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It is Time to Become Data-driven, but How: Depicting a Development Process Model

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Abstract

Background: The business model (BM) is an essential part of firms and it needs to be innovated continuously to allow firms to stay or become competitive. The process of business model innovation (BMI) unfolds incrementally by re-designing or developing new activities in order to provide value propositions (VP). With increasing availability of data, pressure on BMI to orchestrate their activities towards putting data as a key resource and develop data-driven business models (DDBM) is growing.

Problematization: The DDBM provides valuable possibilities by utilizing data to optimize current businesses and create new VPs. However, the development process of DDBMs is outlined as challenging and scarcely reviewed.

Purpose: This study aims to explore how a data-driven business model development process looks. More specifically, we adopted this research question: What are the phases and activities of a DDBM development process, and what characterizes this process?

Method: This is a qualitative study in which the empirical data was collected through 9 semi-structured interviews where the respondents were divided among three different initiatives.

Empirical Findings: This study enriches the existing literature of BMI in general and data-driven business model innovation in particular. Concretely, this study contributes to the process perspective of DDBM development. It helps to unpack the complexity of data engagement in business model development and provides a visual process model as an artefact that shows the anatomy of the process. Additionally, this study resonates with value logics manifestation through the states of artefacts, activities, and cognitions.

Conclusions: This study concludes that the DDBM development process is structured with two phases as low data-related and high data-related activities, inheriting seven sub-phases consisting of different activities. Also, this study identified four underlying characteristics of the DDBM development process comprising value co-creation, iterative experiment, ethical and regulatory risk, and adaptable strategy.

Future research: Further work is needed to explain the anatomy and structure of the DDBM development process in different contexts to uncover if it captures various complexities of data and increases its generalizability. Furthermore, more research is required to differentiate between different business models and consequently customizing the development process for each type. Future research can also further explore the value co-creation in developing DDBM. In this direction, it would be interesting to consider connecting the field of open innovation to the field of DDBM and, specifically, its role in the DDBMs development process. Another promising avenue for future research would be to go beyond the focus on merely improving the VP to maximize the data monetization, and instead focus on the interplay and role that data has on sustainability.

Key words: Business model, Data-driven business model, Business model innovation, DDBM development process, development process

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Abbreviations

VP	Value proposition
DDBM	Data-driven business model
BM	Business model
BMI	Business model innovation
CC	Category consensus
MVP	Minimum viable product

1

Introduction

In this chapter, a brief background about this research topic is provided. Next, problematization elaborates the need for this research and consequently delineate the research purpose and research question. Lastly the thesis disposition as a guidance to facilitate the reading this thesis will be provided.

1.1 Background

Behind any organization, a business model (BM) exists (Teece, 2010). The BM is described as the core or engine of an organization (Osterwalder, 2004) as it operates as the facilitating mechanism for companies to work with strategies in terms of visualizing, communicating, and executing such BMs into operational activity and describe how the firm will create revenue streams (Osterwalder, 2004; Lihua Liu, 2019; McGrath, 2010). In essence, the BM is the part that holds everything together by utilizing the firm's resources and activities to provide a value proposition (VP) to customers and also capitalize on monetary means (Pataci, Danilovic, Liu, Hoveskog & Halila, 2015) which illustrates how a BM is arguably one of the key parts to consider in an existing company or in the establishing a new company (Zott & Amit, 2010; Osterwalder, 2004; Lihua Liu, 2019; McGrath, 2010).

BM is the engine that drives novel ideas and technology through the company to be commercialized (Chesbrough, 2010; Lihua Liu, 2019). In fact, without the BM, those ideas and technologies are often considered less valuable (Chesbrough, 2010) which indicates the importance of BM concerning organizational innovativeness, and its role to continuously provide value for the customers (Teece, 2010; Osterwalder & Pigneur, 2010; Zott & Amit, 2010). Hence,

as Chesbrough (2010) stated, any decisions relating to the firm's BM are essential because the decisions will affect how the ideas and technologies are commercialized, thereby impacting the economic outcome (Chesbrough, 2010). It implies the importance of staying innovative, which is essential for enterprises' survival.

Due to the BM's essential role in the organization, it is advocated how the BM itself can follow an innovative logic (Lambert & Davidson, 2013; Frankenberg et al., 2013). Teece (2010) described how vital it is for companies to continuously provide value to the customers to keep their competitive advantage; thus, their BMs should improve all the time. Similarly, according to Gibson and Jitter (2014), BM is crucial as it is the only way firms in the long term sustain their competitive advantages.

More precisely, the phenomenon of innovating the BM is referred to as business model innovation (BMI) (Teece, 2010). This study adopts the definition of BMI as a process of innovating a BM, where the current system of activities thereof is re-designed or modified in a new way that arguably leads to a new VP (Amit & Zott 2010; Teece 2010). However, this study also adopts the view of BMI to describe a process whereby a new BM can develop, referring to a circumstance where no previous BM has existed. As BMI creates a new market or disrupts the competitive advantage of key competitors (Euchner and Ganguly, 2014), this study considers the BMI process dynamic and not static (Lihua Liu, 2019) since it will be improved continuously as the environment changes (Lambert & Davidson, 2013).

Regarding changes in the environment, the emergence of new technologies such as artificial intelligence and data analytics following digitalization is one of the significant trends disrupting markets and changing the way firms deliver VPs and compete (Engelbrech et al., 2016, Lindgren, 2020). Examples of new innovative BM is illustrated in multiple industries (Lee et al., 2019). In the audio and music industry, Spotify and Apple music have changed the game (Gomez-Uribe & Hunt, 2015). In mobility industries, companies providing micro-mobility as Uber (Lee et al., 2019) and mobility-as-a-service solutions are growing by successfully providing new VPs, and in the accommodation and hotel industry, the entry of AirBnB (Lee et al., 2019) has brought new competition.

Given this, we argue firms must acknowledge how digitalized environment and availability of data will dominate the future (Lindgren, 2020). Therefore, incumbents need to adapt their BM to such an environment to stay competitive, and newcomers must include this trend in their BM development.

1.2 Problematization

With increasing digitization and digitalization within industries, there is a growing volume of available data, which many scholars and practitioners are pointing towards as there is potential for firms to capitalize on this data (Engelbrecht et al., 2016; Hilbig et al., 2020). Specifically, organizations are striving to find ways to utilize the data for different purposes, such as improvement in operational efficiency, and service and product quality (Manyika et al., 2011),

creation of new VPs (i.e., servitization) (Paschou et al., 2020; Coreynen et al., 2016), which in the end, lead to the opportunity for developing data-driven business models (DDBM) where data is considerate a critical resource (Hartman et al., 2016).

Given this, capitalizing on data implies the importance of employing the data as the core of the BMs for the promising positive impacts (Brownlow et al., 2015), which have attracted an increasing number of scholars to investigate the field of DDBMs (Hunke et al., 2017; Schüritz et al.,2017; Fruhwirth et al.,2018:2019:2020; Benta et al., 2017; Engelbrecht et al., 2016; Schneider & Spieth, 2013), but still, companies have been challenged to successfully develop their DDBMs (Mathis & Köbler, 2016).

In an attempt to provide helping information in this DDBM development challenge, Brownlow et al. (2015), tried to build one of the first structural guideline based on six key questions which should be answered by businesses to facilitate creation and implementation of their DDBMs. However, they did not elaborate on any processes through which DDBMs can be developed. Moreover, it seems their blueprint was not designed for any specific context; instead, it could cover the main activities for incumbent companies and start-ups to consider for establishing a DDBM.

Further, Schuritz and satzgar (2016), with the help of conceptual literature analysis, illustrated possible impacts of the data and data analytics on BMs through five data-infused patterns via three main identified components of BMs, including value creation, value proposition, and value capture. However, they brought up this question: how is it possible to design the process to monetize the data? as many companies currently possess big data, but how the data can be monetized is not clear. They also emphasized a deeper analysis of different case studies to progress an understanding of how DDBMs can be designed. Moreover, Hunke et al. (2017) identified the requirements of DDBMs and categorized them into 10 categories to consider in developing DDBMs. However, they discuss that their proposed process model can be used only in the context from which the requirements have been extracted. Moreover, many questions regarding how DDBMs can be refined and improved have remained (Hunke et al., 2017).

So, to conclude, there is an agreement among scholars in this field that the topic of DDBM development is scarcely reviewed (Brownlow et al., 2015; Engelbrecht et al., 2016; Schüritz et al.,2017; Fruhwirth et al., 2018). Furthermore, Brownlow (2015) declared that a few had provided any suggestion of how to undertake a DDBM development process, which is acknowledged by Fruhwirth et al. (2018) stating there is a shortage of knowledge on how DDBM can be developed and implemented in firms. Similarly, Engelbrecht et al. (2016) believed that the field of DDBM is limited investigated as there is neither a commonly accepted definition nor a clear picture of how DDBMs are developed or into where this transition ends (Schüritz et al., 2017). In sum, it seems this type of BM, when having data as its key resource, brings another level of complexity to the business development process (Schüritz et al., 2017).

1.3 Research purpose and research question

Given the discussion above, this study acknowledges the importance of promoting the innovation in BMs (Chesbrough, 2010; Teece, 2010) on the one side, and on the other side, lack of understanding concerning the question of how firms successfully conduct the development process of a BM precisely where the data is the key resource to be monetized (Hunke et al., 2017; Schüritz et al.,2017; Fruhwirth et al.,2018:2019:2020; Benta et al., 2017; Engelbrecht et al., 2016; Schneider & Spieth, 2013; Brownlow et al., 2015). Given this, the purpose of this study is to explore how a data-driven business model development process looks. More specifically, we adopted the research question:

What are the phases and activities of a DDBM development process, and what characterizes this process?

1.4 Thesis disposition

Chapter 1: *Introduction*

We express the background followed by the problematization, which advocates the reasons for this study in the form of purpose and research question.

Chapter 2: *Theoretical framework*

We present the theoretical foundation upon which this research is based. In addition, we introduce different topics of BM, DDBM, and BMI and end this chapter by describing a conceptual framework employed in this study.

Chapter 3: *Method*

We present the structure of steps that were conducted in this study to enable us to answer our research question. As well, explanations of why certain decisions were made will be elaborated. Finally, we end this chapter with a discussion of trustworthiness and ethical considerations.

Chapter 4: *Analysis*

We present our findings from the empirical data.

Chapter 5: *Discussion*

We discuss the analyzed empirical data with the existing literature and present a deep reflection of our findings.

Chapter 6: *Conclusion*

We summarize this research with concluding remarks. We provide theoretical and managerial implications and terminate this research with potential directions for future research.

2

Theoretical framework

In this chapter, a vast range of literature related to the topics of business model, data-driven business model, business model innovation and business model innovation process will be provided to facilitate the understanding of the concepts used in this thesis. This chapter will end by the elaboration of conceptual framework which is the foundation for comprehension of the rest of thesis.

2.1 Business model introduction

In one way or another, every organization possesses a business model, regardless of whether it is implicit or explicit (Teece, 2010). The BM can be described as how the organization can utilize its resources, including human capital, and efficiently provide their customer with products and services through managing activities. These activities will provide a proposed value by meeting the customers' needs or demands and further how companies capitalize in monetary terms by delivering value (Pataci, Danilovic, Liu, Hoveskog & Halila, 2015). Similarly, Teece (2010) described how firms deliver value to customers, entices customers to pay for value, and convert that payment to profit in their BM. Hence, the BM can be described as the rationale of how an organization creates, delivers, and capture value (Osterwalder & Pigneur, 2010).

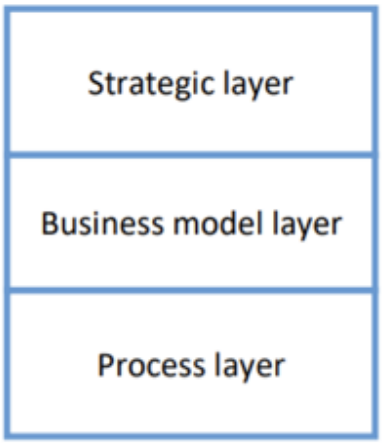
This study agrees and similarly views the BM as it is described above. However, in this research, we approach the topic of BM from a process perspective. Therefore, we consider the BM as a dynamic process and not something static. As Margetta (2002) described, the BM is a system of pieces fitting together that comprise the business. The BM concerns a process converting potentials of value to outcome (Chesbrough & Rosenbloom, 2002). The BM is an engine driving novel ideas

and technologies through the company to be commercialized (Chesbrough, 2010; Lihua Liu, 2019), and without the BM, those ideas and technologies are often considered less valuable (Chesbrough, 2010). Therefore, Chesbrough (2010) exemplifies how a decent technology combined with an excellent BM is often considered more valuable than when superior technology is combined with a decent BM.

The BM is argued to bring a competitive advantage to an organization over other actors in the market (Zott & Amit, 2010). BMs have been understood as related to the company's strategy to become competitive and successful (Klang, Wallnöfer & Hacklin, 2014). Further described by Osterwalder (2004), the BM works as the transferrer of the overall strategic planning of short and long-term views and the development of the firm's business into the actual process implementation. In contrast, the strategy becomes an operational reality (see figure 1). The BM facilitates how companies take their strategies and visualize, communicate, and execute them into operational activity and describe how the firm will create revenue streams (Osterwalder, 2004; Lihua Liu, 2019; McGrath, 2010). In other words, the BM is described by Osterwalder (2004) as the mediating layer between the firm's strategy and its implementation process (figure 1).

Figure 1

Business model as the mediating layer



Note. The business model as glue between strategy and process. (Modified from source: Osterwalder, 2004).

The topic of BM is clearly essential to be discovered (Osterwalder, 2004; Lihua Liu, 2019; McGrath, 2010; Zott & Amit, 2010;Klang, Wallnöfer & Hacklin, 2014), and must be acknowledged by everyone (firm or single – individual) seeking to commercialize their ideas. Any decisions related to the firm's BM are essential. Hence, those decisions will affect how the ideas and technologies are commercialized, thereby impacting the economic outcome (Chesbrough, 2010). This includes both corporations which need to renew their current BMs and the start-up entrepreneurs who need to define and create their first BM (Zott & Amit, 2010).

2.2 Data-driven business model

With increasing digitization and digitalization within industries, there is a growing volume of available data, which many scholars and practitioners are pointing toward as there is potential for firms to capitalize on (Engelbrecht et al., 2016; Hilbig et al., 2020). One of the most common definitions of digitization (Bloomberg, 2018; Schallmo, & Williams, 2018) is the transformation of data in an analog format (a physical artefact) to a digital format during a technical process (Brennan and Kreiss 2014; Bican & Brem, 2020). In this process, analog data obtains the binary value of zero and one (Latecki et al., 1998; Brennan and Kreiss 2014), so the data can be stored, processed, and transmitted via computers (Bloomberg, 2018). Unlike digitization as a technical process, digitalization can have a broader meaning as Brennen and Kreiss (2016, p.6) declared that it "broadly refer[s] to the structuring of many and diverse domains of social life around digital communication and media infrastructures."

Therefore, they discuss that digitalization has a social aspect that makes digitalization to be represented as a sociotechnical process, implying that it can integrate technologies such as artificial intelligence (AI) (Lindgren, 2020; Lee et al., 2019) into daily social life (Brennen and Kreiss, 2016; Schallmo, & Williams, 2018). Lindgren (2020) acknowledges the digitalization and consequently utilization of AI as a core element of future businesses. Similarly, Lee et al. (2019) introduced AI as the catalyst of the emergence of the new BMs dealing with data. They emphasized the importance of leveraging data analytics and AI advances to change the BMs corresponding to the digital environment to capitalize on new technologies involving data.

Capitalizing on data allows firms to optimize their current business processes and establish entirely new BMs (Hilbig et al., 2020). Examples of data capitalization in BMs can be observed in multiple industries (Lee et al., 2019). In the audio and music industry, Spotify and Apple music have changed the game (Gomez-Uribe & Hunt, 2015). In the mobility industry, companies providing micro-mobility as Uber (Lee et al., 2019) and mobility-as-a-service solutions are growing by successfully providing new VPs. In the accommodation and hotel industry, the entry of Airbnb (Lee et al., 2019) has brought new competition. Firms adopting this opportunity and choosing to capitalize on this data through their BMs have coined the term for DDBMs (Hartman et al., 2016; Bownlow et al., 2015). The term DDBM has been grown in interest and is commonly used by practitioners (Hartman et al., 2014). However, there is no clear definition or term regarding the DDBM (Hilbig et al.,2020; Kühne & Böhmann, 2018; Engelbrecht et al., 2016; Schüritz & Satzger, 2016), as the field is relatively new (Kühne & Böhmann, 2019). As well, the term DDBM is questioned regarding its explicit existence as a term at all (Schüritz & Satzger, 2016), as scholars provided their opinions that a DDBM is hard to define since different firms can be data-driven even though the magnitude of data involved can be different. Thus, different versions of DDBM can exist (Hilbig et al., 2020; Engelbrecht et al., 2018). Even though there is a lack of consensus regarding how to define the DDBM, scholars have provided their views and attempted to define the term (see table 1).

Table 1

Collection of data-driven business model descriptions by different authors

Author(s)	Definition/description
Hartmann, Zaki, Feldmann and Neely (2014) (2016).	"data-driven business model as a business model that relies on data as a key resource" "By definition a DDBM has data as a key resource, although data may not be the only key resource of the respective business model. To create the DDBM framework the types of data source used by companies need to be understood"
Brownlow, Zaki, Neely, and Urmetzer (2015)	"Data is obviously fundamental to a DDBM…many businesses are developing new business models specifically designed to create additional business value by extracting, refining and ultimately capitalizing on data" "This high utilization of all available data sources by established organizations is indicative that these organizations understand the value of data and orient themselves towards becoming data-driven"
Engelbrecht, Gerlach and Widjaja (2016)	"A business model of an organization is data-driven, if its core business necessarily requires digital data"
Schüritz & satzger (2016)	"there are no data-driven business models per se; instead, the utilization of data and analytics opens a "continuum" of transformation options for business models. We identify five distinct patterns in which the use of data may alter the value proposition, value creation and value capturing of a business model"
Dremel, Overhage, Schlauderer and Wulf (2017)	"Companies have a tough time transforming towards a data-driven company and recognizing their data not as a side-product but as a source of competitive advantage"
Kühne and Böhmann (2018)	"data-driven business models as business models which use data as a key resource to create new insights for a value proposition for customers"
Hahn, Traunecker, Niever and Basedow (2020)	"data-driven business models… utilize data to offer new products or services"
Hilbig, Hecht and Etsiwah (2020)	"Today, digital enablers such as cloud computing, the Internet of things, and artificial intelligence are essential drivers for a new frontier of business models (BM), named data-driven business models (DDBM)" "both the dimension of value creation and the means of data exploitation are important to understand and establish a DDBM"

As the term data-driven business model implies, it lays a direct focus on the words data-driven, as of which it is perhaps evident data would have a significant role within any attempt to define the concept itself. Thus, logically the first step towards a definition and what seems to be the most accepted term is a *data-driven business model that relies on data as a key resource* (Hartman et al., 2014:2016), as this view is shared among multiple scholars even though it is described differently (Brownlow et al., 2015; Engelbrecht et al., 2016; Dremel et al., 2017; Kühne &

Böhman, 2018). Brownlow et al. (2015) argued for data to be viewed as a fundamental part of a firm's DDBM.

Furthermore, as Engelbrecht et al. (2016) described, a firm's BM is data-driven only when its core business depends on data. It is explained in another way by Dremel et al. (2017) a data-driven firm is acknowledging data, not as a side product rather as a source of competitive advantage. The view of Kühne and Böhmann (2018) is connected as they argued a DDBM uses the data as a key resource to create new insights for a VP for customers. Thus, data has a fundamental part in the DDBM, as indicated by Kühne and Böhman (2018), the term of DDBM is defined in a broader aspect than merely from the point of view of data as a key resource as first indicated by (Hartman et al., 2014) even though the definition offered by Hartman et al. (2014) is not wrong, it is not complete. For example, Hilbig et al. (2020) provided their perspective on the DDBM by highlighting the role of digital enablers as cloud computing, the internet of things, and artificial intelligence as essential parts of the DDBM, rather than data itself.

Thus, to define this term, DDBM scholars further point towards a broader perspective in order to enable a more precise definition of the DDBM (Brownlow et al., 2015; Dremel et al.,2017; Kühne & Böhmann, 2018; Hilbig et al., 2020; Hahn et al., 2020) which covers the role of data as well in connection to the essential part of any BM, i.e., a VP for customers (Osterwalder & Pigneur, 2010). Starting from the views of Brown et al. (2015), the DDBM is designed to create additional business value by extracting, refining, and eventually capitalizing on data. As indicated by Dremel et al. (2017) and Hartman et al. (2014:2016), data is a key part of a DDBM but not the only source for creating a competitive advantage.

Moreover, Hilbig et al. (2020) provided their perspective that the DDBM needs to consider both the dimension of value creation and the means of data exploitation. Furthermore, DDBM is defined as data used as a resource within a BM to create opportunities for new VPs (Kühne & Böhmann, 2018). Hahn et al. (2020) described how a DDBM is utilizing data to offer new VPs in terms of new products or services.

Based on those two paragraphs above, this study chooses to adopt a definition of the term DDBM as follows:

a data-driven business model uses data as a key resource to create new value propositions for existing and future customers

This definition provides a distinction of the concept DDBM in two sides. On the one side, it is clear a firm adopting an DDBM would have *data as a key resource.* On the other side it is evident a firm with a DDBM must find the operational capabilities to use this resource (data) *to create new value propositions for existing and future customers.* In the next section 2.2.1, these two sides of a DDBM are further elaborated in depth.

2.2.1 Elements of a DDBM

Before reviewing the DDBM from a process development perspective, we further provide a more detailed review of the DDBM. Fruhwirth et al. (2020) explained that the existing research in the field of DDBM could be divided into the elements value creation, value proposition, and value capture. Value creation consists of the key resources and activities. VP and capturing comprise offerings (i.e., services) and different types of revenue models related to a DDBM (Fruhwirth et al., 2020). In the following section, an elaboration of each element with subcategories in reviewing the DDBM will be presented. The emergence of unprecedented technological development and the possibility of providing new types of services with the help of big data (Breidbach and Maglio, 2020) increase the unethical implications in DDBMs that need to be considered. Therefore, we end this section with a segment of ethical aspects which need to be considered for DDBM.

2.2.1.1 DDBM value Creation

2.2.1.1.1 Key resource

By the chosen definition, a DDBM has data as a key resource. Although data is the key resource in a DDBM, it does not imply that the data is the only resource used within companies (Hartman, 2016). As described by Barney (1991), firm resources include "all assets, capabilities, organizational processes, firm attributes, information, knowledge controlled by a firm" (Barney, 1991). Still, in this study, we are specifically exploring the DDBM and therefore choose to focus explicitly on the data as a resource.

Within the field of DDBM, data is often referred to the buzz word of "Big Data" (Hilbig et al., 2020) as there is a significant growth in amount of available data which continues to increase in volume (Schüritz & satzger, 2016). Similarly, Manyika et al. (2011) referred to big data as *datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyze* (p.1). However, volume is not the only parameter determining if data should be considered as "Big-Data" or not (Hartman et al., 2016). An accepted definition of big data among scholars has been provided by Gartner (2012), as "high-volume, high-velocity and high variety information that demand cost-effective, innovative forms of information processing for enhanced insight and decision making" (Gartner, 2012). Regarding this definition, Hartman et al. (2016) further reflect and provide their view by breaking it down to three aspects. First, the term big data reflect the direct notion of data-volume but as well the variety of different data types. As well, the velocity of data referees to the speed at which data is utilized within a firm based on its activities.

Secondly, big data within the context of a DDBM is considered as an "information asset" which lends value to the firm. Thirdly, the definition emphasizes the demand for firms to enable new solutions in which they can work with this data cost-effectively (Hartman et al., 2016). Furthermore, it is often suggested that the 3Vs, volume, velocity and variety is complimented with an additional fourth dimension "Veracity" which indicates the uncertainty of the data as questioning the reliability of specific data types (White, 2012).

A firm having a DDBM does not necessarily fulfill these 4Vs in how the firm conducts the usage of data (Hartman et al., 2016). Schüritz & Satzger (2016) illustrated what is considered as big data

will in fact be relative to the specific point in time as well as the maturity of the specific firm, since what is considered big data today might change as time goes forward. Furthermore, one firm can view the same collection of data rather differently (Schüritz & Satzger, 2016).

Therefore, this study does not lay any significant weight in the definition of data, following the term big data, specifically, though we consider the 4Vs as aspects when discussion the DDBM key resource as data.

The literature suggests there are different types of data (Brownlow et al., 2015; Hartman et al., 2020; Kühne & Böhmann, 2018). Thus, having data as a key resource and the 4Vs aspects in consideration, firms have to decide which type of data is most applicable for them in their situation. Those decisions will be necessary regarding their success in constructing a functional DDBM (Brownlow et al., 2015). Following the decision on which type of data a firm work with, it will influence other parts of the BM (Engelbrecht et al., 2016), as different types of data require different ways to be acquired (Brownlow et al., 2015), and different types of data provide different possibilities for VPs (Exner et al., 2017), it becomes arguably essential to understand the source of data itself. The types of data sources are well-illustrated by Hartman et al. (2016) as they provided a summary of different views on this topic. They divided data into eight different data sources, which can be further divided into internal and external data sources. The internal sources include existing data that can be sourced from internal IT systems (e.g., ERP data), self-generated data through tracking (e.g., web-navigation or sensor data), and crowdsourced data created from a broad set of contributors over the web or social collaboration techniques.

The external data includes acquired data referring to purchased data from data providers, customer or partners' data that is not shared for everyone, and freely available data comprises available public data at no direct cost (Hartman et al., 2016). It is argued that the data itself is of no value unless there is an attempt to make sense, analyze, or interpret the data that must be either self-generated or acquired elsewhere or a combination (Hilbig et al., 2020). This puts the focus towards the key activates within the DDBM as those will be affected based on which data source a firm relies on as their resource (Kühne & Böhmann, 2018).

2.2.1.1.2 Key activities

Companies perform different activities to deliver their promised value. In DDBMs, the data has been known as the key resource that allows companies to procure a profit, so specific activities are needed to enable companies to monetize the data (Kühne and Böhmann, 2018; Faroukhi et al., 2020). Although due to the insufficient academic research regarding the monetization of big data, there is no single globally accepted set of activities determined in the DDBMs (Faroukhi et al., 2020), one alternative to describe the data-related activities is the data value chain model as various scholars have employed and improved it over time. This model defines a set of repeatable activities to extract the value of data over the data lifecycle (Faroukhi et al., 2020). Rayport and Sviokla (1995) introduced the virtual value chain model in parallel with the physical value chain to describe the main activities to data as an emergent element affecting the businesses. They assumed five sequential steps in any stage of the value chain (inbound logistics, production process, outbound

logistics, marketing, and sales) for data value creation as gathering, organizing, selecting, synthesizing, and distributing.

This model represented as one of the initial data value chain models even before the trend of big data as a new concept. Hartman et al. (2016), by integrating the different activities provided in the literature along with the virtual value chain model introduced by Rayport and Sviokla (1995), considered seven key activities for DDBMs consist of data generation, acquisition, processing, aggregation, analytics, visualization, and distribution. Cheah and Wang (2017) drew on Hartman et al. (2016) findings and explained the key data-related activities such as data collection, data storage, data processing data application as the last stage in this chain.

One of the main differences of this model to other previous models can be the specification of one data application paving the path of innovation for companies: "data application constitutes utilization of analysis results to support complex decision-making, thereby enabling the experimentation and implementation of business model innovation" (p. 232). Kühne and Böhmann (2018) identified the key activities necessary for data monetization in DDBMs. These activities, which make up the core activities of the data value chain, should at least comprise first, acquiring, second, structuring, and third, analyzing the data. Their reasoning for consideration of these activities as the core activities of the DDBMs is the frequent usage of these activities in the DDBM literature as the common activities in such BMs. Faroukhi et al. (2020), by emphasizing the particular aspects of big data, which are explained in section 2.2.1.1.1 (resource), introduced the big data value chain model. They argued that the data value chain should entail these aspects so that dealing with big data as a significant value resource would be ameliorated. As shown in figure 2, this model's activities that resemble the activities proposed by Hartman et al. (2016) include data generation, data acquisition, data pre-processing, data storage, data visualization, and data exposition.

