business model prototyping. From this point of view, consideration on the fidelity of prototypes is important for learning, as it influences the efficacy of the learning process.

In addition, some researchers also claim that the simple dichotomy of low-fidelity and high-fidelity of prototyping is problematic (McCurdy et al., 2006; Lim et al., 2006) and mixed-fidelity approach is proposed as an alternative approach (McCurdy et al., 2006).

Type	Advantage	Disadvantage
Low-Fidelity Prototype	• Lower development cost. • Prototype Evaluate multiple design concepts. • Useful communication device. • Address screen layout issues. • Useful for identifying market requirements. Proof-of-concept.	• Limited error checking. • Poor detailed specification to code to. • Facilitator-driven. • Limited utility after requirements established. • Limited usefulness for usability tests. • Navigational and flow limitations.
High-Fidelity Prototype	• Complete functionality. • Prototype Fully interactive. • User-driven. • Clearly defines navigational scheme. • Use for exploration and test. • Look and feel of final product. • Serves as a living specification. • Marketing and sales tool.	• More expensive to develop. • Time-consuming to create. • Inefficient for proof-of-concept designs. • Not effective for requirements gathering.

Table 5-2: Advantages and disadvantages of high-fidelity and low-fidelity prototypes (adopted from Rudd, Stern and Isensee (1996))

Furthermore, the minimalism of business model representations is argued rather than the degree of fidelity in the context of business model development (e.g., Ries, 2011). For instance, the concept of minimum viable products indicates that the prototype should be minimally developed just enough to get feedback. Moreover, in software engineering, Floyd already realised in the 1980s the importance of minimalism for exploratory prototyping, stating that “exploratory prototyping can only be recommended if there are tools available which keep to a minimum the effort required in constructing the prototype” (1984, p.7). Lim et al. (2008, p.3) also propose ‘the economic principle of prototyping’, stating that “the best prototype is one that, in the simplest and most efficient way, makes the possibilities and limitations of a design idea visible and measurable”.

In the fieldwork, it seems that the issues of fidelity are not keeping prototypes low-fidelity but how to take a balance between precision and agility (Case 04, VI04). The emphasis on using low-fidelity prototypes can be valuable also for business model prototyping, but the findings from the case studies suggest that the relationship between learning outcomes and iteration is more complex.

It is clear that it has a substantive advantage if a right idea is identified in a very early stage with low-fidelity and low-budget prototypes. However, it is doubtful whether the same level of learning from the implementation of ideas in a real context or 'high-fidelity' prototypes can be gained from such low-fidelity prototypes. This is because the validity of contexts surrounding prototyping influences how to learn the outcomes of prototyping (Blomkvist & Holmlid, 2011a) Therefore, selection of a prototype's fidelity seems to be more sensitive than always choosing low-fidelity prototypes, especially in the context of business model prototyping.

While an advantage of prototyping is described as giving designers the capability of learning from failure, a benefit of using prototyping is also claimed as it can allow the users of prototyping to avoid critical failures, or even guarantee a success (e.g., International Organization for Standardization, 2010; see also Norman & Verganti, 2014). In other words, how failures actually influence the process is not clarified, and how much seriousness of failures is required is almost ignored. Learning outcomes from a big failure can be different from those from small failures.

It hindsight, it may look as if what you have learned from a large mistake could have been learned from a smaller one, but they are different especially when the problems tackled are complex, as the context of the failures is distinctively different. As most of businesses and projects have constraints, the learning process should be effective. Thus, maximum learning with minimum effort should be praised, but it should be acknowledged that being low-fidelity, or quick-and-dirty, does not always produce rich learning outcomes and influence the direction of businesses.

For business model prototyping, it has to be well considered whether learning outcomes from low-fidelity prototypes are the same as the learning outcomes from high-fidelity prototypes. This indicates the importance of consideration on whether the fidelity of prototypes is aligned with the learning objectives.

However, what is minimum for business seems not to be objectively clear but rather contextual, as the complexity of business model development is high. Thus, it is understandable that it is recommended that the degree of fidelity should be low in prototyping, but in the case of business model prototyping, low-fidelity is not necessarily always right. It is because validity is important for business model prototyping, and fidelity influences the validity of learning outcomes.

What makes difficult to understand the concept of business models is that there are various ways of representing business models. Massa and Tucci (2013) identify various tools to represent business models and suggest that the ways of representing a business model can be structured by the level of abstraction (see Figure 2-1). As discussed in 2.2.1.2, it is important to control the level of abstraction to align the complexity or the fidelity of business model representations with the objectives of prototyping.

5.6.2. Scope

As some prototypes represent only part of final products or solutions, scoping what is prototyped is an important point to consider (Lim et al., 2008). Also, how precisely a prototype represents a part or the whole is an important metric to characterise prototypes. Floyd (1984) describes there are two ways of selecting functions to prototype:

- Vertical Prototypes: The prototype represents a detailed function, but not all the functions are implemented.
- Horizontal Prototypes: The prototype represents the full range of the functions, but some details are omitted.[93]

Vertical prototypes focus on a particular aspect of a final outcome, and horizontal prototypes represent the whole impression of a final design but are not fully developed. Houde and Hill (1997) criticise the categorisation of prototypes by attributes, or what the prototype is made of, such as paper prototypes. Instead, Houde and Hill suggest to categorise prototypes by what prototypes prototype. Their proposed categorisation includes role prototypes, look and feel prototypes and implementation prototypes. In addition, they also suggest integration prototypes as another type of prototypes, which represents the whole experience of users. The first three categories can be seen as vertical prototypes, and integration prototypes can be regarded as horizontal prototypes in the terms of Floyd's. Similarly, McCurdy et al. (2006) argue this two aspects of representation as 'breadth' and 'depth'. The argument above suggests fidelity can be managed by controlling the scope with breadth and depth.

[93] Floyd calls them vertical prototyping and horizontal prototyping.

5.6.2.1. The issue of complexity

In business model prototyping, the selection of scope can be controversial. As we have seen, a characteristic of business models is that it can be simple but inclusive. As an advantage of using business models is the inclusivity, prototypes for business models should be holistic. Some components are identified within a business model, and each component can be separately used in prototyping. However, the interdependency of components in a business model may be considered as an independently viable component may not work in a certain business model. In other words, even if separately verified parts are assembled to be a business model, it does not necessarily mean the business model as a whole is viable.

5.6.2.2. The blurred boundary between business and business model prototypes

Another problem for business model prototyping is that the boundary between final outcomes and prototypes is not as clear as argued in the literature of design. Some arguments in design thinking about prototyping point out the difference between prototypes and the final solution. For example, Designer, Bill Moggridge (2007, p.685) regards prototypes as 'a representation of a design, made before the final solution exists'. This is clearly based on the assumption that there is a boundary between prototypes and the final solution. Based on this assumption, it is also plausible to say prototypes are something 'filtered' from intended final design outcomes (e.g., Lim et al., 2008).

However, as business models represent a complex environment of a business, it is difficult to gain a profound knowledge from a simulated situation. In other words, the prototyping process requires a certain amount of validity in the representation, and the level of validity affects the quality of learning outcomes.

In the definition of design by Simon (1996) suggests that even if prototypes work successfully in a virtual situation, it does not guarantee the success in an actual context. A review interview agrees this point, suggesting that all products are a prototype in a long term (VI04).

As a way of resolving this problem, some practitioners recommend to launch a developing product to market in the early stage (Cooper & Vlaskovits, 2010; Ries, 2011; Blank & Dorf, 2012). The main purpose is to gain actual data through an actual product launch. In this approach, the boundary between prototypes and the final solution is blurred or ignored. The prototype should be minimally developed just enough to get feedback as the method of minimal viable products (Ries, 2011; Moogk, 2012; Blank, 2013; Münch et al., 2013).

Surely, from the perspective of risk management, a virtual situation and limited exposure of the representation of the solution are preferable as it can avoid the risk of being copied and damaging brand images. However, to cope with the complexity of businesses, exposure of prototypes to the real market can provide opportunities to maximise the validity of learning and gain a profound insight for business model innovation. In the case 01, the main event rather worked as a prototypes when prototyping is regarded as a learning process.

5.6.3. Representation

5.6.3.1. Form

Representation is about how ideas are represented. Giving forms is important for representation and gaining feedback even in subjects dealing with intangible outcomes, such as interactive design (Vallgårda, 2013). Tangibility is considered to influence how participants engage with prototyping (Ullmer & Ishii, 2000; Liedtka, 2015), and some scholars call the function ‘tangible interaction’ (Hornecker & Buur, 2006; Baskinger & Gross, 2010; Petrelli et al., 2014). In design subjects dealing with hardware, such as engineering design and HCI, physical characteristics are key attributes for representation, and prototypes can be easily associated with physical forms. Thus, from this perspective, a consideration point relevant to representation is whether prototypes are two dimensional (2D) or three dimensional (3D). In this sense, physical objects play an important role to generate tangible interaction (Djajadiningrat et al., 2004).

By some scholars, however, the diversity of the medium for prototypes is acknowledged (Houde & Hill, 1997; Beaudouin-Lafon & Mackay, 2007). For instance, Houde and Hill (1997) define prototypes “as any representation of a design idea, regardless of medium” (p.369). Although Brown (2008) emphasises that prototypes should be tangible even if the prototypes are for services, tangibility in this context does not simply mean that the prototype is a physical representation. Tangibility can be produced by visually represented outcomes such as pictures and videos. Similarly, it is argued that prototypes can be non-physical representation such as visual storytelling (Lockwood, 2010b; Sanders, 2013). Lockwood (2010b) asserts that “prototypes can be concept sketches, rough physical mock-ups, or stories - or role-playing or story boards, for a service design - and always include a form of visualization of concepts” (p.). This broad definition of prototypes can also include some methods and tools of service design such as story boards, customer journey map and service blueprint as prototypes (see also Polaine et al., 2013). Furthermore, even in product design, Moggridge (2007, p.685) regards prototypes as “a representation of a design”, which implies that it is not necessarily physical.[94] When prototypes are seen as boundary objects, prototypes can be conceptualised as something that can be “abstract or concrete” (Star & Griesemer, 1989, p.393; see also Cartwright & Mendell, 1984; Griesemer, 1990). Lim et al. (2008) also assert that they use the term, ‘formation’, rather than ‘construction’ of prototypes because prototypes are not always physically constructed and “can be formed by invisible triggers or behaviors” (Buchenau & Suri, 2000).

Introducing a case of a hospital, Kaiser Permanente, Brown (2008) says “prototypes of a service innovation will of course not be physical, but they must be tangible. Because pictures help us understand what is learned through prototyping, we often videotape the performance of prototyped services, as we did at Kaiser” (2008, p.87). Similarly, NESTA (2011) asserts that “[prototyping] allows alternative ideas to be seen, felt, and experienced before choosing one (or more) for further development” (p.6). Intangibility of services is also identified as an issue for service designers to conduct service prototyping (Blomkvist & Holmlid, 2010). Although tangibility is regarded as playing an important role in prototyping for interaction and reflection (Klemmer et al., 2006), businesses are usually intangible or too complex to physically represent as a whole. Thus, for business model innovation, a necessary consideration for this dimension is intangibility of business models. Prototypes should be tangible to encourage actors to interact through prototypes, but for business model innovation, the traditional sense of physical tangibility needs to be modified to fit in the context of designing intangible business models. [95]

[94] Buchenau and Suri (2000, p.424) also define prototypes as “representations of a design made before final artifacts exist”.

[95] In some arguments, the practice of prototyping is limited as a practice using a physical representation of outcomes (e.g., Brown, 2008). On the other hand, in some arguments the concept is not clearly separate from the theoretical aspect of prototyping. Also the term ‘prototyping’ is used for meaning a physical representation itself rather than the process

In addition to forms, interactivity of prototypes – whether prototypes are interactive or static – is considered to influence how participants engage with the prototype (McCurdy et al., 2006; Beaudouin-Lafon & Mackay, 2007; Jensen et al., 2015). Beaudouin-Lafon and Mackey (2007) consider that the types of representation in prototyping can be divided into online prototypes an offline prototypes, or software prototypes and paper prototypes. However, they also notice that interactive prototypes tend to be online or digital, but as a method called Wizard of Oz exemplifies, interactivity can be represented by designers or participants of prototyping without technical programming skills (Beaudouin-Lafon & Mackay, 2007). In this sense, whether prototypes are online or offline, software or paper, is less important, but whether prototypes represent the interactive aspect of products or services should be considered.

5.6.3.2. How to represent

Mapping tools are a popular tool in the process of prototyping for complex outcomes (Case 01, Case 03, Case 04). In the literature of business model design, there are also various ways to communicate the ideas among actors. One way is using visualising tools such as mapping. Business Model Canvas (Osterwalder & Pigneur, 2010) is a good example of turning the business model to be tangible (Blank & Dorf, 2012), and there are modified versions of the mapping tools for entrepreneurs (Maurya, 2012) and social entrepreneurs (McCahill, 2013) to help them to visualise the abstract structure of businesses or activities. Those tools are useful for simplify a complex context to make it easy for various actors to understand the complex context. On the

(Blomkvist, 2011). Therefore, although the concept of prototyping in this section is more theoretical than physical prototypes, it can be based on the sources both from the theoretical arguments of prototyping and the arguments on the practice using physical prototypes. This point is relevant to the vagueness of the meaning of tangibility.

other hand, actual projects, services and products also work as a stimulus or a trigger to entice various actors to engage with the process and allow them to give feedback.

Also, as using a real context is useful for prototyping of complex things, pitching ideas to potential clients and implementation of actual projects were used for gaining feedback and learning in the cases (Case 01, Case 02). From this reflection, mapping tools are effective for identifying assumptions and problems from a holistic perspective, and a more detailed representations are useful for gaining feedback. In terms of interactivity, as mapping tools are not a direct representation of the product and the service, identifying whether it directly represents the interactive part of the product or service is difficult or is not really important for the approach. Rather, giving a holistic view to the participants helps them to interact with the designers of prototypes.

Furthermore, there are different ways of representing one business model, and they are modified following the purpose of using the prototype. Thus, it can be thought that it is important not to fix one way of showing a business model but handle a set of different representations for different purposes and different actors.

From these arguments and findings from empirical research, this thesis suggests two elements for identifying the minimum level of fidelity: simplicity and inclusivity. The two elements can be difficult to achieve at the same time as they have opposite characteristics. For instance, building high-fidelity prototypes could make a more inclusive representation of an idea, but the prototyping process might become slower due to lack of simplicity. Schrage (1996) introduces an example that Detroit car manufacturers adhere to physical clay prototypes was beat by the competitors with rapid virtual prototypes. However, the balance between the two elements needs to be considered to fit the prototyping process with the objective and reduce the waste of time and effort. Following these ideas, the required level of fidelity of prototypes basically depends on the learning objective and should be minimum. Additionally, as the process is assumed to be iterative, the agility leads faster cycles of iteration, and it will be a fundamental element of the prototyping process.

