Case Study Research:
The Interplay of Technological Innovation and BMI in the Context of Big Data and SAP HANA

To obtain a Master of Science (MSc.) in Innovation Management & Entrepreneurship (Technical University Berlin) and a Master of Science (MSc.) in Business Administration (University of Twente)

Master's Thesis

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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) (BM) is a powerful way for incumbent firms to adapt to such exogenous influences and exploit the, otherwise latent, economic value of technological innovations. The presented thesis is the second of a two-part joint research project that studies the interplay of technological innovation and business model innovation (BMI) 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 BM.

The exploratory research strives to deepen our understanding of technology-driven BMI in the context of Big Data and is organized around the research question: *How do Big Data related technological innovations impact a firm's business model?* Its theoretical foundation is provided by the literature analysis of the first study, which develops a conceptual framework on how to study this impact. The framework focuses on Cavalcante's (2011) process-based perspective on BM and Baden-Fuller & Mangematin's (2013) distinction of four BM elements. Related to these elements, four working hypotheses were created that will be answered by the underlying study. Based on the conceptual framework, semi–structured interviews have been conducted with seven employees of four different companies from various industries. Furthermore, four secondary case studies have been evaluated and further interviews have been conducted with four experts from related fields.

The findings of a subsequent single case and cross case analysis are integrated in a framework and indicate that BMI happens in an iterative process and that the BM elements are affected in the following sequence: 1. Value Chain/Linkages, 2. Customer Engagement, 3. Customer Sensing and 4. Monetization. Evidence for an impact on the BM element Monetization, however, can only be provided for anticipated BMIs as they have not yet been realized. Furthermore, does SAP HANA gain on importance over time, since the needed performance increases as Big Data initiatives in a firm often build on each other and reinforce innovations in other BM elements. These findings finally lead to a number of valuable implications for practice. Firms thus need to (1) train Big Data related skills in their executives and ensure early top management support, (2) decide for a Big Data entry strategy, (3) address the impending talent shortage, (4) educate the employees about legal issues and (5) holistically develop a long term strategy, which (6) integrates all BM elements and business functions, in order to coordinate and align the various projects and BMIs.

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ADAC	Allgemeiner Deutscher Automobil-Club e. V.
BM	Business Model
BMI	Business Model Innovation
BME	Business Model Element
BS	Business Suite
BW	Business Warehouse
C	Company
CE	Customer Engagement
CS	Customer Sensing
CPU	Central Processing Unit
DBMS	Database Management System
DDBM	Data-Driven Business Model
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
KPI	Key Performance Indicator
M	Monetization
NBA	National Basketball Association
n.d.	no date
NPD	New Product Development
OLAP	Online Analytical Processing
OLTP	Online Transactional Processing
p.	page
SQL	Structured Query Language
tab.	table
TOC	Total Costs of Ownership
UI	User Interface
UX	User Experience
VCL	Value Chain & Linkages
WH	Working Hypothesis

1 Introduction & Research Design

This particular study is the second 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, a profound and integrated understanding of the involved concepts such as the BM, BMI and Big Data has been established as knowledge base for the joint project. Therefore, in a first study, existing literature about these concepts has been 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. As main goal of this first study, a conceptual framework for investigating the impact of a technological innovation on a firm's BM in the context of Big Data has been developed. Moreover, specific research questions formulated as working hypotheses have been presented. Building on these first theoretical research results, the underlying 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, 2014g)

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 second study that will help to answer the research question: *How do Big Data related technological innovations impact a firm's business model?*

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 connected 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)

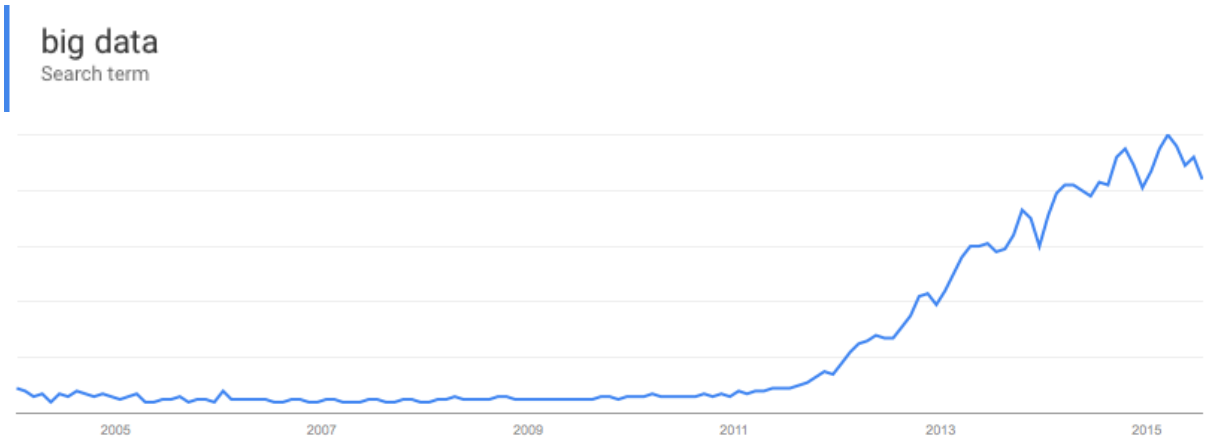

Fig. 1-1: Google Trends Results for the Search term ‘big data‘ (source: "big data", 2015)

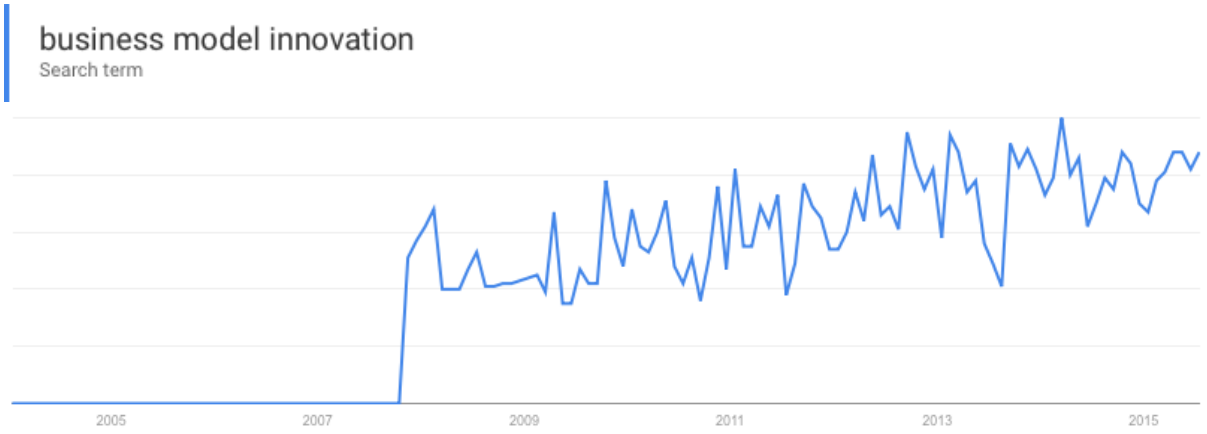

Fig. 1-2: Google Trends Results for the Search Term 'business model innovation' (source: "business model inovation", 2015)

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 (Markides, 2006; Cavalcante, 2013; Baden-Fuller & Haefliger, 2013) 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 of this thesis, there could be no research identified that empirically studies the effects of a Big Data related technological innovation on a firm's BM. Therefore, the contribution of this thesis is to fill this gap, deepen our understanding of this relationship and thus significantly contribute to the growth of the academic knowledge.

The empirical investigation will also provide practical contributions. The findings will support businesses to better assess such technological innovations, and evaluate their potentials and implications for the BM. The study also reveals the Big Data approaches of different companies from various industries, which can help managers to identify opportunities and formulate their own Big Data roadmap (Schroeck, Shockley, Smart, Romero-Morales & Tufano, 2012). However, the challenges of Big Data are also numerous and important (McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012), and are therefore also, to some extent, being addressed by this study. Furthermore, is this research of interest for SAP SE, as it provides an academic perspective on the business impact of their newest technological innovation. Of relevance for SAP SE are also the identified and discussed problems and difficulties related to Big Data or SAP HANA.

1.2 Research Design & Structure

As mentioned above, research on BMs and especially on the technology innovation and BMI link, is still in its early stages. As it is common for research on that early level of maturity, an exploratory approach will be applied for this study, to properly contribute to the current state of knowledge (Blumberg, Cooper & Schindler, 2008). New qualitative insights will be generated by means of a comparative cross-sectional case study methodology (Eisenhardt, 1989; Eisenhardt & Graebner, 2007).

The cooperation with SAP SE will help to identify and contact suitable interview partners for the case studies. An interview guide will help to lead the semi-structured interviews and increase comparability between the different cases. The interview guide as well as the following evaluation of the cases are based on the conceptual framework and connected working hypotheses of the first study of this joint research project. As it became evident quite early in the research process that it would only be possible to contact mostly incumbent firms (and not startups) through SAP SE, the focus of the joint research project, and therefore also the conceptual framework, was established accordingly.

Additional information, insights and assessments about Big Data, SAP HANA or the effects of technological innovation on BMs, will be contributed through interviews with experts from relevant fields like Software Development, Data Analytics, SAP HANA, or Innovation Management.

The case study findings will be analyzed, and through pattern recognition within and across the cases, and by identifying the logic behind them, theory will be developed inductively (Eisenhardt et al., 2007). Additional case study material and success stories concerning SAP HANA, will help to confirm or challenge the findings.

Based on these results, a concluding framework will be developed about how SAP HANA, as a technological innovation related to Big Data, impacts a firm's BM. Lastly, the outcome of the research, the implications for practitioners and researchers, its limitations, as well as point out possibilities for future research will be discussed.

