Structuring the Research on the Interplay of Technological Innovation and Business Model Innovation in the Context of Big Data and SAP HANA -Developing a Conceptual Framework-

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Management Summary

The term *Big Data* is used to describe not only new properties of today's data but also data-related technological innovations, analytical advances, as well as the impact it has on society and business. For companies, this can offer opportunities to completely change the way they are doing business. Innovating their business model(s) is a powerful way for incumbent firms to successfully adapt to such exogeneous influences and exploit the, otherwise latent, economic value of technological innovations. The presented thesis is the first of a two-part joint research project that studies the interplay of technological innovation and business model innovation in the context of Big Data. More concretely, this research focuses on SAP HANA, a Big Data related technological innovation, and its impact on a firm's business model.

By means of a literature analysis, the underlying thesis aims at structuring and subsequently integrating selected concepts and findings for the three topics of interest: the business model concept, business model innovation and Big Data. As a result, a conceptual framework and four working hypotheses are developed that provide the theoretical basis for the subsequent case study analysis, which will be presented as the second part of this joint research project. This exploratory literature analysis, focusing on technology-driven business model innovation in the context of Big Data, is organized around the following research question: *How can research on the interplay between technological innovation and business model innovation in the context of Big Data be structured?*

For identifying and describing a firm's business model, defined as the "design or architecture of the value creation, delivery, and capture mechanisms" (Teece, 2010, p. 172) as well as actual or anticipated business model changes, two main concepts have been selected as part of the framework: Cavalcante's (2011) process-based perspective on business models and business model change, and Baden-Fuller & Mangematin's (2013) distinction of business model elements. Moreover, the potential impact of Big Data, subdivided into more specific megatrends, as well as SAP HANA on a firm's business model have been underpinned and integrated in the framework. In the subsequent case study analysis, this conceptual framework will be applied empirically and the four working hypotheses will be answered and discussed.

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List of Abbreviations

BM	Business Model
BMI	Business Model Innovation
BS	Business Suite
BW	Business Warehouse
CPU	Central Processing Unit
DBMS	Database Management System
DDBM	Data-Driven Business Model
DDBMI	Data-Driven Business Model Innovation
e.g.	exempli gratia
ERP	Enterprise Resource Planning
et al.	et alii
excl.	excluding
fig.	figure
ICT	Information & Communication Technology
IT	Information Technology
i.e.	id est
n.d.	no date
OLAP	Online Analytical Processing
OLTP	Online Transactional Processing

p.	page
tab.	table
TOC	Total Costs of Ownership
UI	User Interface
UX	User Experience
WH	Working Hypothesis

1 Introduction & Research Design

This particular study is the first of two studies of a joint research project, which addresses the topic of technology-driven business model innovation (BMI) in the context of Big Data. After a short introduction of the joint research project and the scientific and practical background, the following subchapter will explain the research design of the underlying study.

Nowadays, we find ourselves surrounded by many new buzzwords like *Big Data*, *Smart Data*, *Internet of Things* or *Industry 4.0*. For many researchers and practitioners, however, these are more than just buzzwords; these are serious technological developments, inheriting a profound impact capability on society as well as business. Tremendous technological and methodological improvements in processing power, data storage and analytics, have created incredible new possibilities for firms to make use of their ever-increasing amount and variety of data. This data does not just provide new and real-time insights into business operations, but also offers completely new ways of doing business. (De Mauro, Greco & Grimaldi, 2015)

One prominent example of the impact Big Data can have on a business is Macy's, a US-based, mid-range to upscale department store chain with over 800 locations and $28 billion in revenue in 2014. Macy's uses advanced real-time analytics on various data points throughout the business such as sell-through rates, price promotions, out-of-stock rates combined with data retrieved from product sales at certain locations and times as well as customer data (i.e. style preferences, visit frequencies and sales, online & offline behaviour). This enables the stores to optimize their assortments to their individual customer segments and adapt the prices dynamically. In addition it creates a more personalized, localized and smarter customer experience across all channels (i.e. offline, online or mobile), including customized incentives at checkouts or highly targeted direct mailings. In turn, these technological advancements helped Macy's to boost its store sales by 10 percent within only two years after exploiting Big Data. (Macy's, 2014; Mullich, 2013; Rijmenam, 2013) Furthermore, other businesses like Google, LinkedIn, Facebook or Amazon would not even exist or certainly not at that scale, if it wasn't for such sophisticated analyses on vast amounts of data (Davenport, 2013).

A powerful tool to successfully innovate the way a firm is doing business and adapt to environmental changes, is the business model (BM) concept. It has already proven its capabilities during the dot.com era of the late 1990s, where it first started to play a role in boardrooms, to discuss the new internet based businesses. (Teece, 2010)

Although a lack of consensus can be observed concerning the concept itself, its definition, boundaries or implications, a very basic definition is the one proposed by Teece (2010). He broadly defines a BM as the "design or architecture of the value creation, delivery, and capture mechanisms" (Teece, 2010, p. 172) an enterprise employs. As a company and its environment develop, also established BMs have to be adapted and innovated over time. This leads to the important notion of business model innovation that is described as "a process that deliberately changes the core elements of a firm and its business logic" (Bucherer, Eisert and Gassman, 2012, p. 184).

Going back to the topic of Big Data and technological innovations in general, little is known so far about how these affect a firm's BM or its innovation. It is clear, however, that the BM often works as a mediating device between technological innovation and exploiting its, otherwise latent, economic value (Baden-Fuller & Haefliger, 2013; Chesbrough & Rosenbloom, 2002). This means that improved products or services do not naturally lead to increased firm performance, which underlines the importance of deploying an appropriate BM to fully exploit a technology's inherent economic value.

With the evident importance of technology-driven BMI in mind, it is quite surprising that the academic research on this topic is still rather scarce (Baden-Fuller & Haefliger, 2013). It is therefore important to fill this research gap by investigating the impact of technological developments on a firm's BM.

This joint research project tackles this challenge in a two-step approach. Firstly, it is important to gain a more profound and integrated understanding of the involved concepts such as the BM, BMI and Big Data. Therefore, in a first study, existing literature about these concepts will be analyzed selectively in order to understand and determine which concepts and trends are most suitable to examine technology-driven BMI in the context of Big Data. The goal of this first study is to integrate different concepts and findings, thus developing a conceptual framework for investigating the impact of a technological innovation on a firm's BM in the context of Big Data. Moreover, creating this framework will yield specific research questions formulated as working hypotheses for the subsequent second study. Building on these first theoretical research results, the second study will apply this conceptual framework and investigate the emerged working hypotheses. In order to further deepen and test our understanding of technology-driven BMI in the context of Big Data, case studies will be conducted with firms that recently adopted an innovative Big Data technology called SAP HANA. The goal of this second study is to test and further develop the conceptual framework by gathering reality-based evidence about how technological developments influence a

firm's BM in the context of Big Data. Both, the conceptual framework as well as the subsequently collected case study evidence are of great value for researchers and practitioners alike. By shedding light on the link between BMI and the deployment of a technological innovation in the context of Big Data, both studies will help to contribute to understanding the impact of technological innovations on a firm's BM.

This research project will be conducted in cooperation with SAP SE, the Hasso Plattner Institut (Potsdam), the University of Potsdam, the University of Twente and the Technical University Berlin. The Hasso Plattner Institute is a German information technology university college, affiliated to the University of Potsdam and in cooperation with the Stanford University (Das Hasso-Plattner-Institut, 2015). SAP SE is the world's third largest independent software manufacturer (SAP SE, 2014a) and develops enterprise software to manage business operations and customer relations.

Since 2010, SAP is shipping its new product called SAP 'HANA' (High-Performance Analytic Appliance) and with that it entered the database market. SAP HANA is an in-memory, column-oriented, relational database management system that enables the processing of great amounts of data in real-time in the system's working memory. Other features are its ability to run transactions and analytic workloads on the same database, creating a company-wide unified data point. Additionally, it features advanced analyses like predictive analytics or the analysis and processing of unstructured data like geospatial or text data, plus the connection to a public cloud platform. (SAP SE, 2014b)

Although SAP HANA is not the only in-memory software solution, it has been chosen as focal technology for this thesis as it appears to be one of the most innovative technologies in the database market at the moment (Henschen, 2014). Moreover, the cooperation with SAP SE and the Hasso Plattner Institute offered the extraordinary possibility to get in touch with technology experts as well as SAP HANA customers.

The following subchapters specify the goal and approach of the first study that will help to answer the research question: *How can research on the interplay between technological innovation and BMI in the context of Big Data be structured?*

1.1 Relevance for Research & Practice

Both topics - BMI and Big Data - exhibit increasing interest in research as well as practice (Schneider & Spieth, 2013; De Mauro et al., 2015). The number of academic publications, reviews, case studies and theoretical publications related to the subject of Big Data or

relating topics like Data Analytics, grew substantially in the last years (Sadovskyi, Engel, Heininger, Böhm, & Krcmar, 2014; Buhl, Röglinger, Moser & Heidemann, 2013) so that by 2014, 1,581 conference papers and articles were published with the term “Big Data” in either the title or keywords (De Mauro et al., 2015). Although the academic interest for the topic of BMs and BMI already started in the mid-1990’s, it did not subside. Since then, BMs have already been studied quite extensively, with more than 1,177 published articles as of 2011 (Zott, Amit & Massa, 2011).

Other evidence for the general increasing interest in the topic, can be observed by the growing popularity of the search terms *business model innovation* and *big data* (see figure 1-1 and 1-2), using the Google Trends Search Engine ("Big Data", 2015; "Business Model Innovation", 2015). Both figures display the “total searches for a term relative to the total number of searches done on Google [y-axis] over time [x-axis]. A line trending downward means that a search term's relative popularity is decreasing.“ (Google, 2015)

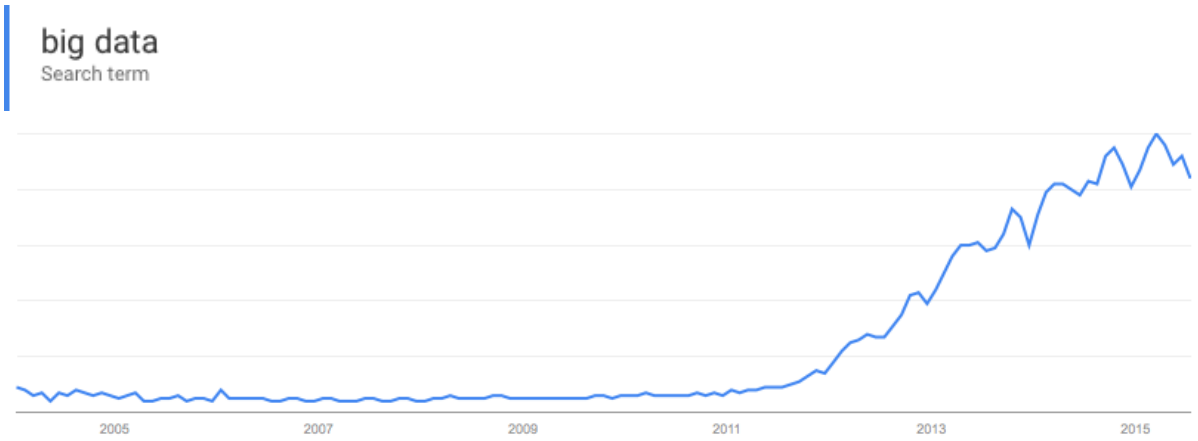

Fig. 1-1: Google Trends Results for the Search term ‘big data‘ (source: "big data", 2015)

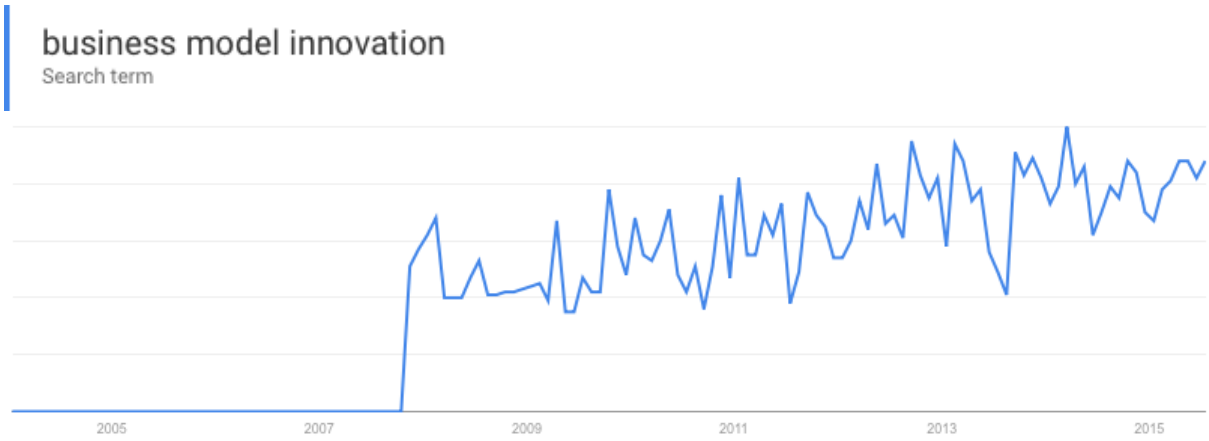

Fig. 1-2: Google Trends Results for the Search Term 'business model innovation' (source: "business model inovation", 2015)

The popularity of the BM concept in practice can be demonstrated by the fact that seven of the top ten Fortune 500 companies, used the term *business model* in their 2014 annual reports (Time Inc., 2015). Empirical research also supports the contribution of the BMI to firm performance (financial as well as non-financial) and competitive advantage (for an overview, see Lambert & Davidson, 2013). With regards to the BM concept, Economist Intelligence Unit analysts even claim: "how companies do business will often be as, or more, important than what they do" (Unit, 2005, p. 9).

The importance of Big Data in practice is as well becoming undeniably obvious. Academic and industry studies have proven gains in productivity, efficiency, and competitive advantage through the deployment of Big Data (Bakhshi, Bravo-Biosca & Mateos-Garcia, 2014; Brynjolfsson, Hitt & Kim, 2011; Bulger, Taylor & Schroeder, 2014).

How technological innovations affect a firm's BM and can enable or evoke BMI has yet rarely been studied (Baden-Fuller & Haefliger, 2013; Cavalcante, 2013; Markides, 2006) and this is especially true for technological innovations related to Big Data (Hartmann, Zaki, Feldmann & Neely, 2014).

Since both - BMI and Big Data - are quite recent topics, a combination of both in research is still rare. However, Buhl et al. (2013) stress the importance of research that aligns Big Data with business processes (BPs), applications or BMs. During the research for this thesis, there could be no study or conceptual framework identified that operationalizes the research on BMI in the context of Big Data related technological innovations. Therefore, the theoretical contribution of this thesis is to fill this gap, foster the research's operationalization and thus significantly contribute to the growth of the current academic knowledge.

The conceptual framework for studying technology-driven BMI in the context of Big Data will also provide practical contributions. Due to the growing importance of Big Data, it is valuable for companies to assess their own data-drivenness (Schroeck, Shockley, Smart, Romero-Morales & Tufano, 2012). This framework can support this process, as it serves as a systematic approach to examine one's own BM with respect to Big Data and upcoming business trends. These findings will be helpful for the firm's management to formulate new business strategies. The investigations will also likely engage employees to reflect on and possibly rethink their ways of doing business. This can help to reveal new growth opportunities through, for example, efficiency gains or improvements of the company's value proposition (i.e. BMI) through Big Data.

1.2 Research Design & Structure

The underlying study follows an exploratory approach, to help answer the research question and derive the conceptual framework. A selective and goal-oriented analysis of the current literature on BMs and BMI aims at structuring different research approaches and findings, to be able to identify the most appropriate concepts for the conceptual framework. The used literature was retrieved from Google Scholar (https://scholar.google.de/), the online library of the Technical University of Berlin and based on recommendations by the thesis supervisor. Nearly all of these articles were published between 2000 and 2015 and a major part of them was published in the *Long Range Planning* journal by *Elsevier B.V*.

Due to the lack of academic research on Big Data and the ephemerality of the IT literature, different sources like management literature, industry studies or recent news have also been taken into account. Furthermore, a personal knowledge gap about advanced IT issues, functions of SAP HANA and their relation to current megatrends was bridged through several interviews with external experts from the respective fields.

As a result of the literature analysis, a sound conceptual framework including testable working hypotheses will be developed, that contributes to structuring and operationalizing the research on technology-driven BMI in the context of Big Data. Lastly, the outcome of the research, its implications for practitioners and researchers as well as point out its limitations and possibilities for future research will be discussed.

2 Methodology

The underlying study is of exploratory nature, aiming at the development of a conceptual framework for investigating technology-driven BMI in the context of Big Data. It is analyzing and drawing on concepts from previous literature on the topics of BMs, BMI and Big Data. The research goal is to gain an integrative understanding of the topics and deductively combine existing literature in a conceptual framework for research on technology-driven BMI. As this framework is supposed to be based on a sound theoretical background, the scanning, identification, selection, analysis and integration of relevant theoretical concepts was necessary.

For identifying relevant literature, different sources and platforms were helpful. First of all, at the very beginning as well as throughout the project, several articles that address the topics of interest were recommended by the project supervisor. Most of these articles and further interesting sources mentioned in their citations were subsequently retrieved and studied in-depth. These leading articles served as major guidance for the selection of additional literature for the analysis.

Next to studying those leading articles in depth, two online platforms were used for further literature research. The online literature database Scopus (www.scopus.com) was primarily consulted. Furthermore, Google Scholar (https://scholar.google.de/) which "provides a way to broadly search for scholarly literature across disciplines and sources" ("Digital Tools for Researchers", n.d.) was used to confirm and complement the retrieved articles. Although Google Scholar has to be used with caution as it does not exclusively search academic articles and journals but basically all academic text sources, it yields the advantage of searching for keywords by relevance. This implies that the most useful and searched for articles are displayed first. Therefore, the relevance-guided search by Google Scholar was considered a beneficial and efficient support for the purpose of developing a conceptual framework based on most relevant concepts.

The time period for the literature search was limited to the past 15 years as the goal of this study is not to create an exhaustive review of existing literature but to develop a conceptual framework that is supposed to be based on selected, most relevant and up-to-date concepts. Next to that, considering the fact that this early in the process of the underlying research project, it would mostly be possible to contact incumbent firms for the case study research through the support of SAP SE, the focus of the research was restricted accordingly. Thus BM, BMI and Big Data literature related primarily to startups has been neglected.