5.6.3.2.1. Simplicity

Through the case studies, it is identified that the interactivity of prototypes is relevant to the abstraction of ideas and the complexity of reality. From the former's point of view, the interactivity of prototypes is achieved by embodying ideas to be a more concrete form. On the other hand, from the latter's point of view, the interactivity is paradoxically achieved through simplifying the complexity of reality as the complexity hinders the participants to grasp the point of prototypes. Therefore, simplicity of prototypes is a key point when prototypes are developed.

5.6.3.2.2. Inclusivity

According to the existing literature on prototyping, the scope and focus of prototypes are important factors of prototyping. 'Filtering' is even considered an important part of prototyping (Lim et al., 2008). For business model prototyping, however, holistic approaches are seemingly more important than other types of prototyping, as problems tend to be too complex to manage by a partial representation of businesses. In other words, it is difficult to split a business to be a testable aspect for business model prototyping. At least, problems managed by prototyping should be identified through a holistic view that the usage of business models provides.

5.6.3.2.3. Dilemma between simplicity and inclusivity

The argument above shows a dilemma between simplicity and inclusivity of prototypes. The simplified idea may not be useful for representing the complexity of a business. However, if ideas are verified through simplified representations of business models, the validity of representations may be still doubtful. Thus, a key question for business model prototyping is not which part prototypes prototype, but how prototypes manage simplicity *and* inclusivity at the same time.

5.7. Business model prototyping as methodology

From reflecting on these dimensions, this thesis concludes that business model prototyping is not a single method or tool but consists of various methods and tools. Also, the dimensions of business model prototyping identified in this research are not independent factors but interdependent elements. Therefore, regarding business model prototyping simply as a method or a tool cannot capture the complexities of the discourses and significance of this activity for business model innovation.[96] Thus, this research proposes that business model prototyping is best considered as a methodology for exploring possible business models through designing, and gaining feedback from the interdependent business components the prototype configures (Figure 5-7).

In some literature, the difference between methods and methodologies is emphasised (e.g., Gasparski, 1986; Baskerville, 1991; Blaug, 1992). In a simple sense,

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[96] This point can be argued from the comparison between performative views and normative or ostensive views. One of the difficulty in defining business model prototyping is that the value of the prototyping approach may not be captured from a normative view for the concept, which pursue what it 'is' and what value it 'has'. Latour (1986) originally asserts this view as ostensive views. The same problems are pointed out in the arguments of intellectual capital (e.g., Mouritsen, 2006) and design thinking (e.g., Johansson-Sköldberg et al., 2013). It is argued that normative views are not preferable for some concepts which are extensively influenced by contexts. For these concepts, clarifying how it 'does' in an organisation and what value it 'may' produce is more useful than developing a general understanding of the concept. This view is conceptualised as 'performative' views (see Mouritsen, 2006). As business model prototyping deals with complex problems as the previous subsection shows, it is also difficult or hardly impossible to exploit the approach only with a normative understanding of the concept. Therefore, also this section discusses the value of business model prototyping based on a normative framework, the argument also pays attention to the performative aspect of business model prototyping. Therefore, instead of proposing a step-by-step process of business model prototyping, this research proposes business model prototyping as a methodology.

methodologies are regarded as “the study or description of methods” (Baskerville, 1991, p.750), and each methodology includes multiple methods (Ishak & Alias, 2005; Wiberg, 2013). Therefore, methodologies should not be an instruction or a mechanical algorithm of specific methods (Gasparski, 1986; Blaug, 1992), but “a study of the relationship between theoretical concepts and warranted conclusions about the real world” (Blaug, 1992, p.xii). In a more practical sense, “a guideline for solving a problem, with specific components such as phases, tasks, methods, techniques and tools” (Ishak & Alias, 2005, p.326). Based on this understanding, this research proposes business model prototyping not as a specific procedure but as a guideline for exploring potentially viable business models.

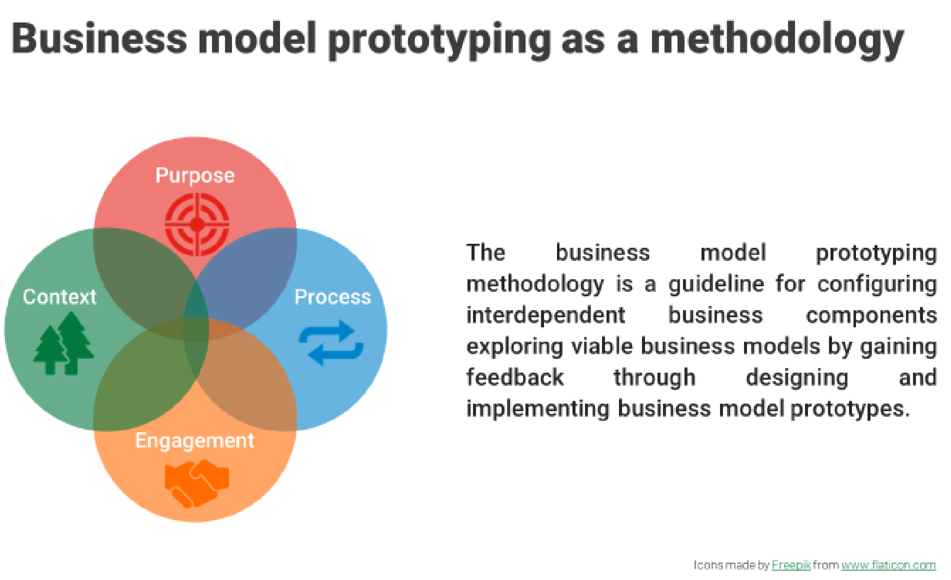

Figure 5-7: Business Model Prototyping as a methodology

6. Conclusion

Although the importance of exploration for business model innovation is acknowledged (e.g., Chesbrough, 2010; Sosna et al., 2010), the concept of business model prototyping is less argued and understood. Thus, this thesis has explored the concept of business model prototyping to clarify the role of design thinking in business model innovation. Through the exploration, this research develops a theoretical framework of business model prototyping with four dimensions — purpose, process, context and engagement — as a foundation for further research on the subject and . The main contribution to knowledge of this thesis. The framework is also useful for bringing the design perspective to the debate of business model innovation, and conceptualising business model prototyping as a methodology.

This thesis identifies the value of connecting the design methodology research with the larger domain of innovation management at the intersection of innovation studies and management research. Most importantly, the value of prototyping in design for business model innovation has not been well addressed. As the literature review reveals, although innovation studies needs to take interdisciplinary approaches for further understanding of innovation, the role of design and design research in innovation management has not been fully captured in innovation studies yet. Additionally, the research on the application of prototyping in business model innovation is still a new topic, and the usage of the term is still ambiguous. Thus, the literature reviews also explored the theoretical landscape of fundamental concepts for this research such as innovation, business models and design thinking. The broad theoretical exploration in this research bridges the gap among the subjects for further understanding of innovation management.

This thesis also defines business model prototyping as a methodology for business model development and innovation. As there are various tools and methods for prototyping, it is significant to understand how to coordinate those tools and methods of prototyping business models for managing business model innovation.

Based on these contributions, this chapter shows implications, limitations, and future directions of this research. ‘Implications’ section proposes what can be suggested from this research both for research and for practice. However, there are limitations in this research that restrict findings from this research, which are shown in ‘Research limitations’ section. Based on the limitations, the following ‘Future directions’ section suggests possible research tracks for the future.

6.1. Implications

This section shows implications of this research from perspectives of research and practice. The implications for research are divided into three levels. The first level is the disciplinary level, which implies a gap between design and dominant disciplines in innovation studies. The second is the methodological level reflecting the role of abductive approaches for design methodology research. The third is the theoretical level, at which are three implications, and the major implication is a theoretical framework of business model prototyping for further research. Moreover, distinguishing the difference between experimentation and prototyping and also between methods and methodologies also strengthen the theoretical understanding on the subject.

The implications for practice are threefold. One is the importance of a holistic perspective for managing business model innovation as a complex, or “wicked”, problem. Another is the need for shifting from focusing on experimentation to prototyping of business models. This implication is in line with a theoretical implication for research about the difference between experimentation and prototyping in business model innovation. The other implications are based on the reflection on dimensions of business model prototyping proposed by the theoretical framework.

6.1.1. Implications for research

6.1.1.1. Disciplinary implications

This research takes design as a main disciplinary position. It also includes, however, the arguments in innovation studies and management as business model innovation and design thinking have been discussed in various contexts and frameworks. In addition, the underlying concepts such as innovation, business models and design are not theoretically grounded with widely accepted definitions. The efforts to articulate the ambiguous concepts result in a theoretical foundation for analysing business model prototyping. Research on business model prototyping is still in the nascent stage of the development, but the theoretical exploration through this research revealed that there is a growing attention in exploring possible business models in innovation studies and management. However, the argument tends to focus on ‘experimentation’, and there is not much consideration on the role of design and design thinking for exploring business models (e.g., Chesbrough, 2010; Brunswicker et al., 2013). The theoretical foundation provided by this research includes the argument of design and design thinking, and it can support to narrow the gap between the research on business model innovation and the study on design methodology. Therefore, interdisciplinary collaborations among innovation studies, management and design will be beneficial for further understanding of innovation management.

6.1.1.2. Methodological Implications

This research relies on the integrated retroductive-abductive research strategy, proposed by Blaikie (2009), as the philosophical foundation and systematic combining, asserted by Dubois and Gadde (2002; 2014), as a theoretical framework of the research design. These research strategies are based on the abductive logic (Peirce, 1934a), which can be shared with the approach of design (Tomiyama et al., 2003; Kolko, 2009a; Kroll & Koskela, 2015) and design thinking (Martin, 2009; Dorst, 2011).

The research subject, business model prototyping itself is a methodology of finding business opportunities in complexity, where it is assumed that Positivistic approaches are rarely useful. As Cross (2007a) argues, the science of design is to examine design activities by a scientific approach, and it does not mean design activities need to be a scientific process. However, in my case, the education of Innovation Management at the master level was based on the methodology of design practices and appreciated more interpretive approaches.

Although the main objective of commercial design research is different from academic research, it was difficult to shift from design methodology, which is for creating new things, to sociological methodology, which is for revealing social activities that already exist. In the early stage of this research, a proposal of a more-action based research was refused and what was recommended instead was case studies examining cases that were already finished due to avoiding the risk of failure.

Based on the condition, this research started as a case study research, but there was an issue for finding suitable cases as an exemplified practices of prototyping in business model innovation. There are various possible reasons for the difficulty, but a potential reason was that although the value of business model prototyping can be theoretically identified, prototyping practices for business model innovation did not exist yet or at least were not in common as much as the cases can be easily found. Some industrial experts I asked about potential cases even replied that they themselves were looking for a way of prototyping a business. Unfortunately, as those conversations were for finding cases not for data collection, they were not stored as explicit evidences, but those conversations gradually moved the target of cases from direct representations to relevant cases for an exploratory orientation.

The systematic combining approach theoretically accepts such reorientation, and rather suggests it is an essential characteristic of abductive research (Dubois & Gadde, 2002; 2014). Also, the philosophical stance respecting both for theories and empirical findings was helpful for theorising the research methodology, as the practice of business model prototyping might not exist yet and simply relying on theories or empirical findings seemed to lead this research to be less plausible. Therefore, setting the purpose of the research to match theories and empirical findings was useful for building a more suitable theory for business model prototyping. Through this experience, it can be recommended that an abductive approach based on Blaikie's theory and systematic combining can be suitable for design methodology research for developing a new practice when you cannot have a direct control of subjects to examine.

6.1.1.3. Theoretical implications

At the theoretical level, there are three implications:

- The dimensional model as inspiration for further research
- Business model experimentation and business model prototyping
- From a method of prototyping to a methodology

First, as an exploratory research study, this research is designed to produce a source of inspiration for further examination of the practice of business model prototyping. The dimensions of business model prototyping can be used as a framework for further investigation for business model prototyping.

Secondly, this thesis contributes to knowledge on business model innovation by suggesting the potential usefulness of prototyping in design thinking for business model innovation. The arguments and study of innovation are mostly dominated by the concept of experimentation (e.g., Thomke, 1998; Chesbrough, 2010; Schrage, 2014). This research proposes using the concept of prototyping instead of experimentation, or at least theoretically dividing the two concepts to further understanding of the process. As this research suggests, it is problematic to implement scientific models to theorise design methodology in managing complex problems (Cross, 1982). This is also the case in business model innovation. As an alternative concept, the explorative element of prototyping in design thinking can support further understanding of the process of business model innovation. The theoretical framework of prototyping in business model innovation proposed in this research can be used as a starting point for further examination.

Thirdly, the debates on business models tend to focus on key components of a business model as well as analytical tools for business models (e.g., Osterwalder & Pigneur, 2010), but the practical use of the tools is less discussed. This research identifies the complexity in business model innovation and the interdependency of multiple dimensions of business model prototyping. Thus, this research concludes that business model prototyping should be considered not as a tool or method but a methodology to manage business model innovation.

6.1.2. Implications for practice

6.1.2.1. A holistic framework for tackling business model development as complex problems

Although tools of business models are useful to holistically capture a business model as a whole (Beha et al., 2015), the actual contexts of businesses also need to be considered. While such mapping tools are useful to spot potential opportunities, business models need to be implemented to make a distinctive change. Moreover, this thesis finds business models are not singular and can be prototyped for different purposes with various levels of abstraction (Massa & Tucci, 2013). Thus, in business model prototyping, the advantage of using business models is to enable actors to perceive a business from a simple and holistic perspective in prototyping. In other words, the purpose of developing business model prototypes is to untangle the complexity of business in order to help key actors to engage with the business idea.

6.1.2.2. Experimentation to prototyping

In business model innovation, interdependency among business components makes it difficult to identify a right business model through trial-and-error approaches. For innovation managers, the theory of wicked problems is useful to understand the characteristics of issues in making innovation. The theory suggests that it is difficult tolearn by trials and errors for complex problems (Rittel & Webber, 1973), and the case studies also indicate even a relatively small change in a business model could take a long time to figure out an effective coordination of business model components (Case 03).