Figure 2

Big data value chain model

Note. shows the activities in the big data value chain model (Faroukhi, et al., 2020)

Briefly, as the general explanation of these steps, data generation refers to the potential ways data can be generated as internal or external. Data generation can be done by humans, systems, sensors (Hu et al., 2014). Data acquisition involves the process of obtaining the raw data, which happens once the data is generated. Data preprocessing is a step important specifically for data analysis and exposition since it impacts the quality of collected raw data. Cleaning, qualifying, and reliability data improvement are the sub-steps performed in this stage. Data storage should be considered to provide the required storage space for the data collected from various sources and facilitate data

analysis. Data analysis is a step whereby the preprocessed data is analyzed to discover any potential correlation, patterns, and novel practical insight for the businesses.

This analysis can show insight about what happened in the past (descriptive) or what might happen in the future (predictive). Also, the analysis can provide the possible decisions being worth considering for running a business (prescriptive). Visualization is a step easing the comprehending information resulted in analysis, which is performed by the graphs, maps, models, etc. finally, data exposition refers to sharing the information among the partners (Faroukhi et al., 2020), customers (Hartman et al., 2016) or even with anyone with an open-data system (Immonen et al., 2014).

2.2.1.2 Value proposition and capturing

2.2.1.2.1 Offering

Part of having a BM includes providing an offering towards the target segment(s), often this offering is called value proposition which is a crucial part of the BM (Chesbrough and Rosenbloom, 2002). In the case of a DDBM, having data as a key resource and conducting key activates is not enough, they have to find ways to create actual business value (Hartman et al., 2016). Therefore, the relationship among elements within the DDBM e.g. activities, resources and value proposition become even more tightly coupled compared to non-data BMs and changing one component could impact the others (Cheah & Wang, 2017). This highlight the challenge and need to understand the DDBMs' VP specifically. Engelbrech et al. (2016) argued how development of DDBM would be beneficial for firms in order create new VPs. More specifically, is Hartman et al. (2014) describe the VP of a DDBM to be data, information/knowledge or a non-data product or service whereas, Kühne and Böhmann (2018), provide a simpler description of the DDBM VP to include a new or improved product or service.

Generally speaking, the idea of emphasis on offering services rather than relying solely on providing products is referred to as servitization which is arguably coined by Vandermerwe and Rada (1988) for the first time, so it is not a new concept, but these days the research centered around this concept is how to leverage the digital technologies as one of the significant parts of today's business (Dinges et al., 2105), to create novelty and offer services which can be unique for the customers and consequently caused differentiation in proposed services (Schüritz et al. 2017).

In the direction of a service VP, there are various ideas suggested by different authors (Chen et al., 2011; Bocsh & Olsson, 2021; Kohtamaki et al., 2019; Zhao et al., 2020). Chen et al. (2011) advocated how new BMs utilize data to be able to provide new valuable types of services. More specifically are two services described as data-as-a service (DaaS) refereeing to giving the customer access to and/or aggregates a large volume of data, as well, analytic-as-a-service (AaaS) includes offering a wide range of analytic services based on demand (Chen et al., 2011).

In connection to these two proposed data-driven service alternatives, Bosch and Olsson (2012), provided their view on how data-driven services can be developed in association with an already established product in the firm's VP. By putting data as a key resource, they could, for example, start to provide software upgrades of those products as a service resulting in improved systems

performances in terms of quality, security and safety (Bosch & Olsson, 2012). This direction of software offering is commonly referred to software-as-a-service (SaaS) which indicates what was shown above how firm can find new VPs based on putting data as a key resource (Sun, et al., 2007; Bosch & Olsson, 2012).

Finally, data-driven services change the view on products as isolated parts and rather explores how connectivity among products will increase and allow data to be captured and used for value creation (Kohtamaki et al, 2019). Bosch & Olsson (2012) also suggested a car sharing service possibility. In this direction Zhao et al. (2020) promoted a new service offering called mobility-as-a-service (MaaS). A MaaS VP is referring to providing an end-to-end customer traveling solution which is delivered through a multimodal transport choices system in a seamless planning and payment system (Heikkilä, 2014). The MaaS offering arguably depends on many factors. However, from the perspective of DDBM and having data as a key resource it is evident that data itself plays a crucial role in its potential existence (Zhao et al., 2020).

2.2.1.3 Revenue stream

A BM also aims to capture value from its proposed VP, often in the form of a revenue model allowing the company to monetize on its offerings (Osterwalder, 2004). In fact, in the long-term it is crucial for a firm to have at least one revenue stream (Hartman et al., 2016). Kühne and Böhmann (2018) conducted a review of different types of potential revenue models in the field of DDBM, and they argue that Schüritz et al. (2017) provide a valuable contribution. More specifically, Schüritz et al. (2017) is describing fours version of offerings and their revenues models that can be expected from a DDBM which provides a service rather than product in their VP. Those four revenue models include subscription, usage fee, gain sharing and multi-sided model. Following is a brief description of these revenue models provided by Schüritz et al. (2017):

- The *subscription* model includes the customer to pay a fee for accessing the service during a specific periodical time. Often does this model include the option for consumer to choose among different subscription models offering different features.
- The *usage fee* model includes the customer to exchange a payment in direct relation to the level of usage of the specific service or product. The level of usage can further be determined based on factors as volume of data which has to be analyzed, the amount of customer visits and the number of queries, channels or request, as well number of access granted.
- The *gain sharing* model referees to the situation where the service provider is paid based on the success of that service provided. Normally, is the revenue capturing based on a certain percentage of the generated value at the customer end.
- The *multi-sided* revenue model referees to firms who utilizes more than one revenue model, at least a combination of two. Doing so, their idea is often to target more than one customer group which allows synergies from one data from target group A to be utilized in a new service offering for target group B which can be monetized through another revenue model.

2.2.1.4 Ethics

While the value of big data in today's business is promising (Günther et al., 2017), the potential ethical issues regarding misusing big data are becoming significant which need more attention to be explored (Breidbach & Maglio, 2020). The ethical issues can be related to the users from which the data can be collected (Breidbach & Maglio, 2020; Günther et al., 2017) or the actors engaged in any activities on data (Breidbach, & Maglio, 2020; Kühne & Böhmann , 2018; Günther et al., 2017).

Regarding the ethics related to the users, some examples can simplify the explanation. Analyzing the customers' buying behavior, Retailor target (TGT) could personalize the advertising for them. In one case, analyzing a girls' buying behavior could show that she was pregnant, so TGT started sending the pregnancy coupons and infant product advertisements. After the girl's father complained to the company for encouraging a high school girl to become pregnant, it turned out that the girl had been pregnant and close to her due date even before the father realized it. After this incident, the activities of TGT were under public investigation for buying behavior analysis of the customers. This example is similar to what Thau (2014) explained about Kohl's Corporation. It is a department chain store striving to predict the buyer's behavior and providing them real-time coupons related to their buying preferences on their cellphone to increase the possibility of the company's sale.

Data can be obtained from all smart devices people possess in their daily lives, such as smart fridges, smart speakers (i.e., Alexa), smartphones, etc. Additionally, data can also be obtained via behavior analysis on different platforms. For instance, social media can show an individual's interest, needs, wants, aims, and so forth when a person joins in a group, channel, or any activities in general. Therefore, at this point, the concerns about types of data, the way data is collected, and how companies analyze data are highlighted (Breidbach & Maglio, 2020). In this regard, the true purpose of data utilization for providing the VP should not be concealed, and the attempt for data monetization should not be made without transparency for the users (Breidbach & Maglio, 2020). It means that companies should increase the awareness of users about the collection and analytics of the data and, after all, give them a choice whether or not they are willing to share their data (Lyon, 2014). Therefore, the examples above showed that regardless of the regulations, organizations should consider the public expectations and ethics in the process of big data value extraction (Günther et al., 2017).

Regarding the ethical issues related to the engaged actors, different types of data governance, depending on to which degree the accessibility to data is open or controlled, are identified (Van den Broek and Van Veenstra, 2015) since the data should be exchange among various types of actors (Günther et al., 2017). These actors can comprise data providers, service providers, application developers, infrastructure and tool developers, and application users (Immonen et al., 2014). These actors involved in data exchange might show the reluctance to share their data with other partners due to multiple reasons such as security, privacy (Chatfield, et al., 2015), strategic position's threat (Breidbach & Maglio, 2020).

Therefore, organizations incline to control the accessibility of the data through different mechanisms. For instance, organizations can give certain rights or ownership to others by contracts and sell the data (Woerner and Wixom, 2015). In some cases, a dominant organization can control data access (Van den Broek and Van Veenstra, 2015), which means the accessibility of the data is under the acceptance of the dominant actor in the network. Therefore, unethical behavior in such circumstances might happen. On the other hand, if there is open access to the data, the data is available to the public both for the organizations and users (van den Broek & van Veenstra, 2015). While creating open-access data can be due to motivating innovation and transparency, the risk of unethical consequences is remarkable. It implies that when the accessibility of the data is potentially provided to everyone, the tendency of organizations to abide by formal contracts is less. Thus, they can easily break their promises even if there is a formal contract (Immonen et al., 2014). So, the risk of contravention should be considered. Moreover, as open data access is structured by IT infrastructure, data manipulation is possible, which reduces the reliability and quality of data. Thus, the importance of ethical consideration in DDBMs is significant.

2.2.2 DDBM development process, challenges, and requirements

The increasing interest in adopting DDBMs and their potential value is hard to neglect as the choice to acknowledge that data as a key resource is increasingly becoming a necessity for firms to sustain their competitive advantages (Brownlow et al., 2015). Nevertheless, few companies have succeeded in their decisions to develop their DDBMs (Mathis & Köbler, 2016). Engelbrech et al. (2016) express how companies have challenging times to develop these DDBMs successfully. Among scholars there is agreement how DDBMs brings many challenges in the development process (Hunke et al., 2017; Schüritz et al.,2017; Fruhwirth et al.,2018:2019:2020; Benta et al., 2017; Engelbrecht et al., 2016; Schneider & Spieth, 2013). First, there is an agreement among scholars in this field that the topic of DDBM development is scarcely reviewed (Brownlow et al., 2015; Engelbrecht et al., 2016; Schüritz et al.,2017; Fruhwirth et al., 2018).

Significantly few scholars have provided any suggestion of how to go through the development of a DDBM (Brownlow, 2015), and thus, the understanding of DDBM is still limited how DDBMs are developed or transition into (Schüritz et al., 2017). Additionally, there is a shortage of knowledge on how DDBM can be developed and implemented in firms (Fruhwirth et al., 2018). Table 2 summarizes the currently existing literature contribution of phases in the DDBM development process.

Table 2

The existing academic view of potential phases in a DDBM development process

Phases in DDBM development process	Hunke et al. (2017)	Benta et al. (2017)	Fruhwirth et al. (2020)
(1)	*Mobilization*	*Mobilize*	*Understand OR initiation*
(2)	*Initiation*	*Understand*	*Ideation OR design, OR case generation*
(3)	*Ideation*	*Design*	*Proof of concept & Evaluation OR prototype & testing*
(4)	*Integration*	*Implement*	*Implementation OR Realization OR professionalization*
(5)	*Realization*	*Manage*	
(6)	*Administration*		

Hunke et al. (2017) provided their development process towards a DDBM in six phases. (1) *mobilization* is setting up a team and initiate the project for developing the DDBM. (2) *initiation* is reviewing of available sources of data and customer needs. This is done by analyzing a potential existing BM and its elements. (3) *ideation* means generating different concepts of DDBMs followed by evaluation of availability and degree of data quality and evaluating the ecosystem to foresee if any tasks should or could be outsourced. (4) *integration* implies going further with a chosen DDBM concept, start prototyping, testing, and refining it. The emphasis in this phase is on risk evaluation, as well as legal and regulatory aspects. In (5) *realization*, the focus is on operationalizing the DDBM, i.e., market introduction. The last (6) *administration* means that it is pivotal after market introduction to managing the DDBM as operationalized continuously, assess the ecosystem concerning any new impact factors from the DDBM, and remember to ensure documentation of the conducted development process to assess and evaluate the positives and negatives (Hunke et al., 2017).

Moreover, the contribution of Benta et al. (2017) is a five-phase process of developing a DDBM. They use the framework provided by Osterwalder and Pigneur (2011). Beginning with (1) *Mobilize*, in this phase, the process begins with formulating objectives, assembling the team, and planning further actions. (2) *Understand* refers to the activity of analyzing the environment of the company. This phase comprises market analysis, customer analysis, and trend analysis. (3) *Design* includes an iterative process that starts with brainstorming for solutions and creating BM prototypes, possibly with the help of existing frameworks. These drafts are tested by obtaining feedback from experts. The most promising prototype is selected and taken over to the next phase. (4) *Implement* means putting the selected BM into practice. The actual tasks in this phase vary depending on the key elements of the BM. These tasks in a BM centered on product differ from a

BM centered on service. (5) *Manage* includes revising the operating BM to find needs of improvement. If required, the BM should be redesigned. The process model then starts again with the 'Mobilize' phase.

Furthermore, Fruhwirth et al. (2020) contributed by conducting a synthesized view from existing research on DDBM development. They provided a process overview of the DDBM development process based on previous contributions, where each phase includes different thermology but is essentially referring to the same activity (Furthwirth et al., 2020). This process starts with (1) *understand* or *initiation*, including analyzing the current situation and identify the potential data source. Next phase (2) *ideation*, *design*, or *use case generation*, includes generating different concepts of DDBMs. (3) proof of concept & evaluation or prototyping & testing refers to testing the conceptualized prototype DDBM from the previous stage and evaluate risks connected to it. The last phase (4) *implementation*, or *professionalization* – is to operationalize the DDBM.

Based on the presented development processes for DDBMs with included phases, there is arguably no clear consensus regarding this type of BM development process. Hence, the literature can be considered immature in terms of discussing phases and activities in a DDBM development process. Thus, there is a need to scrutinize this field further and identify challenges, requirements, and potential aspects to consider in developing a DDBM. Doing so allows the conceptual framework to be built based on such theoretical concerns and then used to explore how companies evaluate their development process in relation to those concerns.

Furthermore, a DDBM, having data as their key resource, brings another level of complexity to the development process (Schüritz et al., 2017). Hunke et al. (2017) explained, by reviewing existing BM development processes, that there is no existing business development process that is suitable for this new emerging DDBM. Regarding this problematization, scholars have started to provide their contributions of concerns or requirements to be acknowledged in developing DDBMs d (Hunke et al., 2017; Schüritz et al., 2017; Fruhwirth et al., 2018:2019:2020; Benta et al., 2017; Engelbrecht et al., 2016; Schneider & Spieth, 2013; Brownlow et al., 2015). This is summarized in table 3.

Table 3

Scholars' reflection on DDBM development process

Scholars' reflection on DDBM development process						
No.	**Authors**					
	Brownlow et al. (2015): Six questions for DDBM development	**Engelbrecht (2016):** Understand DDBM in three dimensions	**Schüritz et al. (2017):** Barriers in service offering	**Hunke et al. (2017):** 10 categories consider in DDBM development	**Fruhwirth et al. (2018):** Internal & external challenges in three dimensions	**Fruhwirth et al. (2019):** Knowledge risk
(1)	Target outcome	Data source	Strategy	Conventional & regulation	Organizational related challenges	Knowledge spillover risk,
(2)	Offering	Target audience	Organizational structure	Industry & market	Business related challenges	
(3)	Data source	Technological effort	Process	Inter – organizational system	Technical challenges	
(4)	Key activities		Skill & capabilities	Intra – organization system		
(5)	Revenue model		Design offering	BMI - value proposition		
(6)	Inhibitors		Design revenue model	BMI - value creation		
(7)			Market	BMI - value capture		
(8)			Culture	Strategy		
(9)			Co-creation	Risk Assessment		
(10)			Organizational structure	Innovation process		

Note. table 3 illustrates different challenges and requirements to consider in a DDBM development process. It shows how different scholars study the DDBM development process from different views

Table 3 illustrates how Brownlow et al. (2015) contribute with an integrated framework that firms could use to develop their DDBMs. Their proposed framework covers six questions (fields) for firms to consider in their DDBM development. (1) target outcome, (2) offering, (3) data source, (4) key activities, (5) revenue model, and (6) inhibitors. Furthermore, Brownlow et al. (2015) highlight two aspects that will reduce potential inhibitors in the DDBM implementation. First, the

importance of sufficiently data-orientated and experienced personnel. Second, the essentiality of a conducive culture.

Engelbrecht (2016) provided valuable insight into the construction of a DDBM and how that research could help firms early on in their development process. He specifically provides three dimensions to consider in distinguishing different types of DDBMs. The covered dimensions are (1) data source referring to the source of the firm's data which can be user data or non-user data. (2) the target audience which is the BM's focus on organizations or consumers (consumer-focus or organizational-focus). (3) technological effort required which means a DDBM requires different amount of technological effort (low or high) depending on its conducted activities. Based on these three dimensions, Engelbrecht (2016) could further see eight different potential versions of DDBMs and would argued that this could be helpful for firms to identify and understand their DDBMs by connecting the BM to those categories. Doing so would allow validation of DDBM ideas when a firm could benchmark with similar existing DDBMs and save the time and money by directly validifying potential hypothesizes which otherwise would have been tested (Engelbrecht et al., 2016).

Schüritz et al. (2017) provided considerable information for development of DDBMs, in form of guidance for firms as they transition into BMs utilizing data and analytics. They specifically illustrate the barriers inherent in the DDBMs offering particularly for servitization, as well as DDBM activities as data analytics (Schüritz et al., 2017). Firms choosing to develop DDBM with a service offering would potentially face ten barriers to consider (Schüritz et al., 2017). They group these barriers as relate to (1) strategy, (2) organizational structure, (3) processes, (4) skills and capabilities, (5) design of offering, (6) design of revenue model, (7) market, (8) culture, (9) co-creation, and (10) transformation. Furthermore, they express how having data analytics as key activity the transition process brings an increased necessity to consider data strategy, a closer integration of stakeholders, an increased importance and impact of the customer relationship, various changes in the service development practice, the management of new revenue streams, a data culture, and skills & capabilities, enabling a new source of competitive advantage. (Schüritz et al., 2017).

Moving further, Hunke et al. (2017) provided a designed development process model for a DDBM. They conducted a significant review of the DDBM requirements that should be in consideration during the development process and then investigated the suitability of existing BMI processes based on those extracted DDBM's requirements. They argued that no established BMI process exists which fully meet all the identified requirements, thus, there is a lack of DDBMs development process (Hunke et al., 2017). More specifically, identifying 57 requirements to consider in developing a DDBM, Hunke et al. (2017) further divided those requirements into 10 categories. Finally, they define the structure and the elements of the development process of DDBMs. Identified categories are as following: (1) Conventions and regulations, (2) Industry and market, (3) Inter-organizational system, (4) Intra-organizational system, (5) Business model innovation –

value proposition (6) Business model innovation – value creation, (7) Business model innovation – value capturing, (8) Strategy, (9) Risk assessment, and (10) Innovation process.

Drawing from the two previous mentioned studies, Fruhwirth et al. (2018) extended their view on the DDBM development. Fruhwirth et al. (2018) conducted their research in regard to challenges in exploring DDBM and starting this type of BM. In their contribution they identified different internal and external challenges firms might face in their ideas to develop a DDBM. Furthermore, they classified those challenges in three categories as: (1) Organization related challenge (*Internal*: corporate culture, data inventory, internal communication and stakeholder management, organizational structure, self-cannabilism of existing business, commitment of management, and, *External*: Collaboration with external partners, and shortage of skilled people). (2) Business related challenges (*Internal*: idea generation finding the appropriate VP, investigate value of data and related prices, communication of benefit and value of data, time-to-market, and *External*: selling a data-driven service, finding the right key partners, legal challenges, dependence on external data). (3) Technical challenges (*Interna*l: development of algorithms, transition of the system into live operation, and *External*: Decision on technology and standers) (Fruhwirth et al., 2018). Arguably, Fruhwirth et al. (2018) bring valuable inputs worth considering in a development process of a DDBM.

lastly, Fruhwirth et al. (2019) argued that the design process of a DDBM should consider knowledge risk as an essential and relevant decision criterion in the development process since there are inherent risks in DDBMs of knowledge spillover through the data-driven offering. For instance, a competitor could extract any valuable knowledge from the data inherent in the offering from the operated DDBM and use this knowledge to gain advantage and increase competition (Fruhwirth et al., 2019). Given this, to decide on benefits and risks in both the design process and overall feasibility of a DDBM idea, firms should be transparent in their interaction with other actors, exchange of data, service, and money. (Fruhwirth et al., 2019).

2.3 Business model innovation

In a competitive market of actors which strives to be the most profitable company, their VPs towards their customers are essential for success (Teece, 2010; Osterwalder & Pigneur, 2010; Zott & Amit, 2010) and how they manage to continually provide new VPs as the demands from customer changes or external changes forces change to be needed (Teece, 2010). The BM can be described to fulfill two purposes for an organization; at one hand, it should provide the stability of the existing business and activities whereas the current strategies are operationalized while on the other hand, it should as well provide the company with the flexibility to adapt to changes in the market (Cavalcante, Kesting & Ulhøi, 2011). flexibility is not always possible as it might refer not only to changing and adopting new products and services to ensure the stability of the existing business but also to the BM as its entity must possess the ability to change. For example, companies allocate money annually to invest in new technologies and ideas to stay innovative and competitive. However, they seldomly remember that the BM must also be innovated (Chesbrough, 2010), which is rather a paradoxical behavior by organizations that limit their business potential. As it is stated by Teece (2010), that businesses will not fully profit from innovation as a whole by

only focusing on product innovation, they also need to consider changes of the BM design with new options while also keeping customer needs in mind.

Illustrated earlier in this paper (see figure 1: Business model as the mediating layer), the BM is the driving force for companies to take their ideas and technologies and commercialize them (Chesbrough, 2010; Osterwalder, 2004; McGrath, 2010; Lihua Liu, 2019). Thus, without keeping the BM in perspective of innovation, companies will most likely fail to wholly and successfully conceptualize the innovation of technologies regardless of how good they are. This highlights the importance and essential part of BMI for organizations (Chesbrough, 2010; Teece, 2010) Instead, it is argued by Teece (2010) that for each new innovative solution, whereas a new product or service is created, it should follow a similar reaction of a matching innovative development of a new custom and suitable BM. So, for providing the long-term continuous competitiveness value to customers, companies should in all times seek improvements of their BMs. As well, it is beneficial for firms to renew their BMs by own means rather than being forced and dictated by other actors through competition or external factors (Teece, 2010).

2.3.1 Business Model Innovation process

It is of importance for companies to have an innovative approach regarding their BMs (Teece, 2010; Lambert & Davidson, 2013; Frankenberg et al., 2013; Osterwalder & Pigneur, 2010; Chesbrough, 2010), but the question can be what precisely the BMI is. BMI is conceptualizing when firms conduct changes of their VP for the customers (Bocken et al., 2014). Lambert and Davidson (2013) describe BMI as the change in the BM and its components and how this is done in regard to changing conditions in the environment. Thus, it is possible to see BMI as something dynamic and not static (Lihua Liu, 2019; Laasch, 2019). The adopted view on BMI in this study is based Amit and Zott (2010) and Teece (2010), arguing that BMI should be view as a process whereas the current system of activities is re-designed or modified in a new way, which arguably leads to a new VP. To clarify, we consider this process to be incrementally characterized and not necessary if the BM changed in a radical event.

This view is reflected by the work of Laasch (2019). Still, to reflect on this adopted view, this study is following the view of BMI as a process, while it also considers BMI as the process of developing a new BM even if there was no existing BM previously, for example, in a start-up situation. In this regard, Euchner and Ganguly (2014) provide their view of BMI as the process as "any new innovation that creates a new market or disrupts the competitive advantage of key competitor". This definition illustrates that a new business without an established or existing BM could also go through the BMI process. Furthermore, viewing BMI from a process perspective is argued important, as it is the only way companies can actually sustain their competitive advantages (Gibson & Jitter, 2014).

In the direction of BMI as a process, different research have described how this process could be structured based on different stages (Gibson & Jetter, 2014; Frankenberg et al., 2013; Sosna et al., 2010; Osterwalder & Pigneur, 2010). These different suggestions are summarized and illustrated in table 4.

Table 4

Description of business model innovation including different phases

BMI process in phases:	Gibson and Jetter (2014)	Frankenberg et al. (2013)	Sosna et al. (2010)	Osterwalder and Pigneur (2010)
(1)	Search & Learn	Initiation	Exploration: BM design & testing	Mobilize
(2)	Articulate & Clarify	Ideation	Exploration: BM development	Understand
(3)	Analyze & Test	Integration	Exploitation: BM scaling & refining	Design
(4)		Implementation	Exploitation: Sustain growth & learn	Implement
(5)				Manage

From Gibson and Jetter (2014) a three-stage process is recommended. The first stage, *search & learn* investigates the current situation and scan for future opportunities and threats. The second stage, *articulate & clarify* includes idea creation for potential new BM and articulating. Third stage, *analyze & test* is to analyze and test those new articulated BM ideas and based on results pivot[1] and adopt until a successful BM is identified.

Frankenberg et al. (2013), propossed their suggested BMI process including four stages. First, *Initiation* is to identify the demand from actors within the firm's ecosystem and potential changes that could impact current BM. Second, *Ideation* with a BM perspective and out of the box mindset, tries to overcome industry dominant logic, and with the help of tools, create new BM ideas. Third, *Integration* is designing of new BM and ensure all stakeholders are included in the development. Fourth and lastly, *Implementation* refers to the actual implementation of the newly designed BM.

Furthermore, Sosna et al (2010) advocated their four stages of the BMI process. Firstly, *Exploration – BM design & testing* stage is described by utilizing prior knowledge and estimations about potential new markets to experiment by testing a new BM idea. Secondly *Exploration – BM development* is a trial-and-error approach to learn by conducting small test results in cognitive maps of new potential BMs. Thirdly *Exploitation – scaling & refining* implying that with the emerging new BM, it has to be translated into all activates and decision making of the firm going forward. As well, utilizing trial and error to learn and make any necessary BM changes. Fourthly

[1] Pivot: Based on feedback from testing revise the business model by changing some model elements while retaining others (Eisenmann et al., 2015).

Sustain growth & learn includes the established and running BM to face potential external forces demanding adoption and changes of the current BM.

Osterwalder and Pigneur (2010) elaborated their five-step BMI process. First *Mobilize* includes framing the objectives to change/develop new BM, testing preliminary BM ideas, plan the process, and assemble a team for the project. Second *Understand* is to create an understanding of the future context in which the new BM will evolve by scanning the environment, study potential customers, interview experts, and research existing BM to validate ideas or get insights easily. Third *Design* consists of brainstorming, prototyping, testing, and selecting BM direction. Fourthly *Implement* refers to introduce the BM prototype in the field and be ready and willing to adapt and change the BM according to its introduction. Lastly *Manage* advocates scanning the environment and continuously assess the BM, rethink the BM, ensure that the BM is aligned in the whole organization, and manage synergies or conflicts among existing and the new BM.

As changes in the environment continuing, companies must ensure they change their BMs accordingly (Lambert & Davidson, 2013). Thus, the process of BMI is crucial for any firm if they seek to have a long-term existence (Osterwalder & Pigneur, 2010: Teece, 2010). However, changing the BM is not an easy process rather, it is a challenging part company must undertake (Teece, 2010).

2.3.2 Business model innovation as a challenge

Competition is one factor that forces companies to improve their BM and revise how they can respond to customer needs by delivering value for which is compelling to customers to pay (Teece, 2010). Even sometimes, improving the BM can be insufficient to guaranty that the competitive advantage is sustainable where the possibility of imitation is high. Thus, the BMI is not such a task feasible to conduct easily since BMI inherently is challenging (Teece, 2010).

Exemplified by history, the plethora of well-established companies failed in BMI such as Blockbuster (Teece, 2009), Kodak (Lucas & Goh, 2009), Nokia (Van Rooij, A., 2015). One of the possible reasons for companies' failure is the bias of today's business and blindness toward tomorrow (Lysek et al., 2016; Chesbrough, 2010). Lysek et al. (2016) explained this issue as a state when companies heavily rely on previous experiences, events, and customer behavior, thus they do not intend to change their current status and take the risk of exploring new opportunities regarding adopting new technologies and providing new VP for the customers. Similarly, Chesbrough (2010) refers to the same issue as the company's dominant logic of creating and capturing value.