In order to achieve the mentioned goal of developing a sound conceptual framework, a multistep process was followed. In a first step, the literature analysis for the BM concept was conducted. After that, the same approach was applied for the literature analysis regarding BMI. In a third step, Big Data as specific research context of this project was examined. As academic literature on Big Data is still rather scarce, the methodological approach in this last step was different than the literature analyses before. The three steps will be explained in more detail in the following subchapters.

2.1 Step 1 - Business Model Concept

Searching for sources on Scopus (only in Social Sciences & Humanities) that contain the term *business model* in the title within the mentioned time period, 1751 results were obtained and sorted by number of citations. Searching for sources on Google Scholar that contain the term *business model* in the title within the mentioned time period, 5780 results were obtained (excluding patents and citations). In order to limit the amount of results of both searches, solely the first 10 pages of the yielded search results respectively were taken into account. As every page displays 10 search results, 200 sources in total were obtained and focussed on.

A first cursory analysis of these articles indicated that several of them were not directly relevant or beneficial for the underlying study. By reading their titles, abstracts and introductions, it became clear that a lot of research on BMs has been done in specific domains already, many of them focusing on different aspects of the concept. Due to the large amount and variety of studies that has been conducted in this field, the focus was put on aggregated literature reviews on BMs.

Literature reviews already summarize and structure existing literature on the topic and are therefore an efficient source for obtaining an exhaustive overview. Again, by scanning the titles, abstracts and introductions of these reviews, articles that deal with the concept in a general sense could be identified and reviews that focus on BMs within a certain domain or context were eliminated. The remaining literature reviews were read in depth and compared for content, citations and relevance. Having done that, the one by Zott et al., (2011) was selected as it offers the most recent but at the same time broad and frequently cited overview of the topic. Therefore, their review was chosen to primarily structure and guide the search and selection of relevant concepts on BMs for developing the framework.

Having selected the literature review by Zott et al., (2011) who structure literature on BMs into three different research streams, the articles and citations mentioned by the authors were scanned and selectively read in-depth. Articles that were published before 2000 were excluded due to the chosen time period in focus. The remaining mentioned literature was scanned and its benefit for the underlying study was judged according to its addressed topics and amount of citations.

Moreover, for the remaining period from 2011 until 2015, which is not covered in Zott et al.'s (2011) literature review, the search for additional articles including the term *business model* in their title was repeated. Oriented by the suggested structure of Zott et al. (2011), more recent studies within each of the three research streams were searched for. Thus, additional sources could be identified that appeared relevant for the underlying study. These were assigned to the different research streams by Zott et al. (2011) and read in-depth.

2.2 Step 2 - Business Model Innovation

In a second step, it was proceeded in a similar way for the topic of BMI. As also this topic has been investigated in different ways and contexts and therefore the amount and variety of publications is manifold, the focus was put on literature reviews on BMI to obtain an overview of existing literature.

An initial search for sources on Scopus (only in Social Sciences & Humanities) between 2000 and 2015 mentioning the term *business model innovation* in the title revealed 141 results (sorted by number of citations). An additional Google Scholar search between 2000 and 2015 mentioning the term *business model innovation* in the title revealed 684 results (excl. patents and citations). Similar to the initial step mentioned above, the titles, abstracts and introductions of the first 100 of these sources respectively were scanned and literature reviews that deal with the concept in a rather general sense could be identified while reviews that focus on BMI within a specific domain or context were eliminated. After this cursory reading, remaining literature reviews were read in-depth and compared with sources that have been provided by the thesis supervisor. Finally, the review by Schneider & Spieth (2013) served as guidance for this literature analysis on BMI due to its recentness as well as the structure it suggests for classifying BMI research.

Consequently, the literature mentioned by Schneider & Spieth (2013), including mentioned citations, was scanned and selectively read in-depth. Articles that were published before 2000 were excluded due to the chosen time period in focus. The remaining literature was

scanned and its benefit for the underlying study was judged according to its addressed topic and amount of citations. However, literature belonging to the last suggested research stream was completely neglected to read in-depth as the results or outcomes of BMI are not relevant for developing the intended conceptual framework. It was assumed that articles belonging to this third research stream do not provide a theoretical basis for the conceptual framework.

For the remaining period from 2014 until 2015 that is not covered in Schneider & Spieth's (2013) literature review, the search for additional articles including the term *business model innovation* in their title was repeated. Thus, additional sources could be identified that appeared relevant for the underlying study. These were assigned to the different research streams by Schneider & Spieth (2013) and read in-depth.

2.3 Step 3 - Big Data

The goal of the third step was to clarify and connect the above mentioned to the context of this study: Big Data. Since the term Big Data can mean different things to different people, it appeared beneficial to firstly obtain an overview about the various meanings based on De Mauro et al.'s (2015) categorization. After having studied the four suggested categories, namely *Data, Technology, Methods* and *Impact*, the technology of interest - SAP HANA – was placed into these categories in order to understand its significance in relation to Big Data and Data-Driven BMs. Furthermore, current business megatrends that are relevant for the SAP customers and for which Big Data and thus SAP HANA can play a central role were identified. Due to these latter preconditions, megatrends like *Demographic Change* were excluded while the ones like *Personalization* or *Management of Complexity* were included.

During this third step of this research, it was found that, although the interest in Big Data - especially of practitioners - has greatly been increasing over the last years, no extensive research on the relationship between Big Data and BMI has yet been conducted. Since it was the main concern to explain the phenomenon itself, mostly academic literature providing a general overview of the topic (e.g. De Mauro et al., 2015) was consulted. Many other Big Data related academic articles go quickly very much into technical details (e.g. Agarwal & Mehta, 2014). However, for the underlying research, this level of technical specification was only interesting with regards to SAP HANA. In order to understand about the most recent and practical developments concerning Big Data, also management literature, industry studies or recent news articles were reviewed.

Additionally, experts from relevant fields like Software Development, Data Analytics, SAP HANA, or Technological Innovation were consulted. That is why, contrasting to the BM and BMI part, the methodology applied in this third step, resulting in the subchapter on Big Data below, should not be considered a literature analysis. Nevertheless, it clarifies Big Data as research context and explains the applied terminology to provide the reader with all the information necessary to understand and follow this study and its specific context. Its main contribution is to assess SAP HANA as a Big Data technology and pre-determine its potential impact on the BM and thus formulate the working hypotheses.

3 Literature Analysis

The following chapter provides a structured overview of literature and sources that have been studied in-depth for being able to answer the underlying research question. After an introduction of the respective topic in focus, the relevant literature and concepts concerning the BM concept and BMI will be outlined. In chapter 3.3 the topic of Big Data as specific research context will be addressed and important findings and conclusions will be presented. It is important to note that, due to the limited scope of this thesis, it is not possible to thoroughly present all literature and concepts that were read in-depth. The selected sources merely reflect what was considered most relevant and influential as theoretical basis for the conceptual framework. Due to the limited scope of this thesis, merely those concepts were decided to explain in detail that were found to be most important in the process of developing the conceptual framework. Consequently, this underlying chapter serves as the basis for the conceptual framework and related working hypotheses that will be developed in chapter 4.

3.1 The Business Model Concept

3.1.1 Introduction

The central theme of this joint research project is the BM concept. As BMI also builds upon or emerges from this concept, it is obvious to dedicate the main focus of this thesis to BMs. Therefore, it is reasonable to begin with a section about the historical background of the concept, its benefits and disadvantages for theory and practice as well as the BM definition chosen as basis for this research project. Moreover, before presenting a selection of the most relevant concepts and a structured literature analysis in the next section, the difference between scale models and role models in the context of BMs will be elaborated on.

It appears valuable to start out with a rather broad and basic explanation of BMs by firstly having a look at the two distinct words that the term consists of: *business* and *model*. As Osterwalder describes in his dissertation (2004) by quoting the Cambridge Learner's Dictionary (2003), the term business in this context refers to "the activity of buying and selling goods and services" and "earning money" (as cited in Osterwalder, 2004, p. 14). The term model he specifies as "a representation of something as a simple description of the object which might be used in calculations" (as cited in Osterwalder, 2004). From these definitions, a BM can be understood as a representation in form of a simple description of how a firm buys and sells products or services and how it earns money with it. In order to

extend the notion of buying, selling and earning money, Osterwalder finally defines the BM as an "abstract representation of the business logic of a company" (Osterwalder, 2004, p. 14). Although Osterwalder's ideas and BM definition have not been chosen to primarily guide this thesis, they are interesting and contribute to the further discussion. With these notions in mind, it makes sense to have a look at the historical emergence of the term BM and its relevance as well as shortcomings today.

Historical Background, Drivers & Shortcomings

There are different views on who first described the BM concept. Osterwalder, Pigneur & Tucci (2005) find that the term itself has long been around, dating back to the middle of the 20th century, where it made its first appearance in an academic article in 1957 (Bellman et al., 1957) and in the title and abstract of an academic article in 1960 (Jones, 1960).

It has since then mostly been neglected, until the rather recent publication by Drucker (1994) called 'The Theory of the Business'. Without explicitly using the term BM, he first describes the BM concept the way we think of it today, in an attempt to explain why established companies fail to keep up with changing market conditions. He defines the concept as a set of assumptions about what an organization gets paid for, its mission, core competencies, customers and their values and behavior, and more. (Drucker, 1994)

The prime reason for the extensive adoption of the BM concept was the advent of the Internet and its ignition of the dot-com era of the mid-1990s, where the new e-businesses needed to pitch their BMs in order to attract funding from investors (Shafer, Smith, Linder, 2005). Other drivers have since been further advances in information and communication technology (ICT), social entrepreneurship and the rapid growth in emerging markets with increasing interest in 'bottom-of-the-pyramid' issues. (Casadesus-Masanell & Ricart, 2010; Zott et al., 2011). All of these new fields of interest are taking advantage of the BM as a powerful tool for organizations to help them understand, analyze, design, compare, implement, communicate, test, and change or innovate their business logic and strategic choices. (Shafer et al., 2005; Osterwalder, 2004)

Although it is also mentioned below as a disadvantage, Eckhardt (2013) suggests that the fact that BMs are used on various levels of analysis (e.g. product or firm) can also be seen as a benefit of the concept. As with the Net Present Value method, the non-standardization of the tool, speaks for its usefulness and flexibility depending on the choice and intent of the user.

All in all, the BM concept is said to contribute to firm's strategic issues, like value creation, performance and competitive advantage (Zott et al., 2011). With the help of BM, the value creation of today's networked markets can be explained. This is not only true for e-businesses' value creation, but also for value creation in respect to social wealth and poverty. In that sense, the BM can help to explain and thus create economic and social value (Thompson & MacMillan, 2010). Value creation in the light of BMs is, unlike with prior frameworks, not looking at organizations in isolation, but rather at the whole network, including all stakeholders and business partners and thus the total value creation, spanning firms' and industries' boundaries (Zott et al, 2011). Zott & Amit (2010), for example, propose four - mutually reinforcing - value drivers through BM: *novelty, lock-in, complementarities,* and *efficiency*. Additionally, does the BM evolve to a source of competitive advantage, since firms are starting to compete through their BMs, where BM with superior value creation may replace established business logics (Casadesus-Masanell & Ricart, 2010; Zott et al, 2011). BMs are also being attributed to firm performance. There are yet different views on whether the BM is the independent variable (Zott & Amit, 2007) or the moderating variable (Patzelt, Knyphausen-Aufseß & Nikol, 2008). In both mentioned studies, however, a positive effect on firm performance has been examined.

The BM has thus rapidly established itself in practice, for explaining how an organization interacts with its suppliers, customers and partners. (Nenonen & Storbacka, 2010; Shafer et al., 2005). Consequently, the concept has gained great momentum and has been widely adopted by practitioners; with seven of the top ten Fortune 500 firms using the term *business model* in their 2014 annual reports ("Fortune 500", n.d.). Because of its great adoption in practice, the applied literature on BM has jumped ahead, offering much more detailed and diverse descriptions, attributes and categories of BMs than its scholarly counterpart. Nevertheless, the BM concept is an area where theory and practice come closely together. Eckhardt (2013) points out that the BM concept –as opposed to mathematical firm-level production/profit functions– can describe a much richer set of relationships between inputs and outputs, bringing it much closer to reality. Therefore, more research is needed, in order to include robust statistical inferences for the rich set of relationships. (Eckhardt, 2013).

That is why increasingly many scholars have dedicated their efforts to study BMs. These studies are mainly concentrating on collecting data that contributes to gain deeper understanding of the BM concept itself. According to Lambert & Davidson (2013), 73% of conducted studies concerning the topic can be classified as empirical research to

"understand this nebulous concept" (Lambert & Davidson, 2013, p. 672). The remaining 23% of studies consider BMs as unit of analysis that can serve to explain or investigate other phenomena. (Lambert & Davidson, 2013)

There is also criticism towards the BM concept and frequently mentioned shortcomings are worth mentioning. Common complaints are the ambiguous definitions (Perkmann & Spicer, 2010), its various uses to explain different phenomena on different levels (Eckhardt, 2013) and the lack of a common and generally accepted language and classification (Zott et al., 2011). This lack of consensus can be traced back to the weak theoretical foundation of the BM concept, which can subsequently be attributed to the fact that the BM has mostly been developed in practice and management curricula (Günzel & Holm, 2013).

However, the BM concept has no solid theoretical foundation in traditional economics or business studies (Teece, 2010). This is partly due to the fact that, in economic theory, the assumptions of established, one-sided markets, perfect competition and equilibrium make business design issues redundant. The market mechanism and pricing system are assumed to guarantee an entrepreneur's ability to create and capture value with his offering. The reality however involves intangible products, two-sided or not even existing markets. Consequently, business model design is an essential tool to create a value proposition for the customer that is profitable for the entrepreneur (Teece, 2010). The fact that the concept has been taken up by scholars from a wide range of social science disciplines, and research streams from strategy, economics, management (Pateli & Giaglis, 2004), e-business, technology, information systems (Shafer et al., 2005), finance, operations, entrepreneurship or innovation, led to the numerous facets of BM being around today (Günzel & Holm, 2013). Other factors are the recent novelty and immaturity of the concept itself as well as the sectors, on which it is being applied (Al-Debei & Avison, 2010). This diverse set of approaches leads to the fuzziness of the concept and brings about confusion, impeding a proper scientific dialogue around BMs (Baden-Fuller & Haefliger, 2013).

Some scholars may also see the BM's disregard of the competition, environment or other contingencies as a shortcoming. This, however, is foremost the task of strategy (the BM-strategy relationship will be shortly discussed below in this chapter) (Casadesus-Masanell & Ricart, 2010). For these reasons and the fact that a BM encompasses a vast amount of variables that would need to be specified and numerous possible relationships that would have to be tested, it cannot be considered a theory, unable to predict any outcomes (Zalewska, 2014). Despite this diversity, most (if not all) practitioners and researchers agree

on the fact that the BM encompasses the description of the value proposition and the value creation, value capture and value delivery (Günzel & Holm, 2013).

Therefore, the definition chosen for this thesis is the one by Teece (2010) reflecting this consensus most accurately. Teece (2010) broadly defines a BM as the "design or architecture of the value creation, delivery, and capture mechanisms" (Teece, 2010, p. 172) an enterprise employs. It is thus a representation of the "management's hypothesis about what customers want, how they want it, and how the enterprise can organize to best meet those needs, get paid for doing so, and make a profit" (Teece, 2010, p. 172). The BM can consequently be understood as "a new unit of analysis, offering a systemic perspective on how to 'do business', encompassing boundary-spanning activities (performed by a focal firm or others), and focusing on value creation as well as on value capture" (Zott et al., 2011, p. 20).

Business Models as Conceptual Models

Having sketched the historical background as well as the meaning and relevance of BMs, it is interesting to take an even closer look at the topic. Clearly, there are many different BMs applied in practice and a lot of literature has already aimed at identifying the most profitable and popular ones. Before presenting a structured overview of the analyzed literature, it is interesting to specify the notion of models in more detail. With this regard, Baden-Fuller & Morgan (2010) have studied BMs as models in a more general sense, emphasizing the difference between *scale models* and *role models*. Scale models are simplified or scaled-down versions of a real object, describing only specific details of it. Role models are ideal models or cases that one strives to copy. As example serves the 'low cost airline model' (scale model) represented by the 'Easyjet BM' (role model). According to Baden-Fuller & Morgan (2010), in the research of BMs, both notions often come together as the investigated firms and their analyzed BMs manifest real examples that represent scaled-down, generic descriptions. The authors emphasize that BMs as models have not only one function and character but many. They can be thought of as scale models, role models, scientific models or practical recipes. All these different roles and functions a BM can play do not mutually exclude each other but rather have strong overlaps and alter for different companies, industries and purposes. With this, the complexity and also fuzziness of the BM concept becomes apparent. (Baden-Fuller & Morgan, 2010)

Understanding and investigating BMs as scale models results in establishing classifications of generic elements or behaviors that belong to certain types or kinds of BMs. In other words, studied firms and their BMs can be grouped according to similarities in their BMs that can be

identified on a more generic level. On the other hand, firms or businesses can be classified into these different BM types once they have been established. The authors further specify that these scale models are neither simply taxonomies, which are generated bottom-up based on empirical work, nor typologies, which are created top-down based on theoretical or conceptual decisions. The classifications of BMs "are based on both observation and theorizing" (Baden-Fuller & Morgan, 2010, p. 162) and can therefore be best understood with Max Weber's notion of "ideal types" (As cited in Baden-Fuller & Morgan, 2010, p. 161). As will become clear in more detail below, the current literature on the topic presents different classification attempts of BMs. Some authors propose typologies while others prefer a taxonomic approach to describe the BM concept. According to Baden-Fuller & Morgan (2010), this division does not make sense for investigating and establishing BMs as scale models. (Baden-Fuller & Morgan, 2010)

Understanding and investigating BMs as role models is a different approach, especially useful to find a basis or orientation for BM design. As mentioned above, role models are ideal cases that can serve as examples to imitate or copy. Gassmann, Frankenberger and Csik (2013) claim in their research that about 90% of BMs are based on redesigning and recombining already existing BM elements and patterns. This involves, for example, variations such as transferring an existing pattern into another industry or geographical area. The authors could identify 55 patterns that serve as basis for many new BMs. As a main research contribution, the authors summarized them in their *business model innovation map,* summarizing the most popular BM patterns and the firms who integrated them in their BM design. These popular patterns entail, for example, 'rent instead of buy' or 'freemium'. Gassmann et al. (2013) consider these popular patterns a useful foundation and inspiration for BMI as will be elaborated on in more detail in chapter 3.2.2. (Gassmann et al., 2013)

Also Abdelkafi, Makhotin and Posselt (2013) pursue this approach in their study, investigating the transferability of existing BM patterns to the context of e-mobility. They claim that patterns from different value dimensions and also different industries can be recombined and imitated resulting in successful new BMs in the e-mobility context. Especially these latter approaches confirm Baden-Fuller & Morgan's (2010) conclusion that understanding and studying BMs as role models and scale models overlaps. Abdelkafi et al. (2013) start out by considering existing and successful BMs as role models for imitation. In a further step these specific exemplary models are consolidated into more generic scale models in form of combinations of BM patterns. (Abdelkafi et al., 2013)

Excursion: BM-Strategy Relation

Before diving deeper into the existing literature and research streams on the BM concept, it remains important to address the relation or separation between a firm's BM and its strategy. Referring to the BM quite simply as the 'logic of the firm' may result in confusing it with the corporate strategy. Therefore, scholars have tried to look at both concepts in more detail and identify their overlaps as well as differences.