In this situation, the prototyping approach is more suitable than experimentation, although the term, experimentation, is often used to represent the need for an iterative approach to manage the complexity. The theoretical framework of business model prototyping proposed in this research suggests the consideration points for practitioners to manage business model innovation. While visualisation tools for business models are popular, less attention are paid to the importance of setting up the right context. Findings from interviews and case studies also support the importance of contexts, and the framework will be helpful for guiding the process.

6.1.2.3. Implications on dimensions

In the field of business model prototyping, the boundary between an exploration phase and an implementation phase is often unclear. As the concept of prototyping suggests, the implementation process itself can be a learning opportunity in business model practices. Thus, implementation can act as a form of exploration.

Lack of resources (e.g. finance, knowledge or skills) can cause difficulties when bringing new ideas from development to implementation. One of the key activities in the early stage of business model prototyping securing resources to continue to explore by sharing the ideas with key actors. Thus, the securing process is crucial also because whether the idea can attract additional supports or not can be an indicator of the feasibility.

The prototyping process can be flexible but still needs to be managed. Rather, the findings in this research suggest that business model prototyping cannot be managed only by following a phase-based process and gradually moving from low-fidelity to high-fidelity prototypes. Practitioners of business model prototyping need to be aware of their mindset and organisational culture when leaning from prototyping. In other words, prototyping process should enhance both the individual's mindset and the whole organisational culture rather than focusing on fidelity.

For instance, low-fidelity prototypes are argued as an effective approach for getting feedback and exploring new ideas. On the other hand, high-fidelity prototypes have an advantage of empowering a user-driven process (Rudd et al., 1996). They are also used as an effective approach for convincing key actors in the decision-making process. Without an established organisational culture that fosters individual's capacity to learn, low-fidelity prototypes function merely as a means to an end.

Moreover, a prototype seen as a high-fidelity prototype from a certain perspective might be regarded as a low-fidelity prototype from another perspective. A high-fidelity prototype in a short-term perspective can be a low-fidelity prototype in a long term. Thus, identifying the minimal level of fidelity for maximise learning from business model prototyping is an important aspect of the process.

6.2. Research limitations

I have to admit that theorising an emergent concept was a tough challenge. The theoretical framework proposed in this thesis is just one way of approaching this complex practice, as this research is limited by a discipline, a methodology, accessible sources and the scope of the conceptual landscape. However, the theoretical framework and identified research questions provide foundations and directions for future research. Thus, before indicating possible directions for future research, this section reflects and articulates some limitations and methodological lessons from this research project.

6.2.1. Disciplinary limitations

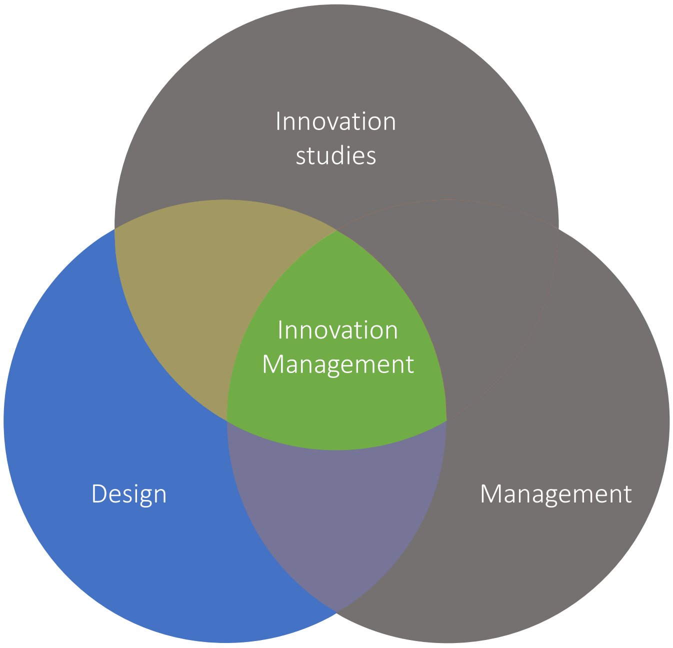

Figure 6-1: The disciplinary landscape of this research

For developing the theory of business model prototyping, this research explored the theoretical landscape of various concepts such as innovation, design thinking and business model innovation. These concepts have been discussed in a range of disciplines from innovation studies to management to design, and the definitions are varied and constantly contested (see Figure 6-1).

Some design scholars also suggest that the design practice itself is shifting from a traditional skill-based practice to a newly formed interdisciplinary practice (e.g., Kimbell, 2012; Yee et al., 2013). Thus, the selection of key concepts and the articulation of the definitions tend to be contextual rather than simply following disciplinary standards. This research explores literature and field data through case studies and interviews in order to avoid making an unbalanced argument. However, as this research is supported by an art and design university, it is encouraged to take the perspective of design as the disciplinary position for this research. While the focus enables the research to be original, the gap between other subjects such as innovation studies and management can be explored more.

6.2.2. Methodological limitations

Although this research argues business model prototyping from a design discipline, it mainly relies on sociological methodologies to collect and analyse data. As a result, initially, there was a confusion in selecting and setting up a research methodology. The confusion may be due to a lack of standardised research methodologies in design for innovation. It is claimed that the study of design should be treated as a subject of social science rather than natural science (Cross, 2007a). However, while the advantage of using a sociological approach is widely acknowledged, the gap between design methodology research and design practices can also be explored more (Krippendorff, 2006).

Hence, this research takes an abductive approach based on design thinking to investigate the gap. The aim is to develop a possible theoretical framework of business model prototyping rather than formulating a general theory. However, as the structure of the PhD research is designed as a phase-based process model from registration to confirmation to examination, the process is not as flexible as abductive research needs to be. A fully adjusted research scheme for abductive research may be useful in further understanding business model prototyping. The possibility will be suggested in the following Future directions section.

6.2.3. Empirical limitations

As an emerging field in practice, the participants and interviewees in this research did not share a common understanding of business model prototyping. Moreover, as the subject was argued in various disciplines, the fundamental concepts such as innovation, business models and prototyping were conceived in different ways by different people. As the meanings of these concepts are context-dependent, the interviews required certain flexibility in order to adapt to their understanding of the business modelling process. The biggest challenge of this research, therefore, is to capture the understanding of business model prototyping in a form of qualitative data. The findings have to be interpreted through the researchers' perspective to generate a coherent logic and terminology for discussion and conclusion. Thus, the researcher's interpretation and translation may have had a significant influence in the outcome and the make-sense of the data.

6.2.4. Sampling limitations

The research methodology is developed on the basis of a critical version of Blaikie's framework of research design (2007; 2009) and case study research (Yin, 2013). As this research relies on a few cases, it follows the 'replication logic' (Yin, 2013). It is argued that based on the replication logic, the number of samples does not reduce the value of research (Yin, 2013). However, further replication of the cases strengthens the generalisability of the findings. Quantitative research based on statistical logic may reveal another aspect of business model prototyping and the value of combined approaches will be suggested in Future directions section.

Moreover, limited resource accessibility also has had an influence in the selection of interviewees and cases. As the importance of business model prototyping as a research discipline grows, the limitation caused by research resources could be solved in the future. Even the growing interest in the subject was observed in this research and the accessibility of information was gradually improved. The growing interest can support researchers to gain resources for further research.

6.3. Future directions

The previous section presented the limitations of this research. Based on the understanding, this section suggests possible directions for future research. The directions are divided into three levels: disciplinary level, methodological level and theoretical level. The disciplinary level describes how design as a discipline can be integrated into the study of innovation management through cooperation with innovation studies and management research. The methodological level presents what can be achieved through different research methodologies. Finally, the theoretical level proposes possible further questions for enhancing the theoretical understanding of business model prototyping.

6.3.1. Disciplinary level

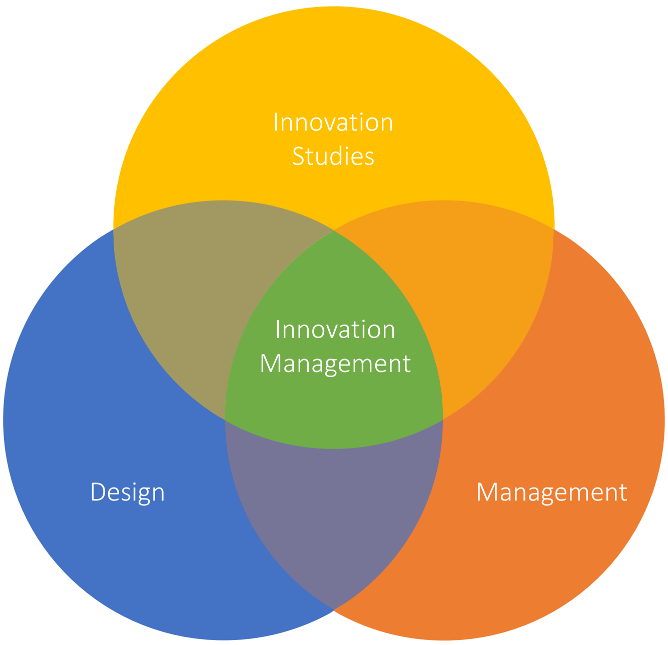

Figure 6-2: The interdisciplinary state of innovation management research

An initial motivation for this research derives from my past experience in professional and academic career. In my Master's education in Innovation Management, I was introduced to the concept of design thinking. At the time, design thinking was still a nascent and emerging concept. Through the experience in the master course, I learned a wide range of concepts and practices relevant to design thinking. However, the comprehensive experience of learning design thinking left me with an impression that while the process of idea generation was overemphasised, the importance of prototyping was undervalued.

This research not only examined the concept of prototyping, but how it could be applied in business model innovation. The expansion of design practices in non-design sectors has also been an emerging trend in the industries (Yee et al., 2013). Bridging the gap between prototyping and business model innovation requires an extensive exploration of various concepts including innovation, business models and design thinking.

While ‘design thinking’ is highly praised by some senior managers and management scholars, there are sceptics and controversies over the validity in the design methodology research. Thus, there are several attempts to define and understand design thinking, but the conclusions are usually drawn to make distinction between traditional arguments in academics and emerging arguments of design thinking in practitioners and management scholars. The situation made me think that there is something missing as prototyping was ‘abused’ in management following design thinking approaches. In order to fully understand the context of design thinking, it seemed necessary to understand the context of management research, especially strategic management, from product-based views to dynamic capabilities (e.g., Teece et al., 1997).

While the design methodology research needs to involve more various perspectives, it is also beneficial for innovation studies to include more profoundly the knowledge of the design methodology research. In this study, it was also identified that innovation studies have become more interdisciplinary than before, but mainly among the field of policy research, technology and business rather than in the area of design. Also, for business model prototyping, it is necessary to take an interdisciplinary approach to understand prototyping as a collaborative and complex process. The design methodology research can contribute to providing the theoretical foundation for managing complex problems, but the applications of the methodology to new areas are highly contextual and need to be understood from diverse perspectives.

Interdisciplinary approaches also help researchers to avoid cognitive biases. For instance, the design methodology research tends to perceive subjects from educators' and consultants' points of view. On the other hand, entrepreneurship research tends to pay attention to specialities of entrepreneurs. Therefore, further interdisciplinary research will allow researchers and practitioners to view the subject from multiple perspectives. Figure 6-2 depicts the interconnected relationship among design, innovation studies and management research to support innovation management research.

6.3.2. Methodological level

A direction at methodological level is to take more intervening approaches such as participatory observations or action research of applying the theoretical framework for business model innovation. While the approach allows the researchers to immerse themselves in the context, they should be aware that there are various practices for developing business models, and the critical and theoretical analysis are essential rather than simply understanding what happens in practice. This research aims to develop an overarching model of prototyping in business model innovation, and the findings will be expanded by close examinations such as participatory observation and action research to reveal more detailed criteria for the selection of methods and the decisions for the development. Moreover, it will help researchers to understand skill sets and traits at an individual level for successfully applying the prototyping methodology for business model innovation.

In addition, quantitative research on business model prototyping will complement the findings of this research, which follows the logic of replication (Yin, 2013) and relies on a small number of cases and data sources. Although it does not aim to generalise the concept of business model prototyping statistically, a quantitative approach such as surveys with a large number of samples will cover the blind spots caused by the limitations of the data collection methods used in this research. Once the concept of business model prototyping is disseminated, surveys and questionnaires may further validate and develop the knowledge on business model prototyping and development.

Moreover, both qualitative and quantitative research have limitations and it is recommended to use mixed methods for further robustness in research findings (Blaikie, 2009). As business model prototyping is an emerging concept, this research chose a qualitative approach. However, the growing interest and increasing understanding of the concept were observed during the course of this research. Thus, combining the findings will contribute to further understanding how to deal with business model innovation through prototyping. Figure 6-3 shows how different research methods can be combined to revise the theoretical framework.