Dominant logic can be referred to as the established way in which companies conduct their businesses based (Chesbrough, 2010). Therefore, companies relying excessively on the dominant logic are in danger of inclination to biases in assessing the information that can be of importance and value for the companies and affecting the business (e.g., market, technology, etc.) (Chesbrough, 2010).

As argued by Christensen et al. (2015), dominant logic can be sometimes misleading for companies when adopting emerging disruptive technology. The reason is that companies might find adopting the emerging new technologies unattractive in terms of income as compared to their current BM since emerging technologies might necessitate the companies to aim at different customer segments, which is less profitable. However, in the long run, it leads to irreversible harm to the companies even at the cost of bankruptcy. For instance, in the case of Kodak, digital cameras using a disruptive technology at that time, were relatively costly, so it was considered an expensive curiosity for a special type of customer. But after the improvements in the production process and consequently decreasing the price by the producers, the demand for digital cameras exponentially grew which was neglected in that period by Kodak and eventually led to a fall in Kodak's camera sale and losing the camera market share (Lucas & Goh, 2009). In line with Christensen et al., (2015), Cavalcante et al. (2011) described how the current BM of a company might not provide the opportunity of exploring new opportunities and commercializing new technologies due to the conflict between the existing BM and the possible changes by the presence of new technologies which deters companies to be willing to embrace the related challenges.

While BMI is de facto vital for a company's success and high performance (Chesbrough, 2010; Frankenberger et al. 2013; Teece, 2010), it is known as a challenging process company inevitably should undergo. Therefore, companies endeavor to continuously work with innovation as not only an outcome but also an inherent part of their BMs (Teece, 2010). Perhaps the ultimate way of how firms should approach the concept of BMI is stated by Teece (2010):

"*a business model is provisional in the sense that it is likely over time to be replaced by an improved model that takes advantage of further technological or organizational innovations*".

2.3.3 Business model innovation and experimentation

Companies struggle with adopting the mindset provided and illustrated in the statement above by Teece (2010), leading to missing opportunities that eventually could lead companies to become obsolete (Lysek et al., 2016). To not end in this destructive manner or lose competitive advantages, many scholars provide a shared understanding of experimentation to be essential in succeeding in BMI (Teece, 2010; Chesbrough & Rosenbloom, 2002; McGrath 2010; Chesbrough, 2010). The BMI process should include experimentation of new possibilities and opportunities of the established and current BM (McGrath, 2010), which includes that companies must extend their experimentation operations to not only be conducted for products and services but also cover evaluating the established and current BM (Chesbrough & Rosenbloom, 2002).

According to McGrath (2010), an experimental approach of BMI can include acknowledging possibilities both within firms and across industries, allowing new insights and opportunities to be identified. Even if experimentations of new BMs do not lead directly or immediately to a new BM, this can still be valuable since it helps companies develop new capabilities of experimentations, which eventually allow them to construct new BMs more quickly than their competitors in times when needed (McGrath, 2010; Chesbrough, 2010). For firms, it has been suggested how tools

could support them in experimenting with new BMs. There exists a variety of such supportive tools, for example, the business model canvas[1] was advocated as a helpful tool (Chesbrough, 2010; Osterwalder & Pigneur 2010), as well, the flourishing business model canvas which is an evolved version of the previous tool but with a distinct inclusion of the society and environment as well (Hoveskog et al., 2018). Therefore, a tool such as the business model canvas is helpful; however, it might not be enough for companies to succeed with BMI (Chesbrough, 2010). Hence, firms must adopt a trial-and-error approach that focuses on experimentation and learning from processes and operations in reality (Chesbrough, 2010; Teece, 2010).

2.4 Conceptual framework

Considering the different perspectives described in section 2.2.2 (DDBM development process, challenges, and requirements), this study argues that Hunke et al. (2017) provides a collective foundation of categories and requirements worth being considered when developing a DDBM (see table 5) since those 10 categories with their 57 additional requirements can cover most of the other views from the other authors. For example, while Brownlow et al. (2015) described their view on six essential questions related to target outcome, offering, data source, key activities, revenue model, inhibitors, to be considered in developing a DDBM (see 2.2.2 DDBM development process, challenges, and requirements), all those aspects are also covered in the categories provided by Hunke et al. (2017).

Another clear example is the expression of knowledge risks by Fruhwirth et al. (2019). They highlight the risk in knowledge spillover to competitors. This specific risk can be related to the category strategy by Hunke et al. (2017), as this category is concerning the firm's market entry strategy and one aspect to consider is intellectual property protection. Furthermore, the contribution of Schüritz et al. (2017) regarding barriers in servitization is all related to the essential offering of a DDBM (see section 2.2.1.2, elements of DDBM - value proposition), and most of the barriers from Schüritz et al. (2017) is similar to those proposed by Hunke et al. (2017).

As well, the three dimensions, including data source, target audience, and technological effort, from Engelbrecht (2016), are covered in the categories BMI – value creation, BMI – value proposition, and intra- organization system by Hunke et al. (2017). Lastly, it is possible to find ways to relate the three dimensions (organization-related challenges, business-related, and technological challenges) from Fruhwirth et al. (2019) with the categories from Hunke et al. (2017).

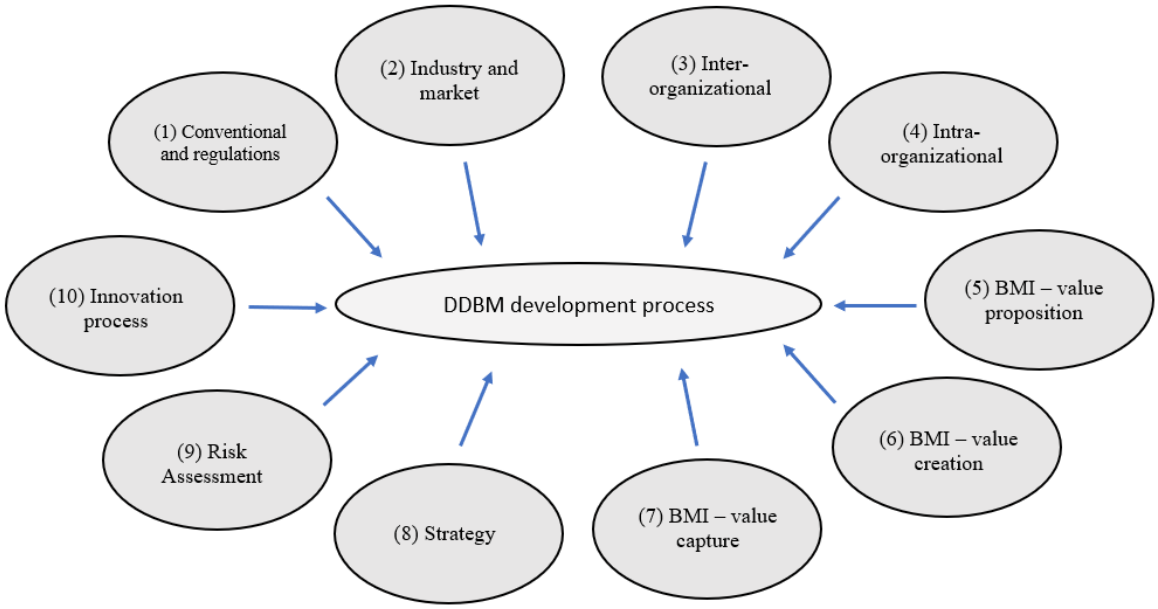
Given this line of argumentation, this study chooses the contribution of Hunke et al. (2017) to be what should be concerned in the process of developing a DDBM. Thus, the 10 categories as (1) Conventions and regulations, (2) Industry and market, (3) Inter-organizational system, (4) Intra-

[1] The business model canvas (BMC) is a tool that can help organizations to describe and illustrate their business model, well as creating an understanding of their competitor's business models. By, reflecting on nine elements: Customer segment, Value proposition, Channels, Customer Relationships, Revenue streams, Key resources, Key activities, Key partnerships, and Cost structure. (Osterwalder & Pigneur, 2010).

organizational system, (5) Business model innovation – value proposition (6) Business model innovation – value creation, (7) Business model innovation – value capturing, (8) Strategy, (9) Risk assessment, and (10) Innovation process, will be used in this study to develop our conceptual framework which is going to be utilized for designing a development process towards a DDBM. Figure 3 can depict how these categories will be used in this study to constitute the final process as it is the purpose of this study.

Figure 3

Conceptual framework in this study



Note. This figure illustrates the 10 categories can be considered in defining the structure of a process for the development of DDBMs (Hunke et al., 2017)

In the table 5, a brief description of the categories will be provided to clarify what we interpret as each category. Our interpretation is based on the structure from (Hunke et al., 2017), however, with consideration of the overall theoretical framework as we formulate our description of those categories in this research.

Table 5

10 categories in DDBM development process (Hunke et al., 2017)

Category (1-10)	Description
1. Conventional and regulation	• Regulation and ethical consideration such as data privacy and protection law
2. Industry and market	• Market analysis including competitors, strength, weaknesses, technological trend etc.
3. Inter - organizational system	•Stakeholder's network, interest, cooperation, alignment of value proposition among stakeholders, data access and ownership
4. Intra - organizational system	• internal capabilities assessment, employee training, management requirements
5. BMI- value proposition	•Customer need assessment, value proposition designing, customer privacy, customer incentivization to share data,
6. BMI – value creation	• Business infrastructure and technical feasibility, cost determination for the new BM, availability, accessibility and quality assessment of data
7. BMI - value capture	•Customer segment, channels, revenue models, break-even point, asses technological feasibility.
8. Strategy	• Market entry strategy and protection mechanism form being copied
9.Risk assessment	• Any related risks with the new DDBM
10. Innovation process	•The process design in terms of characteristics, for example, structured, flexible, iterative, experimental, testing

Additionally, this research was not conducted to validify the aspects of those categories provided by Hunke et al. (2017), rather those categories were adopted as important perspectives to consider in order to explore the develop process of a DDBM and the including phases and activities. Given this, our research adopted the described conceptual framework consisting of 10 categories to consider in the DDBM development process as we continued exploring our RQ: *What are the phases and activities of a DDBM development process, and what characterizes this process?*

3

Method

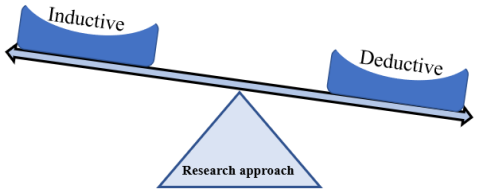
In this chapter, method of this research comprising the research approach, type of research, data collection for the theoretical framework and empirical part of the thesis, various steps of data coding and data analysis will be elaborated. This chapter can contribute to ease the understanding of the process whereby the primary and secondary data lead to finding the answer to the research question.

3.1 Research approach

This study was conducted by starting from the theoretical field and developing a conceptual framework to guide this research. We argue that this study was placed towards the deductive approach (Hyde, 2000; Blomkvist & Hallin, 2017). However, our study acknowledges deductive and inductive approaches as a connected spectrum rather than two separated or isolated directions to choose from (figure 4). Thus, our view is that research can be more significant towards one of the approaches. Still, both approaches can have essential roles within the same research. This is in line with the practice that research often includes both deductive and inductive aspects and that they should not be viewed as counterparts (Hyde, 2000, Saunders et al., 2009, p.490)

Figure 4

Deductive and inductive spectrum



Note. Figure 4 illustrates the view on research approach in this study, as well how this study inclines towards deductive approach

Furthermore, we argue that the deductive approach was a suitable choice for this research considering the matureness of the topic of DDBM, which this study contributes. Given the fact that DDBMs and how those are developed is scarcely reviewed (Brownlow et al., 2015; Engelbrecht et al., 2016; Schüritz et al.,2017; Fruhwirth et al., 2018) in comparison to the field of traditional BMs (Teece, 2010; Osterwalder & Pigneur, 2010; Zott & Amit, 2010) and in regard to developing traditional BMs (BMI), especially from the process perspective (Gibson & Jetter, 2014; Frankenberg et al.,2013; Sosna et al., 2010; Osterwalder & Pigneur, 2010). Thus, we argue the change in the field of BM has brought a new version of such, the data-driven BM, to be explored. Alvesson (2011) advocates the deductive approach in such described situation. Hence, the purpose of this research became to explore how a data-driven business model development process look like, with the additional research question:

What are the phases and activities of a DDBM development process, and what characterize this process?

Consequently, this study approached this RQ by reviewing the existing literature of BMI to create a fundamental understanding of the process firms/start-up go through in order to develop new or change their existing BM. Further, we narrowed our scope and review to what has been researched and contributed already to the specific field of DDBM business development.

Doing so, we were able to extract from previous research on this topic see (Hunke et al., 2017), 10 categories covering DDBM requirements for a development process. Those categories covered areas as (1) Conventions & Regulations, (2) Industry & Market, (3) Inter-organizational system, (4) Inter-organizational systems, (5) BMI-value proposition, (6) BMI- Value creation, (7) BMI – Value capturing, (8) Strategy, (9) Risk assessment, and (10) Innovation process. Instead, in this study, we adopted those categories as our underlying framework since they provided a foundation for shaping a BM development process towards a DDBM, which we argue places this study more towards the deductive spectrum than the inductive.

3.2 Qualitative

This qualitative study seeks to extend the existing theory by designing a new DDBM development process when putting existing pieces of theory together in a new way rather than developing a new theory. Expanding a theory as an attitude for this study is supported by qualitative research (Hyde, 2000; Maxwell, 2008, p.215).

Consistent with the deductive approach in this study, we have our starting point from theory where our 10 categories were extracted and used as a conceptual framework in conducting semi-structured interviews to understand how this framework is employed from a process perspective. Hence, when the research target connects the existing theories with collected data, the qualitative approach is suggested (Bell et al., 2018). This study also pursues a specific situation of developing DDBM and not BM in general, in which the qualitative approach is appropriate (Hyde, 2000).

Furthermore, having a conceptual framework in qualitative research is helpful when organizing the collected empirical data (Maxwell, 2008). Otherwise, data from the interviews could be misunderstood or might seem irrelevant for this study's research question (Maxwell, 2008).

Furthermore, the qualitative approach arguably allows the research to go in-depth in data collection to produce detailed data on a small number of individuals (Patton, 1991).

Regarding our research question, we needed to obtain in-depth data to answer when, how, and why activities in the development process are carried out. We assumed that each type of question as "when," "how," and "why" could be essential as three dimensions to capture the complexities of this process since by asking about "when an activity (in categories) is carried out in the development process" per se could not be adequate to obtain in-depth data.

Given this, we argue that selecting a research question which demands an attitude to ease the capturing the complexities thereof necessitated us to adopt a qualitative rather than a quantitative research. Consequently, interview, which is one of the primary data collection methods in qualitative studies by asking required questions and obtaining the corresponding answers, could benefit this research. More specifically, in this study, the interviews were conducted to capture those three dimensions of "when, how & why" different activities are conducted in each category of the conceptual framework.

3.3 Theoretical framework data collection

The main topics we had to cover in this thesis to make up the theoretical framework in a general level were BM, BMI, DDBM, and DDBM process. Therefore, a vast area of literature should have been combined to create the body of the theoretical framework and finally lead to finding the best fit conceptual framework for our study. Three strategies for collecting the articles were used, including searching on scientific databases, consultation with the supervisor, and snowball method.

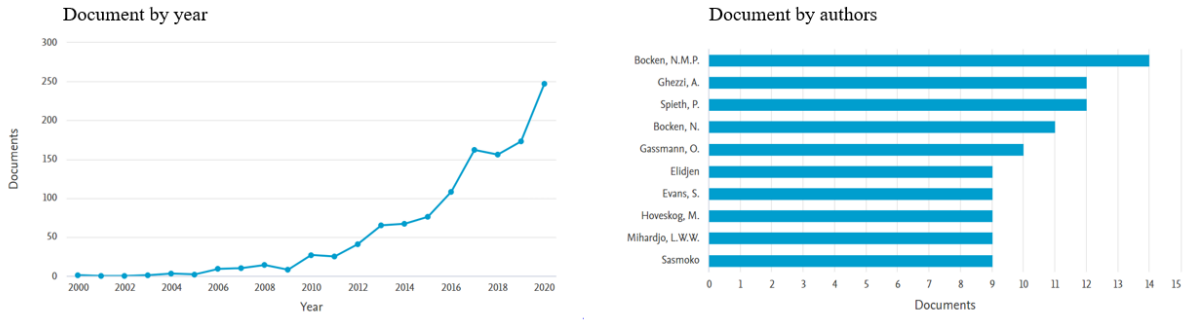
The databases include Google Scholar, Scopus, ScienceDirect, and Emerald to find an adequate number of articles. Google Scholar could provide a general view of the topic to explore and an

insight about the topic's maturity based on the related population of publications. In the next step, we searched in the rest of the databases to use filtration in finding the articles and identify the relevant recent articles in each field. The searching strings used to find the articles mainly were the combination of the following keywords: “business model,” “business model innovation,” “development process,” “digitalization,” “data monetization,” “data-driven business model,” “DDBM,” “requirements,” “characteristics,” “business modeling,” “phase,” “experiment.” However, according to what we needed to explain, other keywords could be used to find the most accurate data. Moreover, in some cases, reviewing how the keywords used in the relevant articles seemed essential to learn how to combine them to stay in the management field (Jesson et al., 2011, p.27).

Searching on databases could help us to obtain different insights about the under-scrutiny topics. For instance, using the analytical function of “analyze search results,” on Scopus, we could analyze topics that potentially could guide us toward the relevant authors and their publications. Moreover, we could observe the trends according to the number of publications for each topic. Figure 5 is one example of how analytical tools in databases could contribute to understanding our research field. The keyword to obtain this result was: “data-driven business model” OR “business model innovation” entered in the Scopus database. The results were limited to the management-related fields. The left image can show how the discussion on DDBM and BMI has been in scholar's focus in recent years. Therefore, it could imply that we were dealing with an up-to-date topic that was motivative. The right image could illustrate the scholars whom we possibly could use their publications and consequently become closer to what we were intended to find.

Figure 5

Example of Scopus analytical tool



In the end, only peer-reviewed articles written in English were included for screening. Due to the newness of our research topic, we decided not to exclude the conference papers and books. However, the condition of being peer-reviewed was applied for all conference papers. After selecting articles, both authors screened the abstracts and decided on keeping the articles for fully perusing.

As declared, in addition to the selected articles in the databases, we considered the articles recommended by the supervisor. Those recommended articles were suggested to intensify the quality of the content along with the thesis period.

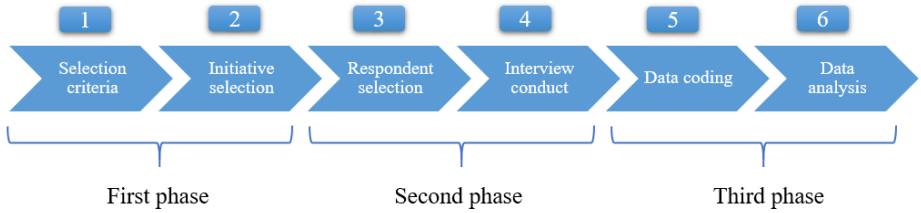
Lastly, for finding some articles whose field was new such as data-driven business development, rather than searching on databases by keywords, snowball method was employed where we could find the articles based on their citations on other articles. Thus, snowballed articles were most likely relevant to the required topics. As well, the inclusion conditions of the article were the same as the previous strategies to ensure the quality of the articles in the end (Jesson et al., 2011, p. 23).

3.4 Empirical data collection and analysis process

In this section we will describe our empirical data collection strategy in three phases which in total includes six steps, illustrated in the figure 6.

Figure 6

Data collection and analysis process



Note. This figure illustrates the data collection and analysis process in this research to be designed with three phases

The first phase included the steps of creating the criteria based on our research purpose which was used as the lens to find and select suitable initiatives which could provide us with relevant respondents for our research. The second phase is our data collection process including how we contacted respondents from respective initiatives and a description of our choice to use semi-structured interviews. The third and last phase comprises the description of our coding process and our analysis of the empirics collected during the second phase.

3.4.1 First phase

In this phase (see figure 6) we elaborate on how we designed our procedure to find the appropriate individuals for the interviews in this research. The first part can elaborate on the selection criteria and the second part of this phase can shows how the initiatives for this study were selected.

3.4.1.1 Selection criteria

Following our qualitative approach and our decision to collect data from interviews, our primary objective was to find the right respondents to interview. Finding the respondents was one of the challenging parts of our research method since the respondents could directly affect the data required to answer our research question. Furthermore, our research consists of a multidisciplinary

topic as the DDBM and designing the development process needed to consider people with different backgrounds and organizational positions (Carillo, 2017). What we mean by multidisciplinary is that a problem or a phenomenon should be observed from different perspectives in the hope that in the end, a coherent picture of the result can be visualized by the pieces of the data provided by different people who observe the phenomenon from different angels (Uiterkamp, & Vlek, 2007).

Additionally, the validity of our contribution was dependent on the source of our data provided by the respondents. Therefore, in the first step, we decided to define some criteria to take one step forward to find the prospective respondents. Choosing the criteria prior to the selection of the respondents could benefit our research in different ways. First, it could help us identify the related people to our project since we could know what type of people we needed to contact. Hence, to some degree, it could reduce the complexities of selecting the respondents. Second, it could increase the trustworthiness of our research as we had a reason behind inviting the respondents to contribute to our research. In the following, an explanation of these criteria will be provided.

Criterion 1:

Since our research purpose pursues designing a process whereby a BM can be developed, the first criterion that could have been considered was business modeling, implying that respondents should understand BMs and as well as how businesses should consider different requirements to develop a BM. As shown in figure 7, we call this criterion “business modeling.”

Criterion 2:

As explained at the beginning of this section, this research investigates a multidisciplinary topic, so the respondents’ selection should have allowed us to find people who could answer the questions which cover a vast area of knowledge. This point deserves to be declared that it does not mean that respondents should have been experts in all categories’ topics, which were asked in the interviews. However, they should have a perception of those categories in their carrier experiences to transfer their knowledge of how those categories could possibly interact with each other. Thus, at the beginning of each interview, we stated that the respondents should not be able necessarily to answer all questions, as a result, the contribution of each respondent in each category would not be equal eventually. This criterion was named “multidisciplinary,” as illustrated in figure 7.

Criterion 3:

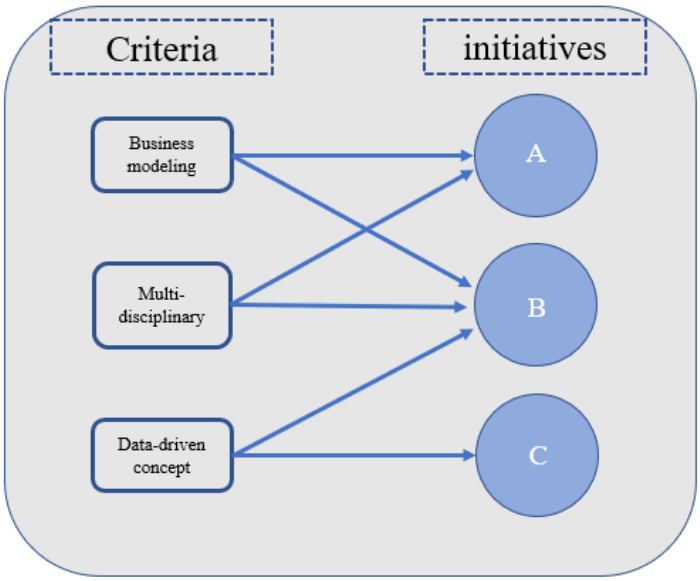
Lastly, as apparent in the topic of this research known as “data-driven business model,” it obliged us to choose the respondents who had been dealt with DDBMs. Therefore, we dedicated one initial question in our interviews to evaluate the respondents’ understanding of the DDBM; otherwise, if a respondent was not familiar enough with the concept of a DDBM, it would not be possible for that person to answer the following questions about different requirements of the development of such BM. This criterion is shown in figure 7, as "data-driven concept.”

3.4.1.2 Initiative selection

Given the previous stage about the selection criteria, one of the possible ways to find the prospective respondents was searching for the initiatives that could play a role of a bridge between the people who could contribute to our research and us. If the initiatives required people who could be engaged in the projects with the same criteria as we needed, it would imply that we could select those initiatives and contact the people involved therein. Considering this logic, we detected three initiatives that fulfilled either one or more of the mentioned criteria. This stage included collecting secondary data, a technique explained by Saunders et al. (2009) to collect information to be used for other purposes. In our study, the secondary data collection allowed us to evaluate the appropriateness of each initiative by obtaining the information provided on the initiatives' website. In the following, we discuss the relevance of each initiative to the selection criteria.

Figure 7

Criteria and initiatives in this study



Note. This figure illustrates the connection between the criteria and the initiatives

Initiative A

Initiative A was chosen based on its fulfillment of two criteria (see figure 7). Firstly, the initiative focuses on innovating BMs in their work to develop and design BMs in changing environments. We consider this initiative could provide valuable information to our research in terms of business modeling. Hence, it fulfilled of our criterion "business modeling". Further, initiative A is a multidisciplinary project in the sense of its inclusion of different field experts, and thus it came to fulfill our criterion of "multi-disciplinary".

Initiative B

As illustrated in figure 7, Initiative B was chosen as a relevant initiative for this study based on its fulfillment of all three criteria's.

Firstly, initiative B is a so-called intradisciplinary research project with project members from diverse fields able to bring different expertise to our research. Given the diversity of stakeholders involved in initiative B, we argued it fulfilled our "multi-disciplinary perspective" criterion, hence a suitable initiative for this research.

Secondly, initiative B has a BMI perspective that deals with the companies' transformation from product to a product-service oriented business in the context of data-driven mobility solutions and contributes with methods for developing BMs and governance frameworks for open innovation in MaaS ecosystems. Specifically, initiative B aims to develop a mobility-as-a-service[1] platforms.

Given this, we consider the initiative to be e related "business modeling" considering their aspect of BMI, and "data-related" based on their relation to developing a data-driven solution.

Initiative C

Initiative C is a government-funded initiative which through international collaboration with companies, academia and the public sector can contribute to a competitive business life and a sustainable society. Moreover, they act as a catalyst for innovation by helping customers and partners to become more competitive on the international stage.

In connection to our research in the DDBM field, Initiative C relevance was connected based on their promotion of socially useful AI and data-driven innovation. They operate as an assistant partner for companies to develop and test new solutions related to the data-driven field. We argue initiative C could be a valuable source of relevant empirical data for this research. Specifically, their perspective in digital transformation and the development of new technologies and solutions related to the risk of cybersecurity and ethics were indicating its relevance to this study. Thus, we argued this initiative fulfilled our "data-related concept" criteria and was chosen as an initiative.

[1] Mobility as a Service (MaaS) is the value adding integration of different forms of transport services into a single mobility service that is available on-demand. To meet customer needs, MaaS offers various types and combinations of transport options, such as public transport, car, taxi or bicycle rental, leasing or a combination of these. For the user, MaaS provides added value by giving the customer access to the full range of services through a single consistent interface and payment channel instead of using multiple tickets. MaaS makes available easy to use solutions for meeting individuals' mobility needs by reducing the complexity that arises when individual trips are combined into larger and more complex transport flows

3.4.2 Second Phase

In this phase (see figure 6), the first part elaborates on how we approached potential individuals from the identified initiatives. In the second part, we describe our reasoning for the interview method and how interviews were structured and conducted.

3.4.2.1 Respondent selection

Based on the results from our research strategy, we had managed to narrow down our scope of where to locate our respondents. We determined three suitable initiatives which fulfilled our criteria. Given this, we contacted 14 individuals and sent each of them a document with the overview of our research and invited them to participate in this research if they found it interesting and relevant for them. In table 6, a summary of the respondents chosen to participate, with additional information regarding background/profession, from which initiative they related to, date, and duration of each interview is illustrated. In total, were nine people chosen to participate; thus, we can acknowledge five individuals, for different reasons, who did not participate. The respondents who choose to participate can be divided into initiatives: B, seven people; C, one person; and A, one person.

As illustrated in figure 7, initiative B could fulfill all three criteria that we required to be able to answer the research question. Therefore, the number of people selected to be interviewed in this research from initiatives B surpasses the other initiatives. By choice to include the thesis overview document in our invitation to the respondents, we argue to fulfill two critical aspects.