Teece (2010) describes BMs as more generic compared to business strategy. He therefore considers a combination of strategy and BM analysis as "necessary in order to protect whatever competitive advantage results from the design and implementation of new business models" (Teece, 2010, p. 180). As major conclusion of their research, Casadesus & Ricart (2010) define a BM as "a reflection of a firm's realized strategy" (Casadesus & Ricart, 2010, p. 205). Moreover, they argue that the same strategy can often be realized through various BMs. Consequently, the authors conclude that there are indeed cases in which both terms could be used congruently. These cases require, however, that there are no contingency factors that potentially force or lead a company into choosing between different BMs to pursue its strategy. Casadesus & Ricart (2010) name contingencies such as an upcoming recession and new competitors or entrants in the industry resulting in more or less substantial BM modifications. In this relation, strategy becomes a "contingent plan as to how the business model should be configured, depending on contingencies that might occur" (Casadesus & Ricart, 2010, p. 205).

Confirming this, Zott et al. (2011) claim that two firms can pursue the same or similar customer needs and product market strategies with very different BMs (Zott et al., 2011). In other words, the BM is often considered the bridge between formulating and implementing a firm's strategy. It explains or specifies how a firm's activity system is structured and how it is functioning to realize a strategy (Richardson, 2008). Relating this to the context of the underlying study, Veit et al. (2014) identify the BM concept as "the missing link between business strategy, [business] processes, and Information Technology (IT) " (Veit, Clemons, Benlian, Buxmann, Hess, Kundisch, Leimeister, Loos & Spann, 2014, p. 45).

Nevertheless, Zott et al. (2011) also argue for a clear separation of the two terms, ascribing distinct subjects or foci of interest to both concepts. While strategy takes especially competition and value capture into account, a BM concentrates on a firm's value proposition, its customers and their role as well as joint value creation involving co-operations and partnerships. It becomes clear that the two terms are closely interwoven and

cannot easily be distinguished. Regarding the topic and scope of this thesis, it can be conluded that there certainly are conceptual differences between BMs and corporate strategy and that the BM plays an important role for realizing a firm's strategy. (Zott et al., 2011)

With this historical and theoretical background, it seems appropriate to have a closer look at the BM concept, and different research streams connected to the topic.

3.1.2 Different Research Streams on Business Models

There exist many different approaches on trying to define what a BM exactly is and which elements it involves. In their literature research, Zott et al. (2011) suggest three different categories under which the BM is approached in research. Firstly, the research stream is highlighted that, according to the authors, mostly concentrates on e-business models. The basic interest of these scholars is to understand and describe the BMs of firms who engage mainly in internet-based business such as e-commerce or e-markets. More important for the underlying study, this research stream offers descriptive results in form of BM classifications (taxonomies and typologies) instead of empirical or causal explanations and outcomes. (Zott et al., 2011)

As second dominant research stream they mention literature concerning a firm's strategy and performance, its form of value creation and its source of competitive advantage. In this context, BMs are mostly described as activity systems. The BM is a set of activities and exchange relationships involving a network of partners. This network spans a focal firm's boundaries while the activities are non-linear but rather complex as well as interconnected. The main interest and contribution of scholars in this field is the differentiation between a firm's BM and its corporate or product strategy as well as understanding the BM as potential source of competitive advantage. (Zott et al., 2011)

The third research stream Zott et al. (2011) highlight looks at BMs from a functionalist perspective. In technology and innovation management literature, the BM is considered a linking mechanism between a firm's technology and its resources, on the one hand and its customers' needs on the other hand. Focusing on its costs and revenues as well as its value proposition and capture, Teece reduces the BM to the "organizational and financial ‘architecture’ of the business" (as cited in Zott et al., 2011, p. 173). In this perspective, the notion of BMI evolves as the BM cannot only be enabled by, for example a technological innovation, but can also itself be the subject of innovation. In the following, some selected

approaches that belong to each of these three research streams and that were studied in-depth will be summarized and explained. (Zott et al., 2011)

First Research Stream: Descriptive Perspective

Starting out with the first research stream, there can be identified a multitude of literature aiming to classify BMs and BM elements. Taking a closer look at these classifications, some authors propose typologies while others refer to taxonomies. As these terms are often used interchangeably, it is important to note the difference. According to Baden-Fuller & Morgan (2010) taxonomies are classifications, generated bottom-up based on empirical work and typologies are created top-down based on theoretical or conceptual decisions.

Baden-Fuller & Mangematin (2013) propose a typology of four BM elements, namely *customer identification, customer engagement, monetization* and *value cahin/linkages*. The authors make clear that they focus on a top-down typological classification instead of a taxonomic approach. The BM is seen as configuration of cause-effect relations that can be changed and transferred to different contexts. A BM can thus be regarded separate from a company, its industry or technology. The four dimensions that they suggest in their paper, function as categories further dividable into sub-categories. These sub-categories can then be combined in different ways, offering a range of possible BM configurations to choose from. (Baden-Fuller & Mangematin, 2013)

Table 3-1 presents an example of how Baden-Fuller & Mangematin's (2013) typology can be further divided into sub-categories.

BM element categories	Customer sensing	Customer engagement	Monetization	Value Chain
Sub-categories	User(s)	Value Proposition	Revenue mechanisms	Activity assignment
	Payer(s)	Interaction, Communication (mental message)	(Non-monetary) value capture	Structure
	Sidedness of the market	Infrastructure (physical creation & distribution)		Coordination
Question	Are users paying? If not, who are the other customers)	Scale-based ('bus') or project-based ('taxi')?	When, what and how is money raised?	Integrated, hierarchical or networked value network?

Tab. 3-1: Business Model Elements and Sub-Categories (Source: Own illustration based on Baden-Fuller & Mangematin (2013), p. 4)

Customer identification or sensing as first category involves the identification and also creation of a firm's target users and customer groups. This dimension also addresses the question of who pays for the offering of the firm, if the market is one-sided or two-sided. The second dimension, customer engagement, is also referred to as the value proposition for the customer or several customers. Here, the authors distinguish between 'taxi' and 'bus' BMs. While 'bus' BMs involve one-size-fits-all offerings, 'taxi' BMs create value for specific clients by solving their specific problem. Monetization as third category specifies what money is raised when and how exactly this is done. It therefore entails more than simply pricing issues. If monetization is categorized as simple, customers pay the price of the offering close to consumption. Other options are that the payment is dependent on an in advance delivered value or a complementary asset as is the case in the popular 'razor-blade-model'. Last but not least, the value chain addresses the networks and linkages by means of which a firm delivers value to its customers. The authors distinguish between hierarchical, integrated or networked ties within the value chain, noting that in the case of multiple interlinking networks the complexity of this dimension is enhanced. At this point it should be noted that, although the authors clearly refer to their classification as a typology, their results are also based on real-world observations. (Baden-Fuller & Mangematin, 2013)

A further BM classification is offered by Al-Debei & Avison (2010) who identify four main BM dimensions based on a taxonomic approach. The four dimensions they establish include *value proposition, value network, value architecture* and *value finance*. In a next step, they develop a more comprehensive conceptual framework including the functions, reach and modeling principles of BMs. As this conceptual framework is not considered useful for the underlying thesis, the focus will be put on their four-dimensional BM taxonomy. Their conceptual framework is visualized in figure 3-1.

The four dimensions the authors suggest describe the elements that need to be taken into account when designing, analyzing, and evaluating BMs. Firstly, the value proposition involves a description of the offering and its value elements as well as the target customer or segment. Secondly, the dimension of value architecture is based on the resource-based view (RBV) specifying a firm's resources, competencies and assets. Consequently, this dimension concentrates on the organizational as well as technological infrastructure of a firm and their interplay. Having a similar name as in Baden-Fuller & Mangematin's (2013) classification, the value network, as third BM dimension, considers the firm and its BM as part of a boundary-spanning value system and the ties between the involved stakeholders. Lastly, the dimension of value finance clearly relates to a firm's financial profitability involving its revenue, price

and cost structures. The authors further point out that these primary BM dimensions and their elements are highly interdependent and equally important when designing a firm's BM. (Al-Debei & Avison, 2010)

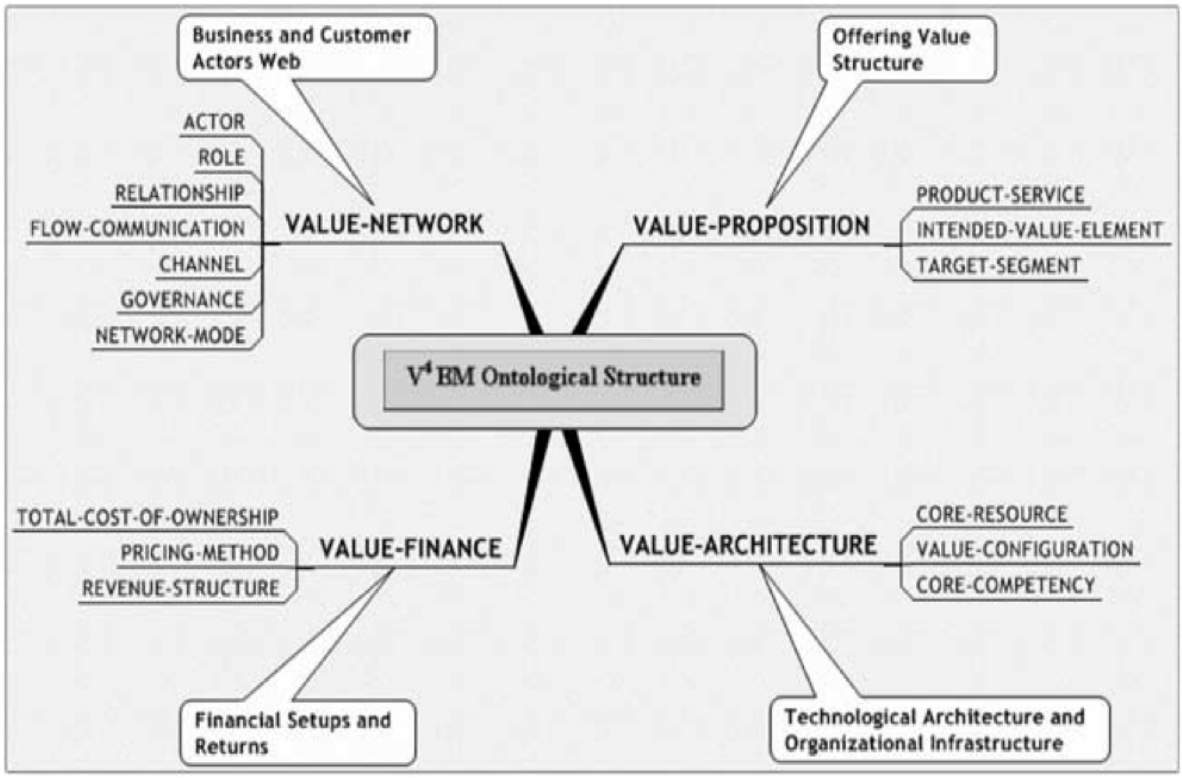

Fig. 3-1: Four-Dimensional Business Model Framework (Source: Al-Debei & Avison (2010), p. 368)

One of the most popular BM classifications is Osterwalder & Pigneur's (2010) Business Model Canvas based on Osterwalder's dissertation *The Business Model Ontology - a Proposition in a Design Science Approach* (2004). The major focus of Osterwalder's research was to establish an ontology that accurately describes the BM of a company. The terms ontology and taxonomy describe the same notion of bottom-up classification but an ontology is mostly applied and referred to in philosophy. Relying on general management literature and the Balanced Scorecard approach, Osterwalder (2004) firstly specifies four areas a BM has to address: *product, customer interface, infrastructure management* and *financial aspects*.

While the first area refers to understanding a firm's business, its products and value proposition, the customer interface addresses questions around target customers and customer relationships. The infrastructure management of a firm deals with efficiency in logistics, infrastructure and the value network and the last BM area refers to the revenue model and the cost structure of an offering.

Having established those four main pillars of the BM concept, Osterwalder (2004) further specifies and splits them into nine elements representing the essence of his BM ontology which later turns into the Business Model Canvas. These nine interrelated building blocks include the *value proposition, customer segments, distribution channels, customer relationships, key resources, key activities/capabilities, key partnerships, the cost structure* and *revenue streams* of a business. Osterwalder & Pigneur (2010) slightly altered the wording for the nine blocks since Osterwalder's dissertation; for this thesis the terms they use in their more recent book *The Business Model Generation* will be applied. These nine terms give a clear indication of what kind of issues and questions could be addressed in the respective building blocks while designing a BM. (Osterwalder & Pigneur, 2010).

In a further step, Osterwalder (2004) specifies every block or element in more detail by decomposing it into a set of sub-elements. The author claims that "this decomposition allows studying business models on different levels of granularity in more or less detail and according to specific needs" (Osterwalder, 2004, p. 47). With his extensive framework, Osterwalder (2004) aimed at an integration or synthesis of existing work and literature on BMs. (Osterwalder, 2004)

Figure 3-2 presents the BM Canvas template (Osterwalder & Pigneur, 2010), which has reached major popularity in BM design or BM innovation and is frequently applied in form of a BM template in practice.

Fig. 3-2: Business Model Canvas Template (Source: Osterwalder & Pigneur (2010), p. 44)

Osterwalder & Pigneur's (2010) handbook about the framework is mainly directed at practitioners who want to apply the Canvas and further suggested tools or exercises. Despite this popularity, critiques point out that the Canvas might be a necessary tool within the conceptual starting phase of BM design and innovation but less suited for BM analysis or evaluation due to a lack of measurable causalities (F. Wijnhoven, personal communication, November 27th, 2014)

Second Research Stream: Activity System Perspective

Next to approaching BMs from a model-component-perspective there is, as Zott et al. (2011) point out, a vast amount of literature dealing with BMs as activity systems. The BM is considered a system of interdependent activities within a network of different stakeholders around a focal firm. Zott & Amit (2009) define an activity as "the engagement of human, physical and/or capital resources of any party to the business model (...) to serve a specific purpose toward the fulfillment of the overall objective" (Zott & Amit, 2009, p. 2). The activities of a firm and the eco-system it is embedded in are the essence of a BM. Consequently BM design involves choices about these activities. Zott & Amit (2009) introduce two sets of design parameters to support making these choices: design elements and design themes. The authors separate design elements into *content, structure* and *governance*. These design elements involve decisions about which activities exactly are chosen, how they are linked to each other and who performs them. The aforementioned four design themes the authors suggest, namely lock-in, novelty, complementarities and efficiency, refer to how a company primarily creates value for itself with the chosen activity system or BM. While novelty as dominant value creation driver implies choosing completely new activities or a new way to structure those, a system based on complementarities involves decisions about bundling activities in order to exploit synergies. Based on these thoughts, the authors establish an activity system design framework as common language and toolbox for BM designers encouraging a systemic and holistic approach. However, Zott & Amit (2009) also consider their approach as conceptually challenging due to a vast amount of activities on various levels of abstraction that need to be identified and aggregated first. (Zott & Amit, 2009)

Very much related to Zott & Amit's (2009) notion of making choices about BM activities, Casadesus & Ricart (2010) suggest that BMs are actually made of two elements: concrete management choices about how a firm must operate, and the consequences of these choices. The decisions the management has to make, involve policies or assets of the company and the governance of decision rights concerning these policies and assets. Examples for such choices involve compensation mechanisms, vertical integration or marketing activities. Intuitively, every choice leads to a certain consequence meaning that

different sets of choices and consequences imply different BMs. Specific consequences are considered either flexible or rigid in the way they are sensitive to changes of other connected choices. The authors suggest the illustration of BMs by means of a loop diagram, indicating choices and connected consequences that are linked by arrows specifying existing causalities. (Casadesus & Ricart, 2010)

Figure 3-3 shows an exemplary loop diagram representing a simplified version of the BM of the company *Ryanair*.