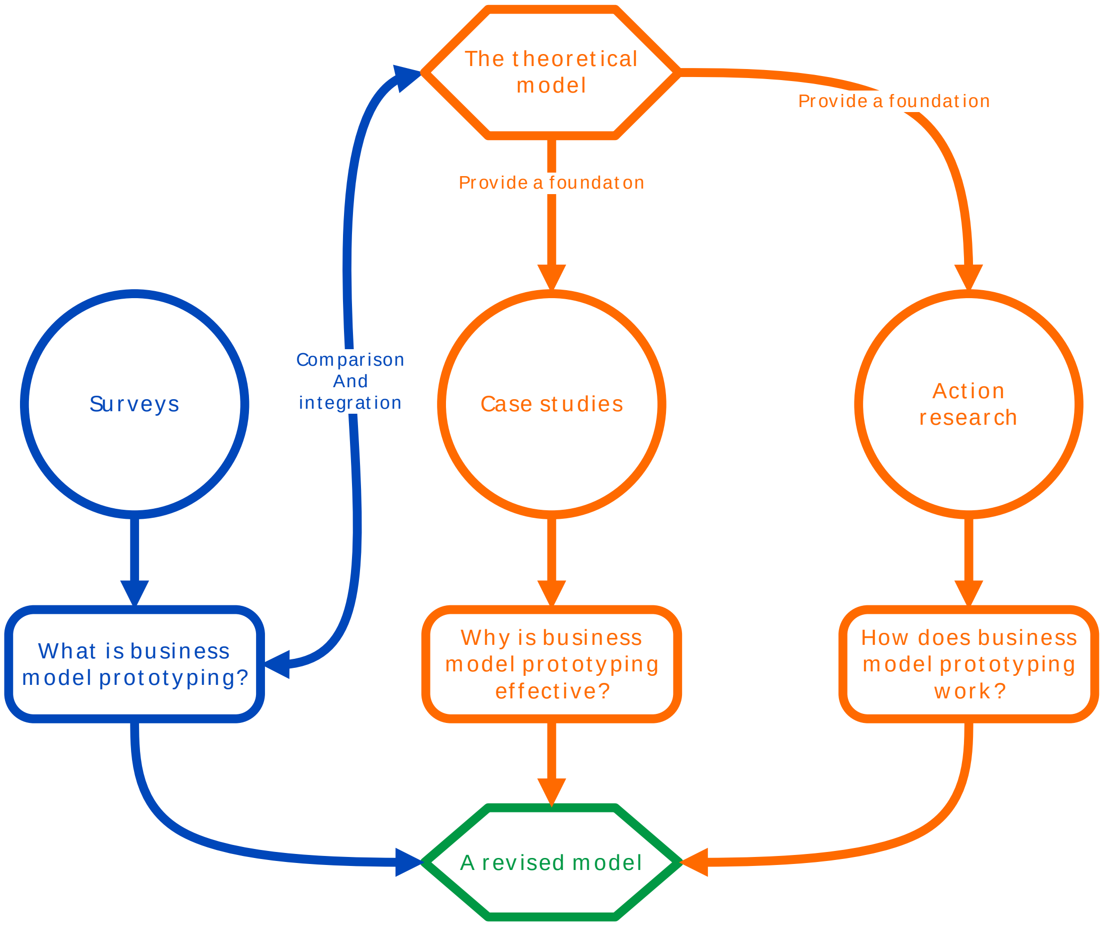

Figure 6-3: A possible combination of research methods

6.3.3. Contextual level

This research focuses on understanding the fundamental theoretical framework of business model prototyping. As we have seen in the section of Research Limitations, there were several limitations on the selection of data sources. Therefore, some characteristics in specific contexts are left for further research. There are four directions to extend the theoretical landscape. First, little attention is paid to sectorial differences in this research. Hence, research focusing on a particular sector or segment can reveal more detailed sector-specific characteristics and requirement in the prototyping process. Secondly, focusing on a certain size of organisations can reveal an impact specific to the scale of organisations for business model prototyping. Thirdly, most of the data were collected in the UK, and geographical characteristics can be captured by spreading research globally. Fourthly, although this research explored some historical literature, the cases were mainly contemporary, while the conducted interviews focused on current practices and perspectives. Therefore, a more in-depth study into historical literatures may be necessary to further understand the contemporary characteristics of the practice.[97]

6.3.4. Theoretical level

The theoretical framework is intended to contribute to further research on business model prototyping, as there has been little theoretical foundation. Thus, this thesis proposes what business model prototyping can be, and it generates questions about how to manage it (Blaikie, 2009).

For further contribution to a more practical side of business model innovation, this section discusses the potential questions in manage business model prototyping. The questions can be divided into three types:

- How to learn from prototyping?
- How to manage organisational cultures and mindsets?

[97] Balance between rigidity and adaptability: In the reflection of this research, it is clear that the interest of business developers has been moving from the capability of rigid planning to the adaptability to complexity during the course of this research. On the other hand, it seems that literature suggests that the need for the adaptability to the complex real world has co-existed with the desire for the rigidity (e.g., Andriopoulos & Lewis, 2008; Raisch & Birkinshaw, 2008; Martin, 2009; Khanagha et al., 2014). This research itself aimed to decode the process of business development and reconstruct it through the perspective of the design methodology and prototyping. However, it should not be a simple denial of the current practice, but as the concept of prototyping suggests, it should be synthesised to be the next level of understanding the reality. Thus, it is hoped that this research stimulates other researchers to further examine the subject of business model prototyping from different perspectives and approaches.

- How to manage engagement / develop business model prototyping?

These questions are not exhaustive, but merely serve as suggestions for possible directions. The following subsections argue each type of questions.

6.3.4.1. How to learn from prototyping?

There are three key questions in evaluating the learning from prototyping. They are:

- How to synthesise the learning outcomes?
- How to integrate analysis and synthesis?
- How to be responsive?

This research identifies the interpretation of outcomes from prototyping is important but also challenging. It is especially an issue when the uncertainty surrounding a business is high. Clear ideas or hypotheses lead to clear analysis in gaining new findings. Thus, choosing what needs to be learned in advance is regarded as important in prototyping for products (Houde & Hill, 1997). Collected data alone, however, cannot provide a clear answer about whether to keep improving the current solution or shift to a radically different direction. In fact, decision making is considered to be influenced by human factors (Ries, 2010). Design thinking methodology suggests that the learning process should be synthetic (e.g., Kolko, 2009a; Gumienny et al., 2011; Kelley & Kelley, 2013). In design thinking, feedback is synthesised, not validated. Kelley and Kelley (2013) include synthesis as one of the crucial phases of design thinking. Design methodology suggests a systematic way of synthesising learning ideas (Kolko, 2009c). It is also the case in business model prototyping. However, the synthesis process is not clearly articulated in innovation studies and management.[98]

As practitioners in entrepreneurship find the benefit and limitation of analytical approaches (McClure, 2007; Croll & Yoskovitz, 2013), there could be further research opportunities in analysing a winning combination between qualitative approach (such as design thinking) and quantitative approach. This research identifies that while rigid approaches for analysing learning outcomes are suggested in the literature, the learning process tends to be more intuitive (see Ries, 2011). Thus, it seems to be difficult to capture how it works by observing form hindsight or the outside of the context. Research methodology should incorporate participatory observation or action research in order to reveal the actual practice of synthesising the learning outcomes.

Findings from the case studies showed that new opportunities were rarely identified in advance, but discovered through the prototyping process as it provides a lot of learning points about possible directions (see also Chesbrough, 2010). Therefore, rather than spending too much time setting up a prototype, it may be beneficial to adopt a reflective and responsive mindset that fosters the importance of learning while prototyping. How to set up a reflective and responsive mindset, therefore, will be another research opportunity for managing the prototyping process.

6.3.4.2. How to manage organisational cultures and mindsets?

This research revealed that organisational cultures and individual mindsets[99] are crucial in business model prototyping in learning and decision making processes. Learning opportunities exist in all phases of business model design processes. It is

[98] An exception is an argument of Jon Kolko (2009a; 2009b; 2009c; 2010; 2011; 2014).
[99] An example of research on the psychological aspect of prototyping by an ethnographic approach is Gerber and Carroll (2012).

important for decision makers in particular to have an open-mind for new opportunities, even though the process is in the execution phase of the business. Context-setting is as crucial as the selection of tools in gaining an effective feedback from business model prototyping. Thus, understanding how to manage organisational culture and individual mindsets for business model prototyping is an important subject for future research and practices.

6.3.4.3. How to manage engagement / develop business model prototyping?

In order to answer how to manage engagement in business model prototyping, there are two key aspects to consider. One is how to select the minimal level of fidelity to maximise the learning from prototyping. The other is how to manage multiple prototypes of business models.

Business model prototyping should be minimally developed for the learning objective, while keeping the holistic perspective in the process. Businesses at an early stage are more flexible than ones at a later stage as it has not spent too much time and resources. Thus, low-fidelity prototypes are recommended at an early stage of a business. While low-fidelity prototypes in an early stage are recommended in the literature of design thinking (e.g., Brown, 2009), this research identifies that there are many shapes of business model prototypes that can be categorised by the level of abstraction. Thus, consideration on the selection of fidelity is important for business model prototyping and clarifying the required level of abstraction for different objectives will be useful for business practitioners.

Moreover, this research identified the plurality of business models in practice, and examined how they are utilised in business model development. The literature review also identified various mapping tools used in business models at different abstraction levels (Massa & Tucci, 2013). The findings indicate that a key role of business models is to represent businesses in a holistic but simple way. The understanding shows that the key components of business models are contextually decided rather than generally formulated as a normative model. From this perspective, the notion of business models as models is theoretically plausible (Baden-Fuller & Morgan, 2010; Massa & Tucci, 2013). Although some scholars and practitioners develop their own formats of business models, the intentions are more or less to promote their methodology. Thus, the arguments tend to focus on a single tool rather than how to use multiple formats effectively. Furthermore, business models themselves can be diverse in a single business. In other words, a business can have multiple business models, and a business model can have multiple business model prototypes. Thus, another question is how many business model prototypes should be developed, and the answer will be useful for practitioners to manage the prototyping process.

This section has suggested future research directions at various levels, and the theoretical framework proposed in this thesis will work as a foundation for the further research. The framework itself can be revised through diversified research approaches as the future directions at methodological level suggest, but it will work as a ‘prototype’ to encourage researchers and practitioners to collaborate over the boundaries.

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8. Appendices

8.1. Accepted Papers

8.1.1. Design Management Academy Conference 2017

8.1.1.1. Conference Paper

Amano, T., Brassett, J., Hestad, M. & Lawrence, G. (2017) Rethinking the Prototyping Process for Applying Design Thinking to Business Model Innovation. In: Hong Kong.

Rethinking the prototyping process for applying design thinking to business model innovation

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This research proposes a prototyping perspective in design for business model innovation to facilitate disruption. The value of design-led approach for managing innovation has been recognised under the concept of ‘design thinking’. In the research on innovation, the concept of business model innovation has been discussed as business models started to be acknowledged as a key aspect of managing innovation. Although experimentation for business model innovation is argued to be of importance, how to apply prototyping of design thinking to business model innovation has been limitedly theorised. This research is based on a literature review to articulate theoretically the concept of prototyping in business model innovation. Through the literature review, this research identifies four key dimensions of prototyping in business model innovation: purpose, process, context and engagement. This paper focuses on the Process dimension to interrogate the existing argument.

keywords: design thinking, prototyping, business model innovation, design process

Introduction

Over the past decade, business model innovation has been acknowledged as an emerging subject and a new approach for innovation management in particular (Chesbrough, 2007; Baden-Fuller et al., 2010; Schneider & Spieth, 2013) and more broadly for management of organisations as a whole (Pohle & Chapman, 2006; Chesbrough, 2007; Amit & Zott, 2010; Teece, 2010). The connection with disruptive innovation with business model innovation is widely acknowledged (e.g., Markides, 2006; Chesbrough, 2010; Koen, 2015)

Part of the reason why the interest in business model innovation is growing is that the domain of innovation studies itself has extended from a subject focusing on technology policy to an interdisciplinary subject. As the dynamics and complexity surrounding our society are increasing (Wallner, 1999; DG MediaMind Research, 2013; Hausman et al., 2014), organisations come under further pressure of finding a way of managing innovation to survive (Dervitsiotis, 2012). As approaches to tackle the issue, business model innovation and design thinking are emerging subjects in various research fields such as management (e.g., Boland & Collopy, 2004; Martin, 2009; Lockwood, 2010), innovation studies (e.g., Martin, 2012; Fagerberg et al., 2013) and design methodology research.

As for business models, despite the growing interest, there is still little agreement on what business models are (Teece, 2010; Spieth et al., 2014; Wirtz et al., 2016). Reflecting the diversity of the argument, researchers on business models, Lorenzo Massa and Christopher Tucci (2013) suggest a broad definition of the concept: "the [business model] may be conceptualized as depicting the rationale of how an organization […] creates, delivers, and captures value […] in relationship with a network of exchange partners" (p.423; see Afuah & Tucci, 2003; Osterwalder et al., 2005; Zott et al., 2011).

In the research on business model innovation, some researchers attempt to apply experimental approaches (e.g., Sosna et al., 2010; Hawryszkiewycz, 2014), but there is still little research on prototyping and exploration of new opportunities in designing business models (Osterwalder & Pigneur, 2013). Furthermore, the approaches are mainly labelled as 'experimentation' (Bucolo & Wrigley, 2012), and the terms, 'business model experimentation' and 'business model prototyping' are often interchangeably used (e.g., Girotra & Netessine, 2013), or prototyping is argued without the articulation of the meanings (e.g., Chesbrough, 2010; McGrath, 2010). According to design methodology research, however, the application of the scientific approach to complex problems has been problematic (Rittel, 1972b; Schön, 1983; Buchanan, 1992; Cross, 2011). Thus, developing the theory of business model prototyping will potentially enable researchers and practitioners to understand the process of business model innovation further.

Prototyping in design and design thinking

The lack of the general definition is pointed out not only about business models but also about design thinking (Liedtka, 2015). Thus, there are several strands in the discussion (Kimbell, 2011; Johansson-Sköldberg et al., 2013), and it is difficult concisely to show the characteristics of design thing. However, former President of the Design Management Institute, Thomas Lockwood, offers a definition of design thinking as "a human centered innovation process that emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping, and concurrent business analysis" (2010b, p.xi). This definition encompasses the key features of design thinking that are also argued as applicable to managing the complexity of innovation (e.g., Neumeier, 2008b; Brown, 2009; Martin, 2009).

Although design thinking is a newly argued concept, the complexity of design problems has been argued as 'wicked' problems at least since 1970s in design methodology research (e.g., Rittel, 1972a; Buchanan, 1992). The differences in ways of thinking among science, humanity and design also support the argument that design as a methodology is also distinctive from science's and humanity's methodology as a discipline (Cross, 2001). It is argued that design has a different way of thinking for tackling complex problems, and design methodology research turns to develop design as a discipline (Cross, 2007b) or a liberal art (Buchanan, 1992) inherently different from science and humanity. From this perspective, design is not a subject in science or humanity, but a discipline with value for everyone to learn (Archer, 1979; Cross, 1982). The difference influences not only a way of thinking but also the terminology used in design, and the argument of design started to use their own terminology. For instance, in the current argument of design thinking, instead of using a terminology of science such as experimentation, the concept of 'prototyping' is often used to represent a feature of the design methodology for managing the complexity of design problems (e.g., Brown, 2009; Lockwood, 2010b; Liedtka, 2015).

Design thinking can contribute to business model innovation as there are some key points in common, and the commonality suggests that the application of the design methodology can be effective also for business model innovation. Prototyping is regarded as an important aspect in the design methodology and process (e.g., Thomke, 1998; Buchenau & Suri, 2000; Terwiesch & Loch, 2004; Hartmann, 2009) as well as a key element of innovation processes in management (Leonard & Rayport, 1997; Mascitelli, 2000; Schrage, 2000; Thomke, 2008). This section reviews the role of prototyping in design and design thinking.

Sanders (2013) asserts that as fields that design contributes to expand, the role of prototyping also changes. The focus of using prototyping was "to help us see what it could be" (p.63), but in the expanded design fields, the focus also expands "to help us […] to make sense of the future" (p.64). For this type of prototyping, prototypes are not simply representations of objects but need to be tools for collectively exploring, expressing and testing hypotheses about future ways of living in the world" (p.64).

As prototyping in this thesis is for business model innovation, which is a new area for the design methodology, the argument in this thesis follows the distinction between prototyping and prototypes and the definitions of the concepts above.