2 Theoretical Background

2.1 Selection of Concepts for Conceptual Framework

The research results of the first study of this joint research project serve as theoretical background for the underlying thesis. Therefore, a summary of these findings will be presented in this section.

In order to answer the research question of the 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* (Spiri, 2015) - selected findings, concepts and megatrends concerning the topics of BMs, BMI and Big Data have been consolidated. As a result, a conceptual framework and connected working hypotheses have been derived from these research efforts. Concepts and findings from various research streams on BMs and BMI have been selected and integrated to obtain a rather holistic and integrated conceptual framework to structure the underlying study and future research.

For the BM concept, all three research streams suggested by Zott et al. (2011), the descriptive, the functionalist and the activity system perspective, are represented in the framework. For the functionalist perspective, the main finding by Baden-Fuller & Haefliger (2013) that BMs mediate between technology and firm performance, has been chosen as general background and guideline for the study. Moreover, one concept of both, the activity system as well as the descriptive perspective have been selected to support the framework: firstly, the process-based perspective of Cavalcante, Kesting & Ulhøi (2011) or Cavalcante (2013) and secondly, the typology of BM elements by Baden-Fuller & Mangematin (2013).

For structuring BMI in the conceptual framework, the literature review by Schneider & Spieth (2013) has served as guideline. However, of the authors' three suggested research streams - drivers/barriers, process/elements, outcome/results - mostly findings of the second one have been beneficial for developing the framework. With this respect, Cavalcante's (2011; 2013) process-based perspective of investigating BMI has been chosen as main BMI concept supporting the framework.

Although growing, the academic literature about Big Data is still relatively scarce (De Mauro et al., 2015). Consequently, it has been difficult to identify and select specific concepts for the structuring and operationalization of the empirical research. Alternatively, academic literature, management literature, industry studies and recent news have been consulted, as well as discussions with experts from relevant fields been conducted. As a result, business

megatrends within the context of Big Data have been identified and integrated in the framework as external drivers of BMI.

For a more detailed explanation of the respective conepts and megatrends as well as the reasons why they have been selected for the conceptual framework, see Spiri (2015).

2.2 Developing the Conceptual Framework & Working Hypotheses

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

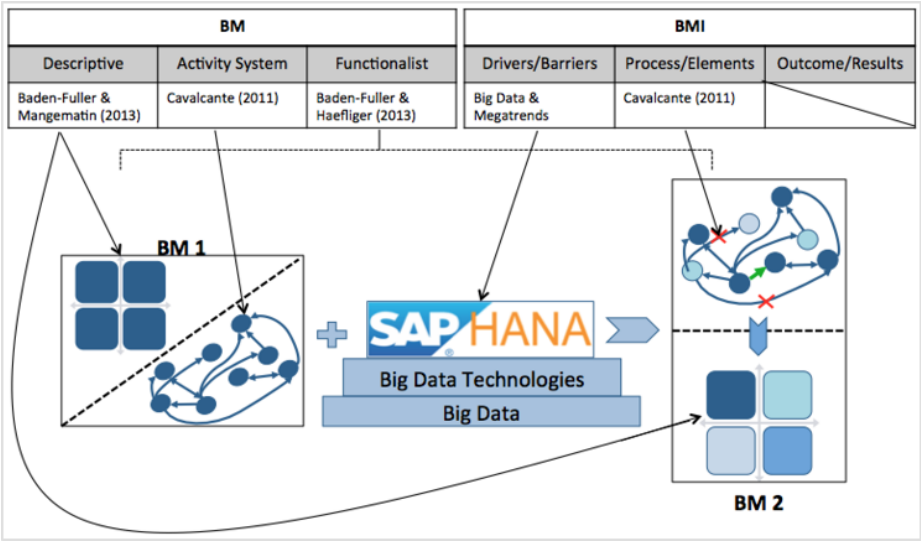

Fig. 2-1: Integration of Theoretical Approaches in Conceptual Framework (Source: Own illustration)

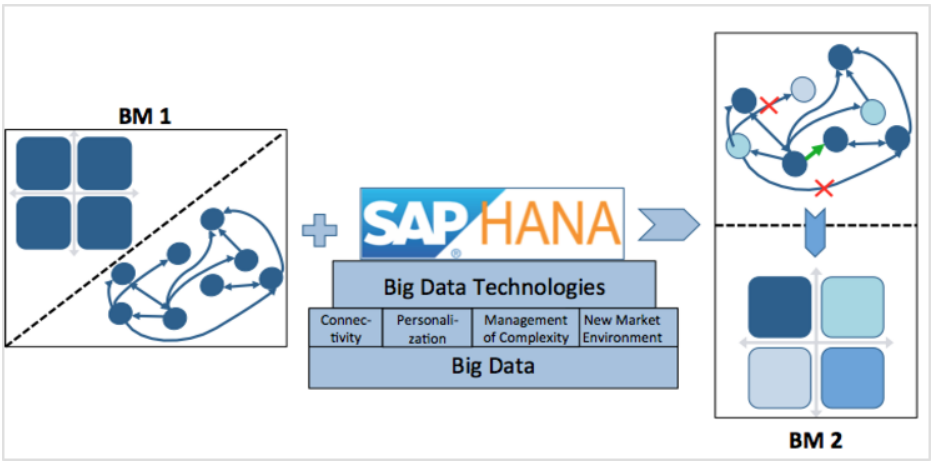

Fig. 2-2: Conceptual Framework for Technology-Driven Business Model Innovation (Source: Own illustration)

This framework represents how the new Big Data technology SAP HANA can impact the existing BM of a firm, and how related research can be structured. 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). (Spiri, 2015)

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. The research conducted by Spiri (2015) on Big Data, business megatrends and 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, Spiri (2015) argues 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 by Spiri (2015) 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 (Spiri, 2015). 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 (Spiri, 2015). 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.*

3 Methodology

3.1 Research Approach

The underlying study is of exploratory nature and based on a comparative case study approach. The importance and usefulness of cases for studying BMs has been confirmed by previous research (Baden-Fuller et al., 2010). Based on Yin (1994), Vissak (2010) argues that a case study "allows expanding and generalizing theories by combining the existing theoretical knowledge with new empirical insights" (Vissak, 2010, p. 371). Consequently, it is a useful method to develop new theoretical and practical knowledge on technology-driven BMI for the example of SAP HANA. By pattern recognition among constructs within and across cases and by identifying the logic behind them, theory can inductively be developed (Eisenhardt et al., 2007). In the first part of this joint research project, existing concepts were selectively combined into a conceptual framework and connected working hypotheses on which the case investigations of this second part were based. During the latter, rich empirical data was gathered from qualitative interviews, guided by the chosen framework and its constructs. The obtained data was analyzed and compared in order to derive theory.

Structuring the interviews of this second study concentrated on two aspects. Firstly, to gain knowledge and understanding about the current state of implementing SAP HANA within selected firms. A rather short- to mid-term perspective intended to understand how the HANA technology has been affecting the BPs as well as BMs of selected case companies. Secondly, a more long-term and future focus aimed at identifying and discussing the potential future impact of SAP HANA as technological innovation on the firms' BMI, since it can be expected that the full intend of deploying HANA has not yet been realized and that firms have assessed HANA's potential and evaluated its application possibilities (Geißler, personal interview, June 23, 2015).

The case study investigations were based on the two main concepts selected for the conceptual framework, which has been developed in the first study. Firstly, the process-based perspective of Cavalcante (2011; 2013) and secondly, the typology of BM elements by Baden-Fuller & Mangematin (2013). Focusing on BPs, Cavalcante et al.'s (2011) framework offers a rather specific and graspable parameter of analysis that is easy to ask for in the case interviews. Interview questions can be designed less abstract but more tangible for the interviewees, which will be specified in more detail below. Adopting his perspective 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 structured in a

straightforward way. Next to that, the analysis of the case companies' BM was tackled from Baden-Fuller & Mangematin's (2013) descriptive perspective.

3.2 Selection and Description of Case Companies & Experts

After the theoretical structuring of the underlying case study analysis has been clarified in the first part of the joint research project, the case companies and experts for the second part of the project had to be identified and selected. This section provides a description of this process and an overview of the case companies and experts that participated in the investigation.

In order to analyze the current state of the HANA technology within firms, case companies were selected that have integrated the technology in their daily BPs. Applying purposive judgment sampling (Saunders & Lewis, 2012), relevant case companies were chosen that seemed "particularly suitable for illuminating and extending relationships and logic among constructs" (Eisenhardt et al., 2007, p. 27) of the research framework. Therefore, only firms that have been actively using HANA since at least one year were chosen, as those were considered to have gathered the necessary experience and routine with this new technology. As single-case studies usually provide less robust and generalizable theory (Eisenhardt et al., 2007), it was decided to investigate multiple cases to enhance the analytic power of this study.

On top of the case companies, it was considered necessary and enriching to interview experts with regards to current or anticipated megatrends, SAP HANA as well as BMI. Due to the fact that case companies can only provide a limited perspective on their company, its business and industry, it was rendered to be relevant to also talk to people who have a broader and more holistic view on the technology, its potentials and future developments.

To further validate or disapprove the case study results, the same amount of secondary case studies that deal with SAP HANA and its impact on a business were included. These secondary cases were retrieved from the SAP case study database that is accessible online (SAP SE, 2014b), and chose the ones that matched the existing cases most.