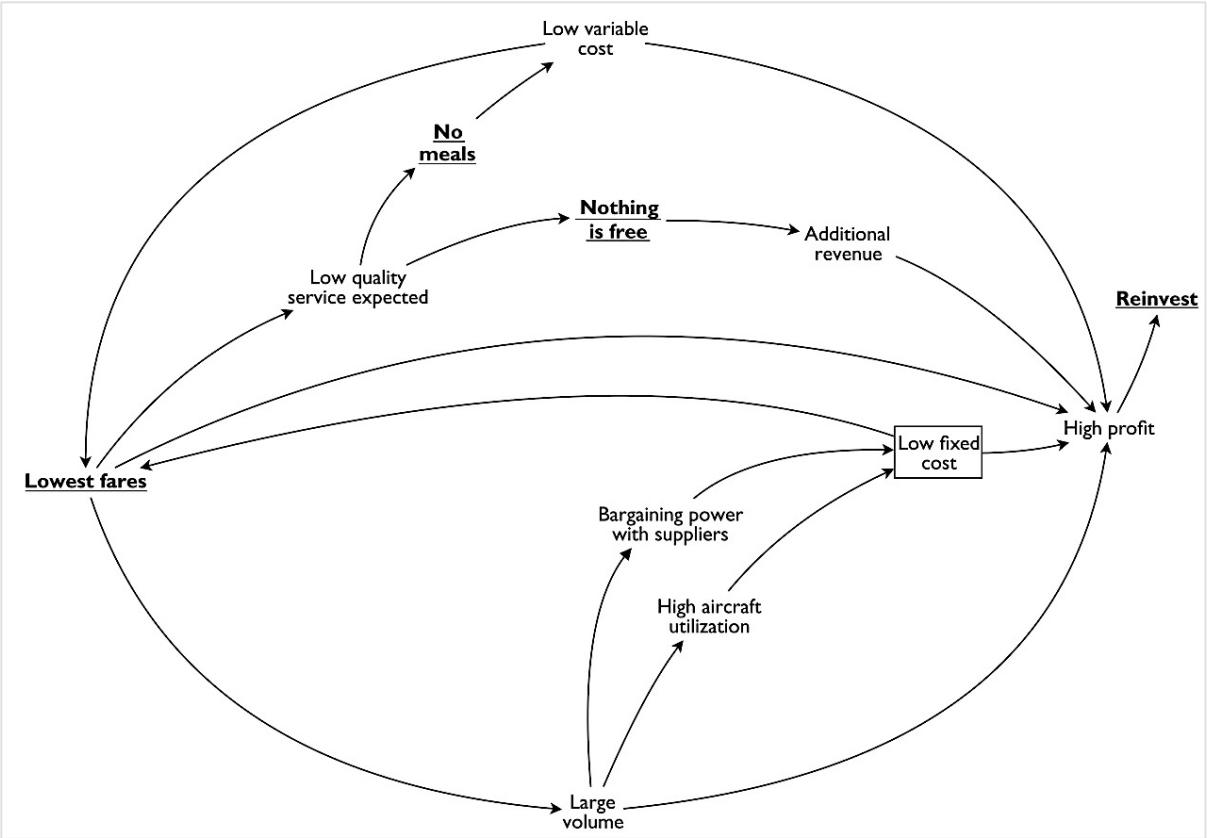

Fig. 3-3: Ryanair Business Model as Loop Diagram (Source: Casadesus & Ricart (2010), p. 201)

With making specific choices that imply specific consequences, a firm decides how to operate, create and capture value. The loop diagram is thus a representation of the firm's BM. Furthermore the authors introduce the idea of virtuous cycles, one part of the loop that strengthens specific components of the BM with every iteration. These virtuous cycles or feedback loops can be crucial for the success of a BM. Casadesus & Ricart (2010) realize the impracticability of their approach for very complex and detailed cases. They suggest to either aggregate or decompose the vast amount of choices and consequence existing in

reality in order to arrive at a simplified and workable BM representation. (Casadesus & Ricart, 2010)

Another dynamic, activity-based perspective on the BM concept is offered by Cavalcante, Kesting & Ulhøi (2011). They introduce a process-based approach, defining the BM as "an abstraction of the principles supporting the development of the core repeated standard processes necessary for a company to perform its business" (Cavalcante et al., 2011, p. 1329). With abstraction, the authors refer to the role of managerial cognition. A strategic abstraction of a firm's processes based on managerial cognition and interpretation is needed for their approach and plays an important role in BM design. They further explain that core repeated standard processes refer to activities or sets of activities that are of key importance to a firm and repeatedly performed in order to achieve its set objectives. The authors conclude that the core repeated standard processes are the boundaries of a firm's BM. However, Cavalcante et al. (2011) do not specify what the core repeated standard processes exactly are as they differ depending on the firm and its ecosystem. Determining these processes is based on constituent BM components that have been identified by other scholars, such as Osterwalder and Morris, and a thorough understanding of what the purpose of a company really is. Cavalcante et al. (2011) highlight that identifying core components of a firm's BM and translating them in terms of its underlying core processes is the crucial difference in his dynamic approach. Processes involve activities and mechanisms that can be changed unlike components that simply manifest a static snapshot of a BM. (Cavalcante et al., 2011)

Excursion: Business Processes

As Cavalcante et al's (2011) approach and framework is rooted in the definition of BPs, it is worthwhile, taking a closer look at the latter. Referring to a combination of processes as 'business system', Davenport and Short (1990) define BPs as "a set of logically related tasks performed to achieve a defined business outcome" (Davenport & Short, 1990, p. 3). As major characteristics of BPs the authors summarize that they have defined business outcomes addressed at internal or external customers, thus being executed across as well as within organizational boundaries. The authors establish a framework for IT-based BP redesign that is rather detailed and therefore interesting for taking a closer at what precisely constitutes BPs. Davenport and Short (1990) differentiate BPs along three major dimensions namely *entities, objects* and *activities*. The first dimension deals with who is involved in the process, if it is an inter-organizational process involving several companies or an internal process executed either by several functions or even smaller teams of employees.

Categorizing BPs according to the second dimension specifies if real, tangible objects or intangible information is being created or manipulated during the process. Lastly, BPs can involve either operational or managerial activities, with the latter helping to provide and control resources for the day-to-day, operational business. Neglecting the authors subsequently developed IT-driven process-redesign approach, their underlying taxonomy can support this research on the level of BPs. (Davenport & Short, 1990)

Speaking of the BP level, it is important to note that many processes can be split up again into sub-processes (Scheer & Nüttgens, 2000). It is therefore not very easy to analyze BPs involving a lot of different actors who execute them on varying levels of abstraction. This is also reflected in Cavalcante et al's (2011) BM approach in which the authors identify a firm's core repeated standard processes as the boundaries of its BM. This implies that next to these core repeated standard processes, there are other processes, either on a more generic or more specific level, which are therefore less interesting and productive to analyze from a BM perspective. Despite this inherent complexity of BPs, they are more clearly definable and graspable than BMs or BM elements itself. Scheer and Nüttgens (2000) emphasize the importance of a process-oriented business management with the general goal to design and control the structure of a company in the most flexible way to make adaptation to changes possible and easy. They further explain that BP (re)design is a continuous process aiming at continuous improvement. This BP (re)design can be triggered by, for example, new technologies that require changes or adjustments in a firm's processes (Scheer & Nüttgens, 2000).

Third Research Stream: Functionalist Perspective

Before turning to BMI, it is important to also address the BM concept from a functionalist perspective, supported by literature findings stemming from technology and innovation management. Recalling the beginning of this section, this research stream mainly deals with the connection and mutual impact between BMs and new technologies (Zott et al., 2011).

Baden-Fuller & Haefliger's (2013) contribution belongs to this third research stream in the study of BMs. The authors investigate the relation between BMI and technological innovation, arriving at some major conclusions. Firstly, BMs and technological innovations regularly interact with each other through, for example, new technologies facilitating new BMs. However, essentially, BMI can also happen without a facilitating technology and can thus be treated as separable construct. Secondly, taking a closer look at the BM-technology-

link, BMs can be regarded as mediators between technology and firm performance. (Baden-Fuller & Haefliger's, 2013)

Chesbrough (2010) puts this assumption even more boldly by stating that "a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model" (Chesbrough, 2010, p. 354). There is more literature investigating and confirming the role of BMs as link between a firm's resource potential and economic value creation and capture. Björkdahl (2009) exemplifies cases that prove the necessity of adapting a BM along the diversification of a company's technology base. Even several years earlier, Chesbrough & Rosenbloom (2002) recognized the important role of BMs as tool for commercializing a new technology. Illustrated by the example of a technology spin-off of Xerox, the authors conclude that "the BM unlocks latent value from a technology" (Chesbrough & Rosenbloom, 2002, p. 529). Considered from a more negative point of view, Cavalcante (2013) regards companies as "often unable to successfully explore a new way of doing business as a result of new technologies" (Cavalcante, 2013, p. 15).

Thirdly, Baden-Fuller & Haefliger (2013) highlight the importance of user engagement and openness or permeability of firm boundaries for developing the right technology. Deciding for a BM that involves customers and other stakeholders in technology innovation can render large benefits compared to more traditional and 'closed' approaches (Baden-Fuller & Haefliger, 2013). In line with this third finding, Lehoux, Daudelin, Williams-Jones, Denis and Longo (2014) emphasize the role of different stakeholders in the negotiations around technology and BM design for spin-offs in the health sector. Based on the stakeholders' competing views on the emerging technology, BM and technology design decisions mutually influence each other in the early stages. These early-stage design decisions reinforce themselves over time and have long-term consequences for the technology and the BM (Lehoux et al., 2014).

Additional technology and innovation management literature has been devoted to the role of BMs for industry or technology platforms. Gawer & Cusumano (2002) define industry platforms "as products, services or technologies that are similar in some ways to the former but provide the foundation upon which outside firms (organized as a business ecosystem) can develop their own complementary products, technologies, or services" (as cited in Gawer & Cusumano 2012, p. 5).

These platforms, prevailing for example in the IT- or high-tech-sectors, affect the competitive dynamics and also innovation at an ecosystem level. The central players in this ecosystem are so-called 'platform leaders' mostly holding the main architectural control of the platform. Gawer & Cusumano (2012) find that these platform leaders need to anticipate not only technological but also BM change while managing the complex co-creation of the ecosystem. The authors specify that the BMs of different actors within this platform should mutually enhance each other. (Gawer & Cusumano, 2012)

Cavalcante (2013) confirms the increasing tendency of especially high-tech firms to co-develop a new technology through platforms. The author analyzes a recently established platform around a new technology and its impact on the BMs of the involved firms. Interestingly, he concludes that, in this specific case study, the technology platform itself might potentially become the new, collaborative-based BM of the involved firms. He, as well, emphasizes the central importance of platform leaders in this context. (Cavalcante, 2013)

Table 3-2 provides an overview of the articles dealing with the BM concept that served as basis to develop the conceptual framework and were studied in-depth, structured by the suggested distinction of Zott et al. (2011).

Three different research streams based on: Zott et al., 2011	
Descriptive Perspective	
Author(s), year	*Key aspects/findings*
Baden-Fuller & Morgan, 2010	BMs are models that can fulfill different roles and functions: scale models vs. role models
Baden-Fuller & Mangematin, 2013,	BM typology: 4 BM elements & their sub-categories
Al-Debei & Avison, 2010	Develop BM framework (taxonomy): 4 primary BM dimensions & their constituents; BM modeling principles, BM interaction with strategy, BPs and IS

Osterwalder, 2004; Osterwalder & Pigneur (2002; 2010)	BM ontology (taxonomy): 9 interrelated BM elements (based on 4 pillars of the BM concept) → BM Canvas
Activity System Perspective	
Zott & Amit, 2009	Activities of a firm & eco-system = essence of BM; 2 sets of design parameters support making choices about activities: design elements and design themes
Zott & Amit, 2010	BM = system of interdependent activities; spans boundaries but goes beyond focal firm; enables value creation and capture
Casadesus & Ricart, 2010	2 BM elements: concrete management choices about how a firm must operate & consequences of these choices → visualization in loop diagram
Cavalcante, Kesting & Ulhøi, 2011	Core repeated standard processes = boundaries of a firm's BM
Functionalist Perspective	
Baden-Fuller & Haefliger, 2013	BM = mediator between technology and firm performance
Chesbrough & Rosenbloom, 2002	BM needed to commercialize a technology; current BM logic can restrict BMI (for new technologies)
Cavalcante, 2013	New technology affects a firm's BM: extension of current BM and creation of new BMs
Gawer & Cusumano, 2012	Importance of BMs on an ecosystem level: platform leaders have to manage both technologies & BMs in their ecosystem
Björkdahl, 2009	BM changes necessary to link technological input and economic output
Lehoux, 2014	BMs shape innovation: align technology and its commercialization (health industry)

Tab. 3-2: Analyzed BM Articles for Developing the Conceptual Framework (Source: Own illustration)

3.2 Business Model Innovation

3.2.1 Introduction

After having discussed the variety and complexity of the BM concept it is appropriate to take a closer look at the life cycle or developmental process of BMs over time. This leads to the important notion of BMI, which, so far, has not yet been precisely and commonly defined, just as it is the case with the BM concept itself. Based on the intuitive assumption that "no great business model lasts forever" (Chesbrough, 2007, p. 15), BMI implies innovating a firm's current BM.

According to Bucherer et al's (2012) broad definition, BMI is "a process that deliberately changes the core elements of a firm and its business logic" (Bucherer et al., 2012, p. 184). Zott & Amit (2015) describe BMI as the "design and implementation of an activity system that is new to the focal firm or new to the product–market space in which the focal firm competes" (Zott & Amit, 2015, p. 395). Consequently, the notion of BMI can also specify cases of incumbent firms engaging in the creation or design of completely new BMs in form of a spin-off, for example. However, the existence of a viable BM that is either changed itself, replaced or complemented by a new one, is a necessary precondition for BMI. As becomes clear, especially considering the mentioned literature on BMs as activity systems, BMs are not static but rather dynamic and must be developed and adapted according to changes in the market, competition or technologies (Bucherer et al., 2012). This change or adaptation can refer to certain building blocks or elements that a BM addresses and consists of or a firm's activity system involving core repeated standard processes or choices and consequences.

As Schneider & Spieth (2013) point out, there is an important difference between BM development and BMI. Both terms presume that a company has an existing and functioning BM in place, which is actively changed or adapted by the company based on recognized opportunities in the environment. BM development refers to potentials in terms of incremental improvements or continuous innovations within the current BM status quo (Schneider & Spieth, 2013). BMI refers to opportunities beyond this status quo, outside the firm's 'comfort zone'. Thus, just as is the case with product and process innovations, BMI is based on different degrees of innovativeness (Bucherer et al., 2012; Schneider & Spieth, 2013). It can involve more incremental improvements on the one hand but also rather disruptive changes of the current BM on the other hand (Bucherer et al., 2012; Schneider & Spieth, 2013). Especially for the latter, the innovation process is not happening sequentially and in a linear way but more unstructured and mostly iterative (Bucherer et al., 2012).

Although product and process innovations can lead to an adaptation of a firm's BM, BMI has to be considered independently from the former (Bucherer et al., 2012). In the same line, Schneider & Spieth (2013) state that BMI "aims at consciously renewing a firm's core business logic rather than limiting its scope of innovation on single products or services" (Schneider & Spieth, 2013, p. 4). Before providing a structured overview of literature and concepts on BMI that are relevant for the underlying study, the topic's relevance and functions in theory and practice will be adressed.

Relevance and Functions of Business Model Innovation

In order to understand BMI more thoroughly, it is helpful to consider the actual functions that a BM is supposed to fulfill for a company. Presenting his working definition of BMs, Chesbrough (2007) highlights six major BM functions: articulating the value proposition, identifying a market segment, defining the value chain, specifying the revenue mechanism(s), describing the firm's position within the value network and formulating the competitive strategy. The author claims that these six parameters can serve as a guideline for BMI, pointing towards different directions or areas for BM improvement. By means of the six parameters it is possible to identify "where innovation might generate new value in an industry" (Chesbrough, 2007, p. 12). The author further specifies a BM framework that sequences BMs according to their advancement. The more advanced a BM, the more valuable it is for the company. (Chesbrough, 2007)

The relevance of not only BMs but especially of BMI is investigated and confirmed by several studies (Zott et al., 2011). An extensive survey called IBM Global Business Services (2006) yields that underperforming firms put only half as much focus on BMI than outperformers (as cited in Zott et al., 2011). Also Giesen, Bermann, Bell and Blitz (2007) prove a positive relationship between BMI and firm performance. They distinguish between three different types of BMI depending on what of the BM exactly is being innovated. *Revenue models* refer to innovations around a firm's value generation. *Industry models* and *enterprise models* address innovations regarding the industry supply chain or the role and structure of the firm in the supply chain respectively. One of the authors' main findings is that all three types of BMI can enhance firm performance. (Giesen, et al., 2007)

Referring to IBM's Global CEO Studies for 2006 and 2008, also Casadesus-Masanell & Ricart (2010) claim that BMI is crucial for achieving and maintaining competitive advantage. The study proves that, in practice, more and more firms are realizing this fact and proactively

search for guidance and engage in innovating their existing BMs or designing new ones (as cited in Casadesus-Masanell & Ricart, 2010).

Also Günzel & Holm (2013) confirm that "many companies seek to achieve a competitive advantage through business model innovation" (Günzel & Holm, 2013, p. 4). As is the case when a firm aims at commercializing a new technology, BMI is often necessary to complement other innovations happening in a company. Moreover, innovating a firm's BM is a form of innovation itself (Zott & Amit, 2001). In other words, the BM can be regarded as "a vehicle for innovation as well as subject of innovation" (Zott et al., 2011, p 16).

Excursion: Business Model Innovation in Practice

Before presenting different research streams, it will shortly be outlined how BMI is approached in practice. As Zott & Amit (2015) point out, although there is a large body of literature on BMI, a relatively small amount of research is dealing with the actual implementation of the phenomenon. The questions how BMI works and what concrete steps there are to be taken by firms to invent and establish innovative BMs remain unanswered.