Distinctions of prototypes from other concepts are argued in some literature. For instance, interaction design scholar, Lars Erik Holmquist (2005) distinguishes prototypes from mock-ups and representations. In his theoretical framework, prototypes embody functionality, mock-ups show appearances and representations have both of the attributes. In this thesis, prototypes are not strictly limited as the embodiment of functions for two reasons. One is to avoid turning the terminology to be too complex. The other is that this research rather regards prototypes as "learning tools" (Coughlan et al., 2007, p.124).

As for piloting, in the context of design thinking, the main objective of prototyping is to get feedback and learn from building and implementing a product or service (Brown, 2008; Lockwood, 2010). This point is sometimes argued as a distinctive difference between prototyping and piloting, which aims at evaluating the feasibility of the product or service (NESTA, 2011).

Therefore, as long as mock-ups and representations are used for learning, they are perceived as 'prototypes' in this research. Further detail will be argued in the following subsections.

A theoretical framework of business model prototyping

This section reviews five conceptual frameworks of prototyping in existing literature to enable this research to theoretically argue about prototyping (McCurdy et al., 2006; Beaudouin-Lafon & Mackay, 2007; Lim et al., 2008; Blomkvist & Holmlid, 2011; Jensen et al., 2015). As various frameworks coexist, there are also various ways to selecting and synthesising the key dimensions of prototyping. However, the main objective of making a conceptual framework in this section is not to precisely represent what prototyping is but to provide a conceptual foundation for the argument of business model prototyping. Thus, the selection and synthesis of the key dimensions are based on the assumption that prototyping is applicable to something intangible and complex problems as various arguments on design thinking do (e.g., Brown, 2009; Lockwood, 2010b; Jobst & Meinel, 2014; Almahmoud et al., 2016). This focus influences the choice of terminology and priorities for each dimension, and also pays more attention to simplicity than precision of the framework. The selected literature spans from Human Computer Interaction, Engineering design, Interactive design and service design (see Table 1).

Human-computer interaction (HCI) researchers, McCurdy et al. (2006) assert that measuring prototypes only by whether they are low fidelity or high fidelity is too simple, and propose five dimensions of prototypes: the level of visual refinement, the breadth of functionality, the depth of functionality, the richness of interactivity and the richness of data models. As their main concern is interaction between computer and the users, the dimensions are set up for how prototypes can be interactive.

Also, in the argument of prototyping in interactive systems, computer scientists, Michel Beaudouin-Lafon and Wendy Mackay (2007) propose a set of key elements of prototyping for interactive design (p.1018):

- representation – the type of the prototype and how it is represented

- precision – how much detail is represented in the prototype
- interactivity - the degree of the capacity for users to interact with the prototype
- evolution – the role of the prototype in the whole expected life cycle

While Beaudouin-Lafon and Mackey see HCI as an interdisciplinary subject among science, engineering, and design, they claim that “prototyping is primarily a design activity” (2007, p.1018).

Other researchers in HCI, Youn-Kyung Lim, Erik Stolterman and Josh Tenenberg (2008) propose a theoretical framework of prototyping consisting of a dimensions of ‘filters’ and ‘manifestations of idea’ as parts of prototyping. Filtering dimensions are the focus of design ideas that designers choose to prototype, and manifestation dimensions are how to represent the ideas. In the framework, both filters and manifestations have sub-attributes. The former’s sub-attributes are:

- Appearance
- Data
- Functionality
- Interactivity
- Spatial structure

The latter’s three sub attributes are defined as (p. 11):

- Material - Medium (either visible or invisible) used to form a prototype
- Resolution - Level of detail or sophistication of what is manifested (corresponding to fidelity)
- Scope - Range of what is covered to be manifested

In this framework, what to prototype and how to prototype are considered as two key metrics of arguing types of prototyping.

From a service design perspective, Blomkvist and Homlid (2011) formulate a framework of service prototyping based on expert interviews and literature review. Dimensions in the framework contain purpose, position in process, author, audience, validity, technique, fidelity and representation. While the frameworks from HCI and interactive design tend to focus on how prototypes are developed, this framework pays more attention to the context surrounding prototyping processes.

More recently, engineering design academics, Matilde Jensen, Stephanie Balters and Martin Steinert (2015) reviewed the literature of theoretical prototyping frameworks to formulate a general model of prototyping. Through a statistic analysis of the literature, they identify important themes of prototyping: material, interactivity, visual detail, purpose, surroundings and technology. Although the authors aim to contribute to engineering design, their review includes Blomkvist and Homlid’s work above and the framework also acknowledges the importance of context in prototyping.

Through the review and comparison of the frameworks, this research develops a theoretical framework of prototyping consisting of key four dimensions: purpose, process, context and engagement.

‘Purpose’ is what prototyping is done for, ‘process’ is how prototyping is conducted. ‘Context’ is in what circumstance prototyping is carried out and ‘engagement’ is how prototyping encourages the participants to engage. Context includes participants, environment and culture as the sub-dimensions. Although ‘engagement’ is usually argued as representation, interactivity or fidelity of prototypes, the selection of those attributes depends on how to make the participants engage with prototypes and prototyping processes. Thus, this research uses the term, engagement as a dimension relevant to representation, interactivity and fidelity of prototypes.

Table 8-1 Prototyping dimensions.

Authors	McCurdy et al. (2006)	Lim et al. (2008)	Jensen et al. (2015)	Beaudouin-Lafon and Mackay (2007)	Blomkvist and Holmlid (2011)
Discipline	Human-Computer Interaction	Human-Computer Interaction	Engineering Design	Interactive Design	Service Design
List of dimensions	• The level of visual refinement • The breadth of functionality • The depth of functionality • The richness of interactivity • The richness of data model	Filtering • Appearance • Data • Functionality • Interactivity • Spatial structure Manifestation • Material • Resolution • Scope	• Material • Interactivity • Visual detail • Purpose • Surroundings • Technology	• Representation • Precision • Interactivity • Evolution	• Purpose • Position in the entire Process • Author • Audience • Validity • Technique • Fidelity • Representation

The process of business model prototyping

This chapter argues the process of business model prototyping as a key dimension. As we will see, the process of prototyping, as well as the design process, is argued in various ways. While normative process models of both design and business model innovation suggest that prototyping is located in a late stage of the process, the importance of conducting prototyping as early as possible is also acknowledged.

This section discusses the position of prototyping in a design process. Initially, it clarifies a normative model of the design process and business model innovation through literature as a theoretical foundation for identifying where prototyping is located in the processes. These models suggest that prototyping is in the late stage of the process. However, it is also assert that prototyping should be done as soon as possible. The following sections reviews the arguments with the consideration of the relationships with purposes and fidelity.

Prototyping in a late stage

By integrating seminal frameworks of the process of design thinking (IDEO, Continuum, Stanford Design School, Rotman Business School, Darden Business School), Liedtka (2015) proposes three sequential stages in the design process: exploring stage, idea generation stage and testing stage. Prototyping is included in the testing stage. She also mentions the similarity of the steps to the key methods of design thinking proposed by Seidel & Fixton (2013): need finding, brainstorming and prototyping. Glen et al. (2015) argue the applicability of design thinking to the curriculum of business schools, and propose brief steps of design thinking. In their steps, prototyping and testing is the fifth step in six steps. These models commonly locate prototyping in a late stage of the process (see Table 2).

In some frameworks of prototyping for business model innovation, the idea generation phase is set before the prototyping phase. For example, Seidenstricker et al. (2014) suggest a systematic idea generation and selection phases for business model prototyping should be conducted before prototypes are actually developed. This point is in line with the process models of design thinking (see Liedtka, 2015).

Table 8-2 Process models of design thinking (adopted from Liedtka (2015) and modified by the author)

Stage	IDEO (2013)	Continuum (2014)	Stanford Design School (The Hasso Plattner Institute of Design at Stanford, 2010)	Rotman Business School (Rotman School of Management, 2014)	Darden Business School (Liedtka & Ogilvie, 2011)	Seidel & Fixton (2013)	Glen et al. (2015)
Stage I: Data gathering	Discovery and interpretation	Discover deep insights	Emphasise and define	Empathy	What is?	Need finding	(1) problem finding, (2) observation
Stage II: Idea generation	Ideation	Create	Ideation	Ideation	What if?	Brainstorming	(3) visualisation and sense-making (4) ideation
Stage III: Testing	Experimentation and evolution	Make it real: prototype, test, and deploy	Prototype and test	Prototyping and experimentation	What wows? What works?	Prototyping	(5) prototyping and testing (6) viability testing

Researchers of business model innovation struggles with finding a process model of business model innovation in management. Thus, they borrow the structure from design (e.g., Zott & Amit, 2015). Although the importance of business model innovation has been recognised, there exists little academic research on the process of business model design, let alone business model innovation (Bucherer et al., 2012; Zott & Amit, 2015). Due to difficulty in finding normative process models for business model innovation from literature in management, Zott and Amit (2015) explore process models in the design literature (e.g., Beckman & Barry, 2007; Bhavani & Sosa, 2008; Brown, 2008) and propose a five step process model for business model innovation: observe, synthesise, generate, refine and implement. Following a notion of Owen (1993), they assert that the first two steps are in the analytical stage, and the last three steps are in the synthetic stage.

From the study of entrepreneurship, Osterwalder and Pigneur (2010) also propose a five step model of business model design: mobilise, understand, design, implement and manage. One of the characteristics of this model is that it starts from mobilise, which other models do not often include. Combining the five steps by Osterwalder and Pigneur with knowledge from their own experience, Bucherer et al. (2012) offer a similar process model: analysis, design, implementation and control. In the study of product development, Frankenberger et al. (2013) propose four phases of business model innovation based on innovation management literature and their case studies: initiation, ideation, integration and implementation. The first three phases are for designing business models, and the last one is for realising it.

By synthesising the models in literature, this research theorises the process of business model innovation with the stages of mobilise, understand, innovate, develop and implement (see Table 8-3). As it suggests, prototyping is located in a late stage of the process, the implement phase in particular, also in the process models of business model innovation.

Table 8-3 Process models of business model innovation

Author	Discipline	(Moblise)	Understand	Ideate		Develop		Implement
Fritscher & Pigneur (2009), Osterwalder & Pigneur (2010)	Entrepreneurship	Mobilise	Understand		Design	Implement	Manage (refinement)	
Bucherer et al. (2012)	Product development		Analysis		Design (an iterative process)			Implementation, Control
Frankenberger et al. (2013)	Product development		Design					Realisation
			Initiation	Ideation		Integration		Implementation
Zott & Amit, (2015)	Design		Analytic		Synthetic			
			Observe	Synthesise	Generate	Refine		Implement

Prototyping in an early stage

Although the process models of design and business model innovation shown in the previous subsection locate prototyping in a late stage, it is also claimed that prototyping in design thinking should be conducted in an early stage (Jobst & Meinel, 2014). In engineering design, Yang claims a "prototype is an early embodiment of a design concept" (2005, p.650). Also, in the argument of social service development, NESTA (2011) defines "Prototyping is an approach to developing and testing ideas at an early stage before large-scale resources are committed to implementation" (p. 6). It is believed that benefits of prototyping in an early stage are saving costs and time of product and service development (Houde & Hill, 1997; McCurdy et al., 2006; Coughlan et al., 2007). These arguments suggest that while prototyping is located in a late stage of design process in normative frameworks of design and business model innovation processes, some literature recognises the importance of embodying ideas in 'an early stage' of the process. Although how early it should be does not clear in most of the arguments, the claims conflict with most of the normative models leaving prototyping to a late stage of a design process.

To understand the conflict between the two notions, the relationship of the design process with the purpose of prototyping should be considered. It is argued that the position of prototyping in the design process is connected with the purpose of prototyping (Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2011; Sanders, 2013). From this perspective, prototyping for exploration tends to be located in an early stage of the design process. As prototyping for evaluation needs to have more specified ideas, it needs to be located in a later stage than exploration (Blomkvist & Holmlid, 2011). Also, prototyping for persuasion is generally located later than evaluation (Voss & Zomerdijk, 2007; Blomkvist & Holmlid, 2011) or at the end of the process (Sanders, 2013).

Process and fidelity of prototyping

Another pattern of the process models of design is that high-fidelity prototypes are used in a late stage, while low-fidelity prototypes are used in early stages. For instance, based on the argument of Skogstad (2009), Vetterli et al. (2012) propose four milestones of prototyping processes following the requirements of prototypes: Critical Function Prototype, Dark Horse Prototype, Functional Prototype and Final Prototype. In this model, prototyping moves from conceptual prototypes to more concrete prototypes. Similarly, Ullman (2009) proposes four classes of prototypes based on the difference of the purposes: proof-of-concept prototypes, proof-of-product prototypes, proof-of-process prototypes and proof-of-production prototypes. In this process model, prototypes in later stages need to prove a more specific issues by higher-fidelity prototypes. Both models indicate the increase of fidelity during the iterative prototyping process. Also, it is argued that "the level of precision usually increases as successive prototypes are developed and more and more details are set" (Beaudouin-Lafon & Mackay, 2007, p.1019). Referring to Sommerville ([1995] 2010), Yang (2005) suggests that there are three stages of prototyping in software engineering: throwaway, evolutionary and incremental. In this process, prototypes in an early stage should be designed to be thrown away, and changes in a late stage are supposed not to be radical but only incremental.

In these process models, the purpose and the stage of prototypes are connected through fidelity of prototypes, and the categorisation of prototypes is based on the level of embodiment of ideas. The process models are based on the assumption that ideas represented in prototypes are gradually verified through iteration. This assumption could be controversial when design problems are seen as wicked problems, as the concept of wicked problems assert that verifying the viability of solutions through trials and errors is questionable because of the complexity in the context surrounding problems (see Rittel & Webber, 1973). Also, the process model with increasing fidelity does not well explain radical changes of the direction in new business (see Ries, 2011; Blank & Dorf, 2012).

The relationship between the purpose and position of prototyping can be also seen in the argument on the relationship between prototyping and piloting. In the context of social service development, NESTA (2011) describes the difference between prototyping and piloting based on the purpose and the position in the design process. Prototyping is in an earlier phase than piloting and the main purpose is to develop services. On the other hand, piloting is located in a later stage of the design process than prototyping for exploration, and the purpose is the refinement of well-verified services essentially for rolling out and scaling the service. Additionally, service designer working with NESTA, Aviv Katz (2011) asserts that the difference between prototyping and piloting as, “there are two main types of prototyping: exploratory (done in early stages of insight and idea generation) and developmental (done after the service has been specified and you know what you’re designing). The former is quick and cheap; the latter requires more planning”. Here, also, the purpose and position of prototyping are interconnected, and even fidelity of prototyping is influenced by the factors. From this point of view, prototyping can be both in an early stage and also a late stage, but the purpose of prototyping needs to shift from exploration to evaluation to persuasion.