First, this allowed the respondents to themself decide to participate in this research which is both an ethical consideration as we do not wish to force any individual to participate against their will. Secondly, this also brings validation to our research as we from two perspectives can determine the relevance of the respondents. On the one side, our view from the initiative as a filter was arguing that these respondents could be relevant for our research, as well, from the other side, the respondents themselves concluded that our research was relevant from the knowledge and interest they possessed.

Furthermore, after the acceptance and showed interest by the invited respondents, we scheduled meetings with respective respondents and sent additional documentation with information concerning how the respondents could prepare themselves before the interview. More specifically, this information told the respondents that there was essentially no preparation needed, instead we provided our adopted conceptual framework i.e., the 10 categories covering DDBM requirements for a development process (section 2.4, Conceptual framework DDBM) and suggested respective respondent to reflect on those from a process perspective. However, we also advocated how those 10 categories should not limit their reflection, and we advocated how other information outside those categories could be as valuable of information. Considering this interaction of information, the respondents prior to the interview of how to prepare or “not” prepare. We choose this approach because of three reasons.

1. Informing the respondents before the interview could reduce stress or other feelings of ambiguity going into the interview. Thus, consideration, a mutual beneficial situation where the respondents feel calmer during the interview and have a pleasant time (Blomqvist & Hallin, 2017). We argue this would also provide the respondents with the ability to reflect and share information more thoroughly thus enrich our empirics.

2. We choose to exclude our pre-structured questions when we share the 10 categories with the respondents. We wanted them to have the opportunity to start to reflect on what would be discussed during the interview, but still, we did not want them to have a bias going into the interview (Boyatzis, 1998) As well, this risk of bias was reduced as we advocated them to consider other topics outside the shared categories.

3. By sharing the preparation information with the 10 categories, we could again ensure the respondent's relevance for this research. This allowed the respondent to evaluate once again their relevance for our research and their willingness to participate. Thus, this further increased our validation of respondents and the collected empirics as well we showed respect for the individuals, which now was part of our research.

With that being said, we are aware that these chosen respondents are not the only individuals who relate to our research topic of DDBM. Obviously, there is a multitude of potential individuals who could have been involved in this research. Therefore, our respondents do not symbolize the whole picture, and other individuals could have brought other perspectives and new information, which perhaps was missed in our data collection. However, we can still conclude that the respondents chosen to be part of this research were relevant, and we argue that the empirical data collected has credibility. However, it does not necessarily imply that the result of the analysis can be considered generalizable.

Table 6

Information of the respondents participated in the interviews

Respondent (s)	**Background/Profession**	**Initiative**	**Date (2021)**	**Duration ≈ minute**
Respondent 1	Business analysist & product owner	B	26th March	34
Respondent 2	Vice President of product management and partnership Member of the management team.	B	29th March	46
Respondent 3	Service Design	B	29th March	75
Respondent 4	Professor of informatics	B	25th March	51
Respondent 5	Product development	B	30th March	47

(Continue)

Respondent (s)	Background/Profession	Initiative	Date (2021)	Duration ≈ minute
Respondent 6	Senior researcher Firms (SMEs) advisor in digitalization	C	6th April	70
Respondent 7	Director of innovation Line manager Driving change for digitalization	B	31st March	67
Respondent 8	Business architect (designs business) Consulting IT companies in Tech & Business Leading a business model-related project (anonymized)	A	30th March	51
Respondent 9	Professor in machine learning	B	31st March	54

3.4.2.2 Interview conduct

From the deductive approach, this research could benefit by starting from theory since a conceptual framework based on theory could support what we intended to discuss in the interviews as our data collection method (Maxwell, 2012). Nevertheless, at the same time, we need to be aware that this approach could lead to a situation where a part of the empirical data can be neglected or missed due to the chosen conceptual framework (Becker, 1986). It shows the possibility that the framework hinders new insights in the interviews (Becker, 1986). Therefore, firstly, we considered a conceptual framework as broad as possible to cover a vast range of questions. Secondly, Semi-structured interviews do not have specific pre-determined questions. Instead, they have a more open design structure than structured interviews (Blomkvist & Hallin, 2017; Bell, 2007). It means we had possible questions regarding each category we planned to discuss during the interviews, but questions were not designed strictly to allow us to have the flexibility to ask new questions (Blomkvist & Hallin, 2017).

This could give the respondents the possibility to reflect on their thoughts as the semi-structured choice made the interview flexible and gentle towards the participant, as the different categories could be presented as the interview was unfolding (Blomkvist & Hallin, 2017). In total, nine

interviews with an average duration of 55 minutes were conducted with the experts related to our topic (see table 6). Before conducting the interviews, we prepared PowerPoint slides containing a brief explanation of the research and information about us as authors. This material was utilized to provide an initial overview of how the interview would be structured and used to facilitate the procedure of the interviews. Also, PowerPoint slides included questions designed based on our categories from the adopted conceptual framework. It means that 10 categories presented in our conceptual framework (see section 2.4) were the main drivers of the interview' questions; thus, the answer to each question corresponded to one of the categories. However, in some cases, the data would have classified in the appropriate category if the authors had diagnosed the answer to be related to another category.

Our questions for each category were designed to embody three types of "when," "why," and "how" questions. Doing so could cover an extensive spectrum of data about each category. In the end, 14 specific types of questions were finalized to be asked regardless of three dimensions of "when," "why," and "how". Considering these three dimensions, 42 questions were potentially asked. Additional to these specific questions, at the beginning of the interview, one question about the personal information of each respondent and one question about the understanding or suggested definition of DDBM in respondents' point of view were asked to enable us to evaluate the knowledge and attitude of the respondents toward DDBM which could be helpful to improvise new questions corresponding to specialty and attitude of the respondents meanwhile. In appendix A, these questions are provided.

As alluded, we had the chance to ask new questions to deepen the discussion on the data that the respondent would share with us. In the interview, author X starts with the general introduction of the interview and explains the interview's agenda. While author X could notice the answers' details, the respondents' expressions and keep the interview to the point and not being degreased, author Y could ask the relevant questions from the respondent. Along with the interview, both authors depend on the topic, and the depth of the answers could improvise new related questions.

Finally, we acknowledge the challenges that we could face when conducting the interviews since this study was conducted during the rare time of a pandemic, specifically the covid-19 pandemic, and thus the interviews had to be held online as face-to-face meetings were restricted by regulation from the government. Still, we assume that the interviewees could choose a location they felt comfortable with as they wished. Instead, our focus was more toward ensuring the online interview with the participant became as natural as possible as though we could simulate the face-to-face meeting by following the manner of behavior in their presence and keeping the formality to induct the feeling of an official meeting.

3.4.3 Third phase: coding and analyzing:

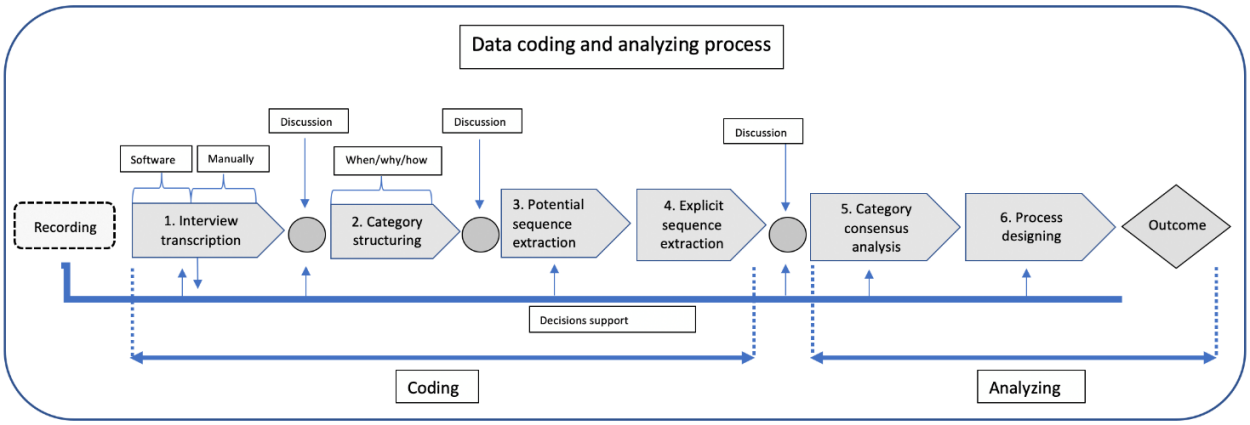
In this phase (see figure 6), we will explain how the primary data collected by the interviews were coded and analyzed to answer the research question (see figure 8). In the first part, an explanation of how the interviews were transcribed will be provided. In the second part, structuring the data

into different categories will be explained. The third part of this phase will be dedicated to the explanation of potential sequence extraction. The fourth part will inform how the potential sequences were interpreted as the explicit sequence for each category.

The fifth part explains how the sequences in each category combined to create a sequence consensus among all respondents. We call this consensus "category consensus" (CC). Eventually, the sixth part will elaborate on how the CCs were integrated into one process to create the final DDBM development process, which materializes our research purpose.

Figure 8

Data coding and analyzing process



Note. This figure illustrates the coding and analyzing process in this research

To clarify what we did in this phase, we provide a short explanation of this procedure to show its logic.

Considering the conceptual framework, explained in section 2.4 (conceptual framework), we came up with 10 categories to use in our interviews and consequently employ them as the main requirements of our process. Each category can illustrate how this process can potentially look like, but each category alone cannot represent the final DDBM development process. Therefore, the development process from the perspective of each category will be portraited as CCs (see part 5) that will be combined to create the holistic picture of the DDBM development process (part 6). By doing so, we could firstly incorporate the essential detail in the development process from ten different perspectives, and secondly, by combining all CC, we could validify to what extent the final development process is comprehensive and unbiased.

Metaphorically, to describe what a human face looks like, it is possible to ask individuals to describe a face from different perspectives. For example, describing the human face from the perspective of ear, eyes, nose, hair, or lips provides different outcomes. However, each explanation illustrates either small parts or shapes of the face or the location of those different parts in the face and provide the general characteristics of a human face. Similarly, we consider our 10 categories to be representatives of different perspectives of the DDBM development process. Therefore,

describing the development process in this study can be metaphorically similar to describing the facial features to visualize a face.

3.4.3.1 Interview transcription

After conducting the interviews, the recordings provided proximately 494 minutes of empirical data to be transcribed. Although the transcribing process was time taking, it would facilitate the familiarization with the data (Riessman, 1993) and consequently data analysis (Braun & Clarke, 2006).

The first transcription of the recordings was created by using the software tool "Kultura" [1]. As part of deciding to utilize this software, we had previously decided to do so, conducted experimentation with the same software to evaluate its value in terms of how accurate the transcription would be. The experiment indicated that the software made fairly accurate transcriptions, although it had flaws and sometimes the transcription was wrong. Knowing this, we still continued using this software to make a first draft of our interviews' transcription. However, we also acknowledge the need to manually review the transcriptions by listening through the recordings while reading the software-made transcript. Doing so saved us a tremendous amount of time and enabled the recorded information to be analyzed twice by machine and human, i.e., independent views. In total, the transcriptions of the recordings included 63 779 words.

After the respective interview had been transcribed, two authors discussed parts or words that had been unable to transcribe. Based on the discussion, we found an agreed understanding of what had been said by listening through the recording once more. Alternatively, the information was marked as unable to transcribe.

At this stage, we had a "Raw" transcription. The interviews were transcribed into raw transcriptions deliberately, implying that the authors did not try to interpret and change sentences. Instead, we intended to respect the empirical data from respondents as the data should by no means be compromised or changed for ethical reasons. Hence, changing data would have been unethical, and it would have reduced the trustworthiness of our analysis of the empirics in the later stages.

So, we concluded a raw transcription of the interviews knowingly included markings and sentences that could be considered as not complete and sent each respondents' transcription to corresponding person, even in some cases, it was sent twice. This procedure was chosen because it allowed the respondents to review the transcript and comment on errors or potential parts to be considered confidential. We argue this helped increase the trustworthiness of the transcriptions and how the empirics were managed and treat our respondents with respect and ethical considerations.

[1] Kultura is a personal storage repository enabling users to add, organize and remove different formats of files including image, audio and video. The accessibility to these facilities was provided through Halmstad university.

3.4.3.2 Category structuring

The next step in our process was to scrutinize the transcriptions (63 779 words) by extracting the information and structure based on the 10 categories (see table 5) selected as the conceptual framework. Each transcription was perused individually, where the information could be extracted and grouped in an excel table. We argue that our decision to have both authors individually structure the information was beneficial in multiple aspects. First, it could empower the confirmability of the findings, as two separated persons would classify the same data into the same category. In comparison to the situation where we could have structured the data together, it could inflict the risk of bias to the coding procedure. Second, another advantage of individually carrying out this stage was to extract the data as meticulously as possible so that if one author missed any data to write in the table, another could compensate. Hence, the possibility of covering all related data was remarkably higher. Thus, it could increase the credibility of our work with the empirical data. The outcome of this procedure entailed narrowing initial transcriptions of 63 779 words to a total of 58 434 words.

The excel table allowed respective authors to structure the data by extracting parts or the whole of a paragraph in the corresponding category. Since the decision to include the three dimensions of when, why, and how, each piece of data would be located in one of the dimensions (see section 3.2 (qualitative) and 3.4.2.2 (interview conduct) for more information).

Table 7

Basic structure of coding tables

Category i {i = 1,2, 3,... 10}				
Respondent	Author	Dimensions		
		When	Why	How
1	X	corresponding text	Corresponding text	corresponding text
	Y	corresponding text	Corresponding text	Corresponding text
. . .		. . .	. . .	. . .
9	X	corresponding text	corresponding text	corresponding text
	Y	Corresponding text	Corresponding text	Corresponding text

Note: Table 7 illustrates our excel table showing how the transcription was structured individually based on each category (1-10) and with additional dimensions of when/why/how.

Once both authors had extracted the information from the transcription and filled out the excel table, there was a discussion where the respective author's coding was revised and compared. Together we reviewed each category, and the empirical data from the respective author had included in each category (and dimensions) for each respondent. However, the discussion in this stage was not conducted in order to establish a consensus of which paragraph to continue with or not. Instead, this discussion was conducted to justify the respective author's interpretation of the data. The outcome of this discussion was three folded:

1. Paragraphs were left untouched when both authors had grouped the data similarity.

2. Some paragraphs were differently assessed (located in different dimensions), and thus the discussion was to review why this had occurred. Reviewing was done by going back to either transcriptions or even recordings to see the bigger context and finally find an agreement.

3. In a situation where no agreement could be made, or the data was acknowledged as wrong or even not providing any value based on the discussion. Then data were excluded.

3.4.3.3 Potential sequence extraction

The objective in this stage was to scrutinize the empirical data (the 58 434 words) and extracting the expressions (sentences or paragraphs) indicating any potential sequence directly or indirectly. Hence, through discussion, the authors reviewed the empirical data to extract any expressions which could indicate a potential sequence. By discussing the previous grouped data, which was

based on category and dimension in the excel table, we could extract the parts which explicitly could indicate a sequence in the categories. We argue finding potential sequences was beneficial to understand the empirics from our research questions perspective (DDBM development process). It would enable us to understand when different activates came into account in this process. The table 8 illustrates how the empirics were scrutinized and fragmented into a piece of information indicating a sequence of activities. This procedure resulted in 58 434 words to be narrowed down to 11 983 words.

Table 8

Expression of potential sequence

<table>
<tr><td colspan="6">Category i
i = {1,2,3…, 10}</td></tr>
<tr><td rowspan="2">Respondent</td><td rowspan="2">Authors</td><td colspan="3">Dimensions</td><td rowspan="2">Expression of potential sequence</td></tr>
<tr><td>When</td><td>Why</td><td>How</td></tr>
<tr><td rowspan="2">1</td><td>X</td><td>I mean I'm not working with this but when I was involved in this project for sure it's one of the important milestones which we need to consider right before the implementation of such kind of service but there is no information regarding this…</td><td></td><td></td><td rowspan="2">need to consider right before the implementation of such kind of service</td></tr>
<tr><td>Y</td><td>I mean I'm not working with this but when I was involved in this project for sure it's one of the important milestones which we need to consider right before the implementation of such kind of service but there is no information regarding this…</td><td>I think the main challenge is to consider a…GDPR and to provide the customer with the information on what kind of data is used and to make sure that all of that data is anonymized.</td><td></td></tr>
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.</td></tr>
<tr><td>9</td><td>X</td><td>Corresponding text</td><td>corresponding text</td><td>corresponding text</td><td></td></tr>
</table>

Note: this table Illustrates one example of how the empirical data in each category was scrutinized from the dimensions (when/why/how) and how the expressions containing a potential sequence was identified

3.4.3.4 Explicit sequence extraction

This stage in our coding process was conducted to extract and define a sequence in the empirical data consisting of 11 983 words. Given the example provided in table 8, it could be questioned whether this step was needed, as the information there is indicating the sequence quite well already. Therefore, we emphasize that majority of "expressions of potential sequences" in stage (search for sequence) included a higher degree of complexity than the example illustrated in table 8. Thus, we advocate the reasons for this systematic approach and why it was demanded. In table 9, we exemplify how complicated expressions were coded into specific sequences. Illustrated, some expressions provided more than one sequence that could be detected.

Table 9

Potential sequence and extracted sequence

<table>
<tr><td colspan="7">Category i
i ={1,2,3…, 10}</td></tr>
<tr><td rowspan="2">Respondent</td><td rowspan="2">Authors</td><td colspan="3">Dimension</td><td rowspan="2">expression of potential sequence</td><td rowspan="2">extracted sequence</td></tr>
<tr><td>when</td><td>Why</td><td>How</td></tr>
<tr><td rowspan="2">1</td><td>X</td><td colspan="3" rowspan="2">…</td><td>I would say that it is important to make it just before the actual development

I mean on the early stages it's just an idea and general idea which could be interesting and interesting for the user for example what could have a demand on the market and then when we already have a first version of the application for example then we just test it and have the user acceptance test and get the feedback from the user the actual user and then we evaluate whether it is a good solution whether we need to reshape it or yeah which is the requirements from the customer.</td><td>C2→actual development

an idea→ first version of application based on the market interest→User acceptance→ test→getting feedback

→evaluation→reshape based on customer requirement</td></tr>
<tr><td>Y</td><td>Otherwise, if we develop product and then make the market analysis… we will spend more time and resources too… modify our solution.</td></tr>
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<tr><td rowspan="2">9</td><td>X</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td></td></tr>
<tr><td>Y</td><td></td></tr>
</table>

This stage practically meant that the authors individually went through each "extracted sequence" in each category and for each respondent to extract what seemed to be the specific sequence inherent in the information. After we together went through and discussed the respective author's

interpretation and suggested sequence in order to reach a consensus on a final defined sequence (see table 9). In this stage, the discussion followed the same logic as previous discussion points. If the sequences were similar, we could validate the sequences as two independent individuals had extracted the same sequence from the same information without any direct impact on how it was extracted. If we could not agree or had different views of what the sequence was, we went back and looked at the previous stages, sometimes also including the recording to have the respondents voice to guide us as the expression of how (tone, speed, context) the respondent articulated the paragraphs can be a key to understand certain words or sentences (Taylor et al., 2015). As a result, this stage had the empirics to be scrutinized and grouped into a total of 117 codes of "extracted sequences" which was collected in a new excel table, illustrated with twelve columns including our 10 categories and eleven rows including nine respondents (see table 10).

3.4.3.5 Category consensus analysis.

Based on the newly created excel table, which included in total 117 "extracted sequences," we conducted a vertical analysis based on the columns with extracted sequences in the respective category. To exemplify, we started with column three referring to category 1 (see table 10) and vertically analyzed all different sequences which were extracted from each respondent who answered the question related to category 1. This allowed us to find patterns on similarities or differences among the sequences and finally combined them into one final sequence. Repeating this procedure for all columns, meaning all 10 categories, came to represent our respondent's views on the development process of a DDBM from each category.

Table 10

Extracted sequences and category consensuses

Respondent (R)	Category (C)									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
R1	Sequence (S)	S	S	S	S	S	S	S	S	S
R2	S	S	S	S	S	S	S	S	S	S
R3	S	S	S	S	S	S	S	S	S	S
R4	S	S	S	S	S	S	S	S	S	S
R5	S	S	S	S	S	S	S	S	S	S
R6	S	S	S	S	S	S	S	S	S	S
R7	S	S	S	S	S	S	S	S	S	S
R8	S	S	S	S	S	S	S	S	S	S
R9	S	S	S	S	S	S	S	S	S	S
Category consensus (CC)	CC 1	CC2	CC3	CC4	CC5	CC6	CC7	CC8	CC9	CC10

Note. This table illustrates all the extracted sequences and CCs in an excel table. The detailed information about the sequences and the CCs are provided in the appendix B.

Two points should be clarified about this procedure. Firstly, this procedure was conducted for all 10 categories. However, it resulted in nine CCs and not ten (4.1, category consensus) since we could not be convinced that category 7 can provide a single process to shape the sequence in CC, but it had multiple shorter sequences which we acknowledge that they could be essential inputs to consider once the whole process was designed as they could be placed in different parts of the development process (see table 12 and 13, value capture row).

Secondly, in some categories such as category 3, 5, 8, in addition to the category sequence consensus, we could extract one or more additional short sequences. We believed those could have a remarkable role in finalizing the DDBM development processes since those short sequences could be used as validation of the resulting sequences identified or filling the missing sequence of the final development process.

The outcome of this procedure could be related to our initial adopted conceptual framework (see figure 3), which indicated how 10 categories containing requirements were essential to consider in a development process of a DDBM. Finishing this stage, we could conclude how each category from a process perspective should be considered in designing the whole development process (see figure 10)

3.4.3.6 Process designing

Continuing with the nine CCs, our aim in this part was to shape the final process by combining the resulted "category consensus" in the previous section (3.4.3.5). In the following, an elaboration of our method to analyze the data will be provided. Process designing comprises five steps as below:

1. Dividing the processes into possible two phases: At the beginning of our analysis, we noticed that CC could be divided into two phases. We decided to call them phase since we could observe that in the first phase, data-related activities are not noticeable (low data-related activities) as compared to the second part (high data-related activities). In other words, data has a more significant role in the second phase. But it did not mean that these two phases were separate from each other. Instead, only together the whole data-driven development process is shaped. The major reason for the necessity of having both phases together was due to the presence of the iterations which connected these two phases, thus having the development process taken apart could disturb the logic of data-driven whereas the iterations could contribute to the flow of data from the first phase to the second phase and vice versa.
2. The sub-phase diagnosis: Given the previous step, in this step we should have found part or parts of each CC which shows resemblance with other CCs. The selection of these parts was conducted cautiously because those respondents could be referring to the same concept, though these concepts might have been articulated differently. Therefore, the diagnosis of these parts necessitated us to refer to the context in which those concepts were stated and analyze whether the concepts are comparable. Based on discussion between both authors, those similar parts in each CC were diagnosed and allowed us to move to the next step. In total, seven sub-phases were identified (see figure 20).

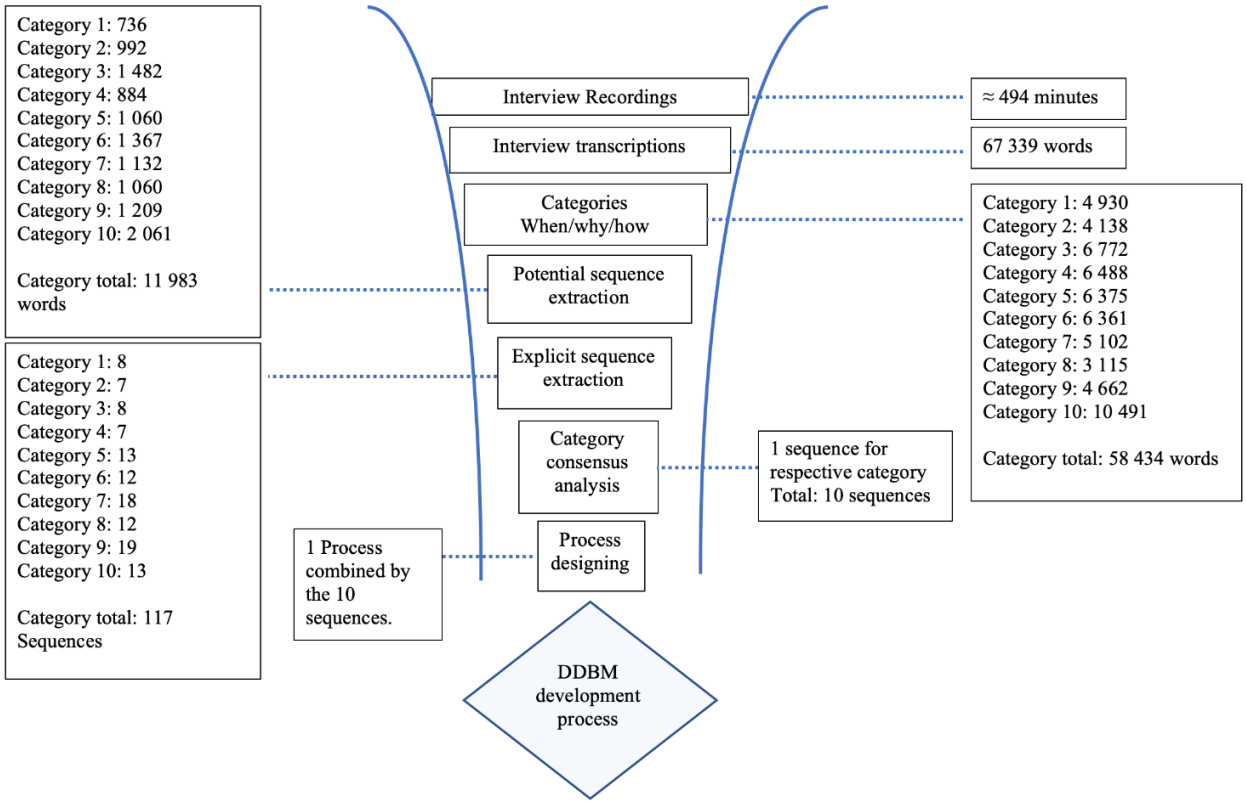
3. Grouping the sub-phases: In this step, the diagnosed sub-phases should have grouped into corresponding phases.
4. Combining the phases: In this step, the initial process in each phase including the sub-phases combined to create a comprehensive process that could show the development process as a single process.
5. Including the additional input of risks and strategy categories as two separate layers: After shaping the initial development process as explained in the previous step, we noticed that the role of strategy (category 8) and risk assessment (category 9) in this development process could be differentiated from the rest of the categories. Therefore, we decided to have these two additional layers in this process. It means strategy and risk assessment were considered indispensable components of this development process. However, they were visualized in separate layers (see figure 20). Therefore, this development process should be materialized with them. Detailed information about strategy and risk assessment will be provided in section 4.2 (process designing).
6. Process finalizing: In this step, we modified our process by applying the additional short sequences explained in section 3.4.3.5 (category consensus analysis) and finalized the DDBM development process.

3.4.3.7 Summary

To summarize, figure 9 shows the transition of the empirical material in this data coding and analyzing procedure. We began with raw recordings of 494 minutes to transcriptions consisting of 67 339 words. Then classification of data in ten chosen categories with the additional three dimensions of “when”, “how,” and “why” resulted in the empirical data consisting of 58 434 words. Further on, the expressions with a potential sequence in the form of 11 983 words. From there, it was made to potential sequences and then defined into 117 specific sequences. Next, those identified sequences were analyzed and aggregated into CCs. Thus, one sequence for each respective category was established, hence ten sequences in total. From there, we cross-analyzed all categories (combining the ten sequences) and could design the final process to describe a DDBM development process.

Figure 9

Empirical data funnel



Note. This figure illustrates the transition of the empirical material in this coding process.

3.5 Ethics

Ethics have been of significant importance for us during this research and in each step conducted. Thus, our ethical reasoning for each activity and decision is further explained separately within our data analysis sections. However, table (11) is a summary of the ethical aspects of this research.