Chesbrough (2007) argues that a company has to initiate BMI from a management level, providing the resources and authority to plan and launch BM experiments. Although the process is expensive and time-consuming, investing in BMI before a firm is forced to do so out of financial distress is essential. (Chesbrough, 2007)

Drawing on previous assumptions as well as design literature, Zott & Amit (2015) make a first attempt to develop a detailed but generalized model of the BMI process offering useful guidance for practitioners. In their earlier works, the authors already proposed different design parameters that are involved when making BM choices. Firstly, they distinguish between content, structure and governance as design elements constituting a BM. These three elements involve decisions about which activities exactly are chosen, how they are linked to each other and who performs them. As mentioned above, they also specify four design themes, namely lock-in, novelty, complementarities and efficiency that refer to how a company primarily creates value for itself with the chosen activity system or BM. (Zott & Amit, 2009)

In a next step, Zott & Amit (2015) suggest a process model of BMI based on a five-step process, which has been used to design new products and services. Its five stages, namely observe, synthesize, generate, refine and implement, are connected iteratively. The first stage involves developing a deep understanding of how all relevant BM stakeholders,

including end-users, suppliers, partners and the focal firm itself interact with a product or service. It implies getting to know their respective roles within an existing BM and the design drivers for a new BM. Based on the recognized problems and opportunities the second phase is a first step towards generating solutions. Synthesizing or making sense of the gathered data ideally results in identifying relevant market gaps, challenges and forces that influence and determine BM design solutions. This second phase serves as preparation for the third stage, the generation of a BM. Supported by various brainstorming and creativity stimulating techniques, potential design solutions are developed on a conceptual level. This can involve creating entirely new BMs or modifying existing ones in such a way that they represent novel BMs. In the fourth stage, the various developed BM concepts are refined in order to narrow down the scope of possible solutions. This firstly means consolidating the different BMs into groups based on alternative fundamental design choices. Subsequently, receiving feedback and evaluating the different designs iteratively is essential to get closer to defining the details of the emerging BM. The refine stage implies the important idea of prototyping a BM in order to receive valuable feedback from relevant stakeholders based on their real and observable experiences. Finally, as the name of the last phase already reveals, a chosen BM is selected and implemented. Zott & Amit (2015) clarify that this step might require organizational and/or strategic redesign to align the new BM with the organization. (Zott & Amit, 2015)

Next to Zott & Amit's (2015) attempt to comprehensively describe and structure the process of BMI with their suggested model, Chesbrough (2007) puts the emphasis on BM experiments. According to the author, the BMI process mainly involves "to conduct some experiments, gather the evidence, identify the most promising direction and then run some further experiments" (Chesbrough, 2007, p. 17). By applying Chesbrough's (2007) framework, firms can assess and evaluate their current BM and its potential. Afterwards, they can plan and induce further steps to innovate and advance the current BM. Most importantly, this process can and should be initiated at any stage of the BM framework in order to adapt the current BM and remain viable. (Chesbrough, 2007)

Finally, as BMI is about innovating an already established BM, it involves competition between the old and a newly emerging BM at some stage. This competition, for resources as well as management approval, has to be managed in a way that each model gets the chance to demonstrate its continued viability. In many cases, the old and new BM can co-exist and serve different or even the same market segments. (Chesbrough, 2007)

3.2.2 Different Research Streams on Business Model Innovation

With their systematic literature review on BMI, Schneider & Spieth (2013) demonstrate how prevalent and diverse the topic is. Consequently, the authors identify three dominant research streams on BMI. The first stream deals with prerequisites for conducting BMI. Literature in this area concentrates on the one hand on drivers such as globalization and new technologies, but on the other hand also on barriers of BMI such as resistance and inertia. The second research stream Schneider & Spieth (2013) propose, addresses the content as well as process of BMI. Scholars in this area are concerned with identifying crucial elements of BMI as well as in what way it is executed. Although this research stream is found to be gaining importance in recent years, it has so far been merely explorative and has therefore not yielded empirical results yet. Lastly, a few studies focus on what kinds of effects can be achieved by means of BMI. In this third research stream, BMI has been found to impact industry and market structures on the one hand and individual firm results and capabilities on the other hand. (Schneider & Spieth, 2013)

Extending this overview of existing literature on BMI, Schneider & Spieth (2013) develop a theoretical framework based on the integration of three dominant theoretical perspectives: the resource-based view, dynamic capabilities and strategic entrepreneurship. The authors first distinguish and then synthesize the distinct explanations for BMI of each of the three approaches. The aforementioned major conclusion they derive is the distinction between developing and innovating a BM. While the latter considers exploring and exploiting opportunities in a firm's environment, BM development emphasizes incremental improvements or adjustments regarding the status quo of a firm's BM framework. A potential overlap between both concepts is acknowledged, however, the authors emphasize that their established distinction aims at improving and facilitating future dialogue within the BMI research agenda. (Schneider & Spieth, 2013)

First Research Stream: Drivers & Barriers

Literature dealing with drivers or prerequisites and barriers of BMI is manifold. When it comes to drivers of BMI, it makes sense to distinguish between internal and external ones. The latter refer to trends and developments in the external environment that, on the one hand, offer the opportunity but, on the other hand, compel a company to innovate its BM. Most scholars mention globalization and the emergence of new technologies or the Web 2.0 as such external inducements for BMI (Lee, Shin & Park, 2012; Wirtz, Schilke, Ullrich, 2010). More tangible and therefore interesting, however, is research on company-internal prerequisites of BMI. Doz & Kosonen (2010) investigate the role of strategic agility, defined as "the ability for companies to stay competitive in their business by adjusting and adapting to new innovative ideas and using these ideas to create new products and services as well as new business models" ("Strategic Agility", n.d.) According to the authors, a company can be made more agile by developing the three crucial meta-capabilities *strategic sensitivity*, *leadership unity* and *resource fluidity* (Doz & Kosonen, 2010). Moreover, the process of ideation in developing and innovating BMs has been proven to be of importance. Eppler, Hoffmann and Bresciani (2011) suggest collaborative idea generation, opening up sufficient space for individual creativity, as a crucial prerequisite in the BMI process. Björk (2012) complements this idea by highlighting a major benefit for companies if individuals involved in BM ideation span different knowledge domains (Björk, 2012).

Rooted in an increasing environmental uncertainty and complexity, Najmaei (2012) claims the BMI process to come with a "bundle of inherent perplexities and difficulties" (as cited in Günzel & Holm, 2013, p. 4). Barriers of BMI are mostly related to resistance towards change or inability to react to something new by the decision-makers or the firm in total. Cavalcante et al. (2011) mention organizational inertia and path-dependency as crucial reasons hindering firms to adapt to fast changing environments (Cavalcante et al., 2011). Günzel & Holm (2013) describe this more clearly as the "inability of the firm to adjust existing resources to complex change" (Günzel & Holm, 2013, p. 9).

Political power games might, for example, be the core of these barriers. If and in what way a company intends to exploit market opportunities is a decision involving several stakeholders with often diverging interests. Resolving potential conflicts is difficult and takes more time than a company might have in an increasingly fast changing environment. (Cavalcante et al., 2011)

Moreover, cognition of employees and managers within a firm, often involving a certain resistance to radical change, play an important role in BMI. Other scholars refer to these observations as unwillingness to move out of the comfort zone or defense of the status quo within a company (Günzel & Holm, 2013). More specifically, there are different gradations or forms of avoidance; BM change and innovation can be completely rejected and neglected from the very beginning, or, only parts of it can be avoided leading to partial changes in the current BM but not its radical revision (Cavalcante et al., 2011). In connection with this, the so-called *dominant logic trap* and *identity trap*, proposed by Tripas and Gavetti (2000), are important to mention (as cited in Günzel & Holm, 2013).

Both refer to the fact that a firm's current BM, representing the logic or identity of the firm, often constrains the development and implementation of new ideas. Chesbrough (2010) summarizes most of the above mentioned by distinguishing between both obstruction and *confusion* as main barriers for BMI. In the case of obstruction, managers already recognize the appropriate new BM but its implementation is hindered by conflicts and tensions with the prevailing BM or its necessary configuration of assets. Confusion however, points towards managers not knowing or being able to identify exactly what new BM the company needs. For both barriers, the authors consider experimentation, supported by BM maps and templates, a necessary and effective solution. (Chesbrough, 2010)

Second Research Stream: Process & Elements

The research of Cavalcante et al. (2011) that has been mentioned above can be ascribed to the second research stream. Although the authors do not directly refer to it as BMI, they analyze the subject and process of BM change. They introduce four different types of BM changes that can occur, rooted in their process-based conceptualization of the BM concept. According to Cavalcante (2013), BM change occurs if the core standard repeated processes within a firm are affected. The four different types of change they define include *creation, extension, revision* and *termination*.

With creation, the author refers to establishing a new BM based on a recognized need or business idea by establishing completely new core processes. As BM creation is not based on the development or innovation of a firm’s current BM, this notion cannot be fully aligned to Schneider & Spieth’s (2013) thoughts on BMI. However, taking into account the possibility that an established firm can create and implement a completely new BM in form of a spin-off, for example, BM creation can also be regarded as BMI. Extending a BM implies that new core processes or activities are added to an already existing and working BM framework.

This can mean changes in working practices and gradually offering more or better products/services, for example. In line with Schneider & Spieth's (2013) notion of BM development as incremental innovation, Cavalcante (2013) describes extension as "related to improving the existing business" (Cavalcante, 2013, p. 12). Lastly, BM revision involves intervening with the processes or activities of a firm's existing BM. Here, core repeated standard processes are removed or replaced, thereby changing the current BM and potentially also a company's actions or direction. (Cavalcante, 2013)

As core processes are more radically affected, the firm's current BM status quo is given up, leading to what Schneider & Spieth (2013), amongst others, refer to as BMI. Possible drivers of BM revision can be recognized opportunities but also anticipated threats of new entrants, competitors or BM obsolescence. Lastly, BM termination specifies abandoning or terminating core repeated business processes or even entire BMs. As both BM creation as well as termination imply radical changes to a firm's BM status quo, they all can be assigned to Schneider & Spieth's notion of more radical BMI. (Cavalcante, 2013)

Figure 3-4 illustrates the process-based framework for BMI based on Cavalcante et al's (2011) and Cavalcante's (2013) findings.

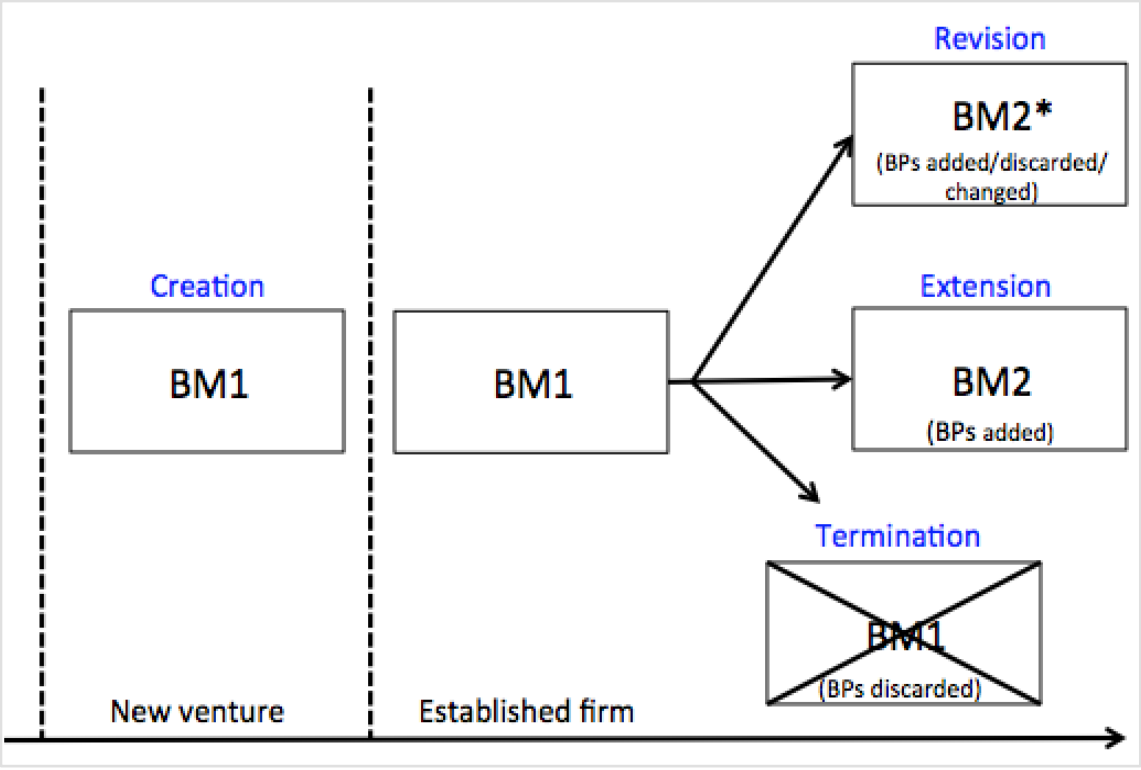

Fig. 3-4: Process-Based Framework for Business Model Innovation (Source: Own illustration)

Very similar to Cavalcante's (2013) approach, Zott & Amit (2009) suggest in their research about BM design that BMI is based on a firm's activities. By linking new activities into an existing BM or altering activities and their structure, they ascertain "the development of new and exciting business models for the future" (Zott & Amit, 2009, p. 9).

Based on the BM Canvas by Osterwalder & Pigneur (2010) and contributions from new product development (NPD) research, Günzel & Holm (2013) offer another, more differentiated perspective on the BMI process. The authors claim that most literature on BMI does not take its complexity and multifaceted structure into account. With their 'one-size-does-not-fit-all' approach, Günzel & Holm (2013) suggest "the need to distinguish between front-end and back-end business model innovation process" (Günzel & Holm, 2013, p. 1/2).

The front-end entails the value-focused side including the value proposition and all elements to its right while the back-end, the left side of the Canvas, concentrates on efficiency. Drawn from NPD literature, they propose different approaches for front-end and back-end BMI. Günzel & Holm (2013) highlight that processes can occur in distinct ways; they can be linear, recursive, evolving and based on selection or trial-and-error. According to the authors, the front-end of a BM should be innovated relying on trial-and-error or experimentation while for back-end BMI processes more linear approaches are recommendable. This conclusion is not in line with most BM literature suggesting that the overall BMI process is chaotic and non-linear. From their differentiated perspective, Günzel & Holm (2013) argue for a *structured flexibility approach* borrowing the term from Biazoo (2009) within the field of NPD. (Günzel & Holm, 2013)

De Reuver, Bouwman & Haaker (2013) go one step further in structuring the BMI process by suggesting a BM roadmap approach based on the idea of technology roadmapping. A two-layer roadmap is being proposed with intermediate steps for realizing a new BM. The first layer entails the anticipated BM changes for the service, technological, organizational or financial BM domains. In the second layer, concrete practical actions (activities) are formulated, which are necessary to realize the BM changes. De Reuver et al. (2013) define four steps involved in the process of BM roadmapping. Firms need to (1) identify the desired changes in the BM, (2) analyze how these changes will impact other BM domains, (3) translate these changes into executable actions, and (4) assess the path- and interdependency between the activities and back-cast ideal transition paths. This enables firms to remain an integrated perspective on their BM, keeping in mind that, for example, "a choice for a new technology may impact the service offering" (De Reuver et al., 2013, p. 7) or other BM domains.

At this point, it is reasonable mentioning the works of Abdelkafi et al. (2013) and Gassmann et al. (2013) again. As another approach explaining the elements and processes of BM design and BMI, the authors propose imitation and recombination of existing BM patterns. This has been noticed already in the context of specifying the term BM and BM concept, but this role-model-based approach is especially crucial when it comes to BMI practice. The scholars introduce the notion of BM patterns as distinct elements of BMs that are flexible and can be recombined in different contexts. In a broader sense, they describe a pattern as a description of "the relationship between a certain context or environment, a recurring problem and the core of its solution" (Abdelkafi et al., 2013, p. 14). Abdelkafi et al. (2013) define the BM as a description of "how the company communicates, creates, delivers, and captures value out of a value proposition" (Abdelkafi, et al., 2013, p. 12). Consequently, the authors establish an own BM framework entailing five different value dimensions, namely *value proposition, value creation, value communication, value delivery* and *value capture*. In a next step, they classify BM patterns that exist within and also outside the automotive industry. They further claim that patterns from different value dimensions and also different industries can be recombined and imitated resulting in successful new BMs in the e-mobility context. Consequently, knowing various BM patterns has the potential to support and alleviate managerial decision-making. By 'borrowing' BM patterns from their own or even another industry, companies can engage in efficient BMI. Relating back to their theoretical framework, BMI is happening if at least one of the five suggested value dimensions is modified or improved by this pattern imitation and recombination. (Abdelkafi et al., 2013)

In the same line of thought, Gassmann et al. (2013) developed their *St. Gallen Business Model Navigator™*, a three-step-methodology for the process of BMI. The methodology is based on their business model innovation map, which has already been mentioned above. The three steps, the authors distinguish between, are called *initiation, ideation* and *integration*. The methodology can be applied in form of a workshop or meeting with, for example, the management team of a firm. During this workshop, the first phase of initiation is about understanding and describing the current BM of a firm as a preparation and common ground for the process. In the following ideation phase, the participants are challenged to think out of the box and recombine existing patterns. By means of a card set containing 55 cards showing the 55 most common and successful BM patterns, the participants' innovative ideas are triggered and played with. In the last stage of integration, promising ideas are completed and combined until all BM dimensions are addressed and the BM is ready for implementation. Clearly, the St. Gallen Business Model Navigator™ offers a very practical and playful approach to BMI. The authors highlight the importance of a clear

and effective BMI process within a company in order to create and implement new BMs successfully. (Gassmann et al., 2013)

Third Research Stream: Results & Outcomes

Completing the overview based on Schneider & Spieth's (2013) suggested research streams, the third and last one deals with the effects and effectiveness of BMI. As both are not direct subjects of the underlying research, this research stream will only briefly be explained. Schneider & Spieth (2013) further distinguish between different effects that are being studied within the concerned literature stream. Several scholars investigate the effects of BMI more generally on the market and industry structure. This involves studying changes in the dominant industry logics or the competitive structure of the market, for example. Others focus on effects regarding either individual firm results or firm capabilities. While analyzing a firm's financial performance is rather straightforward, investigating its capabilities is more complex and complicated. Most literature approaching the latter is concerned with the strategic flexibility of a firm, defined as its "capability to respond to predictable changes in its external environment or unpredicted developments of anticipated changes" (Schneider & Spieth, 2013, p. 14). However, up until now, scholars seem more concerned with the preconditions and the process of BMI resulting in research on the effects and effectiveness of BMI as still being rather scarce.

Table 3-3 provides an overview of the articles dealing with BMI that served as basis to develop the conceptual framework and were studied in-depth, structured by the suggested distinction of Schneider & Spieth (2013).