Interviews with experts	Profession	Date
Dr. Werner Sinzig	Senior Executive Advisor @ *SAP SE*	05.03.2015
Lars Geißler	Managing Director @ *webXells GmbH*	23.06.2015
Thomas Weber	Managing Director @ *UNIORG Consulting GmbH*	01.06.2015
Dr. Heinrich Arnold	Senior Vice President @ *Deutsche Telekom AG Innovation Laboratories*	26.08.2015

Tab. 3-1: Conducted interviews with the experts

Interviews with companies	Profession	Date
Company 1, employee 1	- Director Platform Integration	08.05.2015
Company 2, employee 1 Company 2, employee 2	- Managing Director - Head of CRM/Digital Marketing	15.06.2015
Company 3, employee 1 Company 3, employee 2 Company 3, employee 3	- IT Enterprise Architect - IT Enterprise Architect - SAP Inhouse Consultant	25.06.2015
Company 4, employee 1	- Head of IT-Strategy	15.07.2015

Tab. 3-2: Conducted interviews with the case companies

3.3 Data Collection

In order to analyze HANA's impact on a firm's business model and answer the research question - *How do Big Data related technological innovations impact a firm's business model?* - interviews with relevant key persons of the firms were conducted. These interviews provided a lot of information about the case companies, their BMs, their current use of SAP HANA and their opinion about the technology's future potentials for their companies. To leave room for unsuspected findings, semi-structured face-to-face interviews were lead with one to three employees of each company. The employees varied in their position and roles in the company. All of them were thoughtfully identified and recommended by the respective SAP key account executives or by internal discussions within the company itself.

The interviewees were either business owners[1] or represented the upper echelon of the case companies. The first promised the best cross-functional understanding of SAP HANA's impact on the firm's BPs, on a more technological and operational level. The latter seemed important as an upper echelon can evaluate the current and future impact on the BM in a broader, more strategic sense.

An interview guide was designed (see Appendix 8), helping to lead the interviews and increase comparability between the different cases. This interview guide consisted of three major parts, integrating the two different concepts on which the investigation were based, as well as a future outlook on the situation.

In the first part, questions about the interviewee's role and the company itself opened the discussion. Since public information about the cases had been investigated and collected beforehand, solely questions to fill remaining gaps with company internal information were posed. Subsequently, the firm's current use of SAP HANA and their experiences with the technology so far were tackled. Questions such as '*Which applications currently run on HANA and which departments are using it?*' were asked.

The second part of the interview guide contained questions about the company's BPs and BM elements. Firstly, it was intended to start an open and organic discussion about the firm's core BPs and if or how they have been affected by SAP HANA. Relying on Cavalcante et al.'s (2011) process based concept of BM change, questions such as '*Have business processes been significantly changed (revision), discarded (termination) or newly created (extension) due to the implementation of HANA?*' were asked. As a next step, it had been investigated in more depth how these core BP changes might have impacted elements of the current BM. This investigation relied on Baden Fuller & Mangematin's (2013) typology of BM elements. The interviewees' answers to the BP questions, aimed to find out if the changed BPs have affected the four BM elements customer identification, customer engagement, monetization and value chain & linkages. The interviewees were not directly asked about the rather abstract BM elements but more graspable questions were posed such as '*Do you notice changes in the customer segment through the implementation of SAP HANA?*' or '*Did the technology in any way affect your revenue model?*'. The decision to ask about BPs first and, from there, try to gain more insights into BM elements is not simply based on the integration of both theoretical approaches. More important than that, it was presumed that the

[1] Business owners, in the words of SAP SE, are employees connecting the business and IT departments.

discussion about the complex and fuzzy topics around BMs and BMI would be rather difficult. Asking the interviewees about more concrete BPs and their changes, would supposedly make the questions more tangible and thus yield clearer answers.

The third part of the interview guide was targeted on the interviewees' assumptions and opinions about the technology's future potential for the respective companies and their BMI. In this third part of the interview, the participants were therefore invited to think 'out of the box' and creatively project the firm's future with regards to SAP HANA as well as broader future developments and megatrends. In order to make the latter more restricted and graspable, megatrend cards were designed, which were emailed to the interviewees beforehand and also brought to the face-to-face interviews. For these megatrend cards several topic-relevant trends were selected, based on various management studies concerning current business megatrends related to Big Data or SAP HANA (e.g. volatile economy, internet of things, business mashups etc.) (Z_punkt, 2015; Roland Berger, 2015; Ernst & Young, 2015; PwC, 2014b; Singh, 2014). They were presented including a short description and a current example respectively. Providing this overview intended to establish a clear and common understanding of these buzzwords as well as to inspire the interviewees' imagination about their firms' future by real-life examples. Subsequently, questions were asked such as '*Which megatrends do you regard as relevant for your company and why?*' or '*How do these megatrends influence the core BPs in your company and in what way is HANA involved?*'. Logically, this last part of the interview was the most open and free one. The here received answers immensely depended on the perspective, attitude and open-mindedness of the single interviewees.

The interviews were scheduled for approximately one hour per interviewee. In order to permit a more fluid course of the interview, the conversations were recorded. Afterwards, the recordings were coded (open coding) but not verbatim transcribed. As suggested by McLellan, MacQueen, & Neidig (2003), It was decided that the data analysis is better supported by structured notes derived from and supplemented by a thorough review of the audiotapes than by verbatim transcription. One reason for this decision was that the planned data analysis and evaluation including the cross-case comparison was facilitated by notes structured according to the interview guide. As the interviews evolved very organically, the answers to the guideline questions were often given in a non-chronological and iterative manner. Also, in the course of an interview, a lot of information was provided that served as important background information but was not directly relevant for the data

analysis. The recordings were therefore analyzed, and the main statements were collected, consolidated and assigned to the three sections of the interview guide (see Appendix 8).

3.4 Data Analysis

Following a four step approach, the data analysis was guided by searching for specific answers that can be related to the central themes of the interview guide and the theoretical background. After having created a transcript as a Word document for each interview, structured by the main sections and questions of the interview guide, the data analysis within and across cases could commence. For this purpose, the transcripts were thoroughly scanned, analyzed, and the main statements and drawn inferences were transferred into Excel files for a better overview. In a first file four columns were created for the four mentioned possible changes of BPs according to Cavalcante's (2011; 2013) concept (extension, revision, creation, termination). Moreover, four columns were dedicated to the four different BM elements as suggested by Baden-Fuller & Mangematin (2013) (customer identification, customer engagement, monetization, value network). In a second Excel file, columns were established for every megatrend depicted on the megatrend card. On top of that, meta-categories were established for problems, risks and recommendations that were mentioned throughout the interviews. Based on these Excel file structures, the main statements and related inferences were assigned to these categories for each case company. This provided an overview of what the respective company had responded about BP changes, resulting inferences for BM elements and the technology's future potentials as well as its challenges.

Step one and two intended to connect the answers of the interviews with the conceptual framework of the study and prepare the comparison across cases. As the theoretical terms of BP changes and BM elements were not explicitly ask for, the interpretation and assignment of the given answers to the respective categories had to rely on clear definitions of the categories. Step three aimed at obtaining an outlook on the development of the technology in the future. In a last step, the content within the single categories across cases was finally compared, in order to draw conclusions and answer the working hypotheses. In the following, the single steps of the data analysis will describe in more detail.

3.4.1 Analysis of BP changes (Cavalcante, 2011; 2013)

For analyzing BM changes on a process level, Cavalcante's (2011; 2013) distinction between BM extension, revision, creation and termination was used. Based on his descriptions of these four types, the following criteria were defined for being able to assign the mentioned BP changes within the case companies to one of the four types of BM change.

- Creation: a new business idea is established by implementing a completely new BM i.e. in form of a spin-off, a new business unit/area; there are no relevant previous working practices or repeated standardized BPs to draw on; entirely new BPs are established
- Termination: an existing BM is terminated i.e. by closing down an entire business area or unit while the rest of the company remains operating. All BPs that constituted part of this BM are abandoned
- Revision: an existing BM is modified; specific BPs are removed and replaced or BPs are in another way subject to change
- Extension: an existing BM is extended while the current BPs remain unaffected; new BPs are added

	Previous BPs exist	Previous BPs changed	New BPs added	Previous BPs abandoned
Creation	no	no	yes	no
Extension	yes	no	yes	no
Revision	yes	yes	possibly	possibly
Termination	yes	yes (abandoned)	no	completely

Tab. 3-3: Criteria for the analysis of BP changes

Cavalcante's (2011; 2013) concept also offers the distinction between more incremental BM development and more radical BM innovation. He considers "business model extension when core processes are incrementally affected, and business model revision when they are affected more radically" (Cavalcante, 2013, p. 5). The creation and/or termination of BPs can imply both incremental as well as radical changes to a firm's BM. Although the existence of both incremental as well as radical BMI is being acknowledged, it was decided to neglect this distinction for this analysis. The main reason for this is that evaluating the data regarding the degree of BMI would not be contributing to answering the research question. The focus of this study is *how* SAP HANA impacts the firm's BM, and not to *what degree*. This would

therefore lead to a further discussion that is not the research focus of the study and goes beyond the scope of this thesis.

Moreover, next to separating the four types of BM change and defining revision as more radical than extension, he further explains that, in practice, mostly a combination of these types is constituting BM change. The author emphasizes that "business model extension and revision in particular often go 'hand-in-hand'" (Cavalcante et al., 2011, p. 1335). As mostly various core repeated standard processes constitute a BM, the four types of BM change often intermingle. Different BPs are affected in different ways and, many times, the discrepancy between extension and revision, for example, is not very easy to determine (Cavalcante et al., 2011). This also implies that the distinction between radical and incremental change is not very clear-cut, which would have made the distinction even more difficult. The first step of this research therefore aimed at solely identifying if BPs within the case companies were affected by change in one of the above mentioned ways, and subsequently categorizing them according to the four types Cavalcante (2011; 2013) offers. The data was analyzed according to the mentioned criteria and neglected a distinction between more or less radical BM changes. This straightforward way of investigating the core repeated standard processes within the case companies and how they are affected by HANA, facilitated a prospective analysis of the technology's impact on a firm's BM.