Agility in prototyping

While design processes based on phases are identified as we have seen above, learning through iterative processes is frequently mentioned as a characteristics of prototyping (e.g., Hartmann et al., 2006; Brown, 2008; Leifer & Meinel, 2011). This iterative aspect is also characterised as ‘agility’ (e.g., Neumeier, 2008b; Mootee, 2013). Agility is a widely used concept as a key element of design thinking for managing uncertainty in facilitating disruptive types of innovation (e.g., Brown, 2008; Neumeier, 2008a; Lockwood, 2010b). Agility is also recognised as an effective element for managing innovation as well as business processes, as it is in effect to manage uncertainty surrounding innovation (e.g., Thomke & Reinertsen, 1998; Bessant et al., 2005). In terms of uncertainty in managing innovation, Christensen (2003) claims that a new market cannot be analysed even by market experts. To tackle the uncertainty, designers build a product or service to learn, not to complete it. Production processes should be flawless, but when you regard production processes as part of learning activities, even failure can be used as a learning opportunity (see Rodriguez & Jacoby, 2007).

Despite the growing awareness on the importance of agility, the meaning of agility in design is not clearly articulated (see Lindberg et al., 2011). Iterative processes are in common with other practices dealing with uncertainty such as agile development in IT development and the Lean Startup methodology in entrepreneurship. Indeed, it is asserted that the concept of agility was originally formulated in the study of software development (Abbas et al., 2008). Larman and Basili (2003) also claim that, through the historical review of iterative and incremental development (IID), using iteration for managing uncertainty is not a new approach for software development. Moreover, not only in IT development and design, there is a methodology of developing business models to a viable business through iteration called ‘Lean Startup’ methodology in entrepreneurship (Blank, 2005; Ries, 2011; Blank & Dorf, 2012; Maurya, 2012). The methodology encourages entrepreneurs to expect business development is not a linear but iterative process (Ries, 2011).

In the Lean Startup methodology, there are two key concepts, pivot and Minimum Viable Product (MVP), that characterise the methodology. Similar to prototyping in design, the lean startup methodology usually goes through an iterative process. The methodology relies on a launch of a product that is minimally developed to gain feedback from the market, which is conceptualised Minimum Viable Product. After each iteration, the user of the approach needs to interpret the feedback from the market and decide whether to keep improving the current product (persevere) or change the direction of the business (pivot). Pivot is defined as “structured course correction designed to test a new fundamental hypothesis about the product, strategy, and engine of growth" (Ries, 2011, p.149).

Despite the similarity to other approaches for tackling uncertainty, researchers of design thinking, Tilmann Lindberg, Christoph Meinel and Ralf Wagner (2011) argue that, although a core feature of design thinking is described as “iterative learning and development processes” (p.11), agility in design thinking is different from agile development in IT development at some points. First, agile development tends to reduce options, but the iterative process in design thinking is for diversifying ideas. Secondly, agile development in IT development is less collaborative than that in design thinking. From this understanding, iteration in the design approach is not only for mitigating risks but exploring potential opportunities and supporting collaboration with and involvement of stakeholders. When prototyping is regarded as an exploration, iteration or agility is not only for incremental improvement but can be a source of discontinuous changes.

Prototyping as philosophy and culture

The previous subsections show the discussions to locate prototyping in a certain phase of a design process. In addition, prototyping is also discussed as a culture and philosophy of design approaches as well as the agile aspect of design. Rather, this research faces difficulty in clearly identifying in which phase prototyping should be. In this regard, this research supports the arguments asserting prototyping as a culture and philosophy of design, and the notion can be applied for business model innovation. From business model's point view, final solutions can be a prototype in a long term. Also, prototyping is identified as the core of implementation in social innovation (Brown & Wyatt, 2010). In this process, business models can be seen as fundamental tools for supporting the development of a new business. Therefore, the difference between the development and implementation phases rather derive from the level of exposure of porotypes to external stakeholders such as customers and clients. Feedback gained from the exposure can be a key source of learning for developing business models. Thus, implementation can be seen part of business model development. This point is rather close to the concept of 'effectuation', which is an attitude of learning through doing rather than planning (Sarasvathy, 2001).

Moreover, for business model prototyping, prototyping for evaluation or persuasion can provide also learning opportunities for exploration due to the complexity of business model development. Thus, it is difficult to identify where the position of business model prototyping should be in the entire process of business model development in advance. Rather, learning opportunities seem to exist at any point of business model development processes.

Although this argument undermines the value of normative process models, such models are useful for convincing stakeholders unfamiliar with the process. For the purpose, the process of design and business model innovation is simplified to clarify the benefits of applying a design approach to complex problems by people outside of the design discipline. This simplification and formalisation, however, also causes confusion of the position of prototyping in the process. Thus, articulating the position of prototyping in the design process as a phase-based model may not be suitable to represent the dynamics in the process.

By contrast to the arguments supporting formal models, some researchers point out that prototyping is part of the philosophy and culture of design (Kauber, 1985; Schrage, 1993; Schrage, 1996; Thomke & Nimgade, 2000; Pering, 2002; Brown, 2005), which also suggests that prototyping is part of the design process from the beginning to the end. This resonates with the space model of the design thinking process proposed by Brown (2008). The space model suggests the interconnections among inspiration, ideation and implementation phases. In this model, prototyping can be conducted throughout the design process.

Overall, while various process models indicate that prototyping is an activity in a late stage of the whole process, some theories suggest that prototyping can be effective in an early stage if the position of prototyping is correctly aligned with the purpose of prototyping and the fidelity of prototypes. Furthermore, prototyping can work as a philosophy and culture of the design process. The process of business model prototyping can be also considered as not only iterative but also overlapped over the entire design process. This understanding of prototyping in design is in line with the notion that design is an agile approach (e.g., Neumeier, 2008; Lindberg et al., 2011; Leifer & Meinel, 2011; Mootee, 2013). While agility is argued as a characteristic of processes, it is also considered as an organisational property or "competence" (e.g., Neumeier, 2008a). When prototyping is regarded as philosophy or culture of design, agility can be regarded as part of the philosophy or culture. Although agility is characterised with the iterative process, it does not explain well about the discontinuity in the prototyping process. The following sections will argue it with the concept of evolution and emergence.

Discontinuity in the process

While iteration is an important characteristic of the innovation process, it is reported by practitioners that most of new businesses go through a major change of direction during the iterative business development process (e.g., Blank, 2005; Ries, 2011). Likewise, it is also asserted that while iteration is useful for incremental innovation, 'windows of opportunity' to change get narrowed in quick iterations unless there are interruptions such as unexpected events or new discoveries (Tyre &

Orlikowski, 1994). This point suggests that an iterative approach is effective to mange uncertainty, but at the same time how to manage discontinuity in the process has to be considered to successfully exploit the value of the prototyping process as exploration. In practice, difficulty is in making a decision in the conflict between improving the current solution and exploring new possibilities. It is asserted that “there is a tension between evolving toward the final solution and exploring an unexpected design direction, which may be adopted or thrown away completely” (Beaudouin-Lafon & Mackay, 2007, p.1020).

Regarding design problems as complex problems, each iteration in the prototyping process should include the reconfiguration of prototypes as the business situation dynamically changes and each iteration affects the next iteration (Rittel & Webber, 1973). In other words, each iteration is not the same as it affects the mindset and knowledge of project members is accumulated through the iteration. Thus, the analogy of tornado or a representation of the process in a spring shape is more suitable than a horizontally-recurred circle. Similarly, Lim et al. (2008) assert that the process of prototyping is organic and evolutional.

Although the differences among iteration, increment and evolution are not often argued, software developer, Allan Kelly (2011) divides agile development into three types, which are iterative, incremental and evolutionary development. Iterative development turns large requirements to be small sized requirements that can be managed by short term iterations. In iterative development, predetermined tasks and goals are assumed to be well defined and correct. Thus, even though it uses an iterative approach, all the effort is made for a big product launch and changing requirements is perceived negatively. Incremental development is similar to and based on incremental development, but the product release cycle is shorter than iterative development to gain users’ feedback. Therefore, changes are a positive move and reducing tasks is regarded as saving, although it still starts with predetermined requirements. By contrast, evolutionary development starts with a loose set of requirements, as the approach is based on the assumption that it is hardly possible to identify all the requirements in advance. Not only in software development, specifying required features before prototyping is also questioned in product development (e.g., Boehm et al., 1984; Rudd et al., 1996; Thomke & Bell, 2001).

The process is goal-oriented, and through the process, new requirements and opportunities are emerged and identified. The development has to be measured by how much progress is achieved towards the goal rather than by how many pre-set tasks are done. An important point for this paper is that evolutionary development is a parallel process of creating solutions and discovering new requirements and opportunities.

From this perspective, the findings of this research suggest the term, evolution should be intentionally chosen to describe the process of business model prototyping. It is also argued that business models are a subject to evolve rather than something staying in the same state (Chesbrough & Rosenbloom, 2002; Mitchell & Coles, 2003; Gerasymenko et al., 2015). Thus, at least in the context of business model prototyping, the process can be seen as an evolutionary process as the development of prototypes works as an exploratory process for new opportunities.

Following the argument of the evolutionary process, another question is raised; how the emergence of new requirements and opportunities occurs. Some arguments suggest that iterations gradually improve a solution. For instance, Fixton and Rao (2014) claim that “emergent strategy is an iterative process, one experiment leads to another, and to another, in each case closing in on a workable solution” (p.49). As they apparently regard the iterations as experiments, this might not be exactly the case of prototyping, but an issue in emergent processes is that it is uncertain about whether the direction is right or wrong, and the accumulation of knowledge through iteration is more likely to lead to a fairly radical change of direction (Tyre & Orlikowski, 1994; Ries, 2011; Bogers & Horst, 2014).

Emergence requires deep understanding of the context of innovation opportunities. Peschl and Fundeider (2015, p.142) introduce the concept of emergent innovation, and suggest that the realisation of potential opportunities requires an exploration for a profound understanding on the key contexts. The aim of business model prototyping can be to gain this level of understanding of a new business, and it is expected to lead the emergence of innovation through new business models.

The advantage of the iteration may be to generate the dynamics in the power structure for decision making to widen a window of opportunity to change (see Tyre & Orlikowski, 1994). In other words, iteration is not for gradually validating the parts of business models, but deconstructing and rebuilding the organisational situation for identifying new opportunities for business model innovation. In addition, as the importance of principles and cultures is asserted, simply following the process may not result in intended outcomes.

Conclusion

This paper reviews the arguments about process models of prototyping for managing innovation. While some normative process models are developed in the existing literature, this research identifies the nature of prototyping as a philosophy or culture embedded in the entire innovation process. As there is difficulty in finding the existing literature about the process model of business model innovation (Zott & Amit, 2015), this research contribute to the literature by providing a prototyping perspective to the discussion on business model innovation. This research mainly relies on literature, and further research based on empirical data will strengthen the prototyping perspective for managing business model innovation.

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8.1.1.2. Workshop

Amano, T. & Hayashi, N. (2017) Stretch: business model exploration by a design-oriented card game. In: Hong Kong.

Stretch: Business Model Exploration by a Design-Oriented Card Game

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Workshop Number: 183

Workshop purpose and aim

The main aim of the workshop is to creatively explore various possible business models in a short time and make the participants' mindsets open to new opportunities for business model innovation.

Theoretical relation

While the importance of design and design thinking for business development has been acknowledged (Bonakdar & Gassmann, 2016; Brown, Martin, & Berger, 2014; Bucolo & Wrigley, 2012), the gap between the two worlds still causes difficulty in making innovation through design approaches (Bolton & Green, 2014). It represents an intersection of design methods and management methods to create new business models. There are some tools for analysing business models (Massa & Tucci, 2013; e.g., Osterwalder & Pigneur, 2010; Maurya, 2012), but exploration tools are few. It is argued that the design methodology has an advantage of exploration of new ideas (Beckman & Barry, 2007; Brassett & Hestad, 2013; Brown, 2008; Kolko, 2015; Lockwood, 2010; Martin, 2009), and *Stretch* takes advantage of design approaches to business model development.

The number of startups is rapidly growing in the UK, which increased from 581,173 in 2014 to 608,100 in 2015 (including over 200,000 even only in London). Furthermore, the number in 2016 surpassed the record already in November (Yoshioka, 2016). The rapid growth implicates that there is a growing demand to learn entrepreneurship, but also indicates that most of the entrepreneurs are less experienced in business development than they used to be and need to have an enterprise education and training at a foundation level. Thus, tools and methods need to be simple and user-friendly enough for beginners to engage. However, business education has been traditionally theoretical and lecture-based, and the tools are complicated.

In *Stretch*, a business model consists of four elements: value, create, deliver, and capture (see Johnson, 2010; Massa & Tucci, 2013; Osterwalder & Pigneur, 2010). Specific colours are assigned to each element (red for value, orange for create, green for create, and blue for capture). Each element has 12 patterns, and a deck of Stretch has 48 cards in total (Figure 1). The simplified representation of business elements supports the users to conceive of ideas quickly and engage with the concept of business models.

Figure 8-1 A product image of Stretch

Workshop approach

The workshop has two sessions. The first one has a guideline following a basic mechanic of the card game and gives a brief understanding of Stretch's characteristics. The second session allows the participants to freely play Stretch. It is followed by a time to critically reflect the game itself and business models.

The basic mechanic introduced in the first session is the following. The goal of the game is to collaborate to make as many business model formations as possible and use all the cards in your hands. Every player starts with five cards dealt face down. The rest of the cards are placed as a draw pile also with the face down. If some of your players are not familiar with your business, giving its brief introduction would help other players to imagine what could be the business model. If you randomly play without a particular business in business, it would be good to set an imaginary business people can quickly think of, such as a flower shop and a food company.

The first player is usually the player on the left side of the dealer, and the gameplay typically follows a clockwise direction. Every player views his or her cards. In each round, players collaboratively make a formation of a business model. The first player in a round put a card from his or her hands face-up, and describe what you think the business would be. The next one cannot put a card with the same colour. He or she has to put a card with another colour and add a story of the business model fit with the cards. If you do not have other colours, you have to draw cards from a draw pile until you get one. Once you made a set of four colours, the group wraps up the discussion on the business model and put them aside to move to the next round. Keep playing until all the cards in your hands are used, and try to make as many business models as you can.

In the second session, the groups are rearranged and set some rules by themselves to explore further possibilities of utilising the design-oriented tool for business model development.