Table 11

Ethical consideration of this study

Activity	***Research action***
Anonymizing	We decided to bring full confidentiality in our research when referring to initiative, company or interview as part of ethical consideration of the people involved.
Informing involved actors	To allow any respondents to full insight and choice to themselves consider their participation. This research provided the respondents the possibility to exclude themselves in this research twice.
Conducting interviews	The interviews included: - Introduction of the authors - Introduction of our research - Approval to record interview. Providing the additional information of the transcription to be sent back for approval by respondent. - The possibility for the respondent to ask the researcher question.
Data analysis	The respondent data was objectively considerate and always approached with the objective to minimize any potential of decontextualization.
Discussion	Adopting APA reference structure, hence any used authors has been acknowledging their work and approached with carefulness of decontextualization

3.6 Trustworthiness

This research aims for trustworthiness as this suggests ensuring the quality of our work (Bryman & Bell, 2011). Trustworthiness is dependent and fulfilled as the research commits towards credibility, transferability, dependability, and confirmability (Bryman & Bell, 2011). The below description is how this research was conducted in order to achieve trustworthiness.

3.6.1 Credibility

Credibility is referred to by Shenton (2004) as the level of how congruent the findings are with reality. In our research, we have in multiple steps taken credibility into consideration. Firstly, in our process of finding our respondents to interview, they were twice evaluated as relevant to the purpose of this research. As they twice were provided with information about our research which allowed them to consider their relevance to our research previous to the interview conduction. Secondly, interviews were transcribed and send back to respondents to ensure credibility by being validified. Thirdly, the findings in our results were compared with existing literature which brings credibility (Shenton, 2004).

3.6.2 Transferability

Our study seeks to bring transferability rather than generalizability. Generalizability refers to research trying to make claims about the general in the attempt to extend theory for a larger population (Maxwell, 2012), often in connection with quantitative research (Blomkvist & Hallin, 2017). In contrast, qualitative research more targets generalization in aspects of extending theories to other cases (Becker, 1991). Yin (1994) calls this analytical generalization a term referred to as transferability (Gioia et al., 2012; Maxwell, 2012). Described by Bryman and Bell (2011), the applicability of the findings in the same situation over time or in other situations referring to the transferability of the research.

Given this, as the focus in this study is on the specific situation of BM development towards a DDBM i.e., a BM having data as their key resource, as well our study collects empirical data influenced from the mobility sector. Hence there is a limitation to generalize the results. Therefore, we argue for transferability and not generalizability, given that the outcome in this study will not be applicable in all BM development situations. Instead, it can potentially bring transferability and be helpful in similar situations where the development of a DDBM is the target outcome, not any BM in general. In line with qualitative research aiming for transferability rather than generalizability (Gioia et al., 2012; Maxwell, 2012, p.138; Blomkvist & Hallin, 2017; Yin, 1994).

3.6.3 Dependability

Dependability refers to the degree of how reliable the research work is (Shenton, 2004; Bryman & Bell, 2011). Our research has promoted transparency to the degree we consider clarifying why and how each decision and step was conducted to ensure dependability. This approach includes both the description in text for any potential readers of this research and in practice during contact with respondents. However, due to ethical aspects of anonymization, certain parts have been excluded, though we argue those parts do not affect the overall dependability.

3.6.4 Confirmability

The confirmability criterion of trustworthiness is associated with the level of objectivity of the researchers (Shenton, 2004; Bryman & Bell, 2011). The analysis procedure in this research was designed with the objective of bringing confirmability. Hence, our data analysis process follows a systemic, structured, and objective approach towards the empirical data. However, it also includes multiple reflection points where the empirical data was discussed as our process was significantly influenced by combining individual and group analysis to validate each step before proceeding. Doing so, advocated by Saunders et al. (2009), can reduce the potential biases of the empirical data. Given this, we argue, confirmability as objectively was achieved.

4

Analysis

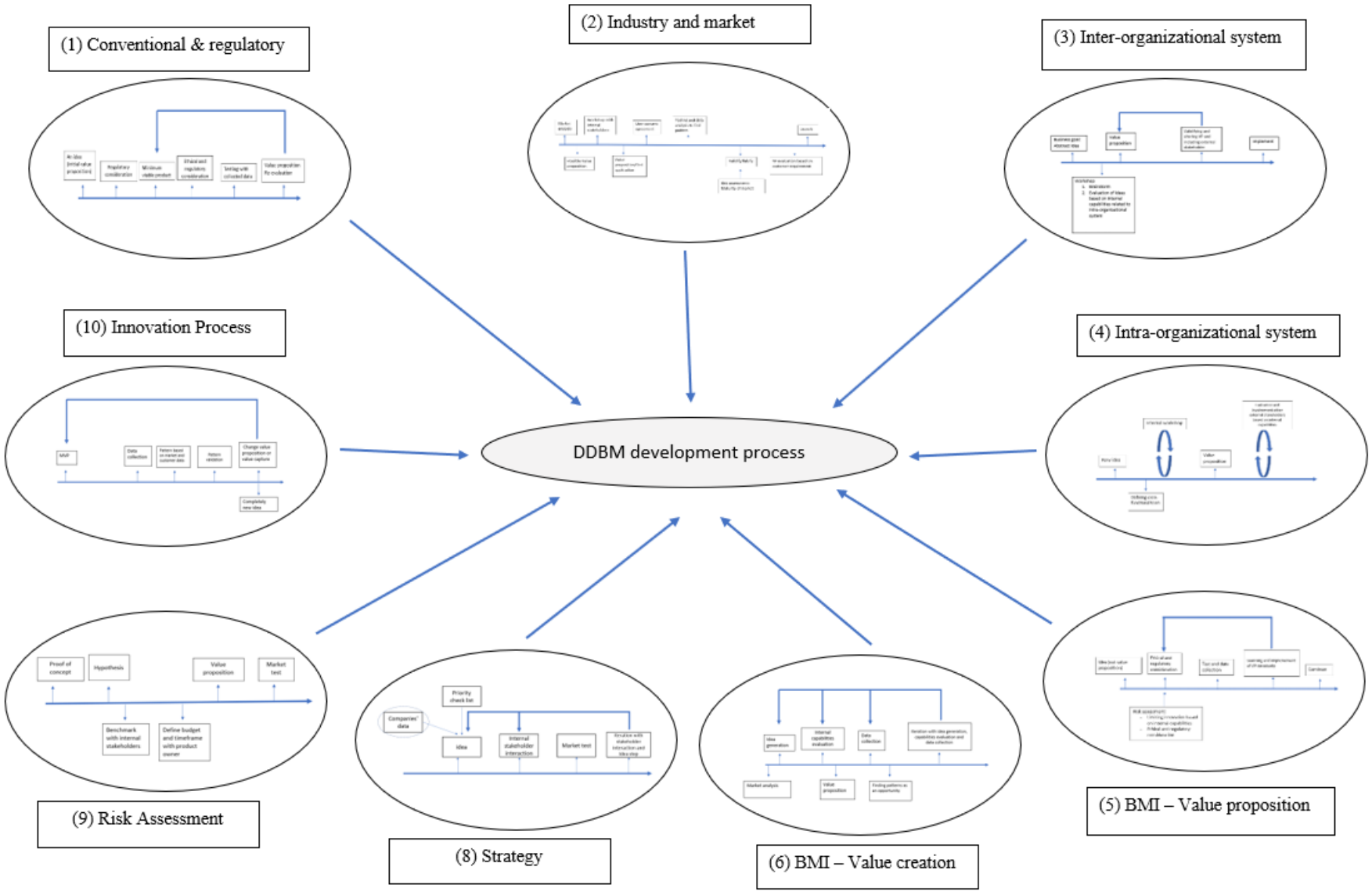
In this chapter, the result of the analysis part comprising the CC analysis and process designing will be explained. This chapter tries to synthesize the coded data to generates the DDBM development process.

4.1 Category consensus

This section will explain how the consensus for each category has been made (category consensus) and illustrate its sequence from a DDBM development process perspective. Considering the adopted conceptual framework in section 2.4 (conceptual framework), the outcome in this stage, illustrates the same framework. However, Figure 10 describes how each CC provides information from the 10 categories perspective, which needs to be considered when designing the DDBM development process.

Figure 10

Category consensus perspective on DDBM development process



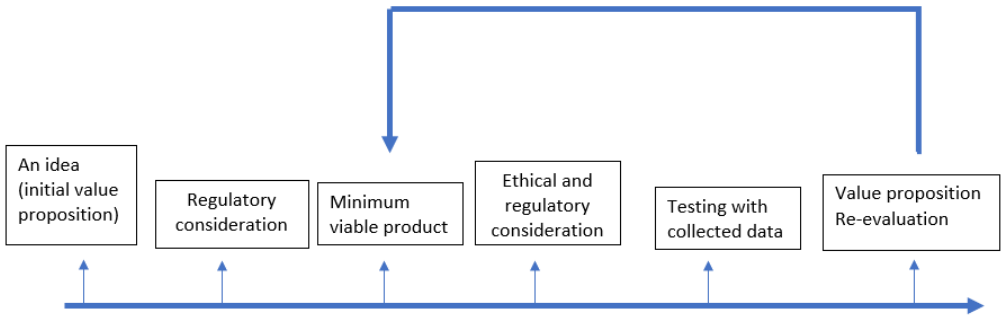
Note. This figure illustrates the adopted conceptual framework in this study and how the 10 categories are understood from a process perspective to describe the DDBM development process

The following discussion described the analysis and how patterns among different respondents view the DDBM development process from each of the 10 categories and how we designed the following sequential process to represent each CC. Also, for clarification, the way we explain each category might be different since each category possessed specific complexities and thus need to be addressed differently.

4.1.1 Category consensus 1

Observing from the perspective of conventional and regulation shown in figure 11, the process can start with an idea considered as an initial VP that needs to be tested to be improved over time. The position of regulation and ethical consideration can be different according to respondents.

Figure11
Category consensus 1



Note. This figure illustrates the DDBM process from the perspective of conventional and regulation

One possible position of ethics and regulation can be after the development of the initial idea, which is before having a minimum viable product (MVP). As respondent 3 declared: *I would say as early as you have, maybe not already at minimum viable product but at least… at value proposition an idea of what you want to develop and why of course… because you are going to save time and money… money even intending the way that you can be sued for not respecting some legal requirements.*

From another point of view, respondent 5 stated that there is a potential risk of letting regulation guide new ideas and BMs to be developed initially, as it can limit the potential novelty: *I just would like to add this is actually a risk if you starting that pocket because if you start to think about the legal and regulatory aspects it actually means that it will decrease the innovation level because you will be stepped into current policies right? and policy makers are not the first ones in line when it comes to innovation there always behind so this to me this is actually what you take when you're more or less done and you think that this is what we want to test in real on the real marke.* Comparing these two points of view provided by respondent 3 and 5 respectively, we can conclude that ethical and regulatory consideration can either be included in this process before having the MVP or after or in both places. It depends on the specific context (Gunthe et al., 2015) in which

the process is conducting such as industry, country, etc., or even on the degree of risk acceptance for any potential ethical and regulatory infringement (Van den Broek and Van Veenstra, 2015).

Respondent 2 provide this point that ethics and regulation should be considered before collecting the data which occurs in testing the VP*: we have learned from the GDPR sort of when it was introduced to the market that you can't really apply privacy afterwards, it needs to be secure and it needs to be private by design before you know it did any coding.* This statement can be approved by respondent 7 which declared the data with which companies work should already comply with the regulation and ethical aspects*: make sure that […] we don't spread data that is, you know, violating integrity so on. And second, taking integrity I would say security as well of course. And then the part are we don't use data to draw wrongful conclusions that are outside or beyond the ethical scope*. Testing the VP follows an iterative logic as the VP might be changed based on the collected data and demand another testing before being ready for implementation.

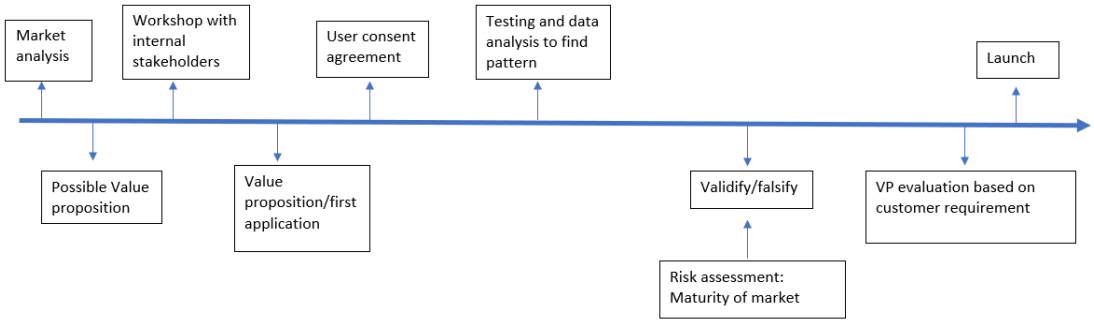
This iterative procedure of taking the change VP back to conventional and regulation before testing again is described by respondent 9: *you collect at least some data. And now by looking at this data, you see, okay, there is actually a potential of something new […] in reality in most cases, you will still need to realize this new idea, you will need to collect more data, additional data and so on. And then again, you need to consider those, those aspects.* Similarly, respondent 5 emphasized the importance of ethical and regulation before the final version of VP through an iterative test: *so this is more when you're more into what you have found that at least when you start to see your value propositions that you think of this might be work you have tested and you're more sure about this […] the question is are there any regulatory aspects that we need to consider so you need to refine your value proposition and the same goes for I think data privacy and ethical aspects,* this view of refining the VP based on conventional and regulation is shared by respondent 1 as well who stated*: need to consider right before the implementation.*

4.1.2 Category consensus 2

Observing from the perspective of industry and market shown in figure 12, it seems market analysis can be one of the initial steps companies take in order to commence the process of DDBM development.

Figure 12

Category consensus 2



Note. This figure illustrates the DDBM process from the perspective of industry and market

This market analysis can contain a small desktop research about the market to enable the companies to have different ideas which allow them to create their VP as respondent 9 declared: *I would assume that you need to do, even before you start doing business model development in like, you need to know your markets. But maybe it's just the first step but that's to me, it even sounds like since before we start talking about business models, you need to know that this is what we want to be looked* and also respondent 3 stated*: I would… desktop research mostly, like opportunities, we can conduct even… OK… some research like surveys and interview we can do it as well but much smaller scale and then, we start creating our value propositions*. It can be confirmed also by respondent 1 who stated: *I mean on the early stages it's just an idea and general idea which could be interesting and interesting for the user for example what could have a demand on the market… Otherwise, if we develop product and then make the market analysis… we will spend more time and resources to… modify our solution*. Therefore, so far, we have a small-scale market analysis on which the initial idea is created. In the next step, it is the time for a workshop or any other internal activity implying that the company should decide about the created idea before deciding on any VPs to be tested as respondent 3 described: *We have some workshops with internal stakeholders maybe external, and we try to come up with some value propositions according to the stakeholders*.

One of the common steps stated by the respondents is the procedure of testing VP and receiving feedback from the customers, which is described differently by each respondent. Some explained it in detail, and some others described the surface. As respondent 1 mentioned: *...then we just test it and have the user acceptance test and get the feedback from the user*. Further, this statement declares a user acceptance consent should be considered previous any testing. Respondent 7, by mentioning co-creation tried to describe the involvement of the customer in the procedure of VP testing: *But, what you suggesting is quite along that that that are actually the….the open co-creation and so on, where you include the consumers and add possible other business partners and so on, along with the…their product development journey.*

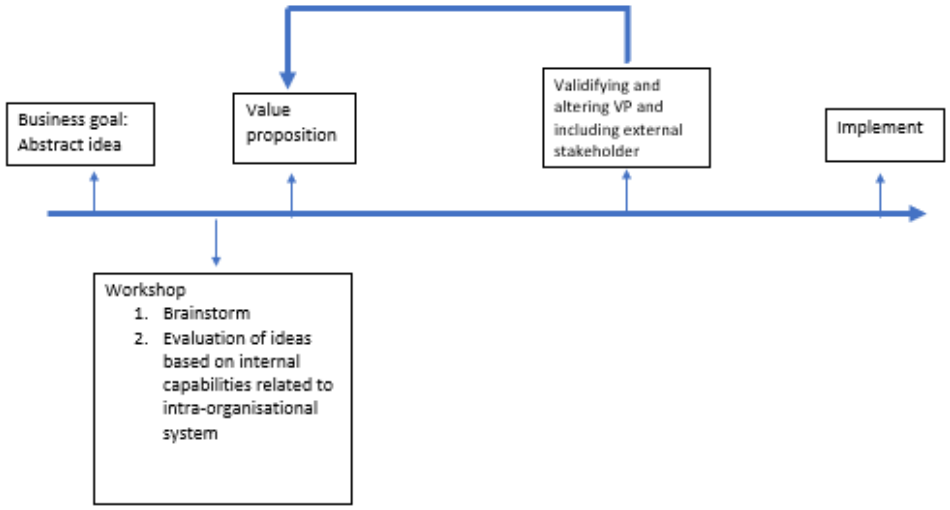
However, respondent 5 elaborate on the market test and receiving the customer feedback by describing as following: *this is very important and I think this goes along with the data analysis when you start to see patterns you need to verify all these patterns accurate and marketing analysis could help you to validate what you what you actually are seeing and it could be that actually the market analysis it might point to that it's not valid but still the pattern might be valid it's just that you have a market that is not mature for it so the question will be done about timing when will you when is the time right to actually launch the service or product*. Here, a considerable risk was referred to by respondent 5, which is the risk of testing a VP in an unmatured market. However, the maturity of the market in this statement is not evident, but as a general statement, it implies that despite that the customer feedback is not compatible with the patterns obtained by the data analysis. However, it does not necessarily mean that the discovered pattern is wrong, but the market is not ready to percept the value companies intend to propose. One of the implications of this statement is making the best decision at the right time for offering any value to the market (Narasimhan & Zhang, 2000) because companies should be able to monetize their offerings which is possible only if the targeted market embrace it. In a similar way respondent 1 considered the evaluation of the VP based on the customer feedback before launching the product or services: *and then we evaluate whether it is a good solution whether we need to reshape it or yeah which is the requirements from the customer.*

4.1.3 Category consensus 3

Observing form the perspective of inter-organizational system shown in figure 13, this process illustrates two parts. Firstly, how the origin of a VP as an “abstract idea” could be developed into a more tangible VP. Secondly, how that VP is further developed and validified by potentially include external stakeholders and together evaluate and alter the VP until it can be implemented.

Figure 13

Category consensus 3



Note. This figure illustrates the DDBM process from the perspective of inter organizational

Concerning the first part respondent 3 provide a good explanation of how the initial idea is created and how they proceed to develop it internally through workshops: *What you have in mind at the beginning is maybe some business goals what do we want to achieve […] so we just know that but we don't know what is going to be the solution so through the workshop we are trying to come up with many ideas and then we have our process now of course of going through idea generations and then we vote for ideas and then we come up with suggestions.*

In this stage the idea should be evaluated based on the firm's own capabilities in relation to necessary involvement of the inter-organizational system as external stakeholders in order to further improve the idea. As explained by respondent 3: *We have some workshops and we start working on creating the idea of which what kind of value we want to create and for whom… so we have to define who are the stakeholders and we are stakeholders and we have internal stakeholders and depending for the project* or the same questions to consider is expressed by respondent 5: *I think this actually when you start to get some kind of an idea the question is then I mean do you still have access to all the data or is it that you need to have the stakeholders in order to get access to the data so you can actually further elaborate on your idea.* The procedure of evaluating the initial VP internally before including or benchmarking with external stakeholders is also shared by respondent 9: *I think you kind of need to figure out what you want to do first. And there's also a little bit personal choice that different people solve the problems differently. But I like that*

approach when you start brainstorming, first, come up with all the ideas. And only after that you do kind of a reality check. Is this even possible or not, or what would be all the constraints and so on. As well, this internal workshop could be validated based on the argument that each new idea of VP could depend on different data activities or sources as described by respondent 5: *depending on the maturity of your business idea it might be that you actually will look into different stakeholders right? because you might have an idea for a particular product but that product will require a certain infrastructure by others that actually you are not interesting so that's other parties that needs to be involved*.

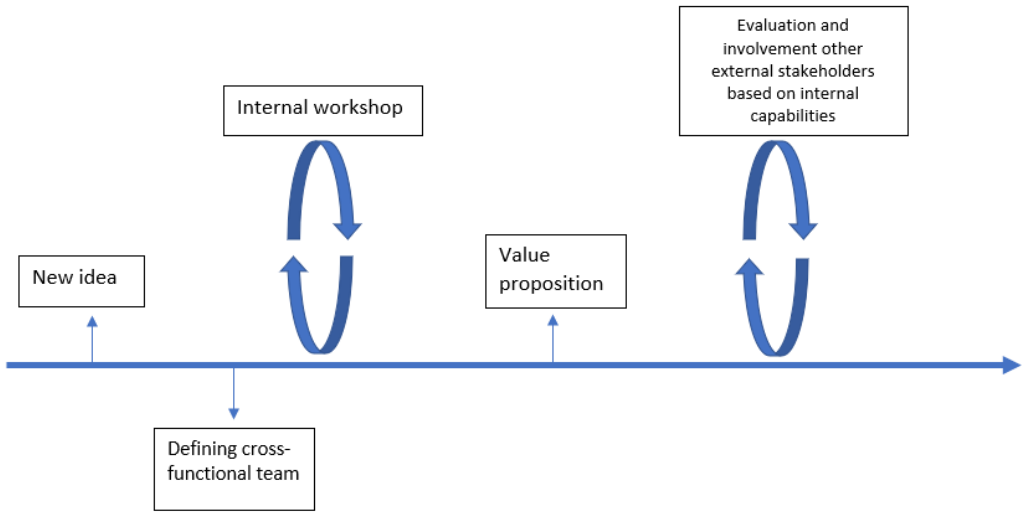
When the initial idea has been progressed and evaluated through the workshop the second part of the process is starting. This means, based on the developed VP including the potential needed external stakeholders or stakeholders which could be impacted by its creation. This is elaborated by responded 4: *once you start to work with an idea and you start to be more, how should I put it, when you actually see the bigger picture more clearly you need to involve others even though you haven't started the implementation of it because you need to validate if your idea will work in real life so if you have a great idea you know that you can develop it but if you don't have an idea if others will support you and that might cause some issues for you to actually handle this innovation to really work business-wise.* For the same reasons described by respondent 1: *we need to consider business interest before creation of their business models… otherwise if. we create the business model and sudden takes the interests of stakeholders it will not work or it will take time to adjust its business model to the market requirements or requirements a company.* This procedure is expected to be iteratively conducted. As the VP is continuously evaluated and step-by-step developed there might be new stakeholders which becomes important to include. As respondent 6 explained: *You need to work I mean very agile in developing these business models.* Once the VP is considerate ready it can continue for implementation.

4.1.4 Category consensus 4

Observing from the perspective of intra-organizational system shown in figure 14, indicated that whenever a new idea is proposed in a company, the process of development can begin with shaping a cross-functional team including the internal stakeholders.

Figure 14

Category consensus 4



Note. This figure illustrates the DDBM process from the perspective of intra organizational

This team has the responsibility to begin internally evaluation of the idea in any different ways one of which can be in the format of workshops as respondent 3 stated: *it's important to build a team and then what we do is we have already different teams with the company but we create, like, temporary teams every time we have a new the creator of a new... product service and then and that is important to define… I can call them stakeholders as well.* Respondent 3 in different ways tried to visualize this process that led to shaping a sequence starting from an idea followed by an internal team, producing a VP, and involvement of external stakeholders in the end: *We define a team basic team and then why we are going through the process we understand we need other people and we drive other people into the team from the company and it could be somebody specialized on the structure like the architecture of on a digital service so we need the knowledge from them.* this statement can explicitly show the precedence of starting with engagement of internal stakeholders as an organizational capability (Handfield et al., 2015) in the development process over the external capabilities thereof. Similarly, respondent 6 delineated the priority of the internal stakeholder over the external ones: *You won't be able to develop the business model is pretty good because it will take a lot of small steps internally, I guess And then again, you need to be able to talk about with, actors in your ecosystem, in your supply chain on a level that you most*

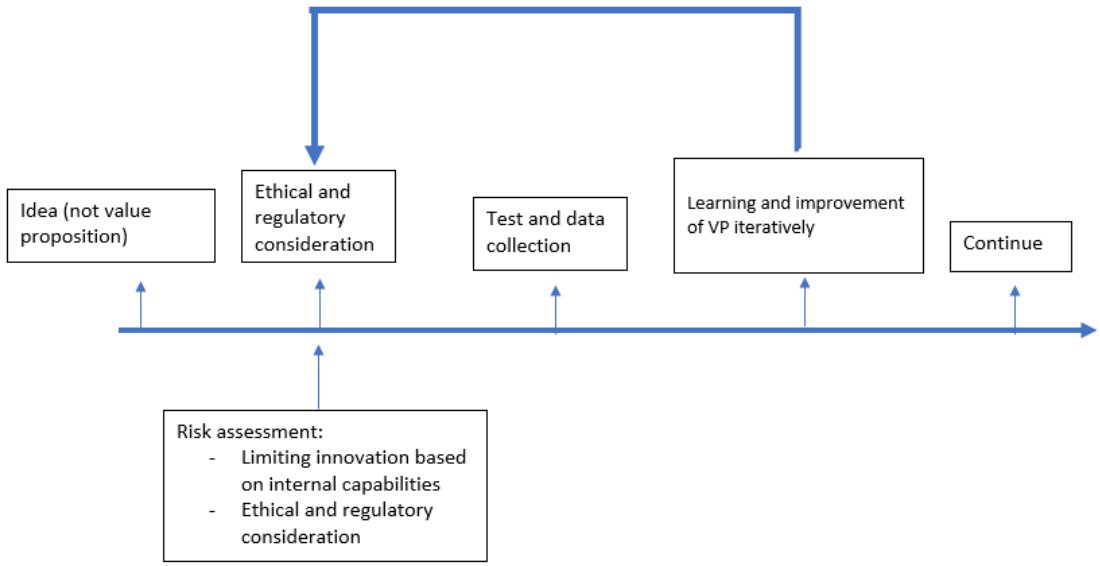
likely cannot talk right now. Furthermore, Respondent 3 beside the emphasis on the before mentioned sequence, referred to a subtle point about the legal consideration which comes after defining a VP followed by the internal discussion: *...the difference is that maybe five people from the beginning and then at the very beginning we take in an important like product owner that we have a workshop with this person or two, and, then when we have define something with them we carry on our process and then we take in some expert that we need, and then they can leave, and then we take in someone from legal when we have understood the what we want to do and where... whenever someone is relevant we try to drag in and so to be more efficient because consider that as well we want to be agile we cannot be too many people as well. So, everyone comes in when is required and is more efficient* additional to the statements explained, respondent 8 helped to increase the process dynamics that allowed to consider an iteration in selection of the stakeholders and VP: *you're now talking about, I mean we haven't even got value propositions organized yet… so how can you know what skills and knowledge and… capabilities you're gonna need until you know what your what the actual offer that you're making to your… what value co-creation you're making to… you're making with your stakeholders.* Combining the previous statements related by other respondents and the previous one stated by respondent 8, we can interpreted the process of development comprises various stakeholders starting from the internal and consequently external ones should be ongoing when defining the VP (Frow and Payne, 2011) due to the fact that on the one side VP definition needs the presence of the associated stakeholders in the process and on the other side, engagement of stakeholder needs a clear VP otherwise companies cannot decide which company with what type of capabilities can come in helpful in this process. Therefore, the need for an iteration for defining a VP and the respected stakeholders can be more tangible.

4.1.5 Category consensus 5

Observing from the perspective of BMI – value proposition shown in figure 15, this process illustrates how a VP is developed and iteratively improved as to become mature and stable in the market.

Figure 15

Category consensus 5



Note. This figure illustrates the DDBM process from the perspective of BMI-value proposition

Starting by viewing this process from the end (right side of the figure 15) we can determine how collecting data through testing becomes the engine and a key part of developing a DDBM and how to develop your VP. Described by respondent 2 how data is key for VP development: *So the value proposition we might have an idea, but it is better to just going from idea out to the market and trying to get hold of the users…[…] But in terms of data… this is why you see on the market all of these freemium subscriptions. It's because people don't know, it's all a matter of getting the user to use it and see whether it's fit to anything and understanding you know how often you use it and so on*. Further, the importance of data and testing from another perspective by respondent 9: *In many cases, it's extremely difficult to evaluate the actual value before you have the data and you can measure things and so on. And the challenge comes partially at least from the fact that it's impossible to know how accurate your predictions will be before you start collecting any data.*

The data is becoming the important feedback to continuously improve the VP by continue, pivot or in fact develop completely new ideas. As put by respondent 1: *evaluating what the customer needs and then they get the feedback after the development what do they think about the actual solution. So, and based on both types of feedback we create the solution.* Also illustrating the VP is iteratively improved by collecting more data is respondent 9 explaining: *So one of the challenges is that it's often very difficult to actually figure it out in detail before you start doing it. If, if you look at the, some of the most successful examples of this personalization are basically come from observations so for, develop one service, and then you see that people, are using it differently. And*

then you start optimizing or the different types of usage. And then it becomes more personalized as you figure out that some people want this feature, other people want another feature, and so on.