3.4.2 Analysis of BM element changes (Baden-Fuller & Mangematin, 2013)

Having categorized the interviewees' answers into the four types of BM changes, based on the process-perspective suggested by Cavalcante (2011; 2013), these findings had to be transfered and integrated to the second concept incorporated in the conceptual framework of the first study. Using Baden-Fuller & Mangematin's (2013) BM typology, intended to translate the rather specific findings on a process level to broader results within the four BM elements customer sensing, customer engagement, monetization and value chain. In other words, Baden-Fuller & Mangematin's (2013) classification was used to 'zoom out' to a meta-level on which the findings could be categorized more generally and thus also be compared across cases. To do so, the interview statements about the case companies' BPs and BM changes had to be assigned to one of the four BM elements. Relying on the authors' specifications of the four elements, the following criteria were established to decide which statements belong to which BM element respectively:

- Customer Sensing: statements concerning the process & methods of identifying customers; who are the targeted user(s) (groups) and who are paying for the product/service; one-sided or multi-sided market
- Customer Engagement: statements concerning the value proposition for different customer groups (internal as well as external); project-based (taxi) or pre-designed (scale) based (bus)
- Monetization: statements concerning the value capture of the firm; when, what and how money is raised; pricing mechanisms, timing of payments; costs/methods of collecting revenue
- Value Chain/Linkages: statements concerning the overall architecture of the information flow and governance of linkages; mechanisms/BPs involved in delivering a product/service to a customer; integrated or hierarchy or network

For the secondary case studies, a similar approach was followed. Here however, the BM element changes were addressed directly, without the intermediary step of analyzing the single BP changes. This was done, because the case studies rarely described single process changes, but already explained HANA's more abstract effect on the business, from which one can derive the BM element changes.

The goal of this second step of data analysis was to obtain an overview of which BM elements were affected by the implementation of SAP HANA within the different companies.

3.4.3 Analysis of statements with regards to megatrends and challenges

In a third step, a further Excel file structure was created for analyzing the respondents' statements about the future potentials of SAP HANA as well as mentioned risks or problems regarding the technology. Therefore a column was established for every megatrend on the megatrend card. Moreover, a column was created for every problem, risk or recommendation that was given by the case companies with regards to the implementation of SAP HANA. Again, the interview transcripts were carefully read, especially the third section of it, and the statements were assigned to the categories. Unlike in step 1 and 2, the establishment of categories and the assignment of content to categories happened in form of an iterative process. Therefore, for this third part of the analysis, also no definite descriptions or criteria of the single categories have been established.

It is important to note that the megatrend cards were used during the interviews to serve as inspiration and support for an open and imaginative discussion about anticipated future developments of the case companies. The corresponding questions in part 3 of the interview

guideline were supposed to invite the interviewees to give free, creative and open-minded answers and assumptions about the future with respect to SAP HANA and BMI. Very much depending on the interviewee, many different statements and responses came up. The given answers were not evaluated and analyzed in detail for each megatrend, risk or problem. However, important statements were extracted about the future plans or anticipated changes connected to SAP HANA from this third part of the interviews. The most important results of this part of the data analysis will be presented as 'future BMI' of each respective company in the following chapter 4. The challenges a company had with respect to SAP HANA or Big Data helped to put the findings in context and to provide more comprehensive implications and recommendations.

3.4.4 Cross case analysis and derivation of framework

As last step of the data analysis, the BM element changes were compared across the case studies as well as the secondary cases. It was noted, which of the four BM element categories were filled with content and which not. The content itself was also compared, to analyze if the affected BPs or BM elements were similar between companies, although different industries were involved. This way, it was possible to identify if the impact of the new technology is focused on one or several specific elements, or if the technology affects the firms' BMs more randomly or diverse. This cross-case comparison finally answered the working hypotheses and derived a framework and main conclusions for technology-driven BMI, which will be presented in the next sections.

4 Results

4.1 Findings of Single-Case Analyses

The following subchapters show the results of the single-case analyses based on the data that was gathered during the qualitative interviews (see Appendix 1 to 4). For this, each BP change and its impact on the four BM elements are presented, namely Value Chain & Linkages (VCL), Customer Engagement (CE), Customer Sensing (CS), and Monetization (M). The impact on the BM elements is identified by interpreting the interviewees' statements concerning their effects. Each subchapter starts with a short company description followed by explaining why and to what extent the firm deployed SAP HANA. After each BP change, its effect on the respective BM elements is explained (i.e. BP1-BME1; BP2-BM2; …).

Following this research are the single-case study analyses of the secondary cases. As described above, the BM element changes for the secondary cases are addressed directly, without the intermediary step of analyzing the single BP changes.

4.1.1 Company 1

Company 1 serves as case within the publishing sector. The firm is an international publishing company focused mostly on the areas technology, science and medicine. The company and publishing group has a long history starting in 19th century, when a first bookstore was opened by its founder. Soon after, this bookstore developed into a publishing house and, nowadays, it is one of the leading publishing companies worldwide. The firm's most important business segments include scientific and non-fictional books and magazines, and educational books. Almost all books and articles are published and can be purchased both online and as a printed version.

Company 1 had its first touch point with SAP HANA in 2012 in form of an experiment project to test alternative options with regards to redesigning its online presence. SAP HANA was tested as a software to facilitate the structured use of SQL-data, aiming at improved semantic analytics capabilities and a more flexible search function on the website. Although the project was promising, company 1 decided to continue with its already implemented software solution and neglect SAP HANA for the mentioned purposes. However, company 1 got interested in the technology and its capabilities, and determined to employ it for improving its business warehouse landscape. Consequently, in 2013 company 1 migrated its business warehouse on SAP HANA. Other applications like the Business Suite on HANA are

being considered but so far solely the business warehouse landscape is supported by the technology.

Current BMI of company 1

In the course of the interview with company 1, only BM revision was mentioned in form of core BP changes. Statements indicating the happening of BM extension, termination and creation, manifested in BP changes, were not made.

1st BP change (revision)

The effects of SAP HANA, stated by company 1, can be condensed to revising the reporting processes on various levels. The reports used to be split up by priorities. Core reports of high priority, like quarterly and annual reports, have already been processed by the *SAP BW Accelerator*, an in-memory appliance to speed up certain OLAP queries. Since this is no in-memory solution for the whole database, other reports took up to several hours to process. This was also true for seemingly non-critical customer reports. These, however, presented a key problem for company 1, as customer meetings with outdated or incorrect reports made a very bad impression on the customer, jeopardizing future business relationships. With the deployment of SAP HANA, all databases have been merged together, making all data processes much faster. The night-time settlement, for example, (i.e. carry out excessive processing activities over night that would typically occur on the following business day) now takes only two hours instead of at least eight hours. This means that when a mistake occurred, there was no possibility to fix it the next day and get the current data. But also the loading time for smaller ad-hoc reports and complex reports has improved, which now take seconds instead of minutes or even hours, as was the case before. Secondly, due to increased storage capacity and processing power, does SAP HANA facilitate the import of additional data sources. Consequently, several data sources can be tapped from the same database which opens up a new flexibility to create individual reports that include other sources as well. This had an impact on the way reportings are being used by various stakeholders. Since the creation and flexibility of report creation increased greatly as stated above, they are being used more frequently.

Effects on the BM elements

This improvement of the flow of information, as well as the informative value of the reports had a positive impact on the BM element Value Chain & Linkages. Obviously, this brings significant advantages not only for internal reporting and decision-making processes.

Especially the reduced dependency on the flawless conduction of the night-time settlement ensures the constant availability of current data, because if needed, the process can be made up on the same day.

But the implementation of HANA also has implications for the customers. As a concrete example serves the key account manager, who benefits significantly from the new real-time analytics capabilities. Only within seconds, sales or customer reports can be generated. The key account manager can thus generate ad-hoc reports about a specific customer before or even right in the middle of a meeting with the latter. Especially in meetings with customers on short notice, it happened that customers were better informed about their current usage. than the key account manager. Either because the reporting took too long, or because of a failed night-time settlement. Thus the improved reporting also has a positive impact on the BM element CE. Key account managers are better informed and they can always rely on the most current data, even within spontaneous meetings. Company 1 can thus offer improved customer service and make a better impression on the customers.

“In the past we said that the customers knew better than us about what they are doing, by now it is so that we know better what the customers are doing." (employee 1, personal interview, May 8, 2015)

Future BMI of company 1

Company 1 is thinking about extending the deployment of SAP HANA as a digital platform for the organization. For once, this can mean to support the development from an offline publisher to a digital online platform for authors, peer reviewers and readers. As it is one core process for company 1 to find matching peer reviewers for applied articles and the amount of applications is greatly increasing, this is a process with potential for optimization. Semantic text analyses (as provided by SAP HANA) can help structuring the articles by content, identifying semantic concepts and putting them in relation. The automatic content analysis of the applied articles and of the written and reviewed articles of potential reviewers, can enhance the identification of suitable peer reviewers. This can be further refined by creating an extensive database about authors and reviewers. Reviewers can be assessed, for example by response time, and better matched with applications und time constraints. Furthermore this can improve the customer experience by better identifying relevant content, structure his/her field of interest, and give recommendations for new arrivals. This will thus have a direct impact on the firm’s value proposition (i.e. Customer Engagement). This HANA supported platform can also further affect the firm’s BM element

Value Chain & Linkages, through analyzing internal documents, projects, communications etc., to better assess the own employees' competencies and provide an overview of what is going on within the company.

4.1.2 Company 2

Company 2, a large, German sports association, served as case in the sports and entertainment industry. Under the umbrella of the association, which exists since 1900, there are 27 different smaller soccer/sports associations in Germany. As operating company, it consists of four different subsidiaries with different tasks and foci respectively: Company 2 Economic Services, Company 2 Media, Company 2 Travel Agency and Company 2 Online. Company 2 Economic Services GmbH operates around licensing names, symbols, signs and the brand of the company itself as well as picture material of the sports players. Company 2 Media GmbH & Co.KG is concerned with the consistent organization and structure of all electronic and software-based matters. Company 2 Travel Agency obviously organizes all journeys of the players while company 2 Online GmbH bundles the firm's online activities including projects around web-presence, apps and mobile devices. For this case study, interviews were only conducted with employees from Company 2 Economic Services and Company 2 Media.