Distinction based on: Schneider & Spieth, 2013	
Drivers & Barriers	
Author(s), year	*Key aspects/findings*
Chesbrough, 2007	Innovation not only involves technology anymore but also BMs
Chesbrough, 2010	Barriers of BMI: managerial cognition; conflicts with current BM or resources/assets
Doz & Kosonen, 2010	Strategic agility (strategic sensitivity, leadership unity, resource fluidity) as precondition to accelerate BMI

Björk, 2012	Spanning different knowledge domains benefits ideation efforts for example in the context of BMI
Lee, Shin & Park, 2012	Identification of four principal types of BMs in SMEs & their evolutionary paths according to the firm's innovativeness
Eppler, Hoffmann & Bresciani, 2011	Using artifacts (i.e. BM template) significantly affects the BMI team process/efforts
Günzel & Holm, 2013	structured flexibility approach: difference between front-end and back-end BMI
Process & Elements	
Cavalcante et al., 2011	Core repeated standard processes = boundaries of a firm's BM; 4 types of BM change: extension, revision, creation, termination
Cavalcante, 2013	Case study analysis about the impact of an emergent technology on firms' BMI activities → mostly extension of BM, creation in form of emerging technology platform
Abdelkafi, 2013	BM patterns = distinct & flexible elements of BMs: can be imitated and recombined
Zott et al., 2011	BMI = linking new activities into current BM or altering activities and their structure
Gassmann et al., 2013	3-step-methodology for BMI process: *initiation, ideation* and *integration*
Bucherer et al., 2012	Similarities and differences between product innovation & BMI → BMI framework
Zott & Amit, 2015	Development of normative model of the BMI process within firms
De Reuver, Bouwman & Haaker, 2013	BM roadmapping process
Results & Outcomes	
Neglected for this research	

Tab. 3-3: Analyzed BMI Articles for Developing the Conceptual Framework (Source: Own illustration)

3.3 Big Data

Unlike the previous sub-chapters on the BM concept and BMI, this following chapter on Big Data does not reflect a thorough literature analysis. It aims at clarifying the specific research context, Big Data, and explains the applied terminology. Furthermore in this chapter, the Big Data technology SAP HANA and its relation to relevant business megatrends will be assessed. Consequently, its potential impact on a firm's BM will be pre-determined in order to help formulate the working hypotheses and the conceptual framework.

3.3.1 Introduction

The term Big Data has become a ubiquitous one in many parts of industry and academia. The frequent utilization of the same term in different contexts potentially brings about confusion and ambiguity. Confronted with this challenge, De Mauro et al. (2015) have developed a definition that takes the many different aspects of Big Data into account.

"Big Data represents the Information assets characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value. " (De Mauro et al., 2015, p. 103)

Except for the following two minor adaptations, this definition of Big Data by De Mauro et al. (2015) was chosen for this master's thesis. As information can be considered an outcome and thus already a form of value from analyzing data (Sadovskyi et al., 2014), the term *Information* was exchanged by *Data*. Then, *Veracity* as a fourth trait of Data was added as this has become established in recent academic and management literature (Sadovskyi et al., 2014; Bulger et al., 2014; Schroeck et al., 2012). The chosen definition of Big Data is thus as follows:

"Big Data represents the Data assets characterized by such a high Volume, Velocity, Variety and Veracity to require specific Technology and Analytical Methods for its transformation into Value."

As already mentioned before, the term Big Data is quite ambiguous. As it can be taken from their definition, De Mauro et al. (2015) categorize the topics surrounding the term Big Data into four themes, namely *Information (or Data), Technology, Methods* and *Impact*. Based on this separation, the following sections will further explain the term Big Data.

Data

Company data has long been around and is per se nothing new. So what is the difference between company data from the previous decades and today's Big Data? Four determining features are widely being agreed upon as distinctively characterizing the 'Big Data's data'. Each of these four traits will now be further discussed. They are referred to as the *Four Vs*: *Volume, Variety, Velocity* and *Veracity*. (De Mauro et al., 2015; Schroeck et al., 2012; Sadovskyi et al., 2014)

Volume - refers to the amount of data. It is the data that organizations harness and then deploy in a value creating way. Referring to Big Data, great comparisons or illustrations are being made, like the one made by the CEO of Google, Eric Schmidt:

"There were five Exabyte of information created by the entire world between the dawn of civilization and 2003, now that same amount is created every 2 days." (Google, 2010)

Although the amount of data will continue to increase and is expected to double every two years, it is not clear at what amount data starts being *big* data. There is no defined threshold, since a large data volume can vary significantly between companies, industries or even geographies. Yet it is clear that more and more firms are facing the challenge of an increasing amount of data that grows at an ever-higher speed, which brings us to the next characteristic. (De Mauro et al., 2015; McAfee, Brynjolfsson, Davenport, Patil & Barton, 2012; Schroeck et al., 2012)

Velocity - refers to latency. Latency is the time lag between the data creation and its accessibility for analysis. Today, many time-sensitive processes depend on real-time information through streaming data, in order to be of any value. The speed of data generation, aggregation and analysis is therefore of utmost importance. A prominent example of that would be fraud detection in the banking sector, where an instant data analysis is crucial in order to react to fraudulent activities in a timely manner. (Schroeck et al., 2012; De Mauro et al., 2015; Sadovskyi et al., 2014)

Variety - refers to the different types and sources of data. These types can be grouped into structured (i.e. databases or spreadsheets that are text or numeric based), semi-structured (i.e. data that can be converted into structured data, e.g. XML, RSS or e-mail) and unstructured data (e.g. location data, audio, video or images). The data sources can be rather traditional (e.g. cash register transactions) and non-traditional (e.g. Twitter tweets),

created through internal processes or obtained from external sources. (Schroeck et al., 2012; De Mauro et al., 2015; McAfee et al., 2012; Sadovskyi et al., 2014)

Veracity - refers to the uncertainty of data. Some kind of data may not be of very high quality or by its nature not very reliable (e.g. weather forecasts or the true meaning of a tweet) but still of great value. One example of that can be found in the energy production. Although future weather conditions are always uncertain, they are still of great value to a utility company, in order to forecast their renewable energy production, and comply with governmental regulations. Organizations have to acknowledge these uncertainties and find solutions on how to deal with them. For example, through combining various less reliable sources, to arrive at a more accurate data point. Deploying data cleansing methods or analyzing the entire population of a dataset rather than just a subset, can further increase the data's quality and reliability. (Schroeck et al., 2012; De Mauro et al., 2015; Sadovskyi et al., 2014)

Technology

The technology aspect of Big Data is mainly concerned with the current technological advancements to cope with these new data characteristics, in order to be able to analyze, store, manage, manipulate and aggregate the data. Increased data storage at cheaper prices, for example, offers the user the freedom to first collect the data and take decisions about the analyses afterwards, thus leading to increased possibilities to experiment. Additionally, the full population can be used for analysis, instead of having to make careful decisions about what data subset to keep, hence facilitating the process and improving the outcome. Improvements in processing increase the speed of analyses to real-time levels, and reduce the costs of testing theories. Enhanced data generation from unstructured data sources, and improved analytical capabilities, allow now to efficiently process them. (Bulger et al., 2014) With respect to these developments, the most prominent technologies include:

Cloud computing - Companies like Amazon, Google, SAP or Microsoft offer other organizations access to their data centers through the internet for extra highly scalable computing resources (i.e. storage, applications or computing power). This way, a company can increase their processing power and storage capacity on a very short notice or even for only a short amount of time, thus turning the fix costs of a Big Data infrastructure into variable costs. Through that, a company is able to experiment and test their Big Data projects, before making any huge commitments. Other benefits are the overall cost reduction and risk mitigation, regarding security or system failure issues, and enhanced

employment of mobile devices. (Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh & Byers, 2011; Schroeck et al., 2012)

NoSQL databases - Not-only-SQL databases (in contrast to relational, SQL databases) store data not in tables (i.e. columns or rows), which is especially helpful when dealing with high amounts of unstructured data, as it speeds up the processing. Additionally, it enables a more efficient way of storing unstructured data, which is of special relevance today, since 90% of data is unstructured and vastly growing. (Kanimozhi & Venkatesan, 2015)

Hadoop - Hadoop is an open-source software framework that is associated the most with Big Data. It is currently managed by Apache and based on concepts developed by Google. (Manyika et al., 2010; De Mauro et al., 2015) It enables a much faster and efficient way of dealing with big computational problems through "distributed processing [and storing] of big quantities of data by using a group of dispersed machines" (De Mauro et al., 2015, p. 99). The Hadoop framework is open source and the basis for many projects, like Cassandra (a high speed NoSQL transactional system), Hive (a read-only data warehouse), HBase (a computational system with MapReduce) or Spark (an in-memory SQL query engine). (Hallenbeck, 2015)

In-memory - In-memory databases have existed since the 1980s but have only recently dropped in price to consider them for large enterprise systems. In-memory databases store the vast amount of data in the computer's main memory instead of disk drives. This speeds up the processing time significantly, as the disks represent the narrowest bottleneck for accessing the data. This enables fast processing for data-intensive analytics and reporting. (Zikopoulos, deRoos, Andrews, Bienko & Buglio, 2014; Plattner & Zeier, 2011)

Methods

Big Data also encompasses data analyses that go beyond the traditional statistical techniques. New sophisticated methods are necessary to grasp value out of extensive quantities and varieties of data, and gain ever deeper and new insights. These analytics can be grouped into *descriptive analytics*, which explain past events; *predictive analytics*, analytics that forecast a future outcome and *prescriptive analytics*, which do not only predict future outcomes, but also provide suggestive decisions. (Brownlow, Zaki, Neely & Urmetzer, 2015) Methods include algorithms for regression, classification, clustering, data mining, A/B testing, association analysis, anomaly detection, visualization or optimization. But also search engines, web crawling or network visualization. Other emerging techniques are

neural networks, genetic algorithms, opinion mining, machine learning, natural language processing and crowdsourcing. But also nature-inspired algorithms like particle swarm optimization and colony algorithm belong into the field of big data analysis. (De Mauro et al., 2015, Manyika et al., 2010; Sadovskyi et al., 2014; Chen, Chiang & Storey, 2012)

For more extensive and detailed description of established and emerging Big Data technologies and techniques see Chen et al. (2012) and Manyika et al. (2010).

Impact

When talking about Big Data, one topic that is often subject of discussion is its impact. This includes the impact on businesses as well as on society as a whole. The impact on society encompasses developments in, for example, the healthcare sector, the public sector, the economy or even the job market. (Bulger et al., 2014; Chen et al., 2012). For the healthcare sector, the analysis of data from electronic health records, payer claims, pharmacy data or mobile health technologies can help to design more streamlined clinical trials, recognize research failures more quickly, and speed up the approval process of new medicines (Ernst & Young, 2015). For Europe's public sector, studies estimate new value of up to €300 billion through cost reduction of administrative activities (Manyika et al., 2010; European Commission, 2015). Even controversial topics like 'predictive policing' - methods trying to predict the likelihood of future criminal activities - are part of society's discussions about Big Data (The Economist, 2013).

Even the overall economy is affected by this trend. Big Data contributes to the economy by creating new growth opportunities, new jobs, and even whole new categories of jobs. In fact, it is estimated that by 2018 the US workforce alone will be short of up to 190,000 people with deep analytical skills and 1.5 million managers, who can analyze Big Data and make decisions based on their findings. (Manyika et al., 2011)

Nevertheless, when Big Data is the subject of discussion, one major concern is always brought forward - privacy. Even though the great amount of personal data is created through actions done by many individuals, the consequences can impact a single individual in unexpected ways. Hence, it is theoretically possible to statistically predict future actions of individuals, raising ethical issues about free will. Because of this, data is commonly being anonymized. However, even anonymization is never 100% effective and can, with some effort, eventually be overcome through de-anonymization. (De Mauro et al., 2015) Because of these concerns, some countries are more resilient in the use of personal data than others.

Here, Germany takes the leading role with one of the most restrictive (and some say outdated) data protection legislation, enforced by the *Datenschutzgesetz* (Lüber, 2014).

More interestingly and relevant for this research, however, are the effects and opportunities of Big Data for each business. A key word that is often used in this context is *Data-Driven Business Model (DDBM)*. But what exactly does DDBM mean?

A DDBM can either mean that (1) the product or service a company offers is fully data based, or (2) that elements of a traditional BM (e.g. manufacturing or retail) is being improved or accompanied by Big Data. DDBM within the first category can range from generating, collecting or aggregating data for other firms (usually B2B or B2B2C) from their internal and external sources, and/or offer data analytics as a service. Startups are the majority of firms belonging to this first category, deploying a BM in which data mining and analytics represent their main value proposition. (Hartmann, Zaki, Feldmann & Neely, 2014; Sadovskyi et al., 2014)

Therefore, the focus will be put on the second category, in which Big Data can be seen as a driver of innovation for products/services, processes as well as other BM elements of incumbent firms. BMI is thus driven by Big Data technologies like SAP HANA, through making the innovation or adaptation of a BM possible or maybe even necessary. Data-driven BMI can therefore be seen as a subsection of the more generic term technology-driven BMI. When exactly a BM can be considered as being data-driven is not specified. (Hartmann et al., 2014)

Taking the automotive industry as an example, data-driven can mean changing the product by implementing a number of new sensors, and generating and gathering more information about the car and customer. Or even adapting the whole BM by selling this data to third parties like insurances. However, even using Big Data for business intelligence and gaining enhanced insights into the own business can be considered data-driven. Another aspect of data-driven businesses involves internal decision-making processes. Data-driven decision-making relies to a much greater extent on data and hard facts, reducing the reliance on common-sense and individual judgments of today's decision-makers. Data-drivenness can therefore also refer to internal changes and processes. Related to the definition of Big Data, a DDBM is thus any BM that uses specific technologies and analytical methods on data of high volume, velocity, variety and veracity, to improve any of its BM elements.

DDBM become increasingly attractive and studies show that data-driven businesses exhibit competitive advantages compared to their more conventional peers. The application of Big Data may not always lead to complete overhauls of BMs, but many cases have shown that at least the efficiency and effectiveness of existing processes can be increased. With increasingly exchangeable products and services, data-driven business processes can make the difference. (Czotscher, 2014) In a joint research by IBM and the University of Oxford's Saïd Business School, 1,144 IT and business professionals were interviewed. The study found that between 2010 and 2012, the interviewees who reported that using Big Data provides them with a competitive economic advantage, increased by 70%. (Bulger et al., 2014) Another study found that industry leading, public North American companies, using data-driven decision-making were, on average, 5% more productive and 6% more profitable than their competition. (McAfee et al., 2012)

At this point, all three aspects that are relevant for the underlying research project can be put together: BM, BMI and Big Data. Relating these aspects helps understanding the purpose of this theoretical study and the following empirical study. The concept of BMs and the constant need of BMI have been presented as crucial for companies to take into account while operating. Moreover, Big Data has been depicted and explained as potential driver of innovation for a firm's products, its services and processes but particularly also for its BMs. With this regard, the possibilities for BMI stimulated by Big Data developments lead to the notion of DDBM. The impact of SAP HANA as a Big Data technology, offering possibilities for BMI and, more specifically, DDBMI, is investigated in this research project.

The technology in focus, SAP HANA, and its potentials for companies with regards to Big Data will be explained in the following chapter. How Big Data developments can be further specified and divided into several important subtrends will be explained in chapter 3.3.3.

3.3.2 Technology Description: SAP HANA

Since 2010, SAP SE is shipping its new product called SAP 'HANA' (High-Performance Analytic Appliance) and with that entered the database market. As part of a research project at the Hasso Plattner Institute in Potsdam, the main focus of this database lies on in-memory technology.

In-memory technology is per se nothing new and has been around for many years, although only for niche markets/applications. Since the price of in-memory technology is dropping noteworthily, deploying an in-memory database for whole enterprise datasets is now becoming feasible for more and more companies (Henschen, 2014). This innovative

approach, with SAP HANA as the first commercially available product, is said to be disruptive to the traditional hard disk-based databases (Plattner & Zeier, 2011). Nevertheless, this study does not explicitly consider the impact of *disruptive innovations* on a BM, because it does not solely focus on the in-memory aspect of SAP HANA. It rather examines the impact of the whole product, since the technology offers a lot of additional Big Data related functions and capabilities. For that matter, this subchapter will explain all of these aspects of SAP HANA in more detail. For advanced technical explanations, however, the following books by Hasso Plattner and his colleagues can be recommended: *The In-Memory Revolution* (Plattner & Leukert, 2015) and *In-Memory Data Management: An Inflection Point for Enterprise Applications* (Plattner & Zeier, 2011).