So, looking earlier (left side of the figure 15) in this process it is illustrated how before conducting any testing through data collection there must be a consideration of ethical consideration towards the users. Assessment of the type of data that is to be collected as this data can impact the agreement with customer to share the data, and thus risk of slowing down the development process with an unnecessary step. Explained by respondent 1: *There is data which is not related to a particular customer and it doesn't require any user consent. So, in this case we we're not asking for any permission from the customer…so it depends on the data.* However, it can be understood how transparency towards users is significantly important in development of the DDBM. Transparency about how the user's data is managed and the intentions of collecting it. In practice how to reach transparency can be to allow customer to agree on a consent before testing. Respondent 5 explains: *if you want to use the data to actually design a value proposition then you need to have that agreement upfront right.* Going further respondent 5 continues *You need to upfront tell them that in order to provide you with a better experience or a better added value we need to have access to the data are you OK with that […] you have to accept the usage of data and I think that most people are OK with that unless you sell the data to others there is where you will come into some kind of struggles.* Similarly described by respondent 7: *As soon as they have a first…minimum viable product, invite customers let them use it, be open and say what you're looking for and let them explain.* On the same topic is respondent 3 elaborating on transparency and ethics and internal working routines: *We are trying to avoid any future problem and we're trying to anticipate all these issues. Like, even just sending out some questionnaire to some users and we're trying to cooperate with legal now because we want to make sure that we write everything to inform them… what are we going to do with this data… why and… how the data is going to be saved and for which purpose.*

This stage of evaluating the ethical considerations and having the customer consent agreement can be reached in two situations. Either, as explained in the first paragraph (the right side of the figure 15) as a company already possess incoming streams of data that allow the current VP to be evaluated and changed. Those changes could call for re-evaluation of ethical or potential need to rewrite new consents with users. The other situation is when there is a new idea origin from elsewhere of data, however does this also call for ethical considerations, as customer agreement, before testing as respondent 5 puts it: *if you're just working on an idea without having any idea about so you don't really have the access to data you just have an idea about something you got some kind of a hint or a feeling that this should be something that will be working of course then you can use that in order to get an agreement from customers would you be able to help us develop this, but in that case we would like to have your data to be able to shape this to add the best value for you something like that so depending on what you mean by value proposition in this case.* In relation to this non-data created idea it is further important to not let the internal capabilities restrict the potential development as it would mean perhaps relaying to much on external stakeholders.

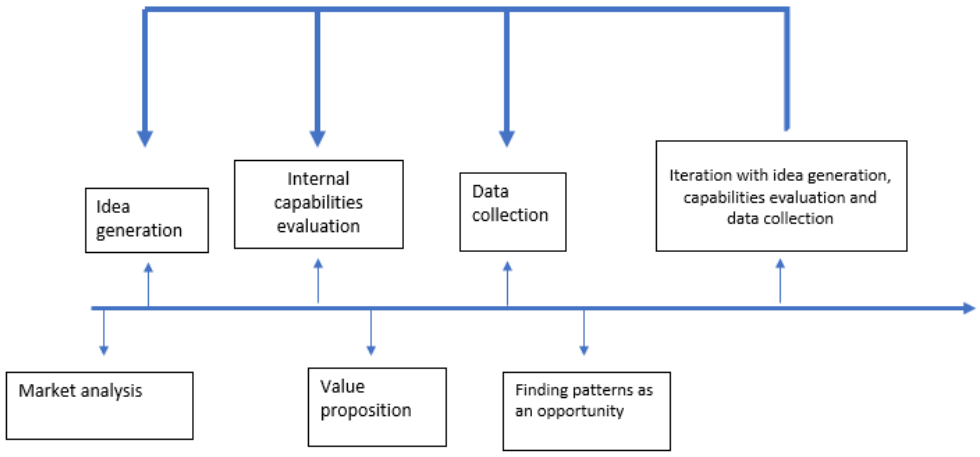
Instead, the idea should be explored before any cancellation as otherwise risk suppress innovation, as respondent 3 puts it: *in the beginning we don't have those kinds of limitations. Because, as we say we are progressive company so we don't like to have those kind of limitations and because you know once you start with those kind of limitations there is no progress. So, it's better to start to develop ideas and then to find a bit later on in the process that maybe we need to rely to an external stakeholder or maybe this is not the proper case for us to continue.*

4.1.6 Category consensus 6

Observing from the perspective of BMI – value creation shown in figure 16, respondents indicated that companies should not necessarily have accessibility to or even own the required data from the beginning, thus they should decide on solutions to solve this issue.

Figure 16

Category consensus 6



Note. This figure illustrates the DDBM process from the perspective of BMI- value creation

For explanation of this part, we start from the same point, so the assumption is that in the beginning companies do not have accessibility to or ownership of data. according to respondent 5, when companies lack the required data, one alternative is to start from the market analysis because it gives the opportunity of finding the VP: *... otherwise you can't look for patterns then you will then you will just in that case you will create the value proposition more based on what you think and more may be based on marketing analysis.* Similarly, respondent 2 declared a statement implying that if companies do not have the data they need, an ideation stage can be helpful to generate and assess the ideas which allows companies to identify the ways they can reach the data:

But, there are also multiple data sources that we haven't yet and this is exactly what we do… we have a you know business idea funnel where we search out and we put the questions how could we get this data so we can understand this and then we need to find ways of producing that kind of data. in addition, respondent 3 complement the previous statements by adding this point that idea generation can be a preface to involve the stakeholder in the development process: *So, it's better to start to develop ideas and then to find a bit later on in the process that maybe we need to rely to an external stakeholder or maybe this is not the proper case for us to continue.*

Combining the preceding statements, it can be construed that in the beginning the initial insights can be shaped based on the market analysis which can provides the preliminary data for the idea generation and companies overtime should decide on what data they need for the possible ideas or who they can involve in the development process. Regarding the engagement of the stakeholders, respondent 5 explained how the strategic decisions affect the involvement of stakeholders by stating: *I can see is that the companies that actually being able to exceed go extremely fast in their innovation path they are very strategic in the way how to go about this when we want to actually start to evolve stakeholders and what stakeholders that you really want to have involved and not just looking to the money but the even maybe say no thank you to some of the stakeholders because they will not actually out any value to you and try really good pick to be very picky about who you involved in this kind of engagement and the more open you are when you have decided who you want to have a board you can decide it along the way you don't need to decide everything up front but I really believe that being brutally honest from the beginning is the best way to actually build that kind of trust worthiness in the relationship*.

This illustrates how strictness in selection of the stakeholders can affect the pace of development as well how stakeholders can be selected along the way not necessarily form the beginning and it refers to this fact that selection of stakeholders is not a linear procedure rather an iteration. Afterward, companies have the possibility to design their VP and by doing so they have the chance to test it in the market and receiving feedback as explained by respondent 3: *So, when they use the product… because the data will help you to create new services… improve actual services and offers… and revenues of course. So, there is different types of data… data that you need to create something and data that you will collect during the consumption of the service or product… to build up your future revenue.* It is understood that testing a VP itself can be considered as a data collection, so in fact, it can be a way of feeding the current VP and new ideas which conclude this fact that releasing a service, or a product is not only a way to monetize the idea but also a way to enrich the databases. This data bases eventually can allow the companies to extract the pattern illustrating a potential VP as respondent 5 stated*: I mean if you're looking for patterns then you need to have the data [up] front.* And respondent 6 in completion of the previous statement articulated: *I have found that value is created at many different points that you didn't really expect when you started your product development journey. That there's so many surprises that pop up along the way. But, so, I would say that having an open mind to this along the journey is more important than starting at a certain point and then locking down on that particular thing. And also will say, nothing, and that is the more value creation points you can add…to a product… to its*

entire life cycle… remember the life cycle doesn't end when the product ships through the door. Today at, that is just, you know, beta or version 1.0 whatever, things that happens after that it is part of the product lifecycle. So, I'm saying that you should continuously strive to add value creation points along the entire product life cycle. So simply, the value creation activities related to data can include a wide range of activities which mostly starts even before data collection when the stakeholders should reach an agreement on the data accessibility and transparency in this process and then data collection, all the data related activities to find any pattern as an opportunity in the data and finally improving the VP or discovering new ideas. Cleary, these activities are not positioned in a linear process and iteration each step of the value creation activities seem to be essential. Respondents refered to all activities carried out through the whole process as value creation activities that mostly related to data. And lastly, value capture can be considered in the last stage along the process and it should be considered not in the beginning since the VP is designed iteratively and the ways companies have the possibility to monetize can be different as respondent 6 articulated: *You need to collect all the data that is going into that value creation point you need…that means that you need to specifically define the function that drives this value creation and what identifying what data is it's available what parameters is fed into that. That is the types of activities you need to make sure that you have connected in order to cash in on that.*

4.1.7 Category consensus 7

Observing form the perspective of BMI – Value capturing, the value capture in a DDBM development process is strongly advocated among many respondents to be after a more defined and developed VP is implemented. Though value capturing can be discussed early on for reasons as respondent 3 explained: *because in the end we are a company and we need to survive then we need to make money to survive,* but most likely it will be designed and implemented significantly late in the development process. Hence, getting the VP right initially will provide the value capturing to be revised and improved as the user base is increasing and new data streams provides new patterns to be analyzed and so implement potential revenues streams for example. Respondent 7 explained: *I would say that value proposition precedes value capture [...] You can actually live long time on by just providing value and processing and providing and make sure that it's is received before we actually capture it and turn it into revenue.* Also described by respondent 9: *So I think that those things are not (dependent or important??) but if you have a Good, good proposition. I think value capture is not tough, you can just figure it out somehow at the end.*

More precisely, as the DDBM development process proceeds the value capturing is more and more evaluated based on the inter-organizational system or ecosystem that becomes connected with the VP. As respondent 7 put it: *And, also it can take you long time to figure out how to capture it as well, cause all the sudden this is not in your own hands only. This has to travel through the ecosystem of users, other businesses, competing models, just the fact that you're introducing something means that each of ,you know, you not at a steady state yet, once you've introduced it and stabilizes it and you have a group of users… do behave differently than the 1st, you know,*

early adopters there is so on. So, for those reasons you cannot necessarily rush that. But, instead you need to be, you know, focus on creating that value and then at making sure that is actually received on the other end. Then you can be open for different pathways of capturing this. Similar view of how DDBM and value capturing demands understanding the broader picture and not only the end user is explained by respondent 2: *So, making the best value capturing so that those developers can do their jobs as smooth as friction free as possible that is the value capture. But, at the same time we need to understand what part of what end-to-end service are we involved in*. As well, described by respondent 5 how value capturing necessary will not be connected to the direct end user of a VP: *it's about understanding because you might have an idea right about the value proposition or you actually might have an idea about very roughly idea that you also see how you what kind of value capture that you can see that you can apply or actually you might actually want to have the value capture uh another customer so the ones that are actually targeting or [are] not your real customers they are just the ones that will give you the data but your real customers is someone else.* Given this, the value capturing is what must be continuously evaluated as respondent 7 explained: *value capture mechanism, that is not clear and well defined. But, instead, should be something that is open and experiment way.*

The value capturing in the DDBM development process follows an iterative logic where the inter-organizational system of actors has a significant role to develop the BM and designing the value capturing by sharing their data. it Provides the indications of a process with perspective of value co-creation rather than value capturing. Explained by respondent 8: *I would say that you need to be looking at all forms of value co-creation. Again, capture says I'm stealing it from you which is not a nice idea from anybody… particularly your customers.* Further elaborated by respondent 6: *So it's again, it's an agile development process. I would say small steps in a direction, learning about everything that is needed to, to get a new business model in place. And doing that together with your customers basically to understand what is needed and how, again, how do we capture value from this. But I think it's, it's very difficult to, early on understand this without experimenting, trying out things, highlighting stuff, you need to pivot your business model multiple times*. Sharing the same view, respondent 4 explained the role of customer and importance of understanding the customer segment in order to finding a revenue model: *who is the customer what does the customer know and then they will create value offerings and it will always be like something is free and then you can earn money you know in some way and sometimes it's like you sort of give something away and then you can earn money sort of further down the stream and it's not obvious or these are connected.*

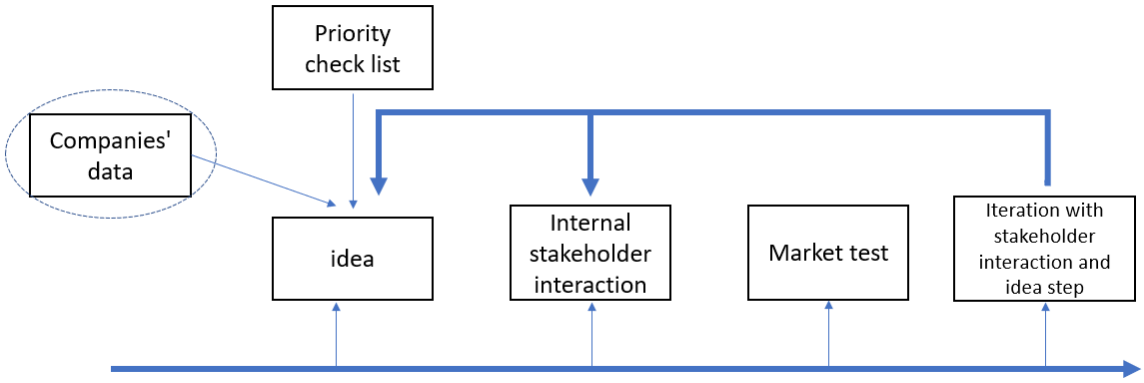
4.1.8 Category consensus 8

Observing from the perspective of strategy shown in figure 17, development process does not move in a predetermined direction which increase the complexities in this process. Because strategy cannot always follow a simple and fixed decision rather a decision which has the possibility to change depends on the internal or even external stakeholders' collaboration, and the

feedback drawn from analyzing the data collected during the market test. In the following, an elaboration on the role of strategy, stakeholder and market test will be provided.

Figure 17

Category consensus 8



Note. This figure illustrates the DDBM process from the perspective of strategy

One of the initial stages in which strategy should be defined cis arguably before the stakeholder engagement as respondent 5 explained: *this is something you probably should start even before you involve the stakeholders but that can come even before you even have an idea I mean you can have some kind of a common strategy for how to work with the data-driven model innovation. But you take a huge risk if you don't have a strategy before you involve stakeholders.*

In a similar way, respondent 3 elaborated a close relationship among different parts of the organization in order to adjust the strategy according to the data which continuously is added and affect their strategic decisions. In exemplified case of respondent 3, two sections in the organization involved in discussion on ideas are business and product / service design.

One of the reasons service designers should interact with business designers is communicating to receive the essential feedback along the development process. In this situation, service designers have the autonomy to advance the project and communication with business design unit whenever it is needed. Another communication between these two sections occurs when business designers make a priority list and the most relevant project complying this list should be introduced first either for market test or implementation: *we have business designers that are in continuous cooperation with us. We… is a two way of information between us. One way is when we communicate what we're working on and then we get feedback from them to understand if this is the right direction if it is something that we need to fix or has to be we need to change maybe direction little bit, and, the other way around is when they try to make a list of what needs to be prioritized and then we in our department it's not like a backlog but it's like really try to follow*

prioritization which project should we take first what is most relevant for the company right now… from a business perspective

Based on this internal discussion, involvement of stakeholders is discussed and regarding the feedback of data, the procedure continues. The data that is used for supporting the decisions can originate from the company's data accumulated over the market test as respondent 1 declared: *because maybe strategy could be shaped based on basic data*. Also, Respondent 3 clarify about the data possibly can help revise the strategy: *[…] And then, based on that we start our process so that is already where we get some… we can say sort of data… like short amount of data from the company but maybe it's backed up but a lot of data. And they tell us this is what needs to be prioritized now, work on this come up with ideas and then we did not see OK for this idea we need this kind of stakeholders internally and this market maybe so we start our workshop with these internal stakeholders and try to engage them and co-create. […].* The priority declared in the statement of respondent 3 can be in line with what respondent 2 stated as the maturity of the market: *So, this strategy is much more understanding the whole value chain. Who are we targeting what is the maturity at that point and what kind of offering is better at that point.*

According to our interpretation, in the preceding explanations, the strategy should be reflected before stakeholder (internal and external) engagement, but it does not mean it will be fixed over the development process as respondent 3 stated: *it's a very thin line. I remember finding myself in a situation where we started a discussion with an external stakeholder about data specifically and because we understood it was relevant for us for our idea. But, later on in the process we understood that we could access our own data and we were able to analyze it and own it and in that case the stakeholder was becoming just a kind of competitor trying to send back to us our own data.*

Respondent 8 has another perspective for strategy implying that strategic decision regarding the market entry should be made after analyzing the market and defining the stakeholders but in an iteration, it should be adapted. In the first glance, it seems to be contradicted with the ideas of the previous respondents stating that the strategy has the necessity to be concerned before the stakeholder engagement, but it can be construed differently that rather strategy should be flexible and not fixed over the development process: *So, I would say this is… early… earlier and it's probably something that you might look at… after you've done the contextual look at the contexts. After you have understand who your stakeholders who you think of stakeholders are… after those two steps is probably when you think about strategy and my guess is a lot of the time when you start to think about strategy that will cause you to go back and look at your context again and your stakeholders again (respondent8).*

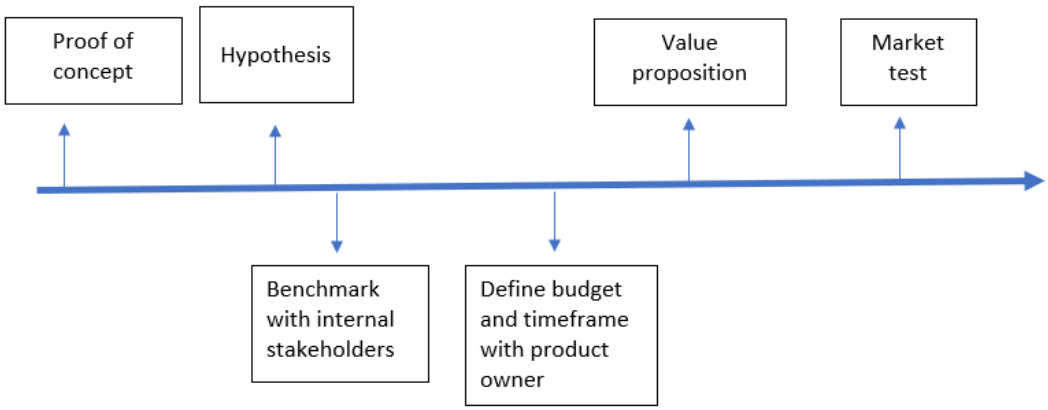
4.1.9 Category consensus 9

Observing from the perspective of risk assessment shown in figure 18, our analysis provided a potential DDBM development process in terms of activities in sequence. However, we could

identify multiple of risks assessment points connected to different activities but not related to a longer sequence rather in isolated parts.

Figure 18

Category consensus 9



Note. This figure illustrates the DDBM process from the perspective of risk assessment

Starting from the identified sequence of a process in figure 18 it is illustrated how the VP in DDBM development process is developed in three steps. Firstly, the VP is a proof of concept or hypothesis. Secondly, through benchmarking procedure with internal stakeholder the VP is further developed. Thirdly, its tested in the market in order to understand how accurate or valuable the VP is. The first and third step was elaborated by respondent 2: *we apply… sort of quite agile business management where you have your proof of concept and the hypothesizes in the beginning and then you have some idea of the value you want to bring to the market and then you go out to the market and you know who is interested and you get your leads and suspects and having them to you know define this to the next step with you so this is it should be you can't make it the perfect before you go to the market*. Whereas the second step was advocated by respondent 3: *Because, in like the case right now the process started and then when we had like…what we thought being a good idea like quite a heavy to be revealed or explained to important stakeholders we talked with business department and then we present it to the product owners like management and then they probably assess the risk on their own and came back to us with the budget OK we believe in this this is the budget you have this is the time…come back in four months and this is what we would like to have like this page of the idea. And so, we present the plan and we keep on working.*

Going further, from a risk assessment point of view, the development process of a DDBM includes different points in the process where different risk assessments have to be considered. Therefore, there will be a continuous assessment of potential risks as the development process goes on. For

example, as stated by respondent 3: *something at something at the beginning and then during before scaling up I would say there is a second risk assessment* further explained by respondent 8 *I mean I've always thought about risk assessment is one of those things that you have to be doing all the time […] so I would say, starting at the very beginning and ongoing.* Also advocated by respondent 2: *So, risk assessment is always and we applied actually in our management system… constantly. So, it's about to do we have the right to tech, do we have with the right business, do we managed everything in the right way.*

Now to concretize, there is an underlying risk related to managing data. having data as key resources brings the risk of cybersecurity and hacking to be considered before implementing the new DDBM as explained by respondent 7: *I think that the first thing that people think of when it comes to data and risk is leaking… information to companies and individuals who shouldn't have it. And that you need to consider before you launch a product and going to market of course.* Sharing the same view and elaborating on how data security is a competitive advantage is explained by respondent 2: *of course, you know, the whole idea of a security privacy and security is… really getting so much more… the cybersecurity is… I mean it has been sort of something you do in order to take care of stuff…but, it's become something that it's really making you stand out in the competition.*

As data is a key part of testing and developing the BM itself there is different risk assessment related to this part. To begin with, transparency towards users or other involved actors is essential in this development process as respondent 5 put it: *this is when you work with transparency because transparency is key to actually build trust to build that kind of relationship that you want you need to have risk assessment and risk assessment within agile product development or agile innovation or whatever you like it it's dealt with on daily basis so you need to have this kind of awareness what kind of risk does it bring and how will we mitigate that.* Also explained by respondent 1: *I think the main challenge is to consider a…GDPR and to provide the customer with the information on what kind of data is used and to make sure that all of that data is anonymized.*

If transparency and ethical considerations are not applied there is significant risk associated which could harm the DDBM development, consideration the explanation by respondent 7: *Then, I would say that…it's today ethical risk assessment has been rising and is so essential that it could … it could damage your brand and thereby making… all of your product development efforts in vain, if you don't take care of that already from the start. But that also means that you need to know what your… your audience or your consumer prefers when it comes to ethics in their… in their consumption.*

Then there is as well an inherent risk in regard to maturity of market and the technology which has to be assessed. As explained by respondent 6: *I mean, technological risk is huge here because many cases the technologist is immature. So, you need to develop solutions, your specific technological solutions on your own together with partners*. This indicates the inclusion of potential external stakeholders as partners as relevant risk assessment once starting the development. Respondent 2 provides further explanation: *So risks are also about understanding,*

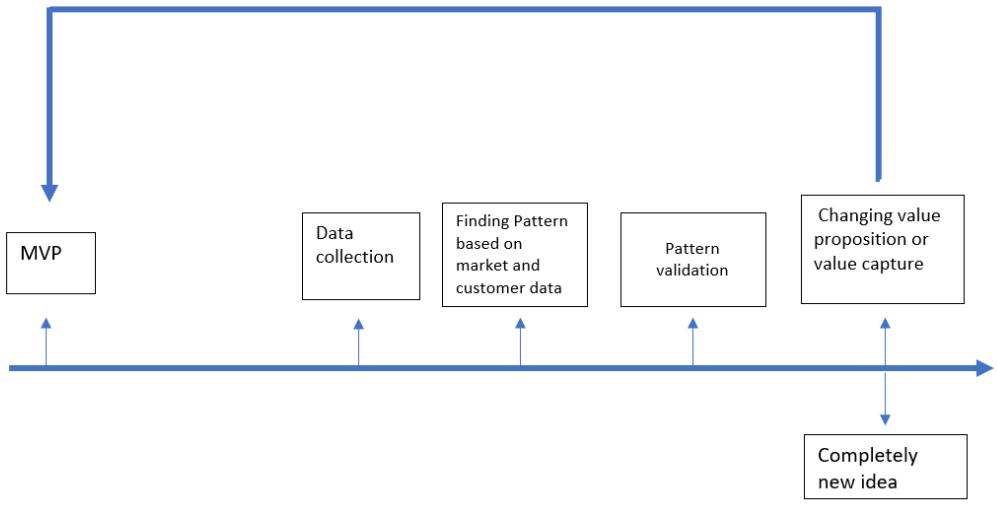
as I said the maturity… who is ready to buy the data, and this is… I mean back today my business to business perspective, can our customers are they positioned in a sense where they can actually purchase and source our way over you know providing this data are they ready to just use it, is it, you know, easy to map… Not understanding the market could provide negative consequences as described by respondent 7: *Then of course, there is always a risk that you fail in the business model because we couldn't find the right data and so on, but that's another kind of risk.* Another risk assessment related to the co-creation part of DDBMs where external stakeholders become closely involved is to decide about data transparency and data ownership which refers to as open or closed ecosystem (Immonen et al., 2014). In fact, this is a risk assessment part of the firm's strategic decisions. Further explained by respondent 4: *today companies are so aware of this so that they have that as part of strategy work, you know, how should we do it should we be open should we not be… and they know about you know these are the benefits and these are the drawbacks. So, if there can becoming more and more aware of that and like you said risk assessment here… that is one type of risk you know, either that you open and you become outcompeted by someone else is much smarter than you or you too close so that you will not gain any attraction and the whole thing will die.*

4.1.10 Category consensus 10

Observing form the perspective of innovation process shown in figure 19, illustrates the potential architecture of the DDBM development process. It indicates how the process is iterative and continuously innovative.

Figure 19

Category consensus 10



Note. This figure illustrates the DDBM process from the perspective of innovation process

Starting from the left side, it is demonstrated that once MVP/VP is developed it should be put into test which allows data to be collected and patterns to analyze in order to revise the VP by improving or change it. :

Indicating the sequence of quickly testing a developed idea with potential users in the market respondent 1 stated: *So perhaps, we tried to implement solution quite quickly to get the feedback quicker from the customer and then perhaps push the innovation to the market.* However, the following testing is depending on how far the VP is developed. Hence, there is different levels of testing based on the maturity of VP. If the VP is in the earlier stages, it could be valuable to initially make smaller scale tests based on the internal capabilities which could make process more efficient while having the transparency and ethical considerations for any data collection. Respondent 2 explained: *you cannot play around with them customers data […] So, this is why we actually need to have our own fleet of cars for instance. I mean company cars and people who you know provide total consent so we can do those early testing.* Part of conducting the tests includes a problematic dilemma, as many times there is a need for large volume of data in order draw correct conclusions of the test. Reaching large volumes of data can be hard to collect from an internal controlled testing as this demands certain resources. Further explained by respondent 2: *This is really difficult for many companies. This is really one of the highest risk, where you actually cannot learn 'cause you don't have proper data.*

Next, once the test has been completed the VP can be changed and companies have the chance to provide new ideas, as respondent 2 declared: *[…] But, the value proposition might be totally different. Cause, the MVP might sort of uncovered that, you know, that this was so complex to just add a data point. Then we know that, you know what? [this] is not this fancy…data insight…but the actual putting the data in place was the complex parts. So, value proposition and for us it has shown, you know overtime, that the actual solution creation has been the value proposition not the cool service in the end.* It shows the iterations causes a new understanding which has been captured from the data patterns that allow to VP to be changed. Moreover, iterations can potentially influence on value capturing and consequently monetizing VP. The impact on the VP after the test is also explained by respondent 5: *I think that you are still within the value proposition, creation, and capture. That's where you're iterating the whole time.*

Given this, once the first minimum valuable product or VP has been tested and patterns from data has brought new possibilities of the VP it is crucial to once again go back and repeat the process but this time to validify the patterns which brought the changes of the VP. Respondent 5 explained: *I've seen some companies is that they take huge risks because they see like big data or you just need developers and data analyst you don't need any other competence and they tend to create things that actually are not needed no one really wants it so you missed out that this kind of validation of the pattern I mean is the pattern really valid will someone really want to pay for this kind of idea that I see that I can create so I still see that that need is there or even may be greater because then you when you see this kind of data pattern you are not really sure about how this pattern has been established why are you seeing what you're seeing it could be some explanation*

that actually gives you this false pattern but that's actually a good terminology to use false I mean is it the false pattern or a true pattern.