In 2012, after a period of considering alternative options, company 2 Economic Services GmbH agreed to cooperate as pilot customer for the new ticketing system application on SAP HANA. This implied a tremendous change for the company as, up till then, the whole ticketing process had been outsourced to an external service provider. Next to that, company 2 Media GmbH & Co. KG decided relatively soon to emigrate its complete business warehouse on HANA in order to establish one central database. As the firm had not been using a CRM tool ever before, a further quantum leap was the establishment of a customer relationship management (CRM) system immediately on HANA. Both projects were accompanied by an experienced software consultancy. Moreover, as a smaller project, the financial accounts department of company 2 partly implemented the technology in its daily business by making use of ERP on HANA. However, not all accounting processes rely on HANA and there are also other software applications (e.g. Sage) in use.

Current BMI of company 2

In the course of the interview with company 2, only BM extension and revision were mentioned in form of core BP changes. Statements indicating the happening of BM termination and creation, manifested in BP changes, were not made.

1st BP change (extension)

Company 2 had so far completely outsourced its ticket sales processes to an external event managing firm. As one of the first companies, company 2 adopted SAP's Sports and Entertainment solution using SAP HANA Enterprise Cloud Service for their ticketing processes. Company 2 therefore extended their old BM by one more activity, which included processes like marketing, sales or local services (e.g. access control).

Effects on the BM elements

This had a large impact on the internal BM element Value Chain & Linkages. With the adoption of the ticketing service, the company's responsibilities increased, but it also gained the data ownership of the customer data. Although a new sales process had been integrated, the experience of the customer did not change. This is why only the BM element Value Chain & Linkages is affected and not for example Customer Engagement.

The newly won customer data by the introduced ticketing process had then been merged with the data retrieved from the Online Shop, the Newsletter subscribers, and the Fan Club (which had previously also been separated) in one CRM database in the cloud. This centralized database also improved the way to market to customers. One commonly used marketing technique has been email marketing. Previously, each department (or external partner) had its own database with which it conducted its marketing activities. This resulted in one customer occasionally receiving multiple emails by company 2. Due to the consolidation of the databases, this is now of no further concern. Every customer or subscriber now receives only one, cross-promotional email, leading to a more uniform appearance of the company and therefore an improvement of the BM element Value Chain & Linkages.

"Three out of four departments [...] were sending out newsletter, which we have now, with the system introduction, integrated into the CRM. So that we now send the newsletter plus the campaigns [...] out of one system, and thus also have the transparency and the control." (employee 2, personal interview, June 15, 2015)

The newly won customer data and the merger of the different datasets also had a positive impact on the BM element Customer Sensing. Before, no real segmentation had been conducted. But sharing one database as single source of truth improved the analyses and allowed new possibilities for segmentation. One exemplary outcome of this, are the cross-

promotional email campaigns, which are now much more individualized and targeted at specific customers.

2nd BP change (revision)

The database consolidation efforts had also another effect on company 2's BPs. The new amount and variety of available data had a positive impact on the conducted reports and analysis, but also on other marketing aspects. Internal reporting processes, that had been executed separately within different departments so far, are now generated more cooperatively and in coordination with other internal stakeholders. The management of all marketing campaigns had so far been discussed and decided on a merely strategic and tactical level only. Due to the improved data availability, variety and consolidation facilitated by SAP HANA, campaign management can happen on an operational level as well. Company 2 thus extended their marketing processes, by establishing a 'jour fix' every three months. Here, different departments meet and exchange their thoughts over the reporting, and express their ideas and requests concerning specific marketing activities. This implies that there are campaign-specific meetings at which varying departments are involved and decide about content, text and timing of single campaigns.

Effects on the BM elements

This had a very positive effect on the BM element Value Chain & Linkages. Firstly, the transparency of the marketing activities and efficiency increased, and every department knew exactly what the others were doing. This was facilitated by the newly established 'jour fix', which also had a very positive impact on the collaboration of the departments. A shared understanding of the customer and a more common goal for all employees emerged, fostering a greater sense of unity within the company.

HANA also enhanced the assessment of key activities by providing instant feedback about the efficiency of marketing campaigns. This improved the planning reliability for future key actions, which used to rely more on a 'gut feeling' and can now be based on pure facts.

Future BMI of company 2

As a next step to improve the internal reporting, company 2 is thinking about deploying mobile devices that will depict reporting dashboards in real-time, supported by HANA. This will improve the management's flexibility and keep them informed at all times, which can be said to have a positive impact on the BM element Value Chain & Linkages.

The individualization of the customer journey is also going to increase. For that, company 2 wants to do a data-driven customization approach for their ecommerce activities. A learning system that considers each customer individually as he visits the website, which is improving the firm's Customer Engagement. For example, if the system recognizes the online customer and that he has bought a specific product last year, it can then recommend him/her that there is now a new version of that product.

Furthermore, already first field tests with iBeacons[2] are being conducted. These are placed at staked areas on stadiums (e.g. such fanclub tents or busses), to improve the customer experience by providing customer and location specific information and services, and retrieving information from the event. HANA can help to process the data from the event and relate it to the customer data already available, to provide these real-time services. This has an obvious effect on Customer Engagement. Moreover, the information retrieved can enhance the firm's segmentation efforts and thus its Customer Sensing.

Further in the future, company 2 imagines to use HANA's real-time analytics to offer dynamic ticket pricing that recognizes stadium capacity (i.e. supply and demand). This idea emerged as fans often criticize that the tickets are not priced adequately, considering the game's relevance and capacity. This will then have a direct effect on the BM element Monetization.

4.1.3 Company 3

Company 3 served as case in the automobile industry. It was founded in 1967 as a brand-specialized tuning and engineering firm and started cooperating with a large and well-known car manufacturer in 1990. Since 2005, company 3 has been a full subsidiary of its initial manufacturing partner. As original equipment manufacturer (OEM) of its parent company, the firm's core BM is to independently develop, manufacture and customize automobiles of the parent company. In their own words, company 3 stands for a unique driving experience combined with the intention to be the innovator in the high-performance automobile segment.

Company 3 had its first touch point with SAP in 2009 when it adopted the SAP enterprise resource planning (ERP) solution. SAP was then looking for a HANA reference customer from

[2] iBeacons are part of the trend *Connectivity*, and are small Bluetooth low energy devices that can enable mobile devices (e.g. smartphones or tablets) to perform actions when in close proximity.

the automobile sector. As pioneer of the parent corporation, company 3 went live on HANA in 2013. Since then, the firm's complete ERP relies on HANA with the single exception of human resources (HR) which are managed centrally by the parent company. In the past years, company 3 has been developing the infrastructure and acceptance around HANA, using the technology in its everyday business for approximately more than two years now. The company initiated and currently runs three innovative projects enabled by HANA.

Current BMI of company 3

Within company 3, neither BM creation nor termination were described as consequence of BP changes affected by SAP HANA. However, BM revision as well as extension can be recognized from several statements during the interview.

Generally, internal processes were subject to change as they became faster, leaner and more efficient due to the implementation of SAP HANA. In more detail, this can be confirmed by describing the three mentioned projects that the technology has been facilitating since its introduction.

1st BP change (revision)

Company 3's first process revision concerned its accounting and finance. Due to the company's vast growth over the past years, the operational and budget planning and controlling processes (on a project level) have never been standardized, and all financial analysts had their own procedures and datasets. With the introduction of HANA, the complete IT system landscape had been redesigned, reoriented, and the various separate databases had been integrated into a single BW. The consolidation efforts have been used to also standardize the regular controlling processes across the company, and own UI5 applications have been developed, according to the newly designed planning processes. However, HANA also provided the flexibility to align the planning and controlling processes with each employee's individual needs.

Effects on the BM elements

This process revision had a big impact on the BM element Value Chain & Linkages. So far, project meetings had frequently exhibited problems due to uncertainties over certain figures, since the numbers were usually one day old. As a consequence of the consolidation of the separated databases, the transparency of the whole company increased, since every action made by one employee is now instantly visible to everyone else. Now, project

managers can plan with information about historical projects, material resolutions, and actual as well as potential payments to the supplier. All from one database and in real-time, enabling more efficient and effective budget planning and thus better resource allocation. With the alignment of the planning and controlling application to the employees' individual needs, a management information cockpit has been created. This displays only relevant information and KPIs to the manager, to mitigate distractions from any irrelevant information.

Integrating the legacy system into the BW also saves time because it is no longer necessary to regularly transfer the ERP system (which amounts to 70% of all data) onto the BW. The gains in speed are also fostered by HANA processing power. For example the creation of the reports is now much faster, so that even bigger ones that used to take a few days, like the monthly financial statements, can now be created within minutes.

"We now have virtually the possibility to do real-time planning, which is to make decisions based on the actual transaction data in that situation and moment." (employee 1, personal interview, June 25, 2015)

2nd BP change (revision)

Secondly, another project was introduced to completely revise the process of new product development (NPD). The impulse for this project was given top-down by the management after having recognized the need for restructuring the tasks and responsibilities around NPD. NPD had so far been conducted by teams according to specific automobile models, who were developing the whole model from front to end. Now, however, competence teams around different automobile components (e.g. the brakes) were established that worked on NPD for all automobile models. SAP HANA played a crucial role in the restructuring effort. Again, over the years the old system landscape had grown into many different silos, which were now being integrated into one database. Using the Design Thinking[3] method, user-specific information needs had been worked out and with the help of SAP UI5, respective applications had been developed. Employees involved in the NPD processes, can now rely solely on one consolidated system that recognizes their competence-specific profile.