Due to the highly demanding requirements on a firm's database system, it typically deploys a database management system (DBMS) for Online Transactional Processing (OLTP), as well as one for Online Analytical Processing (OLAP). Transactional data is being created, for example, when sales processes create, modify, or delete data about a certain customer and his/her purchase. This data is typically stored on the OLTP system in a disk-based and row-oriented fashion. For analytical data processing (e.g. quarter-end closing or customer segmentation), however, the row-oriented data storage is very inefficient. The increasing analytical workloads had an impeding effect on the performance of the whole database, leading to the separation of the two systems and the creation of the business (or data) warehouse. The business warehouse (BW) is storing a subset of recent transactional data in a columnar way, optimized for analytics and reporting. As a business grows and complexity increases, this kind of data management inherits many difficulties and costs concerning the redundant data storage, data transfer and the synchronization between the systems. Thus, the main benefit HANA promises again, is to integrate these two systems into one and allow for transactional as well as analytical data processing on the same data, at an even higher speed than before. To reach this level of performance, the latest hardware is being employed (i.e. multiple CPU cores, large main memory, and caches) and the database content being compressed. The HANA database has the ability to store data row- as well as column-oriented, even though the focus clearly lies on columnar storage. Especially for analytics, data has so far been aggregated beforehand, in order to reach adequate response times. One drawback this approach implies is that all needed analytical requests have to be known in advance. Due to HANA's high performance, no pre-aggregations are necessary anymore, leading to more flexible analytics. In combination with the integration of the OLTP and OLAP system, this means analytics in real-time, with almost zero latency between data

creation and analyzing this data. (Färber, May, Lehner, Große, Müller, Rauhe & Dees, 2012; Plattner & Leukert, 2015)

Because of the higher processing speed and parallelism, completely new algorithm classes are possible within the ERP systems. Many mathematical methods have been added to the system and 'R' - a statistics software often used in science - has also been integrated. The high processing power, new functionalities, and the access to the whole dataset (including historical data and not just a BW subset), allow for very sophisticated analyses like predictive analytics, link prediction, statistical tests, time series analyses, outlier detection, classification, and clustering. (Färber et al., 2012; Plattner & Leukert, 2015)

Another major feature of HANA is the analysis and processing of unstructured data like text or geospatial data. (SAP SE, 2014b). Text data, for example, can be linguistically analyzed and positive or negative sentiments can be detected. Through natural language processing, entities like locations, people or products can be extracted. This helps structuring the unstructured text data and correlating as well as processing it with other structured data. (Plattner & Leukert, 2015)

Additionally, SAP HANA is able to work with Hadoop and is therefore also compatible with NoSQL databases. This is also a great plus for the many businesses that are already working with Hadoop (Hallenbeck, 2015; Bhoj, 2013)

Another major feature is the connection to SAP's cloud services. SAP offers application as well as platform cloud services. This enables companies to store their increasing company data in the cloud, securely access and share the business content anywhere and anytime, and fast and effortlessly get the latest software updates and deploy third party applications. (SAP SE, 2015a)

SAP SE's enterprise applications (called Business Suite or BS), which address a wide range of business operations (e.g. Customer Relationship Management, Enterprise Resource Planning, Product Lifecycle Management, Supply Chain Management, Supplier Relationship Management), have all been migrated to the HANA system shortly after its release. In 2013, SAP launched its new Business Suite (BS) 'on HANA', meaning that all its applications have been optimized for the new database system. All of these applications now take advantage of the accelerated analytical processes and the reduced data footprint through enhanced data compression, integration of OLTP and OLAP into one system, absence of pre-aggregations and redundant data. In a next step, SAP aims at completely rebuilding their

existing applications and adding new ones to their BS that fully exploit the analytical capabilities of HANA. (Plattner & Leukert, 2015)

Consequently, customers have two options to deploy HANA. One is to only deploy HANA as a high performance database with much faster analytical processing, reduced data footprint and the integration of OLTP and OLAP. Another option is to also acquire/license the HANA optimized applications or upgrade the existing ones. In 2014, *SAP Simple Finance* was released, the first application that was completely rebuild for HANA. To demonstrate how risk-free it is to switch to HANA, SAP SE moved its own financial system to Simple Finance. Due to its new analytical capabilities, real-time screening of anomalies resulted in 10% fewer fraud cases than before. However, other solutions like logistics, supply chain or productions are yet to follow. In February 2015, SAP launched its new BS called S/4 HANA. Although Simple Finance is still the only true HANA application, a new User Interface (UI) or User Experience (UX) has been introduced with S/4 HANA - SAP Fiori UX. All future SAP solutions will be based on SAP Fiori, which is web-based and can therefore run on any mobile device connected to the HANA database via cloud computing. (Plattner & Leukert, 2015)

However, the user or firm is not locked within the SAP solutions. So called *stored procedures* give the user full flexibility and enable him to write own queries or whole applications that can access the entire database and fully exploit HANA's capabilities (i.e. processing speed or analytical abilities). The same is true for third parties, which can range from startups to larger consulting firms, and can develop whole applications for HANA. This makes SAP HANA a Big Data platform or ecosystem. In addition, does SAP also provide a HTML5 development toolkit, called UI5, with which developers can quickly and easily create customized business applications for any platform any device (i.e. mobile and desktop). (Plattner & Leukert, 2015; Plattner & Zeier, 2011; SAP SE, 2015b)

Advantages of SAP HANA for businesses in a nutshell

Increased data compression and storing the data in a columnar fashion reduces the overall data footprint. This reduced data footprint combined with the increased speed through parallel processing and the in-memory database, lead to the consolidation of the OLTP and OLAP systems. This further reduces the necessary storage capacity as well as the complexity and administration efforts for the whole system. Therefore, after an initial investment, the total cost of ownership (TOC) will decrease significantly in the long run. Eliminating the BW also increases the consistency of the overall IT environment, creating a unified data point - *a single source of truth* - for all applications and the whole company. The access to the whole

dataset does not just increase the quality of analyses, but, combined with the improved performance, data analytics reaches a whole new level of sophistication and reliability. Both the stored procedures and not having to predefine the queries, enable the user to iteratively browse through the data and make instinctive ad hoc queries and analyses. This and the advanced analytics capabilities can greatly improve the decision-making in real-time, on the management as well as on the operational level. Coupled with SAP's cloud services that are also based on HANA, the database access via mobile devices promises enhanced flexibility. SAP HANA is thus truly a bundle or platform of state-of-the-art Big Data technologies and methods.

3.3.3 Relevant Megatrends

As mentioned above, Big Data can be considered a major driver for innovation within companies resulting in the notion of DDBM and DDBMI. The four main themes or aspects of Big Data based on De Mauro (2015) have been outlined in detail and also the most important technical characteristics and possibilities of SAP HANA as Big Data technology have been explained. However, the emergence of Big Data as phenomenon which impacts businesses as well as society as a whole can be specified in more detail. This is especially important in order to limit the research scope and it influences the conceptual framework as well as the subsequent empirical research. Moreover, it makes clear that SAP HANA as Big Data technology has a potential impact on all four BM elements suggested by Baden-Fuller & Mangematin (2013).The process of identifying and selecting relevant business will be explained in more detail in this chapter.

There are currently two major trends that led to the emergence of the Big Data phenomenon. The first one is called *Digitization*, which is "the process of converting continuous, analog information into discrete, digital and machine-readable format" (De Mauro et al., 2015, p. 98). All these digital events are now being generated due to the widespread application of digital sensors. These sensors can be found in sensor-enabled, connected devices, like mobile devices, RFID-tags or others. The subsequent trend to Digitization is called *Datafication*. Datafication means organizing these digital phenomena into a quantified format so that they can be further analyzed. These two trends, Digitization and Datafication, form the basis of Big Data and the reason for its emergence. (De Mauro et al., 2015)

However, these trends will not be discussed in this thesis. Although Digitization and Datafication are basically what made Big Data possible, there are several other occurring

trends that describe the businesses opportunities that are build on Big Data. It is the underlying research goal to develop a conceptual framework on how SAP HANA can impact a firm's BM and create related working hypotheses. However, the possibilities a Big Data technology like HANA offers are hard to grasp and it is thus difficult to determine how it can potentially impact a firm's BM. Through the examination of major current and future business trends that are related to Big Data, the scope was limited and thus HANA's impact on a firm's BM was theoretically determined. Based on these findings the working hypotheses have been formulated, which can be tested in the subsequent cases study.

The appendix provides an overview of the consulted studies and the megatrends they identified. The studies were authored by prominent consultancies and deal with current megatrends relevant for society, governments and businesses. These studies were consulted to determine the megatrends that are most relevant for the approached businesses and that are related to Big Data or SAP HANA. Although one could argue that Big Data is a megatrend itself, it is such a broad term, encompassing many distinct developments, that it makes sense to break it down into a subset of trends.

After carefully studying these trends, they were extensively discussed with selected experts from the fields of Software Development, Data Analytics, SAP HANA, or Technological Innovation. Taking the studies and the experts' opinions into account, as well as using own judgment, a selection of the most prevalent developments that potentially have an impact on a firm's BM and are connected to the topic of Big Data was established.

Personalization

With personalization, a new level of mass individualization will be reached. The customer wishes to be heard, understood and dealt with as an individual. Increasing information about the customer, for example through social media or behavioral analysis, will provide a more precise understanding of customer segments and each individual. (Z_punkt, 2015; Roland Berger, 2015) In combination with enhanced possibilities for customization (e.g. through smart factories), this trend will lead to truly personalized "products and services [that] can be tailored to the level of the individual" (Ernst & Young, 2015, p. 10).

One extreme example of this development can be found in the personalized medicine, where information from wearable and implantable sensors or even personal genome sequencing will serve as the basis for truly personalized healthcare and nutrition services or products. (Ernst & Young, 2015)

Connectivity

Connectivity includes developments in Cloud Computing, Mobility, or Internet of Things. The number of firms offering public cloud services (i.e. infrastructure-, platform-, or software-as-a-service) is increasing while Amazon is still leading the way with their *Amazon Web Services* (Metz, 2015). Cloud Computing opens up a whole new spectrum of opportunities for firms. Although the companies centralize their data in major data centers, it dramatically fosters the mobility, flexibility and autonomy of the employees as well as the consumers. (Ernst & Young, 2015) This is, again, promoted by the widespread adoption of mobile devices like smartphones or tablets. The declining PC usage is demonstrated by the fact that, in many countries, webpage views from mobile phones have now already outnumbered those from PCs (mobiThinking, 2014). Employees will be virtually connected to their work anytime, from anywhere, and with any device, and consumers will purchase their goods mainly via mobile (i.e. m-commerce) (Siwicki, 2014; Singh, 2014).

Nevertheless, connectivity does not stop at the customer or employee. The Internet of Things is connecting various machines, device, or products that are often equipped with mini-computers or sensors, making physical objects 'smarter' and virtually accessible. This provides opportunities for new products (e.g. the connected and autonomous cars) and value chains. Key words like *Smart Factory* or *Industry 4.0* describe the interconnection of entire value chains, leading to streamlined processes, monitoring of machine performance or production completion, better inventory management and improved resource efficiency. Thus, instead of acting on historical data, problems can be anticipated and proactively encountered. (Roland Berger, 2015)

New Market Environment

Changes in the overall market environment can also be observed. An increasingly volatile economy demands very short reaction times, to adapt to changing market conditions. This can be exhibited, for example, at stock exchanges, where high frequency trading allows for automated problem evaluation, decision-making and execution within milliseconds (Lopez, 2013). Firms do not just have to be quick in regard to price changes, but also need to react fast to political regulations, technological developments, or changes in the customer behavior.

Furthermore, the boundaries between different companies, industries and markets are continuously dissolving. At the interfaces of these convergences, new markets and business opportunities arise (Z_punkt, 2015). One example would be smart grids, because in order to

integrate the increasing amount of green electricity intelligently, economically and with a high quality of supply into the power networks, the distribution networks need to be upgraded with information and communication technology (ICT). These smart grids are therefore based on the close integration of power and data networks. (Potocnik, 2006; Singh, 2014) Other examples with regards to Big Data are the emergence of digital platforms like Apple Music, Spotify, Netflix, Facebook or Google.

A final transformation of traditional market conditions that is worth mentioning is the increasingly empowered customer. Expanding transparency and easy access to different sources of information and feedback via Web 2.0, give a new voice to the consumer. Businesses are thus striving to understand the customer by analyzing social media platforms or via crowdsourcing. By these means, upcoming trends or negative headlines can quickly be detected and reacted on. (PwC, 2014)

Management of Complexity

Companies and their value chains are becoming increasingly complex. This complexity needs to be dealt with in more efficient ways. Improvements in business intelligence tools and technologies like visualization or optimization techniques help to grasp complicated correlations between multidimensional parameters in order to gain valuable insight and truly understand the own company and value chain, markets, competitors, products and customer behavior. (Z_punkt, 2015)

Advancements in technology are also giving rise to a new kind of job mechanization. After traditional automation impacted blue-collar jobs, white-collar jobs are increasingly being targeted as well. Innovations in artificial intelligence and machine learning and sophisticated mobile robotics are all fueling this expansion of systems that work autonomously and organize themselves. (Frey & Osborne (2013) in Ernst & Young (2015))

The following quote gives an outlook on upcoming technological trends and developments: “After 2020, software will process large data by replicating human behavior, followed by software allowed to make unsupervised decisions after 2025.“ (Roland Berger, 2015, p. 27)

In Sum: Megatrends and Their Impact on BMs

Most of the challenges and opportunities these mentioned megatrends provide can, in some way or form, be addressed by the applications and capabilities of SAP HANA that were described above. Due to the breadth of the topic and the wide range of potential Big Data

application fields, basically every aspect of a firm's BM can somehow be affected by this technology. Considering the BM definition by Teece (2010), it becomes obvious that all BM dimensions - value creation, value capture and value delivery - are greatly affected by these developments. Teece's (2010) three BM dimensions encompass the various BM elements that have been suggested by different scholars. Consequently, it can be argued that SAP HANA potentially affects all four BM elements by Baden-Fuller & Mangematin (2013), as the classification of BM elements which has been chosen for this thesis. This assumption is further underlined by Sadovskyi et al.'s (2014) study, which finds that Big Data can be applied to all of Porter's (2008) nine value chain activities (i.e. Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, Service, Procurement, Human Resource Management, Technological Development, Infrastructure).

As one example serves the trend New Market Environments, which, as explained above, involves the convergence of companies and whole industries. These 'Business Mashups' cause changing market structures, new business opportunities and new forms of partnerships between stakeholders. Having an impact on a firm's value chain, these developments potentially influence the BM element Value Chain/Linkages (Baden-Fuller & Mangematin, 2013) as part of a firm's value delivery (Teece, 2010). There are further examples of how the selected megatrends impact a firm's BM. As outlined above, the trend Connectivity (including IoT) leads to the emergence of new and increasingly 'smarter' products that can also increase valuable customer data, which can support the customization efforst related to the trend Personalization (Porter & Heppelmann, 2014). These new products potentially change a company's value proposition and therefore affect the firm's value creation and value delivery. Consequently, the BM elements Customer Engagement and Customer Sensing can be affected by these trends. Lastly, as part of the value capture dimension, completely new revenue or business models are enabled through Big Data, which, in turn, affects the BM element Monetization. Firms such as Google, for example, sell the retrieved customer data of their products by offering targeted advertizing. Also other aforementioned digital platforms such as Amazon or Facebook base the success of their BM on the deployment of Big Data (Davenport, 2013).

The potential impact of the four specified megatrends - Personalization, Connectivity, New Market Environment and Management of Complexity - as most relevant 'sub-trends' of Big Data and therefore drivers of DDBM/DDBMI is illustrated in the conceptual framework in chapter 4.2.

4 Results

4.1 Selection of Concepts for the Conceptual Framework

In the previous sections, concepts and literature that is considered most relevant for the underlying research project has been presented and discussed in a structured way. Moreover, Big Data as the specific research context including the technology in focus and related megatrends has been presented. In order to answer the research question of this first study of the joint research project - *how can research on the interplay between technological innovation and BMI in the context of Big Data be structured* - selected findings, concepts and megatrends had to be consolidated. As a result, the conceptual framework and connected working hypotheses that have been derived from the research efforts will be presented in this section.

As becomes clear from the sections 3.1.2 and 3.2.2, there exist various different approaches and concepts about how to determine and investigate the BM concept as well as BMI. Consequently, with the goal to create a conceptual framework and connected working hypotheses that can serve as basis for the second part of this joint research project as well as further research, different concepts had to be selected and combined. In order to obtain a rather holistic and integrated conceptual framework to structure future research, concepts from possibly all mentioned research streams on BMs and BMI had to be selected and combined. Moreover, having in mind that the second part of this joint project will use a comparative case study approach based on the underlying research results, the suitability and practicability of selected concepts for gathering empirical case study evidence were important.

For the BM concept, an integration of concepts and findings from all three research streams suggested by Zott et al. (2011), the descriptive, the functionalist and the activity system perspective, was aimed at. As this joint research project will contribute to technology and innovation management literature, the functionalist research stream is already represented by the overall interest or topic of both studies: the link between a firm's BM and its technologies. This is supported by the fact that the BM definition by Teece (2010), which was chosen for the underlying thesis, is put forward from a functionalist perspective. Moreover, the main finding by Baden-Fuller & Haefliger (2013) that BMs mediate between technology and firm performance, was selected as general background and guideline for developing the conceptual framework and deriving working hypotheses.

For actually structuring and operationalizing research on a firm's BM, one concept from both, the activity system as well as the descriptive perspective was chosen: firstly, the process-based perspective of Cavalcante et al. (2011) or Cavalcante (2013) and secondly, the typology of BM elements by Baden-Fuller & Mangematin (2013). As mentioned before, the most important reason for this decision was the attempt to integrate an activity system perspective with a descriptive perspective, obtaining a holistic point of view on BMs and BMI. Moreover, focusing on BPs, Cavalcante's (2011; 2013) approach offers a rather specific and tangible parameter of analysis, which facilitates the operationalization of BM research. However, in order to not reduce the conceptual framework to an activity-based perspective, a concept of the descriptive perspective was integrated as yet another point of view. As mentioned above, Baden-Fuller & Mangematin (2013) suggest a typology of four BM elements, namely customer identification, customer engagement, monetization and value chain/linkages. These dimensions function as categories that can further be divided into sub-categories, helping to determine a firm's BM (see above table 3-1). As all four BM elements contain or involve respective BPs, the connection between both theoretical approaches is manifest as well.

The reason why Baden-Fuller & Mangematin's (2013) typology was preferred instead of the other presented descriptive concepts is mainly due to its recentness and simple four-element-structure with sub-categories. The basis of Al-Debei & Avison's (2010) framework also involves only four BM elements, however, focusing on the keyword *value*, the authors arrange these elements and their constituents in a different way than Baden-Fuller & Mangematin (2013). Next to that, Al-Debei & Avison (2010) add complexity to their framework by integrating BM design parameters, which do not add value to the underlying topic of research. Consequently, the simpler and more recent typology by Baden-Fuller & Mangematin was chosen. Osterwalder & Pigneur's (2010) BM Canvas with its nine interrelated building blocks also appeared suitable for the purpose of the underlying research. Being originally based on the four BM pillars product, customer interface, infrastructure management and financial aspects, that are split into nine blocks that can, again, be divided into sub-categories, it shows similarities to Baden-Fuller & Mangematin's (2013) approach. However, the latter is a more abstract and comprehensive mental model than the BM Canvas template, which aims more towards BM practicality. Also, it was decided to apply Baden-Fuller & Mangematin's approach as it is the more recent one of the two options. On top of that, the thesis supervisor had provided an interview guideline for innovative BMs based on the Baden-Fuller & Mangematin's (2013) typology. This guideline was chosen to support the operationalization of the joint research project, being integrated

in the interview guideline for the case-study-analysis of the second part of this project. Consequently, it was decided to integrate the BM typology, on which the guideline was based, in the conceptual framework.