Thus, the process is iteratively developing the VP towards becoming mature. Deciding on frequency (how many times) of the iterations need to be done before the maturity of the idea could be part of underlying strategic decision in this step. As described by respondent 2: *How much should we try… before we…I mean how many failures should we accept before we nail it. So, there should be a strategy for that and that's good, and that's part of systematic innovation.*

4.2 Process designing

In this section, we analyzed and designed the DDBM development with the help of combining the CC perspectives described in the section 4.1 (Category consensus). Our result is illustrated in table 12 and table 13. Together they described the DDBM development process containing two broader phases, underlying sub-phases, and activities.

In phase 1 of the proposed DDBM development process, the data-related activities are not intensive (low data-related activities), including four sub-phases with additional respective activities. The process in this phase 1 begins with identifying and possible VP potentially in the form of an abstract idea. From there, an initial cross-functional team is created to go further with the idea. Further sub-phase is an internal workshop initiated for ideation and evaluation, which leads to choosing a possible VP to proceed with. Next, the chosen VP is scrutinized together with newly included stakeholders (internally and externally) and designed into a tangible VP to be tested in the market (see table 12).

In phase 2, which is the following phase of the development process, companies are more involved in data-related activities, which means the role of data in this phase is more tangible as compared to phase 1. Hence this first phase is characterized as high data-related activities. In this phase, the aim is to test the idea provided in phase 1 in the market and make decisions based on the data analysis, creating different iterations in this process. These iterations are the means to move back and forth possible, thereby keeping the whole process dynamic over time (see table 13).

4.2.1 Phase 1

Idea pool generation

The *Idea pool generation* sub-phase describes how the first activity of the DDBM development process is described and consequently how the initial VP is obtained. This VP origin from two directions. Firstly, based on the CC2 and CC6, it is described how market analysis regarding surveys, interviews, or small desktop research could provide new ideas to be developed. Secondly, described in CC3, indicating how broader business goals of the firm can be the creative source of a potential idea of a VP.

In this sub-phase, there is as well a risk assessment to be considered. The internal capabilities should not be the determinant factors to continue or not with the identified idea. According to CC5, respondent 5, it is suggested to continue with the idea and in later sub-phases evaluate the idea

based on the internal capabilities. Otherwise, there is a risk of suppressing the innovativeness and development of the DDBM idea.

Team Creation

This sub-phase, *Team creation*, indicates the second activity of creating an initial team. This team would initiate the development of the found idea from the previous stage. From CC4, CC6, and CC8 it is described how this team should be a collection of relevant stakeholders and where cross-functionality in terms of knowledge is an admirable aspect of the team dynamic.

Ideation

Based on the CC2, CC3, CC4, and CC8 the *Ideation* sub-phase advocates the third activity of a workshop with the defined team and including internal stakeholders to start exploring the idea. As described by CC9, this workshop allows the idea to be benchmarked with different internal stakeholders and provide new perspectives to be considerate in finding a potential VP. The objective in this phase is to scrutinize and extract a potential VP and decide for whom this value is to be addressed and finally, Find the right target segment. As described by CC3, this workshop could use brainstorming to find potential VPs and discuss which actors or customers this would bring value to. This could lead to multiple different VPs to address the potential needs of different stakeholders. Given this, as new ideas are explored, those should be evaluated based on internal capabilities. For example, how is data sourced and created and whether we possess the capabilities to handle this data internally. This evaluation brings an understanding of how the potential VP can be managed in the future, and depending on the internal capabilities, would impact any potential needs to include other actors and build a relation to the inter-organizational system in the development process.

In this sub-phase of *ideation*, there are two additional inherent risk assessment points. First, according to CC7, respondent 3, assessing the technological feasibility of any potential VP is also advocated as necessary. Secondly, described in CC1, respondent 5, it should be noted how regulatory frameworks typically lack the technology transition. Thus, in this early stage in the development process, regulation could become a risk of suppressing innovativeness if it is used to assess which VPs to progress.

Furthermore, it is described by CC8, respondent 3, how cross-functionality is a strategic decision in this sub-phase. Having cross-functionality as a strategy in DDBM development makes the development more efficient and reduces the risks of conducting mistakes in the early stages. Thus, reducing the possibility of the development of an idea with fundamental flaws, which in later stages becomes identified and forces the development process to stop.

Idea designing

The sub-phase of *idea designing* takes its beginning with the input of the defined potential VP in the previous ideation phase. This sub-phase starts the fourth activity with the objective to further design the VP into something tangible that can be tested in the market. As explained in CC2 and

CC10, this tangible VP could be considered a minimum valuable product, as illustrated at the beginning of phase 2 (see table 13).

According to CC3 and CC4 this sub-phase will be conducted to validify or falsify the potential idea of the VP by including new stakeholders into the discussion. These stakeholders could be external actors, evaluated as essential or needed in the previous ideation phase.

However, this *idea designing* phase is an iterative phase, as the new actor's inclusion can be considered as a continuous activity. As described in CC3, the outcome after the first iteration in this phase could either be a VP ready to test in the market or the realization of another needed stakeholder to design the VP. Hence, another iteration of this phase would begin with the inclusion of the new stakeholder.

Additionally, CC7 expresses how value capturing in terms of revenue models could be assessed in this stage, given that firms, in the end, depend on financial income to survive. However, it is strongly suggested that VP precedes the idea of financial monetizing and most likely will the revenue model be designed in later stages once data has been collected and the VP is further developed.

In this sub-phase of *idea designing*, the strategy has two connection points. First, according to CC9, respondent 4, this phase would include the evaluation of data accessibility. This refers to, how and who will have access to the data connected to our developed DDBM and what benefits and drawbacks would either option bring to the DDBM once its operating in the future. Moreover, there must be a strategic evaluation in terms of the broader ecosystem of actors which would interact in this future DDBM, as the VP is designed. Advocated in CC8, respondent 5, there is a significant risk of including external stakeholders without a predefined strategy for this. Further described in CC8, respondent 2 the whole value chain must be considered. However, based on CC8, respondent 9, there is a reason to consider the strategy to be revised as this phase is iteratively structured. So, after one iteration, the strategic view can change.

There is also a related risk assessment in this sub-phase. Expressed in CC9, respondent 2, there is a market maturity risk to be assessed. In terms of the future potential customers, this sub-phase should include evaluating if they are positioned and ready to connect and interact in terms of data purchasing today. Essentially, if the customer and the future market mature enough for this VP. The same expression was described in CC9, respondent 6, which advocated there is a technology maturity risk to be assessed in this phase.

Table 12

Phase 1 of the DDBM development process

Category consensus	phase						
	Idea pool generation		Team creation	Ideation		Idea designing	
	1	*	2	3	**	4	***
CC1		An idea (initial value proposition)				Regulatory consideration	
CC2	Market analysis (small scale survey)	possible Value Proposition		workshop with internal stakeholder	VP**		
CC3	Business goal (abstract idea)			workshop, brainstorming ideas, creating many ideas, choosing one by voting, evaluating idea based on internal capabilities and intra-organizational system	VP**	Validifying and altering VP** and including external stakeholder	VP***
CC4		new idea	defining cross-functional team	workshop with internal stakeholder	VP**	Evaluation and involvement other external stakeholders based on internal capabilities	VP***
CC5		Idea (not VP)					
CC6	market analysis	idea generation and internal capabilities evaluation					VP***
CC8		idea	Internal stakeholder interaction		VP**		
CC9		proof of concept→ hypothesis		benchmark with internal stakeholder→ defining budget and time with product owner and managers			
Value capture				Technological feasibility		Potential revenue model	
Strategy				Stakeholder involvement (CC8, R3)	Data accessibility (CC9, R4) Stakeholder involvement (CC8, R2, R5, R9)		
Risk assessment		Internal capabilities (Suppressing innovation CC5, R3)		Legal and regulatory aspects (suppressing innovation, CC1, R5) Technological feasibility (CC7, R3)	Market and technology maturity (CC9, R6 and CC9, R2)		

4.2.2 Phase 2

Safety check

The Sub-phase of *safety check* starts with the MVP, which as explained in phase 1, sub-phase of idea designing, MVP in this phase, and VP*** in the idea designing refer to the same concept, so some CC include VP*** and some other include MVP, but these both VP*** and MVP have been considered as one concept in these tables.

In the *Safety check* sub-phase, we have only one type of activity associated with ethical consideration and user acceptance that must be included in the development process before testing the VP. Moreover, we identified one type of risk in CC5 and CC10 stated by respondents 1 and 2, respectively. It implies that sometimes companies need to assess whether or not it is essential to spend time to obtain customer consent for data collection since an unnecessary assessment can slow down the development process. For example, respondent 1 explained that if the data is not related to any particular customer, it can be safe to use, and therefore, there is no necessity to obtain the customer's consent. In contrast, respondent 2 exemplified a situation that companies are obliged to use their internal facilities (in that example, the car fleet) due to the danger of any possible privacy violation. Thus, it shows that the assessment of the circumstances where the customer consent means to be vital depends on the company's diagnosis.

Testing

In the testing sub-phase, we have identified three main activities (illustrated as activity 7, 8 and 9 in table 13) need to be conducted to allow the development process to be undertaken.

Activity 7: In CC1, CC5, CC6, CC9, and CC10, we found that testing the VP can be a data collection method since each time the companies intend to test their VP, they need to collect the customers/ users to be able to analyze what they are providing and based on the analysis, have the chance of continuous improvement. Moreover, a risk regarding cybersecurity was articulated by respondent 7 in CC9. It means that protecting the collected data from any possible dangers should be considered from the beginning of data collection. Therefore, it shows the importance of data security, which should be prioritized before conducting the VP test.

Activity 8: This activity refers to any technical activities that companies carry out to analyze the data leading to finding potential patterns that can contribute to improving the VP or other decisions that can be made (pivoting, defining new ideas, etc.). CC2, CC6, CC10 can show that this activity is placed after the data collection and should be undertaken continuously. We found two risks corresponding to this activity in our analysis. The first one is concerned with finding the authentic data on which the analysis can be based. According to respondent 7 in CC9, there is a risk of failure due to lack of possession of the right data that consequently negatively affect the analysis. The second risk found in this activity is the volume of the data required to allow companies to draw the patterns out of the data analysis. Respondent 2 in CC10 explained that sometimes it is impossible to find the pattern since collecting the proper amount of data is not viable for the companies.

Activity 9: this activity can be the last activity companies should carry out in the testing sub-phase. CC2 and CC10 express that after data analysis leading to finding a pattern, this pattern should be validified in terms of an inherent potential value since merely due to being a pattern discovered in the data, it cannot result in a VP for the market. In other words, this pattern cannot turn into a VP by default. It seems there is a risk in this activity of creating and relying on false patterns. As explained in CC10 by respondent 5, a false pattern is not an outcome of wrong data analysis. Instead, it is a potential risk of making a misleading decision for VP that will not contribute to any competitive advantage. This risk has been scarcely investigated and discussed in the literature of BMs, particularly DDBMs (Grover et al., 2018), which is addressed in the last activity of the testing sub-phase. Respondent 5 also in CC2 alluded to the possible reason for the aforementioned risk, which is the immaturity of the market, implying that the market does not have the willingness to appreciate the offered VP. Thus, one of the strategic decisions companies can consider is finding the best time to introduce their VP resulting in progress in their market entry strategy. Perhaps this point of view of respondent 5 can be different from what respondent 1 stated in CC10 that implies companies after the receiving the feedback from the customers should implement their innovation ideas to the market. Considering both points of view, it is clear that companies' decisions for market entry should be adjusted in different situations, which again shows the importance of timing decisions for market entry.

Evaluation

This is the last sub-phase of the development process, leading to making different iterations in this process. The majority of the respondent (7 out of 9) have various statements regarding this sub-phase that eventually enable us to show the dynamics of the development process. It means that the DDBM development process is not a linear process whose activities necessarily should be performed one time to reach the final activity. Instead, it is a process therein iterations create a circular movement between activities in the hope of continuous improvement.

CC1 and CC5 create an iteration that connects the evaluation sub-phase to the safety check, implying that sometimes after evaluation of any result in the market test, the customers' consent needs to be revised by the companies to make sure that any changes in the VP are in the legal and ethical framework.

CC2 and CC6 enable this process to have an iteration between evaluation and data collection activity (activity 7) in the sub-phase of testing because reshaping here means companies might encounter a situation where they should check whether the customers' requirements are satisfied. Therefore, this assessment can be performed in this iteration that contributes to the optimization of the VP.

CC6, CC8, CC9, and CC10 describe different iterations which connect the evaluation activity to idea generation pool or idea designing. Iteration with idea pool generation occurs when a new idea generates during the market test. This data can be investigated by the companies, which can finally shape a new VP. Iteration with idea designing refers to the feedback acquired from market tests

resulting in changing the stakeholders' combinations. In this circumstance, companies need to decide whether to continue or cease their collaboration with their stakeholders for undertaking the development process.

Furthermore, the decision on the value capture or any other related tasks about revenue streams can be made in the evaluation sub-phase where companies experiment with their market test, and with the help of discovered pattern, they can monetize on their VP. This point deserves to be declared that even after the value capture, all the other iterations are ongoing, and monetizing does not imply that the DDBM development process reaches the last activity as stated earlier, in this type of development process, no final activity to end this process can be imagined.

Finally, two strategy viewpoints can be applied in this sub-phase. The first one is about the data, which can be influential on the strategy of the companies as the strategy cannot be fixed. Mainly since market entry strategy is one type of strategy in this thesis, the data, which is the outcome of the market test, can play a role as feedback to the strategic layer, thereby benefiting the companies in deciding on their market strategy. The second one defines the decision about the failures of the VP after the market test. Companies should determine what criteria to consider a market test as a failure and how many times they need to repeat the iterations to obtain the expected success. Here, the definition of success can be different depending on the companies' aim in repeating the iterations. For example, success can be defined as reaching a specific revenue, the number of customers, new idea generation, and so forth.

Table 13

Phase 2 of the DDBM development process

Category consensus	Phase 2					
	Safety check		Testing			Evaluation
	*	6	7	8	9	10
CC1	MVP	Ethical and regulatory consideration	Testing with collected data			VP re-evaluation based on ethical and regulatory consideration (phase2)
CC2	VP	user acceptance agreement		Testing and data analysis to find patterns	validify/falsify with the market	VP evaluation based on customer requirement
CC5		Ethical and regulatory consideration	test with collected data			Learning and improvement of VP by Iteration with safety check (phase 2)
CC6			Data collection	Finding patterns as an opportunity		Iteration with phase 2, testing Phase 1, Idea pool generation Phase1, idea designing and deciding on monetization
CC8					Market test	Iteration with idea pool generation (phase 1) and ideation (phase 1)
CC9	VP		test with the market		Market test	
CC10	MVP		data collection	pattern based on the market and customer data	Pattern validation	Iteration with phase 1, idea pool generation Phase 1, idea designing Continue
Value capture						Deciding on revenue model
Strategy					Market entry timing (CC2, R5; CC10, R1)	Strategy revision data (CC8, R 1&3) Failure strategy (CC10, R2)
Risk assessment		Transparency and ethical (Slowing down the process) (CC5, R1; CC10, R 2)	Cybersecurity (CC9, R7, R 2)	Right type of data (CC9, R7) Volume of the data (CC10, R2)	Risk of false pattern due to market maturity (CC10 and CC2, R5)	

4.3 Final process

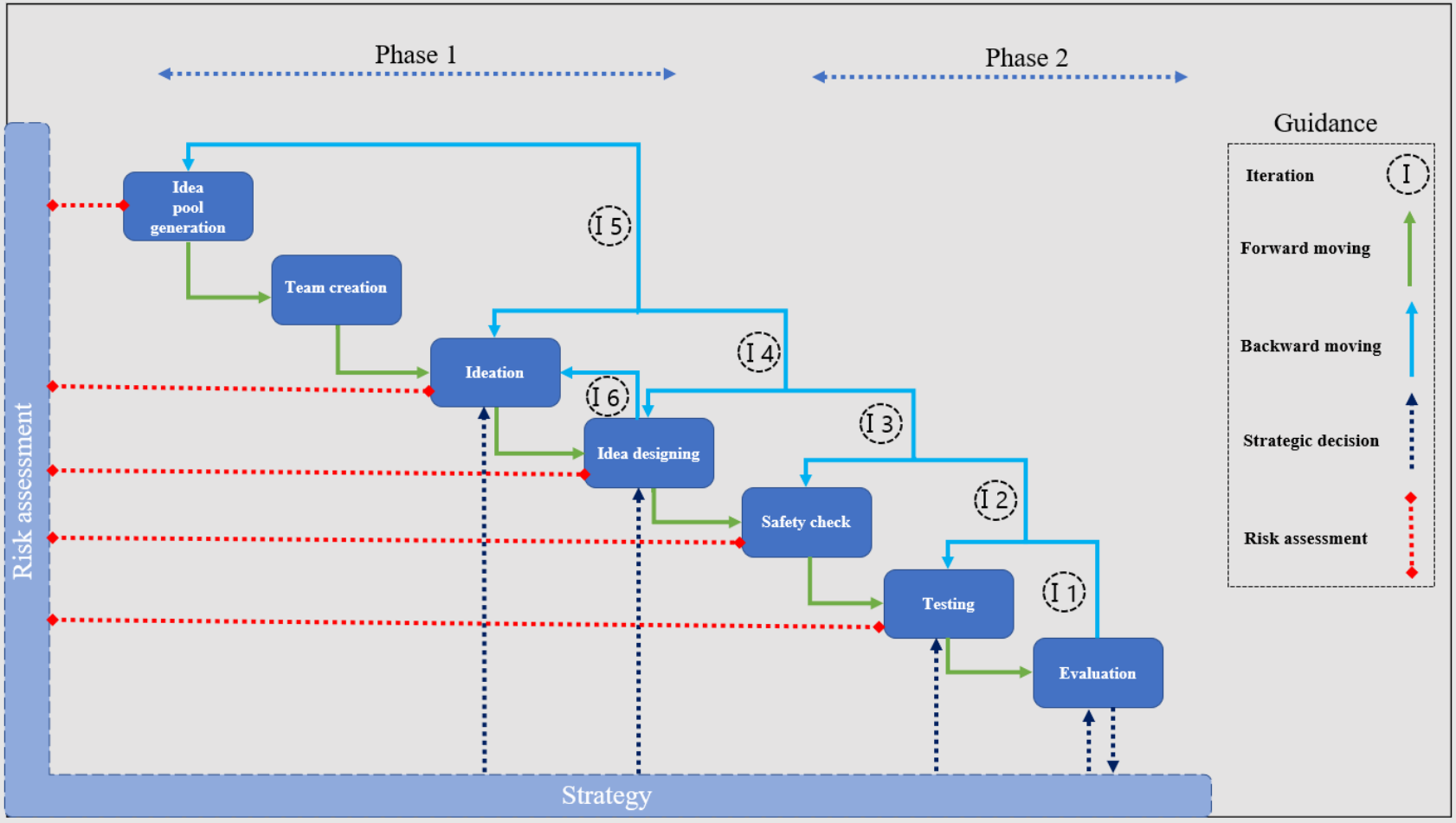
The final DDBM development process is illustrated in figure 20. This figure can simplify the explanation provided section 4.2 (process designing), including two main phases identified, each of which has different sub-phases, and some of the sub-phases have different activities, as shown in figure 20. Idea pool generation, team creation, ideation, and idea design comprise phase 1. Safety check, testing, and evaluation comprise phase 2.

Moreover, figure 20 shows how iterations are part of the DDBM development process as there is one potential iteration between the ideation sub-phase and the idea designing sub-phase. Furthermore, once reaching the evaluation sub-phase, it brings five possibilities to iterate back to previous sub-phases. Two additional layers of this process are risk assessment and strategy. Risk assessment might affect five sub-phases: idea pool generation, ideation, idea design, safety check, and testing. The strategy can be included in three sub-phases as ideation, idea design, and evaluation. The information as an outcome of the analysis in this process can transfer to strategy decisions, and consequently, this information can be new insights to influence other sub-phases. It should be declared that illustrating the risk assessment and strategy layers on vertical and horizontal axel respectively do not imply any scale or priority to the risk and the strategy.

Arrows in figure 20 can illustrate the mechanism of operation of this process. The green arrows show the forward movement from the initial sub-phases to the final sub-phases. The blue arrows show the backward movement when it comes to the iterations. The impact of the risk assessment in this process is visualized by the red dotted lines. The strategic points of this process where the strategic decision should be made are depicted in blue doted lines.

Figure 20

Data-driven business model development process



Note. This figure illustrates the phases, sub-phases, strategy and risk layer, and the iterations of the DDBM development process

5

Discussion

In this chapter we discuss the existing literature on BMI and DDBM together with the findings of this study to answer the research questions *What are the phases, and activities in DDBM development process and what characterizes this process?* The discussion consists of two main sections. The first section (5.1) focuses on the phases and activities in a DDBM development process, whereas the second section (5.2) focuses on the characteristics of this process.

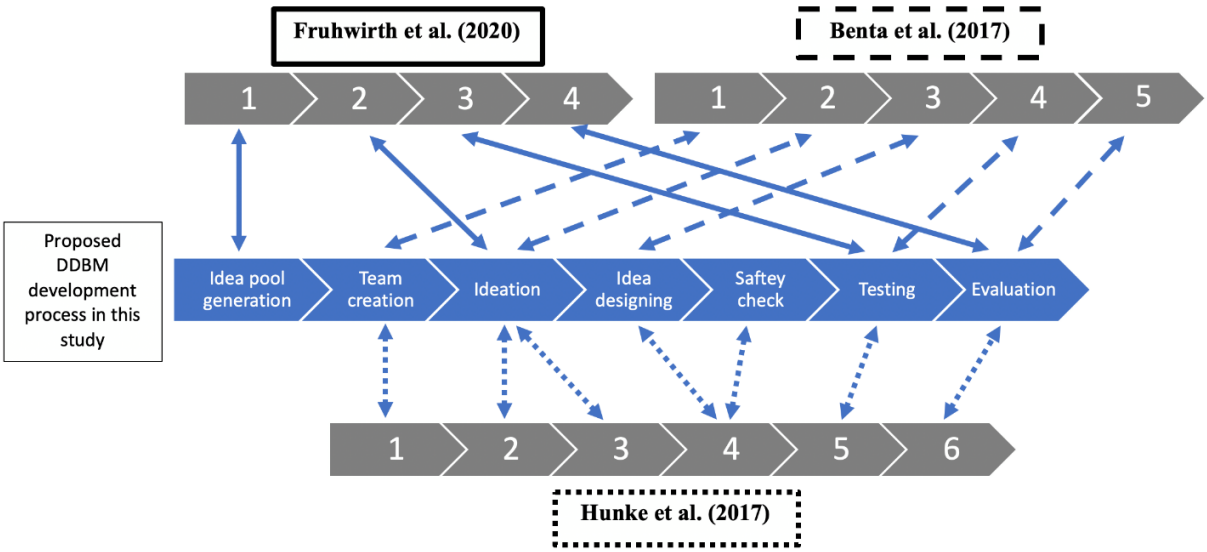
5.1 Phases and activities in a DDBM development process

The existing literature in the field of BMs has advocated the importance of BMI in order to create new and change current businesses (Teece, 2010; Lambert & Davidson, 2013; Frankenberg et al., 2013; Osterwalder & Pigneur, 2010; Chesbrough, 2010). From the perspective of BMI as a process of developing a BM, different authors have provided ideas of how firms should do, considering different phases and activities to conduct as they seek to take an idea to become an operating BM (Gibson & Jetter, 2014; Frankenberg et al., 2013; Sosna et al., 2010; Osterwalder & Pigneur, 2010). However, in the context of DDBMs, the literature is scarce in terms of proposed phases and activities (Fruhwirth et al., 2018). This study has acknowledged three previous contributions in this context of the DDBM development process, considering the contribution of phases and activities (Hunk et al., 2017; Benta et al., 2017; Fruhwirth et al., 2020). Comparing the results from this research with existing literature, we propose the DDBM development process to include two broader phases which consist of 7 sub-phases and inherent activities. It is possible at first glance to acknowledge certain similarities but still differences in comparison to existing literature (see figure 21). In terms of the number of phases, our result is higher. However, we argue that the

number of phases is unimportant as we consider the underlying activities inherent in those phases as the essential part. In the following the discussion and reflection of the DDBM development process from the perspective of phases and activities with existing literature is illustrated in figure 21.

Figure 21

DDBM development process comparison



Note. This illustrates the connection among phases in a DDBM development process by comparing this study's results with existing literature.

5.1.1 Sub-phase 1: Idea pool generation

Beginning to compare our first phase idea identification pool with the existing literature (Hunke et al., 2017; Benta et al., 2017; Fruhwirth et al.,2020), it is demonstrated how our results are in line with the proposed first phase by Fruhwirth (2020), while the contribution from Hunk et al (2017) and Benta et al. (2017) do not consider this phase. According to Fruhwirth (2020) the DDBM development process begins with analyzing the current situation and identify the potential data source. Similarly, our result indicates how the development process begins with identifying an idea that could originate from either market analysis, business goal, or as data inputs from the last evaluation phase if an existing DDBM already exists (see 4.1.7 phase 7 evaluation).

5.1.2 Sub-phase 2: Team creation

Going further, our second phase of team creation has agreement from both Hunke et al. (2017) and Benta et al. (2017). Once an idea is identified, our results indicate the following activity of team creation, dedicated to proceeding with the idea. This result in terms of activity is shared by existing literature (Hunke et al., 2017; Benta et al., 2017). However, our result stands out in terms of

advocating the team to have a cross-functional dynamic. Furthermore, compared to our results of placing this activity as a second phase, it is explained as being the first phase by Hunke et al. (2017) and Benta et al (2017). Also, it is notable how this activity is neglected in the contribution from Fruhwirth et al. (2020).

5.1.3 Sub-phase 3: Ideation

The third phase, proposed in our results referring to the ideation phase, arguably includes similar activates as those proposed from existing literature. Our result advocates how this phase would include a workshop consisting of exploring versions of VPs and decide for whom they can be valuable. As described by Benta et al. (2017) in their third phase would include brainstorming to find solutions. Also, this is in line with the second phase in Fruhwirth et al (2020), the third phase in Hunke et al (2017), describing the activities of generating different concepts of DDBMs. Arguably concepts of DDBMs can be considered as potential VPs. Further, our results argue that this phase would include the activity of evaluating those VPs based on internal capabilities as to how data is sourced and created. Again, in line with what is proposed in the second and third phase of Hunke et al (2017), which consist of analyzing the existing BM in terms of review available sources of data, its quality, and customer's needs. However, we argue this can be conducted with an imaginary BM based on the identified VP in situations where no already established BM exists.

Additionally, it is important to assess the technological feasibility of the VP and, based on internal capabilities, assess the inter-organizational systems of potentially need to include external actors. This activity is similarly explained by (Benta et al., 2017) in their second phase as it promotes the perspective on the environment the existing company work in, including analyzing the market, customers, and trends. Also, Hunke et al. (2017) explain in their third phase, the activity to evaluate the ecosystem based on any concepts of DDBMs to foresee if any tasks should or could come to be outsourced.

5.1.4 Sub-phase 4: Idea designing

In our results, the fourth phase is Idea designing which aims to design the VP into something tangible. This VP could refer to an MVP and would be tested in the market. Based on our results, this phase would include new stakeholders (internal and external) to evaluate and validify the idea of a VP. In line with this direction, Benta et al. (2017), in their third phase, advocate creating prototypes with expert's help and then choose the most promising prototype to continue with.

However, based on the discussion in our phase three ideation and four idea designing, two reflections can be made by comparing our results with the existing literature. Firstly, our results are alone in the advocation of separating these two phases. Hence, first having one phase, ideation, exclusive for internal stakeholder and how the external stakeholders are first involved in this phase of idea designing. Though, Benta et al. (2017) argue for the inclusion of experts in this phase which arguably can include external stakeholders. Otherwise, in comparison, it is arguable that Hunke et al. (2017) and Fruhwirth et al. (2020) illustrate these two separated phases as one in their contributions. Still, as argued before, we consider the activities to proceed the specific number of

phases. Thus, we can still see the similarities of the sequence of activities to be conducted, explained in the above paragraphs.