[3] "A methodology for innovation that combines creative and analytical approaches and requires collaboration across disciplines" (Stanford, 2015)

Effects on the BM elements

The restructuring of the process greatly increased the efficiency of the NPD. The component specific competence teams are involved in the development of all car models. Since the NPD processes concerning each components are often similar for the different car models, a lot of issues can now be resolved much faster and effectively. Thus, these newly distributed responsibilities lead ultimately to more output.

Additionally, the usage of the IT system has greatly been unified and simplified. Before that, because of the various system landscapes, you had to really understand the landscape and to know where and how to get your information from. Many employees had to log into multiple systems to get the information they needed.

Thus, the consolidation made it much easier to find what you are looking for and improved the working experience of human resources. Furthermore, since all projects are now connected with each other over one shared database, delays in one project, for example, are now automatically visible for all other affected projects.

3rd BP change (revision)

Thirdly, the process of engine quality assurance has completely been revised. Engine testing is a costly and data intensive process, with up to 30.000 data sets being created per second over one hour. So far, tools have been used that mainly accumulate but not evaluate the data. After an engine test the engineers had to work their way through huge Excel files to identify any outliers. If anything went wrong during the test, it would only become apparent afterwards. With the help of SAP HANA's, high performance analytics and visualization, the data is now being processed 'on the fly'. Engineers can now detect engine failures as soon as they happen and terminate the tests immediately. Next to that, the technology's predictive analytics capabilities correlate historical test data in real-time with current test data, which enables the engineer to anticipate how the engine will behave.

Effects on the BM elements

Deploying SAP HANA for the engine quality assurance process, significantly improves the reliability and efficiency of the last step in the production process. The time savings through faster evaluation and the ability to abort failed engine tests, are estimated to equal one extra day of testing capacity per week. Thus time and cost resources can be conserved.

4th BP change (extension)

"Ok, performance-wise you have virtually shortened the month-end closing so much that you now have room for other topics." (employee 3, personal interview, June 25, 2015)

The time savings HANA has created, for example, through the faster monthly financial statements, have been used by the employees to come up with new process improvements. By offering the possibility for stored procedures[4] , SAP HANA enabled the execution of faster and more flexible queries directly on the database. Using the increased query flexibility, a new scrap disposal process was established. Within the old ERP environment this was not so easily possible. With that, the internal logistic processes have been extended by a new scrap disposal process that was added as a completely new activity.

Effects on the BM elements

A new query was developed directly on the database to quickly identify and locate parts that are ready to be disposed. This made the overall disposal process faster and more efficient.

Future BMI of company 3

Concerning its budget planning and controlling activities, company 3 will apply predictive analytics, after an extensive, company and department wide BW integration has been accomplished.

Like company 2, company 3 is anticipating the deployment of mobile devices throughout their organization. This means, not just on the management level, but also for example for the engineers. As stated above, this will improve the employee's flexibility and keep them informed at all times, which has a positive impact on the BM element Value Chain & Linkages. Connected to the topic of Industry 4.0, the internal value chain is going to be further optimized in terms of tracking and tracing the production equipment and refining the material flows (similar to the disposal process above). This will be done through the faster creation of new IT processes and faster analysis of vast amounts of sensor data.

Another development that is expected, is the advancement of the connected car that is equipped with a great amount of sensors and network technologies. Through this, company

[4] Functionalities that allow to store SQL-procedures that are easier to write, that can access the entire database, and are accessible like other incorporated functionalities.

3 will obtain an abundance of information about the car, as well as about the customer or driver. With the help of SAP HANA, this data can be efficiently and usefully processed and analyzed. This will have several implications for car manufacturers. The new amount of information about the car and its components (e.g. the engine) can be used to identify its 'weak spots' to further optimize the product and the production (i.e. Value Chain & Linkages). This information coupled with SAP HANA's predictive analytics, can offer the customer new services (i.e. Customer Engagement) like predictive maintenance (i.e. determine the car's condition to predict when maintenance will be necessary). New revenue potentials will open up with novel business partner. This can already be witnessed by the new cooperations between car manufacturers and insurance companies who use this information to customize their policies (i.e. Monetization). Lastly, the firm's segmentation efforts can be enhanced, as new information about, for example, the customer's driving behavior will be obtainable and - with HANA - analyzable (i.e. Customer Sensing).

4.1.4 Company 4

Company 4 served as case within the field of trade and commerce. As an institution under public law, company 4 is operating around one of the largest and most important harbours in the world. Used by approximately 10,000 ships per year, 200 freight trains and 5,000 trucks a day, the high performance of company 4 is supported by numbers. This translates to an annual turnover of 9ml containers, which is expected to increase to about 25ml by 2025. Since 2005, the firm has been providing port management services next to bearing the central responsibility for the landside and waterside port infrastructure, safety and the port's economic conditions. It has thus three central tasks that are infrastructure management, property and construction management and traffic and transportation management, and is the overarching and coordinating entity for the various stakeholder or participants in the port. The core business is thus to ensure a reliable infrastructure, with dependable transport paths, and transparent and efficient communication both marine as well as land-based. Since turnover and traffic is increasing and the space is very limited, new solutions are in need to cope with these developments and thus strengthening the position of the port and enhancing its growth potential as well as expansion possibilities in the future.

As the firm's ERP system already relies on SAP software, company 4 decided relatively quickly to engage in SAP HANA Cloud by setting up this first pilot project in cooperation with a global IT services and consulting company and SAP SE.

Current BMI of company 4

In the course of the interview with company 1, only BM revision was mentioned in form of core BP changes. Statements indicating the happening of BM extension, termination and creation, manifested in BP changes, were not made.

1st BP change (revision)

One of the three core BPs - traffic and transportation management - is currently being revised. The project started in 2011 and aims at connecting all participants at the port to effectively handle orders and freight traffic and increase its turnover capacity. With the help of SAP HANA's Cloud service, the port authority established a platform on which data from various stakeholders come together. Previously, all participants had their own datasets, which made collaboration and coordination more difficult. The platform aims to integrate all relevant information and enhance the collaboration between the port authority, two transport companies and the parking providers. Using this platform, an app has been created that also benefits the port's customer and user by providing information about traffic inside the port area (e.g. closed bridges) and about the situation of the terminals (e.g. are they closed because of a bottleneck or an IT breakdown). The app (provided as a 'freemium' version) also serves as a messaging platform, which increases communication between all participants. Haulage companies benefit, for example, from the information about free parking spaces, current route situations or waiting times. Loading slots can be made available on short notice and diverting the traffic helps avoiding jams. Cargo ships can now decrease their idle time and transfer their time of arrival to bridges, so they can open just-in-time. But also the terminal operators use the app and benefit from the higher efficiency and can better plan their business.

Effects on the BM elements

The data consolidation in the cloud and the app built upon it had a large effect on the port authority's BM. On the one hand, it enables a real-time traffic-system management to smooth out the traffic at the port and thus increase its efficiency. This is also due to the increased communication and collaboration between all participants. Furthermore, new partnerships emerge through the direct communication possibilities with other port participants, like the truck drivers, which was not able like this before. These improvements had an effect on the BM element Value Chain & Linkages. Additionally, the app changes also

the port authority's value proposition as completely new services can now be offered, which affect the BM element Customer Engagement.

"We now have a very detailed overview about the current traffic situation inside the harbor. And this traffic situation we somehow have to get out. So have it available not only to us, but also to the truckers, logisticians, the citizens, and whomever may be interested. And that's been a new step for us, which we previously did not have." (employee 1, personal interview, July 15, 2015)

Future BMI of company 4

In a next step, additional data of other transport companies, container terminals, weather data, and traffic information from the ADAC is planned to be integrated into the platform, which will further improve the port's efficiency. Furthermore, the infrastructure management (i.e. maintaining the roads, for traffic on rail, street and water) is going to merge with the traffic and transportation management. The data consolidation will help to improve the operation of both functions, through, for example, new abilities like predictive maintenance. Regarding the internal processes, a new business intelligence tool that puts different KPIs in relation (e.g. for financial reports) is currently being initiated, using HANA's fast processing and advanced analytics. These future ambitions all relate to the BM element Value Chain & Linkages.

Lastly, a spin-off in the form of an IT consulting company is currently being planned that sells know-how about the above mentioned capabilities and possibilities to other harbours. This spin-off will have an effect on the BM element Monetization, as it provides a whole new revenue potentials.

4.1.5 Secondary case studies

In this section, a short summary of the four additional case studies will be presented that were retrieved from the SAP case study database (SAP SE, 2014b). The cases shortly describe the implementation and current as well as anticipated effects, of SAP HANA within the respective companies. These four external cases were added as data source in order to challenge and thus further validate the case study results.

Danone (SAP SE, 2014c)

Danone is one of the world's largest food, beverage, and nutraceutical manufacturers with its Headquarters in Paris, France. Danone's strategic focus lies on using nutrition to promote the health and well-being of their customers.

Since 2013, Danone is using the SAP HANA Cloud Platform to build web applications. In South Africa, Danone already improved its call center operations through a web application that supports the management of the entire order-to-cash cycle. This helped to streamline the call center operations and improved the employees' work experience (i.e. VCL). Other call centers are about to follow. Furthermore, did the deployment of HANA improve the whole IT performance of Danone that helps to make business decisions based on real-time data (i.e. VCL).

In the future, Danone wants to also reach their consumers on their mobile devices. Product related mobile applications will be provided to the consumer, linking them directly to the company's back-end systems (i.e. CE). The retrieved customer data will then also be combined with other resources such as Facebook and Twitter. Its analysis will give new insights about the customer (i.e. CS).

NBA (SAP SE, 2014f)

Founded in New York City in 1946, the National Basketball Association (NBA) is now the preeminent men's professional basketball league in North America and maybe even the world.