The workshop is designed for a group work, and the ideal number of people in a group is five. If the groups can be organised as five people, five decks of Stretch will be prepared for up to 25 people forming five groups. The format is:

1. 20 mins: An overview of the concept of business models
2. 20 mins: The First Session (a guided session)
3. 10 mins: Break
4. 20 mins: The Second Session (a freestyle session)
5. 20 mins: Q&A and reflection

Take-aways for the participants

As explicit outcomes of the workshop, the participants will generate various formations of business models and identify some business model archetypes applicable to a business idea. The findings will lead the participants to action plans to explore and verify the feasibility of the insights on business models. One of the obstacles to identify suitable business models is that people tend to follow existing and verified business models for their business. A problem for managing innovation, however, is that verified business models do not guarantee success in the future (Christensen, 2003; Martin, 2009). Repeatedly playing *Stretch* helps the players to keep their mindset to be open for new formations of business model elements as well as new opportunities for business model innovation.

In addition to the outcomes, the workshop potentially provides various benefits. First, through the workshop the participants will learn the key theories and typical patterns of business models. Secondly, the participants can see how a design-oriented tool applies to a business and management mission. Finally, using the tool will encourage the participants to discuss the potentials of design approaches to business model issues.

Results and reflection

This project aims not only to provide a tool for business model innovation but also to develop a community to share ideas of creating and designing new business models. Thus, after running various workshops and disseminating *Stretch* to creative users, our next step is to build an online platform to share the users' ideas and reflect upon their insights with other users.

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8.1.2. 1st Business Model Conference

Amano, T., Brassett, J., Lawrence, G. & Hestad, M. (2017) A Theoretical Framework of Business Model Prototyping: Applying Design Thinking to Business Model Innovation. In: Venice, Italy.

8.1.3. A Theoretical Framework of Business Model Prototyping: Applying Design Thinking to Business Model Innovation

8.1.4. Purpose

Over the past decade, business model innovation (BMI) has been acknowledged as an emerging subject and a new approach for innovation management in particular (Chesbrough, 2007; Baden-Fuller et al., 2010; Schneider & Spieth, 2013) and more broadly for management of organisations as a whole (Pohle & Chapman, 2006; Chesbrough, 2007; Amit & Zott, 2010; Teece, 2010). Furthermore, surveys on senior executives indicate the importance of business model innovation; for example, IBM published a report featuring business model innovation back in 2006 (IBM, 2006). Management consultancy, the Boston Consulting Group (BCG) also started to consider and examine the value of BMI at a relatively early stage (Lindgardt et al., 2009). BCG has published an annual survey of senior executive views on innovation since 2004, one that charts the growing interest in the field in the period. BCG's 2014 survey indicates that innovation is a top three priority for executives (Andrew et al., 2010; Taylor et al., 2012; Wagner et al., 2013; Wagner et al., 2014). Of particular significance, the survey asserts that successful innovating companies more often than not engage in business model innovation (Lindgardt & Hendren, 2014).

The interleaved concepts of uncertainty and complexity are key drivers of enhanced attention to BMI issues (Chesbrough, 2010). These concepts are also core to recent theorising in relation to design thinking (Cross, 2011; Liedtka & Ogilvie, 2011). However, the application of design thinking to business model innovation is not well theorised. This paper proposes a theoretical framework of business model prototyping that demonstrates a means of applying design thinking for business model innovation. It does so to encourage and support practical efforts to deploy business model prototyping, and to underpin and encourage further research via provision of a theoretical foundation for the concept.

Approach

The paper will include a literature review and discussion of fieldwork that has consisted of expert interviews, multiple case studies and extension/validation interviews. Relevant ideas from the literature review, and findings from the fieldwork are combined to generate an enhanced and coherent theory (Dubois & Gadde, 2002; Dubois & Gadde, 2014), one that is crystallised in the form of a theoretical framework. An 'abductive' approach – a key characteristic of design practice and design thinking (Neumeier, 2008; Martin, 2009), and distinguished by an ability to make creative, sideways connections – has also been deployed in development of our framework. In addition, the study has employed dimension-based models of prototyping, synthesising these to map the four dimensions (purpose, process, context and engagement) that constitute what we will show as the basic vectors of the business model prototyping framework that we propose. This basic version has been elaborated via use of fieldwork findings (from expert interviews and case studies) to create a more nuanced model, one that is reflective of both theory and practice. We contend that this business model prototyping framework is a substantive contribution to BMI theory and practice, which we will detail further below.

Findings

The key finding of this work is a theoretical framework of business model prototyping developed abductively. This framework consists of four dimensions: purpose, process, context, and engagement.

The ‘purpose’ of business model prototyping can be categorised as exploration, evaluation and persuasion. We will show that exploration is an undervalued, but highly important aspect of this dimension of prototyping. While the ‘process’ in which prototyping is used is often regarded as phase-based (e.g., Seidel & Fixson, 2013; Liedtka, 2015; Zott & Amit, 2015) – i.e. that it fits within clearly set processes of the development of goods or services – we find that how prototyping fits within processes owes a lot to an organisation’s culture or philosophy (Schrage, 1993; Thomke & Nimgade, 2000; Pering, 2002; Brown, 2005). ‘Context’ influences learning through prototyping. Although the importance of context in prototyping has been acknowledged (e.g., Nielsen, 1993; Snyder, 2003), it is not so well regarded as the attributes of prototypes themselves, such as fidelity (e.g., Virzi et al., 1996; Nilsson & Siponen, 2006) or materials (e.g., Sefelin et al., 2003; Akaoka et al., 2010). Recently, however, some researchers have started to afford greater attention to the context surrounding prototyping – including factors such as participants, environment and organisational culture – as an influential factor on their outcomes (e.g., Lim et al., 2006; Sauer et al., 2010). Another key dimension of prototyping is to learn from feedback. ‘Engagement’ with users and other actors in prototyping is a crucial factor of improving the learning outcome (Beaudouin-Lafon & Mackay, 2007; Han, 2009; Rizzo & Cantù, 2013; Bogers & Horst, 2014; Jensen et al., 2015). Prototypes support the facilitation of communication within and across different actors in design processes (Erickson, 1995; Kolodner & Wills, 1996; Schrage, 1996; Schrage, 2000; Kelley & Littman, 2001; Yang, 2005; Blomkvist & Holmlid, 2009), which is considered a difficult activity (Voss & Zomerdijk, 2007). The traditional literature on prototyping coming from product design, however, discusses engagement largely in terms of 'interactivity', and focusses upon only whether the prototype has an interactive function (e.g., Beaudouin-Lafon & Mackay, 2007; Lim et al., 2008). In addition to the interactivity of prototypes themselves, the proposed model in this paper considers interaction among actors and situations through prototyping as a key factor in the value of prototyping (see Latour, 1996; Reckwitz, 2002; Kimbell, 2012). Fidelity – either lo-fidelity rough and dirty models, or high-fidelity almost finished products – is also a widely discussed subject regarding prototyping (e.g., Rudd et al., 1996; Virzi et al., 1996; Houde & Hill, 1997; Walker et al., 2002; Lim et al., 2006; McCurdy et al., 2006; Sauer & Sonderegger, 2009). However, as business model prototypes are not necessarily physical, because the level of abstraction of business models is high in itself, their prototypes can be manifest in diverse ways, even narratives (Magretta, 2002; Massa & Tucci, 2013). For this paper fidelity, in the dimension of engagement, relates to how precise the prototype affects the engagement of actors in the design and development of business models. Thus, this paper sees engagement not as interactivity or fidelity but embraces a wider definition of its possibilities.

From reflecting on these dimensions, this paper concludes that business model prototyping is not a single method or tool but consists of various methods and tools. Also, the dimensions of business model prototyping identified in this paper are not independent factors but interdependent elements. Therefore, regarding business model prototyping simply as a method or a tool cannot capture the complexities of the discourses and significance of this activity for business model innovation. Thus, this paper proposes that business model prototyping is best considered as a methodology (Gasparski, 1986; Baskerville, 1991; Blaug, 1992; Ishak & Alias, 2005) for exploring possible business models through designing and gaining feedback from the interdependent business components the prototype configures.

Research Limitations

This work follows a logic of replication (Yin, 2013) and relies on a small number of cases and data sources. Although it does not aim to generalise the concept of business model prototyping statistically, a quantitative approach such as surveys with a large number of samples could complement the limitations of the data collection methods used. Therefore, once this type of business model prototyping is disseminated, surveys and questionnaires of senior management, business development managers and design practitioners could potentially further validate and develop the knowledge on business model prototyping and development.

Originality/Value

First, while the importance of exploration for business model innovation has been widely acknowledged (e.g., Chesbrough, 2010; Sosna et al., 2010), there are few arguments on prototyping, and especially its exploratory use, as most prototyping research focuses on its significance in experimentation. Secondly, although the value of design and design thinking for innovation has been addressed well over the last decade or so, the value of prototyping for business model innovation has not.

Thus, this paper proposes a theoretical framework of business model prototyping according to the four dimensions identified, as a theoretical foundation for further research and practice on the subject.

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Prototyping in Business Model Innovation: Exploring the Role of Design Thinking in Business Model Development

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The role of design for innovation management has been argued especially under the discourse of design thinking by scholars and practitioners. For fostering innovation, one of the obstacles is the uncertainty over the process, and prototyping has been acknowledged as a key element of the design methodology to embrace the uncertainty. However, the focal point of the discourse is often on the human-centric aspect and there is less argument on prototyping.

Concurrently, the argument of design methodology for innovation has started to identify the need for a more comprehensive approach than approaches focusing on product innovations, and the argument has expanded to business model innovation.

By clarifying the concept of business model innovation and the relevant concepts by literature review, this paper proposes a theoretical model of business model prototyping with the four key elements: iterative and agile learning, tangibility, complexity and synthesis. It is accompanied by the examination of the possible domains of further research.

Through the development of the theoretical model, this research serves as the basis for arguing the relatively neglected issue of prototyping for business models.

Keywords: Design thinking; prototyping; business model; innovation; business model innovation

Introduction

It has been acknowledged that managing innovation is surrounded by a high degree of uncertainty (Christensen, 2003) and the required strategy to embrace the risk in the uncertainty is different from management strategies in the conventional management discipline (MacGrath, 2000; Ries, 2011; Blank and Dorf, 2012). In line with the growing importance of innovation, the strategic role of design has been argued under the concept of design thinking as an alternative methodology for fostering innovation (Dunne and Martin, 2006; Brown, 2008; Lockwood, 2010; Plattner et al., 2010).

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Also business models have become a popular concept relevant to innovation (Amit and Zott, 2010; Chesbrough, 2010; Teece, 2010), and some tools based on the concept are developed to explore new opportunities in the uncertainty (Osterwalder and Pigneur, 2010).

While innovation is traditionally regarded as a matter of technology and products (Fagerberg, 2006; Chesbrough, 2007; Norman and Verganti, 2012), it has started to be acknowledged that business model innovation is a new area of innovation. Different from innovations categorised by the output of innovation such as product innovations, the concept of business model innovation rather provides a new approach to fostering innovation than specific cases, and the concept is still under development (Schneider and Spieth, 2013).

This paper will examine the possibility of applying the methodology of design thinking, especially focusing on the method of prototyping, to business model innovation. It will also propose a theoretical framework of business model prototyping focusing on the four elements of the concept: iterative and agile learning, tangibility, complexity and synthesis. Finally, it suggests the possible area of further research.

Key Concepts

Innovation

It is recognised that there is a wide range of research and attempts to define innovation (Fagerberg, 2006; Cruickshank, 2010). Therefore, before moving to an argument on the contribution of design thinking to business model innovation, this chapter will clarify the definition of innovation for this paper as the conceptual foundation, and it also reveals the conceptual difference between product innovations and business model innovation.

The definition of innovation

This paper mainly follows two definitions of innovation.

One is provided by OECD, and the other is offered by Sir George Cox, a former director-general of the Institute of Directors. In Oslo Manual, OECD (2005, p.46) defines innovation as:

> *An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.*

This definition encompasses various types of outputs as innovation and emphasises implementation as a key aspect of innovation.

Cox (2005, p.2) also defines innovation as ‘the successful exploitation of new ideas’. Here also exploitation is the key point of innovation. It seems that, as innovation tends to be misunderstood as invention, which is more likely to be mere idea generation, these definitions try to ground innovation on a larger basis including the implementation of ideas. Following the definitions, this paper regards innovation as a comprehensive activity.

Product innovations

OECD (2005) also proposes a taxonomy of innovation that divides innovation into four types: product innovations, marketing innovations, process innovations and organisation innovations. It defines that ‘Product innovations involve significant changes in the capabilities of goods or services. Both entirely new goods and services and significant improvements to existing products are included’ (p.18). This definition suggests that this categorisation is based on the output of innovation. For instance, the characteristics of product innovations in this definition is that the innovations are delivered through goods or services. Another point of this definition is that the word ‘product’ does not only mean goods but also includes services. In other words, the physicality of the products is not focused as the key element of products.

It is not new to think that the boundary between products and services is vague. For instance, an argument on service-dominant logic reveals that the product is only a medium to provide a service and it should be regarded through a logic concentrating on services (Vargo and Lusch, 2004). In this logic, products are a physical medium of the services to deliver the value.

Business model innovation

The brief overview of the concept of product innovations shows that the argument on innovation conventionally focuses on the output of innovation.

If following the same scheme of the argument, business model innovation would be the implementation of a new business model. However, as we will see, one of the advantages of using the concept of business models for fostering innovation is that it provides amore holistic perspective of the business and helps the users to avoid sticking to a single element of the business.

To clarify what business model innovation is, the next section will frame the concept of business models as the theoretical basis for the innovation.

Business models

The definition of business models

There are numerous arguments on the definition of business models and the general definition has not been formulated (George and Bock, 2011; Schneider and Spieth, 2013). In the early stage of the research on business models, the term was used to mostly describe the financial side of business (Schneider and Spieth, 2013). In the progression of the argument, it became a concept representing the holistic architecture of a business. Teece (2010), for instance, asserts that business models are more conceptual and holistic than a mere financial model.

To settle the definition, this research focuses on the definitions by key researchers on innovation. Chesbrough and Rosenbloom (2002) describe it as a medium between the technical domain and economic domain. Their argument basically suggests that technological progress itself hardly fosters innovation, and the consideration of commercialisation of ideas will be needed to exploit the opportunity. Johnson (2010) also points out the importance of the delivery of values. He argues that a business model 'defines the way the company delivers value to a set of customers at a profit'.