5.1.5 Sub-phase 5: Safety Check

Our results provide the fifth stage Safety check to consider the explicit evaluation of the VP in terms of conventional and regulations. We argue that the regulatory implications in developing a DDBM are to the degree that this should be highlighted. This phase also includes the ethical and transparency consideration as those aspects, based on our results, indicate as essential in the development processes of a DDBM. We discuss that our proposed development process is the only process that contains a separate sub-phase for regulatory and ethical consideration before testing. However, other scholars (i.e., Hunke et al., 2017; Benta et al., 2017) tried to indicate the same consideration incorporated in their activities but not as a stand-alone phase as we did.

5.1.6 Sub-phase 6: Testing

Our proposed sixth step refers to testing, an exciting phase, once comparing to existing literature. Hence, our results describe this phase to include the procedure where the VP is tested in the market. By collecting data enable the VP to be validified or not. However, the fascinating point with our result is that this phase indicates different views on the testing phases compared to normal BMI processes for non-data-driven business models (see 2.3, BMI) where testing is previous to the implementation phase. Instead, our results promote the testing itself to represent the implementation of the DDBM. This phase is an iterative procedure that is repeated as the VP through iteration becomes mature for the market.

Given this, our testing phase includes similarities once compared with Benta et al. (2017), their fourth phase, as they express how the prototype in this phase is put into practice and how it can include different tasks depended on key elements of the BM. Arguably, it could indicate the iterative aspects as we argue the DDBM after each iteration could possess new aspects to be tested again to improve it.

Furthermore, comparing our view of a testing sub-phase with an implementation phase, it can be compared to Hunke et al. (2017), which chooses to divide their fourth and fifth phase based on testing and operationalizing. However, they consist of similar activities as we propose in this testing phase. As explained by Hunke et al. (2017) in their fourth phase, does this phase includes going further with the chosen DDBM concept and start prototyping, testing, and refining. Moreover, they also advocate the risk evaluation of regulatory aspects (Hunke et al., 2017). Our results advocate this regulatory risk to be assessed explicitly before testing in the market, i.e., phase 5 safety check. Then according to Hunke et al. (2017), their next phase would include a focus on operationalizing the DDBM in the market.

In comparison to our result, this is done within the same procedure as the testing is conducted. A similar observation in terms of a divided perspective of testing and implementation can be noticed from the contribution of Fruhwirth et al. (2020). Their third phase includes testing the prototyped DDBM and evaluate the risk towards it. Their fourth phase, implementation, would be

operationalizing the DDBM (Fruhwirth et al., 2020). In terms of activities, we argue that existing literature provides similar explanations as our results have shown, even though we acknowledge this phase to be more iteratively conduction rather than a liner.

5.1.7 Sub-phase 7: Evaluating

Our results provide a seventh phase as evaluating, referring to the activity of evaluating the outcomes from the testing phase in terms of new potential VP, the need to collect more data, or potentially change something with the current VP. In essence, the evaluation will result in different feedback loops to the development process. It means that the DDBM development process cannot be imagined as a linear process whose activities necessarily should be performed one time to reach the final activity. Instead, it is a process therein iterations create a circular movement between activities in the hope of continuous improvement. Sharing our view, Benta et al. (2017) explain their last phase to include the activity of constantly reviewing the operating DDBM to improve it. This means redesigning it and sometimes go back to previous phases and start over (Benta et al., 2017). Similarly, Hunke et al. (2017) express in their last phase containing the activities of assessing the operating DDBM in terms of new ecosystem impacts. However, they also express the activity of documentation of the conducted development process to assess its positives and negatives (Hunke et al., 2017). Hence, an activity which we have not found in our result.

5.2 Characteristics of the DDBM development process

In this part, we discuss what characterizes our development process with the existing literature. We found the necessity of this discussion to explain our DDBM development process from another perspective. The core topics discussed comprise value co-creation, iterative experiment, ethical and regulatory risk assessment, and strategy.

The reason for having this discussion is to illustrate that our proposed development process is not formed by only a set of sequences organized together, but as a holistic picture, it shows the potential characteristics which are inherently formed our development process and, to some degree, explained in our chapter 4 (analysis). Therefore, the sequences merely cannot be representatives of our process; rather, there is a need to comprehend the characteristics through which this process can be elaborated. Noticing the fact that this part is not aiming to add another level of analysis to our primary data implies that discussing the characteristics of this process aims to visualize a deeper layer of our findings articulated in the chapter 4 (analysis). However, this part can help to deepen the comprehension of the findings by making a discussion.

5.2.1 Value co-creation

As explained in the literature (2.2.1.2, value proposition and capturing), one of the VPs that can be considered for DDBMs is the inclination of these BMs to provide services known as servitization (Coreynen et al., 2016) which implies they most likely follow a service-dominant logic (Payne et al., 2008). We claim that value co-creation is one of the characteristics of our process, which respondents continuously in different categories explained explicitly and

implicitly. Despite one of the categories selected for the creation of the development in this research was value creation, and even we differentiated it from VP and value capture, our result showed that value creation solely could not be meaningful when data analytics make up a considerable portion of business activities and data is a key resource (Schüritz et al., 2017). Since the value in such BMs should be created in mutual collaboration with stakeholders, including customers and partners (Schüritz et al., 2017) as Vargo et al. (2008, p. 146) stated the condition of value co-creation possibility by "jointly and reciprocally, in interactions among providers and beneficiaries." It is debatably interpreted that value co-creation is a need for DDBMs if assuming the logic of developing such BMs is to deliver the desirable services for the customers in a sense that they can satisfy the customers' expectations (Coreynen et al. 2017).

By a detailed look at our proposed development process, the first footprints of value co-creation can be seen in the ideation and idea designing (Phase 1) when internal and external stakeholders discuss their mutual benefit. In the testing (Phase 2), the value co-creation can be vividly observable when companies endeavor to find the pattern in the customers' data. It means, in the end, the value is the result of what customers have shown by their behaviors. Moreover, since in the evaluation sub-phase, the results of the data analysis are, in fact, feedback that needs to be discussed with business partners,

the mutual benefit of all stakeholders involved in DDBMs is taken into consideration that augments this fact that value co-creation is what characterizes the DDBM development process. Similarly, Kowalkowski et al. (2015) explained the importance of the ideas originating from the customers and integrated collaboration between business partners to provide services for the benefit of all parties.

Given this, we identified value co-creation as one of the inherent characteristics of our process that can be confirmed by our analysis of interview data and the literature of DDBMs.

5.2.2 Iterative experiment

Another characteristic of the proposed DDBM development process is iterative experiment. As shown in this process (see figure 20), phase 2 can be the starting point of experiments. In fact, testing is a possible way of experimenting with the potential VP. This test can be performed on a small scale which has applicability at the beginning of the process; thereby, the initial VP has the possibility of being tested by the customers. As a result, the companies have the opportunity to analyze the received feedback and endeavor in the direction of improving their VP (Teece, 2010; Chesbrough & Rosenbloom, 2002; McGrath 2010; Chesbrough, 2010), generation of novel ideas (McGrath, 2010), pivoting the VP by changing some elements of the BM and revising the VP experiment (Blank, 2013, Eisenmann et al., 2015) and so forth. The approach of experimenting, particularly in BMIs, is confirmed by many scholars who explained how the experiment could lead to new opportunities and, as a result, survival of BMs (Teece, 210; Lysek et al., 2016). Baldassare et al., 2017, discuss the importance and influence of the experiment when designing a VP which aims at concurrent value creation for a vast range of stakeholders, including customers,

shareholders, partners, society, and environment- as they called it a sustainable BM. They indicated how a user-driven approach to iterative experiments could satisfy the users' needs and simultaneously develop profitable opportunities.

Similarly, in our development process, firstly, as explained in the previous part (co-creation), companies should consider an extensive range of stakeholders over this process. Particularly in phase 1, the iteration of stakeholder selection can be the evidence that constructive collaboration is of significant importance in the DDBM development process, which should not be underestimated. As a result, an experiment approach seems to be helpful since it allows companies to have the autonomy to decide on continuing or ceasing the collaboration with business partners according to the evolvement of their VP. Secondly, a user-driven view is what DDBMs should consider since a significant part of their effort in designing the VP is discovering new ways to co-create the value for all stakeholders. In this regard, some nuances need to be clarified. First, the DDBM development process experiments should involve a major part of stakeholders (i.e., shareholders, customers, users) (Pera, Occhiocupo, Clarke, 2016). Second, users are not necessarily the customers of the DDBMs, implying that although the experiments in the format of iterations can target collecting the user's data, it does not mean that users are the only group of stakeholders benefit value. This is why stakeholders' involvement and consequently finding the optimal value, which is satisfactory for all stakeholders, become significantly challenging (Parmar et al., 2010). Therefore, iterations are not only a way of experiment with the VP but also a loop to optimize the value on which stakeholders can agree.

Given this, our proposed development process is facilitated by six iterations, 5 of which include iteration 1,2,3, 4, and 6, covering the experiments that DDBM companies need to optimize various types of stakeholders. In particular, iteration 1 can show how users and customers are involved in creating the value when respective data is collected and analyzed by the companies.

Iteration 2 allows experimenting by considering the ethics in the DDBM development process. Lastly, Iteration 4 and 6 depicting the engagement of any external and internal stakeholders that can potentially influence the business. Therefore, one of the characteristics of our development process can be iterative experiments that fitted in different sub-phases of our process. Another characteristic of the proposed DDBM development process is an experiment. As shown in this process (see figure 20), phase 2 can be the starting point of experiments. In fact, testing is a possible way of experimenting with the potential VP. This test can be performed on a small scale which has applicability at the beginning of the process; thereby, the initial VP has the possibility of being tested by the customers. As a result, the companies have the opportunity to analyze the received feedback and endeavor in the direction of improving their VP (Teece, 2010; Chesbrough & Rosenbloom, 2002; McGrath 2010; Chesbrough, 2010), generation of novel ideas (McGrath, 2010), pivoting the VP by changing some elements of the BM and revising the VP experiment (Blank, 2013, Eisenmann et al., 2015) and so forth. The approach of experimenting, particularly in BMIs, is confirmed by many scholars who explained how the experiment could lead to new opportunities and, as a result, survival of BMs (Teece, 210; Lysek et al., 2016). Baldassare et al.,

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5.2.3 Ethical and regulatory risk

Considering that this research has not been aiming to identify the risks in the DDBM development process, we disclaim those risks of such a process beyond the scope of this research. However, one of the risks, which has been on the focus of the respondents and literature, is ethical and regulatory risk. Therefore, we explain how ethical risk seems prominent in our DDBM development process to be addressed in the following.

Our result showed that the sub-phases of the development process should be placed in a way that enables companies to include ethics and regulations. The importance of ethical issues in DDBMs,

which is illustrated in section 2.2.1.4 (ethics), can confirm the fact that in the process of DDBM development, companies might deal with different types of ethical implications that challenge the companies when utilizing the data analytics techniques (Breidbach and Maglio, 2020). According to Günther et al. (2017), the ethical issues in DDBMs cannot be limited to the customers but embody other stakeholders. One of the possible issues in stakeholder engagement is the interest conflict on sharing, combining, and, consequently, valuing the data sources.

In our process, there is a possibility to check the ethics and regulation in both phase 1 and phase 2. idea designing is the first sub-phase that enables companies to assess the risk of ethical alignment among stakeholders. It can help companies address the issues that might happen when a new stakeholder is engaged in each iteration.

Iterations 3, 4, and 6 applied in the sub-phases of idea design and ideation, respectively, can provide the possibility of assessing this risk (see figure 20). Therefore, the issue of stakeholder conflict can be addressed in the initial iterations of the development process.

In phase 2, the sub-phase of safety check is another point that the VP's ethical and regulatory aspects can be discussed between the involved stakeholders. One of the benefits of the utilization of data analytics techniques in DDBMs is increasing the level of innovativeness in VPs (Maglio and Breidbach, 2014). One innovativeness in value offerings can be the personalization of the VP due to analyzing the customer/consumer data (Weekes et al., 2015; Rust and Huang, 2014, Lindgren, 2020). But if there is no boundary to do so, it can lead to hyper-personalization, which Rust and Huang (2014) refer to as "market-segment of one". As a result, customers might feel that they do not have enough freedom to behave since businesses scrutinize them (Breidbach and Maglio, 2020). Therefore, the security check sub-phase is one of the helpful steps for the businesses to address this issue, specifically when after every iteration except iteration 1, they should pass the security check sub-phase to be able to start testing their VP.

5.2.4 Adaptable strategy

In our proposed process, different strategic points were explained in section 4.2 (process designing), but in this section, we will explain the strategy's adaptability which can be reflected particularly in the revenue model in DDBM development process. By doing so, we argue that adaptable strategy is one of the characteristics of the DDBM development process.

Firstly, as Osterwalder (2004) explained, the BM acts as a transferrer of strategic decisions into operational practices. However, we argue our results illustrate not only the connection between strategy and BM but also it is illustrated in the level of phases and activities how the relationship between strategy and BM interacts during the development process of a DDBM.

Secondly, our result indicates how the development process is initially guided by strategy. However, when the VP is placed in the market and tested and starts to generate data, a change is identifiable as the collected data begins to function as a driving mechanism of the strategy (see figure 20). Concerning this phenomenon witnessed in the evaluation sub-phase, we could identify how especially value capture (revenue model) was connected to this. Following the description of

Shafer (2005), the strategic choices and their implications are reflected in BM, which includes the value capturing as a revenue model. Specifically, our results indicated how strategic decisions regarding revenue models are revised or adapted as the DDBM is operating and collecting data. In this way, the BM facilitates strategic decisions about revenue streams, as explained by (Osterwalder, 2004; Lihua Liu, 2019; McGrath, 2010).

Given this, our results indicated how the DDBM, in its early development, adopts a freemium revenue model for strategic reasons. From one perspective, the revenue model is designed and affected by the collection of data. Hence, the customer base must reach a significant size, as this is the source for generating data, previous any evaluation of implementing revenue model for monetization. It implies that the initial adoption of the freemium model is due to facilitate the growth of users as fast as possible. From another perspective, in connection with the previously explained logic, the revenue in DDBM is not necessarily received from the end-user; rather, it can come from third-party actors within the ecosystems as it grows (Schuritz et al., 2017; Brownlow et al., 2015). Thus, our results illustrated that as the DDBM matures, with an increased user base providing data, the freemium revenue model can change as data brings feedback to the strategic layer (see figure 20 testing and evaluation sub-phase). This can include changing the current revenue model for the existing end-users. However, as described above, revenue models in DDBMs vary considerably between different actors in the ecosystem, which indicates how DDBMs can source data from one segment of a user while monetizing from other actors referring to a multi-sided revenue model (2.2.1.3, revenue stream). Hence, the strategic decision could include keeping the freemium model for the end-user, i.e., the data provider, while a new VP and revenue model is adopted and connected to a new actor within the ecosystem.

6

CONCLUSION

The purpose of this study was to explore how a DDBM development process looks like. The research question that guided this thesis was *what are the phases and activities of a DDBM development process, and what characterizes this process?*

The conclusions of this study are two folded. First, this study can conclude that the DDBM development process is structured with two broader phases as low data-related and high data-related activities, inheriting seven sub-phases consisting of different activities (see figure 20). In addition to phases, sub-phases and activities, this study also illustrates how strategic and risk assessment comprised as external layers have a significant impact and connection to the different sub-phases of the development process. Second, this study identified four underlying characteristics of the DDBM development process comprising of value co-creation, iterative experiment, ethical and regulatory risk, and adaptable strategy. Being characterized with value co-creation, the DDBM development process is compatible with stakeholder involvement under flexible condition where the stakeholders can be replaced over time. As well, the significant role of users as value co-creator changes the value logic as compared to traditional BMs. Furthermore, the iterative experimentation characteristic of the DDBM development shows how it unfolds and how it operates continuously once it becomes mature. Additionally, we concluded how strategy follows a traditional connection to BM in the initial phases. However, once testing begins, the DDBM strategy becomes continuously revised and improved by the inflow of collected data. Moreover, two risks as ethical and regulatory, as well as stakeholder engagement seemed to be significant in the process of DDBM development that addressing of which necessitated us to consider risk assessment as one of the characteristics of this process.

6.1 Implications and contributions

This study brings to life both theoretical as well as practical implications and contributions. From a theoretical perspective, this study enriches the existing literature of BMI in general and DDBM innovation in particular. More concretely, this study contributes to the process perspective of DDBM development, which is overall scarcely researched (Brownlow et al., 2015; Engelbrecht et al., 2016; Schüritz et al.,2017; Fruhwirth et al., 2018). Understanding the phases, sub-phases, and activities of a DDBM process is essential, given the increasing digitalization within industries that generates a growing volume of data which turns into a key resource with potential for firms to capitalize on it. From a BMI perspective, this brings another level of complexity to the business development process (Schüritz et al., 2017). This study helps to unpack this complexity and provides a concrete visual process model, an artefact, that shows the anatomy of the process model.

Additionally, this study resonates with Laasch (2019) and the value logics manifestations through the states of cognitions, artefacts, and activities. Specifically, this study puts focus on two of those elements: (i) a visual process model, an artefact; and (ii) the activities that are carried out through the process. While the third state, cognition, is not explicitly explored in this study, the way the process is visualized and the sub-phases that it includes, will have implications for the cognition or how managers think and organize the DDBM development process. Furthermore, this study also confirms the dynamic of the BMI and the way of seeing it as an incremental, continuous process, rather than an exceptional event (Laasch, 2019).

From a practical perspective, this study provides managers with a process that would allow them to create a competitive advantage from data and capitalize on it via BMI. The process, suggested in this study, can also enable companies to become more data-driven by following a BM development process specifically designed to capture the complexities associated with data and DDBM. More specifically, managers should ensure value co-creation is considered by including internal and external stakeholders in the process. However, doing so under efficient terms where different stakeholders can be involved during different phases of the development process. Moreover, it is important that managers take specific care about ethical and regulatory considerations during any activity connected to user data. Furthermore, managers shall let strategy guide decisions in the development process, but once data collecting begins, it can be of value to utilize it for improving the strategy and not only the VP per se. Finally, managers shall not underestimate the role of using a visual process model, as a boundary object that can facilitate discussion and collaboration between different internal and external stakeholders throughout the different phases, sub-phases, and activities of the DDBM development process.

6.2 Future research

While this study provides interesting insights about BMI in light of the increasing digitalization and how companies can monetize data through BMI, specifically in the context of mobility, further work is needed to explain the anatomy and structure of the DDBM development process. More specifically, the DDBM development process model suggested in this study shall be tested

empirically in different contexts to uncover if it captures various complexities of data and increases its generalizability. Related to that the existence of different classifications for DDBMs (i.e., Hartman et al., 2016, Hilbig et al., 2020) makes it hard to investigate process aspects on a fine-grain level. Thus, in this study, we have considered DDBM on a general level and have not specified the type of DDBM for which we scrutinized the development process. Therefore, more research is needed to differentiate between different types of BMs and consequently customize the development process for each type. Future research can also further explore the value co-creation in developing DDBM. Continuing in this direction, it would be interesting to consider connecting the field of open innovation to the field of DDBM and, specifically, its role in the DDBMs development process. Another promising avenue for future research would be to go beyond the focus on merely improving the VP in order to maximize the data monetization and instead focus on the interplay and role that data has on sustainability. In other words, how to utilize the capacity of data analytics techniques to contribute to sustainability.

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Appendix A

Interview questions for each category

Interview Questions	
Background Questions	
1. Name of the company:	
2. Current position in organization:	
3. Length of service in organization:	
4. What is your understanding of DDBM?	
Specific Questions	
Category:	**Introduction question:** *In development of a data-driven BM,* ***when / why / how*** *do you consider…*
(1) Conventional and regulations	• legal and regulatory aspect to be assessed during this process? • data privacy or ethical to be assessed during this process?
(2) Industry and market	• market analysis (opportunities, competition, technological trends, strength/weaknesses internal) aspect to be assessed during this process?
(3) Inter - organizational system	• stakeholders (network, cooperation, outsourcing, access/ownership to data) aspect to be assessed during this process?
(4) Intra - organization system	• internal preparation for the future business model (current capabilities, evaluation of existing BM, employees & management training) to be assessed during this process?
(5) BMI- value proposition	• customer assessment in the value proposition (needs and wishes, targeting customer, privacy concerns with customers, transparency) to be assessed during this process?

(Continue)

Appendix A

Interview questions for each category

Category:	**Introduction question:** *In development of a data-driven BM,* ***when / why / how*** *do you consider…*
(6) BMI – value creation	• data as a resource you need for the value creation process? • types of activates (collection, preprocessing, storage, analysis, etc.) you need in value creation process? • Infrastructure you need in value creation process? • cost structure to be assessed during value creation process?
(7) BMI - value capture	• value capturing (customer segment, channels, revenue models, break-even point, asses technological feasibility) to be assessed during this process?
(8) Strategy	• implementation strategy (market entry, and protect from competitors copying/imitating) to be assessed during this process?
(9) Risk assessment	• risk assessment (any related risks with the new DDBM) to be assessed during this process?
(10) Innovation process	• the innovation process design (Structure & systematic, flexible, iterative, experimental & learning, testing, prototyping, ideation, integration of stakeholder/customer) to be assessed during this process?

Appendix B

Table of extracted sequence and category consensus

Respondent (R)	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10
R 1	C1 →implementation	"C2→ actual development an idea→ first version of application based on the market interest→User acceptance→ test→getting feedback→ evaluation→ reshape based on customer requirement "	C3 →Implementation		"idea" →Customer feedback → solution →Customer feedback → actual development data →BM design/development C1 (C9, risk evaluation of the data is consent needed otherwise it just slows down process) → using a new application			C8 →VP Datta collection→ C8	C1→data collection←> C9(sensitivity of data)	VP before "market analysis" C5 → C2
R 2	C1→Coding C4 →fundamental thing to consider for development		C3 →"Tangible" VP → C3 (how does it work in my ecosystem)	C4 → fundamental thing to consider for development	C4 →fundamental thing to consider development	Have data (Data collection →Opportunity) have no data: (Ideation of business ideas to understand what data is needed and how to collect it? →produce/collect data).	C3 → C7 VP → C7	C8 →C7 (segment) →VP Datta collection → C8	(<C9>) C9 → can customer provide data C9 →privacy & security (cybersecurity) Proof of concept → hypothesis → VP (idea of value) → test (with users/stakeholders/market)→ improved VP	"C5→C2 After each iteration all c but specifically C5 should be revised. C9→C1+C4 + (transparency) → test (C4 means that they have to have their own fleet) idea→MVP→VP"
R 3	MVP →C1	Small scale C2 (survey, interviews, desktop research) →Possible VP →Workshop (internal stakeholder) → VP → build BM	Busines goals (Very abstract VP idea) → C3 (internal/external stakeholders) → Workshop procedure (many ideas→ vote which to choose)→ Prototype	New idea →Define a team → "Workshop" (Internal/ product owner) → Define "idea" → Continuously C3+C4+C1 (based on relevance include others + kick out after they are done) C4→ C3	C9→ C1→data related activities idea (which is not VP)→C9→ C4→C3→ Test (continue/pivot)	"VP" →Test (collect more data)→VP + C7 Idea development→rely on stakeholder or maybe this is not a proper case to continue	(C9 → C7 tech feasibility) C4→workshop→VP (In the workshop they are discussing the C7 as revenue)	C8 → C4 (internal cross-functional work) "Co-creation" Idea → C4 (include relevant stakeholders to test idea) Workshop → "new" idea → C3 (include relevant stakeholders to test idea) → workshop →"new" idea	1. C9 → Beginning (not defined) → C9 → Scaling up 2. Idea (quite developed) → C4 (include/benchmark with stakeholders) → Product owners/managers (C9 → gatekeeper, provide budget and timeframe) → Pivot/continue.	Defining team →including stakeholders (he describe it as framework) Idea → multiple VPs (Based on each potential stakeholder)→ C4 feedback→ choose VP to continue with After iteration (prototype/test) → getting feedback about market & customer →changing the VP. Iteration →new ideas → potential to implement new OR existing projects
R 4				C4 → fundamental thing to consider development	Data collection → Test new BM/VP → Connect new data collection → Learn	customer segment identification (C7) → Customer passement → VP →(C8 "Freemium") → C7 (revenue)			C8 <--> C9 C9 → C3 (open or closed data shared network)	
R 5	Test→ C1→ VP	Data analysis → Pattern → C2 (validify/falsify) + C9 (market analysis can be incorrect e.g. market is not mature thus VP is actually good) → Launch	Idea (fairly developed)→ C4 (assess internal capabilities etc. based on idea)→ C3 (include potential needed stakeholders) →alter and evaluation of the VP→ implementation	(>4<)	"just an idea" → C1 (customer agree to share data) → Collect data → Design/create VP	either: having/collecting the data→ finding the patterns→ value proposition or: market analysis→ VP C8 → C3 (choosing stakeholder strictly along the process and have an agreement on data accessibility from the beginning)	data collection → C7	C9→ strategy→ C3 (stakeholders involvement) C8 → (Idea)	C9 → "C5" (transparency) is key for relationship → C3	after iteration→ changing in C5-7 data collection → patterns→ new potential VPs (new ideas) in the last one we should consider the risk assessment to confirm as true

(Continue)

Appendix B

Table of extracted sequence and category consensus

Respondent (R)	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10
R 6			(>C3<) (potential validation of previous cell)	C4 → C3			needs iteration VP <--> C7	C9 → C8 (implementation strategy, conflict of interest... transparency towards stakeholders VS don't show to much)	C9 (maturity of tech, risk of betting on "wrong" solution) C3 (we have consultants sitting there working on "spotting")	
R 7	C1→ draw a conclusion from data	(>C2<)	C3→ C7 (revenue model)		MVP → (C1, transparent mindset) → Test (invite user to use) → VP	Data collection = Value creation Value creation → Validify/falsify/Feedback to VP C6 → C7 (revenue)	C5→ C7 C3→ C7 C6→ C7	Data → C8	C9 → leak info to unwanted people or firms → launch on market C9 in C1 C9 → ethical profile → before starting "anything" C9 → (don't find what you want) in data collection	Ideation → Strategy for continue/pivot/perish (how many times can we fail before giving up on VP). Value proposition → Value capture (revenue).
R 8	(>C1<)		C2 → C3	C3 → VP (actual offer) → C4	Transparency process → C1 (ethics and moral)	C4<-->C6		C2 + C3→ C8 (iterative)	(>C9<) → C x (for all)	
R 9	C1→ collection of data → VP (opportunity from data collection) → C1 → Collect more data based on your VP opportunity	C2 →<-- idea (>C2<)	brainstorming→ reality check		"Idea" (from observation) → data collect <--> Optimization idea		C5→ C7	BM development → Implementation C8		
Category Consensus	an idea→ regulatory consideration→ MVP→ ethical and regulatory consideration→ testing with collected data→ value proposition and re-evaluation	market analysis→ possible VP→ workshop with internal stakeholder→value proposition/first application→ user consent agreement→ testing and data analysis to find pattern→ validifying/falsify→ VP evaluation based on customer requirement→ launch	Busines goals (abstract idea) → workshop→ value proposition→ validifying and altering VP and including external stakeholder→ implement	new idea→ defining cross-functional team→ value proposition→ evaluation and involvement other external stakeholders based on internal capabilities	idea (not VP)→ ethical and regulatory consideration→ test and data collection→ learning and improving of VP iteratively	market analysis→ idea generation→ internal capabilities evaluation→ VP→ data collection→finding patterns as an opportunity→ iteration with idea generation, capabilities evaluation and data collection	C5(C3)→ C7 C3→ C7 C6→ C7 C9→ C7 (technology feasibility) C4→ workshop (which in that they are discussing the C7 as revenue)→ VP (>C7<) data collection→ C7	idea→ internal stakeholder interaction→ market analysis→ iteration with stakeholder interaction and idea step	C1→ data collection<--> C9(sensitivity of data) (<C9>) C9 →can customer provide data C9 → privacy & security (cybersecurity) C8 <--> C9 C9 → C3 (open or closed data shared network) C9 → leak info to unwanted people or firms → launch on market C9 in C1 C9 → ethical profile → before starting "anything" C9 →(don't find what you want) in data collection C9 (maturity of tech, risk of betting on "wrong" solution) C3 (we have consultants sitting there working on "spotting") C9 → "C5" (transparancy) is key for relationship → C3 proof of concept→ hypothesis→benchmark with internal stakeholders→ defending budget and timeframe with product owner→ VP→ market analysis	MVP→ data collection→finding pattern base on market and customer data→ pattern validation→ changing value proposition or value capture

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