In 2012 the NBA implemented SAP HANA to manage their vast amount of statistical data about the teams, players and games etc., and provide it via the internet. As a result, a single, interactive statistics web site had been created that is available to NBA teams, players, fans, and the media. The real-time data platform enables the league to bring its entire database of historical data and situational statistics directly to 380 million fans' fingertips, who can then slice and dice the data as they like. This new statistical experience (NBA.com/stats), has already led to a growth in visitors to the NBA Web site and a twice as long time spent on the web page (i.e. CE).

For the future, the NBA wants to integrate more video content and provide a mobile experience as well through applications for smartphones and tablets that will further enhance its value proposition (i.e. Customer Engagement).

Fire & Rescue New South Wales (SAP SE, 2014d)

As an example for an organization from the public sector, serves the firefighting agency from the Australian state New South Wales. With 7,000 firefighters and 7,000 community fire unit volunteers, *Fire & Rescue New South Wales* has to deal with about 130,000 incidents a year in Sydney and other urban areas.

Since 2014, the firefighting agency has been used SAP Business Suite on SAP HANA that cover all aspects of running the organization, i.e. finance, payroll, HR, procurement, training, logistics, etc. Since the deployment of HANA, the report generation time had been dramatically decreased so that real-time business analytics are now possible (i.e. VCL).

Four more New South Wales agencies have adopted SAP HANA: *New South Wales State Emergency Service, New South Wales Rural Fire Service, New South Wales' Attorney General's Department* and *the Ministry for Police and Emergency Services*. With the deployment of SAP HANA, all five agencies have standardized their processes for the first time, improving the interoperability among the agencies (i.e. VCL).

In the future, Fire & Rescue New South Wales want to predict the possibility of a fire outbreak up to a week in advance. Combined with an advanced asset management system (for its 500,000 pieces of equipment, 9,000 vehicles, and 3,000 properties) and their personnel's up to 30 years long training record, it is aspired to improve its fire and rescue services through the optimal dispatching of the crews to areas where they are most likely to be needed (i.e. CE bc new/better service).

Joskin (SAP SE, 2014e)

Out of the automotive industry, the family-owned JOSKIN Group manufactures agricultural trailers and tools at five production sites in Europe. In 2013, the JOSKIN Group migrated their SAP Business Suite applications to the SAP HANA platform to speed financial, production, sales and service, and after-sales processes.

This speeded up one of Joskin's key activities - the material resource planning - five to eight times, and thus enabled a real-time stock management (i.e. VCL).

Additionally, do the financial reports that used to take couple of minutes to run, now only take three to five seconds. The daily production control reports, for example, are now up to

1,721 times faster than before SAP HANA. This enables real-time analyses and ad-hoc financial information (i.e. VCL).

The products of Joskin are highly customizable, which is why each machine and thus each customer request is different. One of Joskin's agricultural machines for example, the *slurry spreader*, has 70 basic types and offers 1,500 different options that can be combined. To keep providing good customer service, telephone inquiries are best responded to immediately. Thanks to HANA, the service team can access the customer install base with all critical information about equipment and bill of materials within one second and with the customer still on the line (i.e. CE).

However, any concrete future aspirations of the company have not been openly expressed.

The following table 4-1 provides a summarizing overview of the individual cases, by relating each BM change to its respective BM element.

	Value Chain & Linkages	Customer Engagement	Customer Sensing	Monetization
C1 current (since 2013)	- Increased information flow and informative value of reportings through faster analytics	- Improved value proposition through better customer service based on faster data analysis	-	-
C1 future	- Enhance human resource management by better assessing the employees' competencies - Analysis of internal communication improves monitoring of the company's activities	- Improved value proposition through better content recommendation	- Enhanced content analysis improves segmentation of customers (peer reviewers)	-
C2 current (since 2012)	- Improved collaboration between departments through the establishment of a 'jour fix' - Improved planning reliability through enhanced the assessment of key activities	- Personalized customer relation activities with cross-promotional email marketing through the new ticketing process and merging of datasets	- Enabled extensive customer segmentation through merging of various data sources	-
C2 future	- Deployment of mobile devices improves flexibility and availability of information flow	- Improved distribution channel through data-driven customization of ecommerce activities - New value proposition through new iBeacon services	- More extensive customer segmentation with new customer info from location based services (iBeacons)	- Dynamic ticket pricing through real-time supply-demand analysis
C3 current (since 2013)	- Increased company transparency through merging of different datasets - Better resource allocation through more efficient and effective budget planning - Enhanced information flow through mitigation of irrelevant information - Omitting the data transfer process enabled real-time planning	-	-	-

	- Redesign of NPD increased its speed and output - Simplification of IT system improved work experience of human resources - Increased transparency within NPD through merging of datasets - Improved reliability and efficiency of engine quality assurance tests - Improved internal logistics through new disposal process			
C3 future	- Improve planning reliability through predictive analytics - Deployment of mobile devices improves flexibility and availability of information flow - Improved internal logistics through faster creation of IT processes and faster analysis of sensor data - Production optimization through analysis of product data	- New value proposition through new services like predictive maintenance	- More extensive customer segmentation with new customer info from more connected products	- New revenue potentials through new partnerships based on more data
C4 current (since 2011)	- More and combined information about the harbour increase its efficiency smooth out the traffic at the port and thus increases its efficiency - New communication possibilities with other port participants (i.e. truck drivers) increases its efficiency	- New value proposition through new app services	-	-
C4 future	- Improved value chain efficiency through the analysis of additional data - Improved operations through new abilities like predictive maintenance, based on merging of transportation and	-	-	- Creation of a new revenue model through the spin-off of a consultancy company

	infrastructure management - Improved reporting through new business intelligence tool with advanced analytics			
total current	**14**	**3**	**1**	**0**
total future	**10**	**4**	**3**	**3**
Danone current (since 2013)	- Streamlining the call center operations improved the efficiency of the activities - Faster and more reliable business decisions based on real-time data	-	-	-
Danone future	-	- New product related mobile applications extent the firm's customer relations	- More extensive customer segmentation through connecting customer info data from Facebook and Twitter	-
NBA current (since 2012)	-	- Enhanced value proposition through new statistics web site	-	-
NBA future	-	- Enhanced value proposition through new mobile experience	-	-
FRNSW current (since 2014)	- Faster and more reliable business decisions based on real-time business analytics - Increased interoperability among other business partner (agencies) through standardized processes	-	-	-

FRNSW future	-	- Improvement of its services through predictive analytics and optimizing crew dispatching	-	-
Joskin current (since 2013)	- Real-time stock management through faster material resource planning - Increased information flow and informative value of reportings through real-time analyses	- Improved value proposition through better customer service based on faster data analysis	-	- x
Joskin future	-	-	-	-
total current	**20**	**5**	**1**	**0**
total future	**10**	**7**	**4**	**3**

Tab. 4-1: Overview of the future & current BMI per BM element and case company

4.2 Findings of Cross-Case Analysis

About two-third of all BM changes related to the BM element *Value Chain & Linkages* that have been mentioned during the interviews or in the secondary literature, have already been undertaken. All firms, except for the NBA, have experienced at least two BM changes in that respect. The majority of these changes have to do with efficiency and effectiveness gains of the information flow and decision-making. Efficiency increases can mostly be observed by the standardization and alignment of planning or reporting processes, as well as conducting those much faster or even in real-time, which leaves time for iterative data analyses or other tasks. The effectiveness is being enhanced through the increased informative value and reliability that can be extracted out of the data, by combining different datasets and personalize the displayed information. The effectiveness is also increased through higher transparency (merging and simplifying datasets) within the organization and better collaboration between the departments. Additionally, also productivity is being increased through, for example, redesigning a new NPD process or introducing a new disposal process. Other changes like new business partners are still rather scarce. One example for the latter however is the new direct communication possibilities between company 4 and the truck drivers.

For the future, the BM element Value Chain & Linkages will be affected by introducing new advanced analytics (i.e. new business intelligence tool or predictive analytics), to better understand the own company and employees, and improve reporting and planning. Furthermore, internal connectivity will gain importance (i.e. industry 4.0) and increase the productivity and efficiency of various business functions. Products (i.e. cars of company 3) or the internal infrastructure (e.g. the bridges of company 4, or the machinery of company 3), will add new sensor data. On top of that, the broad deployment of mobile devices is planned by many organizations.

Almost half of all BM changes concerning the BM element *Customer Engagement* that have been mentioned during the interviews or in the secondary literature, have already been undertaken. The current BM element changes are characterized by new services (i.e. mobile application and online service) and improving on customer services through personalization, in the sense of approaching each customer individually (e.g. customized mails), or always having the right information at hand. BMI plans concerning this respective BM element in the future deal predominantly with providing mobile experiences and new personalized services (e.g. iBeacons or predictive maintenance).

80% of the BM changes related to the element *Customer Sensing* that have been mentioned during the interviews or in the secondary literature, have not yet been undertaken. All of these BM changes have to do with customer segmentation. More specifically, aggregating all available customer data to further enhance the segmentation efforts, instead of improving upon the applied segmentation techniques or methods.

So far, no BM changes related to the BM element *Monetization* that have been mentioned during the interviews or in the secondary literature, have been implemented. Nevertheless, future changes of this BM element are anticipated. These future BM changes, however, are the most diverse ones of all BM elements. The BM element Customer Sensing, for example, is all about segmentation. For the BM element Monetization, completely different approaches of entirely redesigning or adding new revenue models have been developed.

In sum, the most mentioned BM changes (current or future) as well as the most already implemented BM changes can be observed for the BM element (1) Value Chain & Linkages, followed by (2) Customer Engagement, (3) Customer Sensing, and lastly (4) Monetization.