Research by Osterwalder (2004) is also broadly acknowledged, and the definition of business models encompasses a more comprehensive set of the elements in the concept. The definition is that 'a business model describes the rationale of how an organization creates, delivers, and captures value' (Osterwalder and Pigneur, 2010, p.14). The creation of value is the traditional focal point of innovation management, which is about the generation of new ideas, products and services. The delivery of value is an adaptation of the new ideas to the market including the customer segment, channels and customer relationship. Capturing value is the monetisation of the scheme. Through clarifying the three key aspects of business models, the definition shows business models as a holistic overview of a business.

Key aspects of business models

The argument on the definition of business models indicates that *comprehensiveness* is one of the key elements of business models.

Another key aspect is agility. Blank and Dorf (2012) compares the advantage of business models with that of business plans. His assertion is that most of the business plans for a new market or a new business do not survive at the first contact with customers in many cases. In other words, those plans actually include many assumptions.

This point resonates with one of the assertions by Christensen (2003). He argues that a market research, even if it is made by expert analysts, cannot predict the future of a new market and simply a market that does not yet exist cannot be analysed. He adds that most of new successful ventures actually abandoned their original plan in the implementation of their business.

Rather than spending much time only for planning, Blank (2005) suggests that those who develop new businesses should go out and start to validate the scalability of their business from the early stage. Christensen (2003) also suggests that action needs to be taken to learn before planning, and planning is only needed for learning new markets.

Comparison with product innovations

Innovation as the output of innovations

The previous section reveals inclusiveness and agility as the key characteristics of business models.

In this understanding, the concept of business model innovation does not fit in the categorisation of innovations OECD provided. As we have seen, the categorisation by OECD is based on the outcomes of innovation. For example, product innovations are the innovation of products and marketing innovations are the innovation of marketing methods. The report uses the plural form for innovation and this also implies this point.

Business model innovation as an approach

On the other hand, the concept of business models include various aspects of businesses. The insights from the analysis of business models can end up as any type of innovations in the taxonomy of OECD. The analysis of a business model, for instance, might identify a new value creation or a new way of delivering value as a potential opportunity of innovation. The former can be categorised as product innovations and the latter can be process innovations.

Business models are also tentative (Osterwalder and Pigneur, 2010), and it is rather a conceptual tool or concept itself to explore latent opportunities than an outcome directly influencing the business.

Therefore, business model innovation is hardly settled in this categorisation. It seems that business model innovation is not the innovation of business models but the innovation through the analysis of the business model. In other words, the characteristics of business model innovation is how to identify the opportunities for innovation rather than the type of the outcomes.

Need for a new approach to innovation

The reason why the research on innovation began to more frequently discuss business model innovation is not because product innovations became obsolete and we need to move to a new realm of innovation, but because it is gradually revealed that focusing on a single element of the business can miss the potential opportunities of innovation and the opportunities can actually be in the area of other elements of the business. For example, while you focus on a product innovation, the actual opportunities of innovation can be in other areas such as the realm of marketing innovations or organisation innovations.

An advantage of business model innovation approach, as we have seen, is to enable innovators to capture the whole picture of their business or activities and help to identify possible opportunities of different types of innovation.

The clarification of the conceptual difference between product innovations and business model innovation will support the argument in the following section on design thinking as the strategic role of design and the contribution to business model innovation.

Design thinking

The previous argument clarifies what business model innovation is. This section moves to the argument of the contribution of design and design thinking for innovation, especially product innovations and business model innovation.

The limited view of design for product innovations

While being aware of the integral role of design for innovation, OECD (2005, p.17) conceptualises product design as part of marketing innovations as well as product innovations. It argues that 'Marketing innovations involve the implementation of new marketing methods. These can include changes in product design and packaging, in product promotion and placement, and in methods for pricing goods and services' (p.17). This idea is derived from the theory of marketing chiefly represented by the concept of 4P's. One of these Ps is product, and product design is regarded as an element of the product in the marketing theory (p.31). In this context, product design plays a role of increasing the attractiveness and appeal of products to a new market or a target market segment.

Design thinking as the strategic role of design

Design has been discussed as a broader activity, even since Simon (1996) argued design in his discussion on the sciences of the artificial. He argues that 'everyone designs who devises courses of action aimed at changing current situations into preferred ones' (p.111). In this point of view, the role of design is not necessarily limited in the area of physical objects but rather it is about providing better situations.

Moreover, there has been an argument for the strategic role of design under the concept of design thinking.

Despite the controversy, this section builds the theoretical ground of the strategic role of design from the concept of design thinking, as the concept is relevant to the application of design approach to outside of the design discipline, which is the main theme of this research.

The key elements of design thinking

The next section discusses the key elements of design thinking to clarify the potential contribution of design thinking to business model innovation. This research will mainly follow the five tenets of design thinking by Lockwood

(2010), the former director of the Design Management Institute.

The tenets comprehensively summarise the characteristics of design thinking. To theoretically complement it, it is integrated with other frameworks of the methodologies based on design practices, such as IDEO (Brown, 2008) and Adaptive Path (Merholz et al., 2008).

The elements are:

- Human-centredness / Field research (mainly with observations for deeply understanding consumers)
- Collaboration (with customers and/or internal multidisciplinary teams)
- Learning through iterative process (Prototyping; Agile Development)
- Visual Storytelling (Prototyping)
- Concurrency with business analysis (integrative thinking; divergent and convergent thinking)

Contribution of design thinking to business model innovation

Introducing cases of Frog and IDEO, Simonse et al. (2012) suggest that strategic designers can contribute to innovation by providing a new business model. They also refer to Buchanan (2001) for claiming this point. His assertion is that the domain of design has expanded from things and symbols to systems and environments.

This argument overlaps the concept of business model innovation. The key objective is not to provide a better good or service but to build a better architecture and system of a business or an activity.

For this objective, the element of business to be innovated should be identified before the development for innovation begins. This is a distinctive difference between an approach to product innovations and business model innovation, and there will be unique issues of business model innovation.

Compared to product innovations, the output of business model innovation can be varied. This suggests that there is a wide range of directions business model innovation can possibly take, and identifying a right direction is an important part of the process. For this purpose, the iterative learning process plays a vital role, which is represented by the concept of prototyping in design thinking.

As a similar concept, Chesbrough (2010) also recognises the importance of business model experimentation as a learning process. Although the word, experimentation, can be associated with the verification of a pre-defined ideas (Brunswicker et al., 2012), in the case of Chesbrough's claim the key point of business model experimentation is revealing knowledge, latent before the experimentation, for the future steps in iteration. The main objective of the experiment is consistent with the benefit of prototyping.

From this point of view, this paper will propose a concept of business model prototyping as part of the contribution of design thinking to business model innovation.

A proposed concept: business model prototyping

This paper proposes a conceptual model of business model prototyping. The key elements are the following:

- Iterative and agile learning
- Tangibility
- Complexity
- Synthesis

The subsequent sections will discuss the detail of each aspect.

Iterative and agile learning

One of the key elements is iterative and agile learning. The main objective of prototyping is to get feedback and learn from building and implementing a product or service. This point is sometimes argued as a difference between piloting and prototyping (NESTA, 2011). Moreover, the learning process is often iterative.

The iteration in the process of design thinking is regarded as a key element of managing uncertainty in facilitating radical innovation (Brown, 2008; Lockwood, 2010). As Christensen

(2003) claims, a new market cannot be analysed. To tackle this problem, designers build the product or service to learn, not to implement. Traditionally production should be flawless, but if you think that the production process itself is a learning process, even failure can be a learning opportunity. This aspect of design is conceptualised as prototyping in the argument of design thinking.

In the process of business model innovation, what element should be innovated needs to be identified before the development of the element. Relevant to the search, there is a significant concept of the lean startup methodology called *pivot*.

Similar to the concept of prototyping, the method of minimum viable products usually goes through an iterative process. After each iteration, the user of the method needs to interpret the feedback from the iteration and decide whether to keep improving the current product (persevere) or change the direction (pivot).

In addition, there is an argument in design practice about the level of fidelity of prototypes (Houde and Hill, 1997;McCurdy et al., 2006).

The concept of minimum viable products indicates that the prototype should be minimally developed just enough to get feedback. In the context of design thinking, also low-fidelity prototypes are theoretically preferable for getting feedback as designers can be open to the feedback when they spend less effort and time for the prototype and avoid the fixation with their initial idea (Gerber and Carroll, 2012).

Following these ideas, the required level of fidelity of prototypes basically depends on the learning objective and the development should be minimum. Additionally, as the process is assumed to be iterative, the agility leads faster cycles of iteration and it will be a fundamental element of the prototyping process.

Tangibility

Tangibility should be considered as a key characteristic of business model prototyping.

Prototyping can be also part of visual storytelling, as prototypes are fundamentally tangible representations of the concepts. Lockwood (2010) asserts that visualization of concepts is always included in prototypes, and the form of prototypes is various from concept sketches to physical mock ups. The variation can also include some methods and tools of in service design such as stories boards, customer journey map and a service blueprint (Polaine et al., 2013).

This tangibility of prototypes in design thinking makes it easier to obtain feedback and facilitate interaction among stakeholders (Brown, 2009). There is usually difficulty in the collaboration among people in different departments as they tend to have a different view of their own businesses and customers from each other. Prototypes can work as a medium of sharing the common understanding of their business and service (Star and Griesemer, 1989; Henderson, 1991; Carlile, 2002).

Business model canvas can be a good example of turning the business model to be tangible (Blank and Dorf, 2012), and there are similar mapping tools for entrepreneurs (Maurya, 2012) and social entrepreneurs (McCahill, 2013) to help the visualisation of the abstract architecture of the business or activities.

Complexity

Arguments in design thinking about prototyping sometimes point out the difference between prototypes and the final solution. For example, Moggridge and Smith (2007, p.685) regard prototypes as 'a representation of a design, made before the final solution exists'.

However, as business models represent a highly contextualised environment of business, it is difficult in some cases to gain a profound knowledge from a simulated situation.

As a way of resolving this problem, some practitioners recommend to launch a developing product to market in the early stage (Cooper and Vlaskovits, 2010; Ries, 2011; Blank and Dorf, 2012). The main purpose is to gain actual data through an actual product launch. In this scenario, the boundary between prototypes and the final solution is blurred.

If we think back to the definition of design by Simon (1996), design is for creating a preferred solution and it can be an endless activity. There is always a possibility that any final solution can be overcome by a preferred solution in the future.

Obviously, from the perspective of risk management, a virtual situation and closed exposure of the representation of the solution are preferable as it can avoid the risk of being copied and brand damage. However, in some cases, the actual exposure of prototypes to the real market is required to gain a profound insight for business model innovation because of the complexity. Therefore, the level of exposure should be considered depending on the learning objective.

Synthesis

One of the biggest challenges in prototyping for business models is the way to interpret the feedback they get. A suggestion from the methodology of design thinking is that it should be synthetic. The way to respond to the feedback in design thinking is presumably more synthetic than validation. Kelley and Kelley (2013) include synthesis as one of the crucial phase of design thinking.

Obviously quantitative analysis tools are useful for that matter, but the collected data cannot provide the clear answer about whether you should keep improving your current solution or shift to a radically different direction based on validated learning you got by that time. The decision is fundamentally influenced by human factors. Because of this, feedback should be synthetically analysed and an integrative alternative solution should be provided through the method of business model prototyping.

Limitation

Due to the lack of general definitions of some important concepts in this paper, such as innovation, business models and design thinking, this research focused on some of the seminal definitions. Other theoretical basement obviously can lead to a different conclusion.

Also as this research is based on literature review, additional supports by empirical data are needed to propose a more reliable suggestion.

Moreover, although this research relies largely on the concept of design thinking, the validity of the argument of design thinking is controversial in the design research community (Kimbell, 2011; Johansson-Sköldberg et al., 2013). The reason is that the origin is mainly from the research community of management (Martin, 2009) and the practice of a leading design agencies such as IDEO (Brown, 2009) and they hardly refer to the literature in the design research community. Therefore, if the concept is revised by a more comprehensive theory, it might lead to other conclusions.

Further Research

This paper explores the theoretical model of business model prototyping. There are other possible future directions of further research.

Methodology

Case studies in actual contexts

Exploring case studies of using business model prototyping can be a possibility of the further research. In the real context, those iterative learning might be conducted with a different name. The integration of theoretical analysis and empirical case studies can provide a more solid framework and argument.

Experimental application of business model prototyping

The other possibility is to apply the theoretical model to develop an experimental tool-kit of business model prototyping, and test it in actual projects. This can also possibly generate an enriched empirical data.

Research themes

How the result of prototyping is synthetically interpreted

One of the problems in business model prototyping is how to interpret the gained knowledge. The decision of whether incrementally improving the current solution or changing the direction is still regarded as an unavoidable human element and mythical part of venturing new businesses (Ries, 2011).

Clarifying how the gained knowledge is synthesised in the application of prototyping in design thinking to business models is a potential theme that needs to be examined.

How business model prototyping can turn the complexity of a business to be tangible

This paper argues that the complexity of a business represented by a business model is one of the obstacles to facilitate business model innovation, and the advantage of prototyping is tangibility to support the learning process and collaboration.

The concept of design thinking regards prototypes as visualisation of concepts rather than only a partial representation of the final solution, and there are popular tools to visualise a business model such as business model canvas.

However, a business model itself is also a simplified overview of a more complex reality of the business. Only visually mapping out the elements does not appear to be sufficient enough to embrace the complexity of the business.

In the context of entrepreneurship, utilising the real market to tap into the complexity is one of the methods to tackle the problem (Blank, 2005; Ries, 2011). Obviously, the advocates of design thinking have also promoted the importance of field research in the real situation to gain insights (Neumeier, 2008; Lockwood, 2010; Kelley and Kelley, 2013), but the main objective is basically the development of new products and services.

How the tangibility of prototyping can be expanded to the level of business models to tackle the complexity can be a theme of the future research.

Conclusion

This research discussed the key concepts relevant to business model prototyping, proposed the theoretical model indicating the key elements, iterative and agile learning, tangibility, complexity and synthesis. Built on the analysis, it also suggested the possible opportunities for the further research.

Prototyping has been a key method in design thinking and it has a potential for contributing to business model innovation. While there are commonalities between prototyping in design thinking and the application to business model innovation, such as iterative learning and agility, there is also a particular problem of business model prototyping to tackle such as the complexity. The tangibility of prototyping will provide an advantage for solving the problem, but it needs further research to clarify the role.

This research is an attempt to produce an integrated and more inclusive concept of business model prototyping. Empirical research will be the next step to verify the key elements identified in this research. As the research theme, how to synthesise the gained knowledge into a new solution and how to turn the complexity of the business to be tangible need to be examined.

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