For BMI, it appeared that the integration of all three presented research streams - drivers/barriers, process/elements, outcome/results - as suggested by Schneider & Spieth (2013) is neither possible nor necessary for the scope of the underlying research project. The third research approach dealing with outcomes and results of BMI is important but can be neglected, as it is not part of the focus of this study. Moreover, the findings of the first research stream dealing with drivers and barriers of BMI are so diverse and unsystematic that it is complex while not adding much value to operationalize them in one single framework. Nevertheless, the notion of drivers and barriers for BMI is important for the underlying research. As will be explained in the next paragraph, the consideration of relevant business trends in the context of Big Data as external drivers of BMI was integrated. However, academic concepts or research findings from this first research stream were neglected for the conceptual framework. Consequently, operationalizing BMI in a conceptual framework had to rely on the second research stream concerned with the process and elements of BMI. Cavalcante's (2011; 2013) process-based perspective of investigating BMI was chosen. Adopting his approach of core repeated standard processes as boundaries of a firm's BM and his suggestion of BM change as innovation activities affecting these core processes, BMI can be operationalized in a straightforward way. As mentioned above, Cavalcante (2011; 2013) specifies creation, extension, revision and termination as four different types of BM change on a process level. This distinction offers a suitable and practical way to investigate BMI and gather empirical case study evidence.

Since for Big Data the academic literature is still rather scarce, it was difficult to identify and select specific concepts for the operationalization of the empirical research. Although literature like De Mauro et al. (2015) helped to clarify and define the topic, it was not very suitable for integrating Big Data related specifications into the conceptual framework. Based on own research that included academic literature, as well as management literature, industry studies or recent news, discussions with experts from relevant fields have been conducted. Through this approach, Big Data related business trends that could have an impact on a firm's BM were identified. The discussions furthermore helped to assess SAP HANA as a Big Data technology and pre-determine its potential impact on the BM and thus formulate the working hypotheses.

4.2 Developing the Conceptual Framework & Working Hypotheses

After having explained the selection and integration of relevant concepts and trends, the conceptual framework itself can be presented and explained. An illustration of the theory selection for the conceptual framework is shown in Figure 4-1. The conceptual framework itself is presented in Figure 4-2.

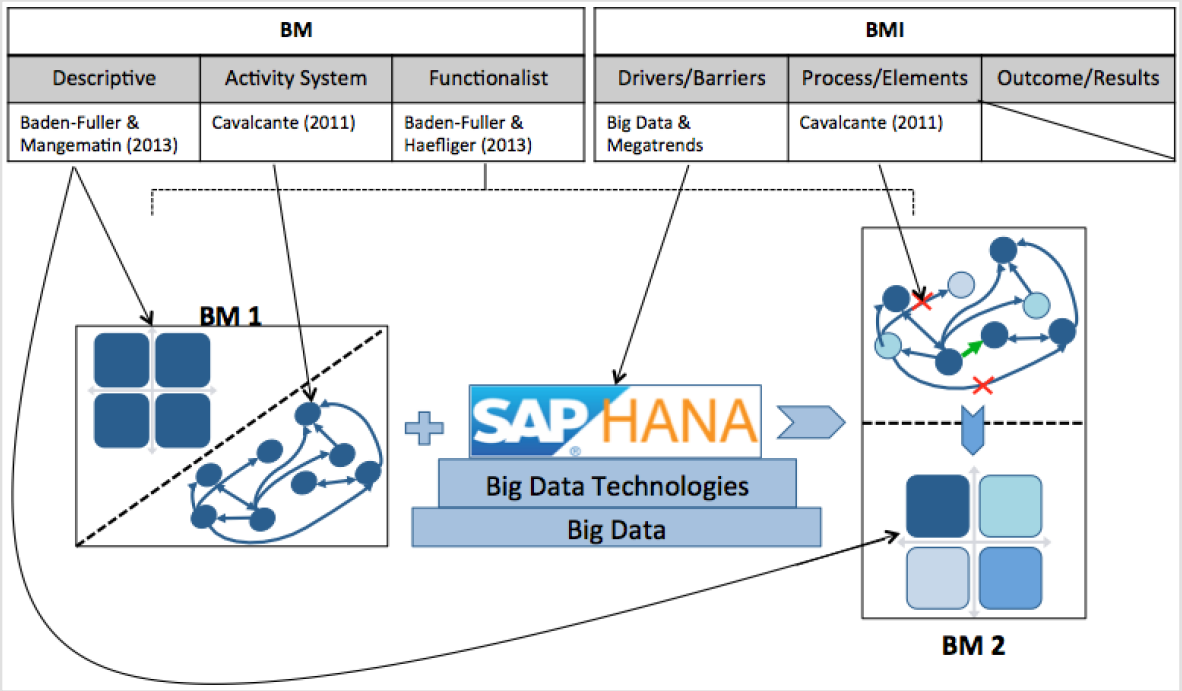

Fig. 4-1: Integration of Theoretical Approaches in Conceptual Framework (Source: Own illustration)

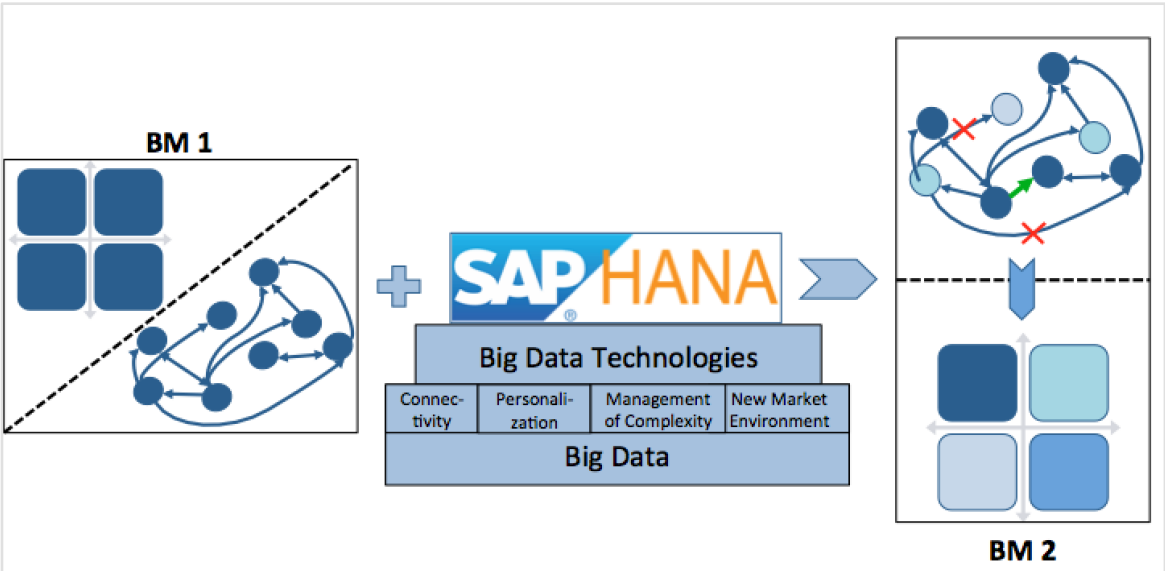

Fig. 4-2: Conceptual Framework for Technology-Driven Business Model Innovation (Source: Own illustration)

This framework represents how the new Big Data technology SAP HANA can impact the existing BM of a firm. On the left side of the illustration the existence of the current *BM1* of the firm is visualized. This current BM can be defined through identifying the core repeated standard processes that are executed in the firm based on Cavalcante (2011; 2013) as well as by specifying the sub-categories of all four BM elements according to Baden-Fuller & Mangematin (2013).

The pyramid-like representation in the middle of the illustration shows Big Data as the specific research context that encompasses all 'sub-trends' (i.e. Personalization, Connectivity, New Market Environment and Management of Complexity). These trends specify what firms can achieve through Big Data. All of these trends can have both, an insignificant as well as a profound impact on the firms' BM, and can thus be seen as drivers for BMI. As a means to pursue these opportunities, different Big Data technologies can be applied, one of which can be SAP HANA.

On the right side, the conceptual framework shows how - affected by the Big Data technology SAP HANA - BMI within a firm can take place and can be investigated. In a first step, BMI can be identified through existing or potential BP changes as suggested by Cavalcante (2011; 2013) (i.e. creation, revision, extension, termination). Having traced these existing or potential BP changes that lead to a (future) BM2, they can be related and arranged to respective BM elements by Baden-Fuller & Mangematin (2013) (customer sensing, customer engagement, value chain/linkages, monetization). According to Cavalcante (2011,2013), changes in a firm's core repeated standard processes will also become manifest as changes in the four BM elements of Baden-Fuller & Mangematin (2013). As BP changes are very firm specific, arranging and categorizing them within the four BM elements will yield more generic results that are better comparable across cases.

Supporting Cavalcante's (2011; 2013) concept of existing and potential changes, De Reuver et al. (2013), with their suggested BM roadmapping approach, add an important notion to the BMI process, when related to technological developments like SAP HANA. That is the importance of assessing a technology and its impact on a longer term, in order to integrate business and technology and increase the cooperation among all disciplines (Groenveld, 2007). This appears especially relevant for the underlying research project, as the expert interviews revealed that the full impact potential of SAP HANA will most likely not be reached after just one, two or even five years. Thus, one can expect that firms will have (or at least should have) evaluated future application fields for such a large investment beforehand, making the future oriented research indispensable. Therefore, this research is

based on the assumption that the full impact potential of extensive technological innovations like SAP HANA will most likely not be reached after just one or even five years. Instead, such investments are much more future oriented, as they can have an impact on all business disciplines (Groenveld, 2007).

Based on the conceptual framework, four working hypotheses were derived. These working hypotheses refer to the four BM elements as suggested by Baden-Fuller & Mangematin (2013) respectively. As elaborated on above, the research on Big Data and relevant megatrends as well as the interviews with experts revealed that SAP HANA - as a comprehensive Big Data technology - has touch points with all BM dimensions as proposed by Teece (2010), namely value creation, value delivery and value capture. As Teece's (2010) BM dimensions encompass the various BM elements suggested by different scholars, it can be argued that SAP HANA potentially affects all four BM elements presented by Baden-Fuller & Mangematin (2013). Taking the long-term perspective as suggested by De Reuver et al. (2013) into account, it is important to mention that the *impact,* stated in the working hypotheses, is addressing both the actual (current) as well as the planned (future) impact. This is being done partly because it can be expected that the full intend of deploying HANA has not yet been realized by the time this research project is being conducted, and that firms have assessed HANA's potential and evaluated its application possibilities.

Referring to Teece's (2010) first BM dimension - value creation - the author describes, for example, that a BM "makes implicit assumptions about customers, (...) the changing nature of user needs, and likely competitor responses" (Teece, 2010, p. 172). This description makes clear that Teece's (2010) first BM dimension focusses on the customer and the value proposition that is being created for the customer in a given market. Consequently, it appears reasonable that the BM dimension value creation includes the two BM elements Customer Sensing and Customer Engagement that are suggested by Baden-Fuller & Mangematin (2013). As has been concluded above that SAP HANA affects all BM dimensions of Teece, the technology's impact on the two BM elements as part of this value dimension is a logical consequence. Therefore, the first two working hypotheses can be formulated as follows:

WH 1: SAP HANA as Big Data technological innovation has an impact on the BM element *Customer Engagement.*

WH 2: SAP HANA as Big Data technological innovation has an impact on the BM element *Customer Sensing.*

The first and second BM dimension proposed by Teece (2010), namely value creation and delivery, imply that a before defined value is generated and delivered to a customer who is expected to pay for it subsequently. According to Teece (2010), value creation and delivery involve a "proper design and operation of the various elements of the value chain" (Teece, 2010, p. 191). This statement explicitly refers to a firm's value chain which is the third BM element Baden-Fuller & Mangematin (2013) suggest. Consequently, it can be concluded that SAP HANA also has an impact on the third BM element: Value Chain & Linkages. Additionally, this assumption is supported by Sadovskyi et al.'s (2014) aforementioned study, which finds that Big Data (and therefore also SAP HANA) has touch points with all of Porter's (2008) nine value chain activities. This leads to the third working hypothesis which is formulated as follows:

WH 3: SAP HANA as Big Data technological innovation has an impact on the BM element *Value Chain/Linkages.*

Lastly, Teece's (2010) third BM dimension, value capture, involves all aspects and mechansims to make customers pay and earn revenue from created and delivered value. Clearly this BM dimension becomes explicit in Baden-Fuller & Mangematin's (2013) fourth BM element: Monetization. This element involves all aspects around a firm's revenue mechanisms and value capturing activities. As SAP HANA affects all of Teece's (2010) BM dimension, the technology's impact on the BM element Monetization as part of the third value dimension is a logical consequence. Therefore, the last working hypothesis is formulated as follows:

WH 4 SAP HANA as Big Data technological innovation has an impact on the BM element *Monetization.*

The four working hypotheses that were derived from the conceptual framework will be investigated and answered in the second part of this joint research project.

5 Discussion

5.1 Implications

In this section, the main implications for theory and practice that can be derived from this first part of the joint research project will be summarized. The most important contribution of this first study is the resulting conceptual framework. This conceptual framework and the connected working hypotheses serve as basis for the second part of this joint research project. It therefore facilitates the operationalization of the intended case study analysis. Both studies in combination will provide theoretical as well as empirical up-to-date insights into technology-driven BMI in the context of Big Data focused on the technology SAP HANA.

As mentioned above, the conceptual framework combines and integrates various findings and concepts from different research approaches and sources. Consequently, it offers a more holistic and integrated perspective and operationalization of BMI-research than previous studies that are solely based on one approach or perspective. Therefore, the developed framework can also foster empirical research in relation to technology-driven BMI in a more general sense. It can serve as inspiration for operationalizing empirical research with a similar focus.

Moreover, Big Data as a very specific research context has been addressed in the underlying study. Big Data, involving several business megatrends, has been elaborated on as a still very recent but important topic for current and future businesses. The identification of the main business megatrends that are Big Data (and SAP HANA) related can steer the research on technology-driven BMI. Discussing and integrating Big Data and relevant megatrends into academic research is an important aspect, making the boundaries and focus of the underlying research more clear and tangible. This discussion can serve as a starting point for a more exhaustive consideration of Big Data as research context. Next to that, one could imagine transferring the conceptual framework to other research contexts and their related megatrends in order to extend the findings on technology-driven BMI.

5.2 Limitations & Future Research

In this section some limitations of the underlying first part of this joint research project will be put forward. At the same time, this will rise questions and possibilities for future research in order to extend and improve the results of this study.

First of all, it becomes clear from the amount and variety of research that has been conducted on BMs and BMI since these terms have become increasingly popular, that it is beyond the scope of this study to provide an exhaustive literature review and evaluation on these topics. As mentioned in the methodology part, the choice of relevant literature on these topics has been very selective and goal-oriented. Therefore, a more thorough review and analysis of existing literature might yield, for example, additional research streams of BMs or BMI that have not been suggested by Zott et al. (2011) or Schneider & Spieth (2013) respectively. Also, as mentioned above, using Google Scholar as main tool to search for literature on the topics of interest can be regarded as critical. Although the reasons for this have been explained and major advantages of this approach have been pointed out, it can be argued that a literature research limited to academic journals and books might yield additional and, in some cases, more valuable articles.

Secondly, the time period for the literature search has been chosen by personal reasoning and in order to include the most important articles that were advised to consult by the thesis supervisor. Extending or also restraining the time period in future research can yield more exhaustive or more focused results respectively.

Thirdly, referring to the choice of the actual concepts for the conceptual framework, the reasons for relying on Cavalcante's (2011; 2013) and Baden-Fuller & Mangematin's (2013) approaches have been outlined before. Despite these reasons, there are some drawbacks of both theoretical approaches. As mentioned before, Cavalcante's (2011; 2013) process-based perspective offers a very firm-specific, concrete and tangible way to investigate a firm's BM based on its core-repeated standard processes. However, it remains crucial for obtaining valuable research results, in a case study for example, to clearly define the level of abstraction and specificity on which the firm's core BPs are studied. BPs can be arbitrarily divided into more specific sub-processes. Identifying and analyzing the core repeated standard processes on a not too specific but at the same time not too generic level of abstraction seems a challenging and time-consuming research effort. This might only be possible by means of a thorough in-depth case analysis. Moreover, as pointed out above, the choice for Baden-Fuller & Mangematin's (2013) BM typology, as other theoretical basis integrated in the conceptual framework, can be scrutinized. There are also other BM classifications, such as Osterwalder & Pigneur's (2010) BM Canvas, that could support the operationalization of subsequent case study research, maybe in a different and more beneficial way. It is thus recommendable to question single constituents of the conceptual framework and develop it further in future research.

Lastly, it must be mentioned that the chosen context of this joint research project is very specific which limits the generalizability of both studies. Focusing on Big Data and related megatrends as well as SAP HANA as investigated Big Data technology allows to specify and thus better operationalize the underlying research endeavor. However, the developed conceptual framework cannot be identically transferred to and applied in other research contexts with other technologies. It is therefore even more interesting to conduct further research efforts with the goal to obtain a more generalizable and transferable conceptual framework for studying the impact of new technologies on a firm's BM.

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Appendix

Appendix 1: Overview of the Consulted Studies and Their Identified Megatrends

Z_Punkt	**Ernst & Young**	**PwC**	**Roland Berger**	**Forbes**
Demographic Change	Digital Future	Demographic and Social Change	Demographic Dynamics	Connectivity and Convergence
Individualization Reaches a New Stage	Entrepreneurship Rising	Shift in Global Economic Power	Globalization & Future Markets	"Bricks and Clicks"
Social and Cultural Disparities	Global Marketplace	Rapid Urbanisation	Scarcity of Resources	Future of Mobility
Reorganization of Healthcare Systems	Urban World	Climate Change and Resource Scarcity	Climate Change & Ecosystem at Risk	Urbanization – City as a Customer
Changes to Gender Roles	Resourceful Planet	Technological Breakthroughs	Dynamic Technology/Innovation	Social Trends Changing
New Patterns of Mobility	Health Reimagined		Global Knowledge Society	Health, Wellness and Well-being
Digital Culture			Sharing Global Responsibility	"Innovating to Zero"
Learning from Nature				Smart is the New Green
Ubiquitous Intelligence				Value for Many
Technology Convergence				Future of Energy
Globalization 2.0				
Knowledge-Based Economy				
Business Ecosystems				
Changes in the Work World				

New Consumption Patterns				
Upheavals in Energy and Resources				
Climate Change and Environmental Impacts				
Urbanisation				
New Political World Order				
Global Risk Society				

Declaration of Authorship

I hereby declare that the thesis submitted is my own unaided work. All direct or indirect sources used are acknowledged as references.

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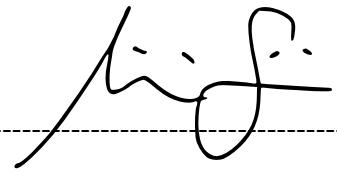

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