Year of implement-tation	**Average amount of BMI** (current/future)			
	VCL	**CE**	**CS**	**M**
2011	2/3	1/0	0/0	0/1
2012	1/0.5	1/1.5	0.5/0.5	0/0.5
2013	3.5/1.5	0.5/0.75	0/0.75	0/0.25
2014	1/0	0/1	0/0	0/0
Ø	**1.9/1.3**	**0.6/0.8**	**0.1/0.3**	**0/0.4**

Tab. 4-2: Average amount of BMI per BM element and year of implementation

Table 4-2 shows the average current and future BMI for the respective year of implementation and BM element. The average across all years shows that the order of affected BM elements appears to be rather consistent (i.e. 1. VCL, 2. CE, 3. CS, 4. M). It is, however, difficult to work out a clear correlation between the amount of BMIs and the year SAP HANA was introduced in the companies. The year of implementation does not seem to play a determining role concerning the rate of BMI. Companies that introduced SAP HANA one year ago, did not yield significantly less BMI than the ones that introduced it three or four years ago.

Answering the research question & working hypotheses

Based on these main findings, the four working hypotheses, which have been formulated in the first study of this joint research project, can be answered. As the research question is based on Baden-Fuller & Mangematin's (2013) BM elements, answering these working hypotheses thus answers the research question of the underlying study: *How do Big Data related technological innovations impact a firm's business model?* As stated above, these working hypotheses take the long-term perspective on BMI and technological innovation into account, as suggested by De Reuver et al. (2013). This means that the *impact,* stated in the working hypotheses, addresses both the actual (current) as well as the planned (future) impact. Within the interviewed case companies it becomes apparent that, except for the BM element Monetization, every BM element has already been impacted by SAP HANA. However, it must be said that many BM changes are planned for the future and have not yet been realized. It can already be concluded that SAP HANA has a distinctive long term impact on the BM elements of a company.

WH1: The working hypotheses 1 "SAP HANA as Big Data technological innovation has an impact on the BM element *Monetization*", can only partially be supported by this study. The interviews reveal potential impacts that this technology can have on this BM element, however, these are solely anticipated for the future.

WH2: The working hypotheses 2 "SAP HANA as Big Data technological innovation has an impact on the BM element *Customer Engagement*", can be fully supported by this study. A variety of projects are implemented by the firms that have altering effects on this BM element. Additionally, even more projects with similar effects are planned for the future.

WH3: The working hypotheses 3 "SAP HANA as Big Data technological innovation has an impact on the BM element *Customer Sensing*", can be fully supported by this study. One project is implemented by company 2 that affects this BM element. Additionally, company 3 and other firms plan even more projects concerning this BM element for the future.

WH4: The working hypotheses 4 "SAP HANA as Big Data technological innovation has an impact on the BM element *Value Chain/Linkages*", can be fully supported by this study. Already 20 projects affecting this BM element are implemented by all organizations, except for one. Additionally, the most projects that were mentioned concerning the future involve this BM element.

4.3 Developing a Technology-Driven BMI Framework

The BM element Value Chain & Linkages is by far the most affected one, with the most current and future BM changes. Additionally, VCL is affected in a rather short term by SAP HANA, as it usually exhibits the first BMIs of all BM elements. This is being related to the fact that most of these BM changes can be more easily and quickly implemented compared to BM changes concerning the other BM elements. As initial step for the interviewed case companies it was found in the course of the conducted interviews that the management needs to be convinced by internal Big Data 'promoters', to invest into an in-memory database. Once this step was made, the manager who invested in this new technology, wants to see first results as quickly as possible. The least complicated way to achieve fast results, is simply making use of the speed of the database and taking already available internal data (no privacy issues). Thus, the majority of these projects were implemented in a relatively short time period and deal with streamlining information flow and making BPs more efficient and effective. Additionally, it becomes apparent that no future projects for this BM element can be identified in the secondary literature. A possible explanation for this can be that this information has not been considered interesting enough or too sensitive to make it public.

Although the BM element VCL is generally the first one that is being affected, the resulting BM changes will definitely not end there. Subsequently to these quick changes, in some cases even bigger and more complex core BPs experienced a complete redesign, like the NPD and disposal process of company 3, or the ticketing process of company 2. Furthermore, after all immediately available data has been analyzed, the firms anticipate to take the next step. They plan to add additional data sources and improve on the analytical methods, to further increase internal efficiency, productivity, reporting and planning. With this regard, the emergence of industry 4.0 will have an extensive impact on various business functions. However, this transition will not be very sudden but rather involves a long lasting development with several smaller steps to be taken (new stored procedures, sensor technology, mobile devices etc.). This shows that, over time, the complexity of the BMIs grows, which increases the relevance of SAP HANA as well. Other bigger BM element changes such as new key partners (e.g. company 4's new direct communication to truck drivers), are still very scarce across all case companies.

The BM element Customer Engagement is affected the second most by the implementation of SAP HANA. Often, in an attempt to create new and diverse use cases for the technology, HANA is firstly being used to correct certain flaws within this BM element (e.g. company 1's

customer report, Joskin's customer service or company 2's concurrent emails), and subsequently improving upon them. The ability to quickly process large amounts of data, helps to address the customer in a more personalized way. Firms usually already have access to a lot of customer data that is not yet being analyzed. Thus, firms utilize this available data before gathering new data. Future BMIs of this BM element (and in some cases already implemented) deal predominantly with providing mobile experiences and new personalized services (e.g. iBeacons or predictive maintenance).

These new personalized services often accompany the subsequent segmentation efforts of the BM element Customer Sensing. As with the BM element VCL, firms firstly concentrate on gathering and combining various kinds of data, before improving on the methods and techniques of the data analysis. Many of the future projects rely on the new Customer Engagement efforts, like new products or services (e.g. connected car or iBeacon services) that provide additional customer data. This shows that the firms already think in a data-driven way. On their way to a data-driven business, everything has to link and fit together. When thinking about a new service, firms simultaneously need to think about the data they can retrieve and how they can apply the data for new services or internal improvements (e.g. value chain or segmentation) (Porter & Heppelmann, 2014). Both, Customer Sensing and Customer Engagement, are thus mainly being affected in the medium term, meaning after the implementation of the first VCL and before Monetization related BMIs. Furthermore, do the BMIs of these BM elements exhibit increasing sophistication over time, similar to VCL.

As no BMI related to the BM element Monetization could be observed during the interviews and only a few future projects appear to be vaguely planned, this kind of BMI is obviously only relevant in the long term for incumbent firms. However, these projects are therefore much more diverse and holistic than, for example, the reporting or segmentation efforts of the BM elements VCL or CS respectively. As is the case with the BM element VCL, secondary case studies provide no information about Monetization related BMI (future or current). As mentioned above, this information might be too sensitive, or the organizations have not yet planned so far ahead. Even though no concrete case evidence exists, the increasing complexity and sophistication of the BM element Monetization can be assumed, based on the fact that this is also true for all other BM elements. Moreover, the interviews with the experts reveal that future BMs and revenue models will most likely rely heavily on Big Data related technologies like SAP HANA (Geißler, personal interview, June 23, 2015; Arnold, personal interview, August 26, 2015).

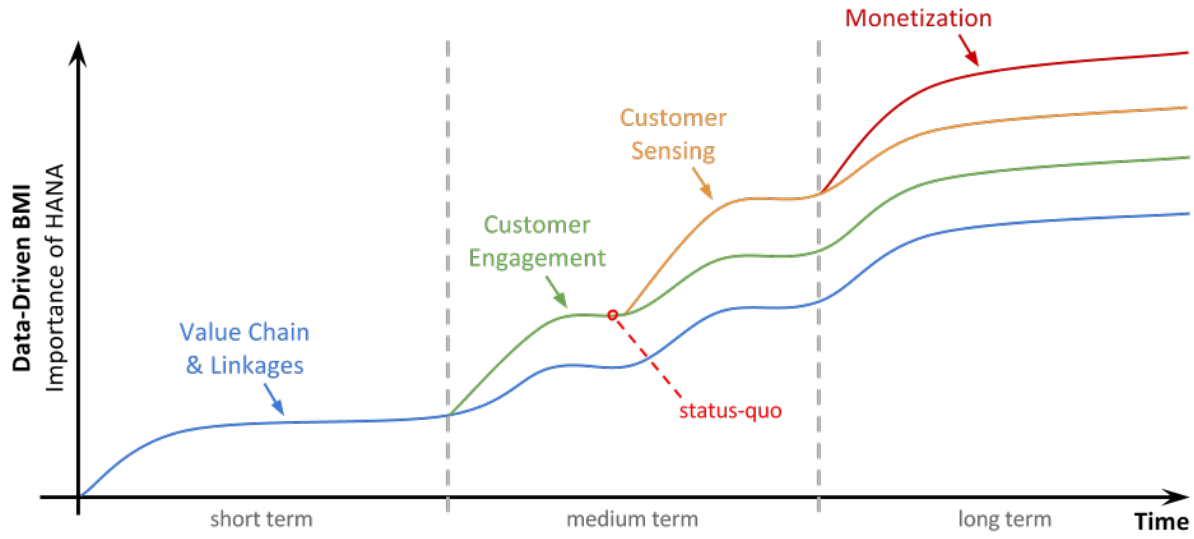

Fig. 4-1: Framework of the interplay of technological innovation and BMI in the context of Big Data and SAP HANA

Based on the interviews and the single- and cross-case analyses, a technology-driven BMI framework regarding the Big Data technology SAP HANA has been developed (see fig. 4-1). The y-axis shows the increasing relevance of SAP HANA. The x-axis represents a timeline, depicting the maturities of respective BM changes (i.e. short, medium and long term). As elaborated above, BMI related to the BM element VCL is usually the first to happen, and implemented in a rather short term. After that, on a medium term, projects connected to the BM elements Customer Engagement and Customer Sensing are implemented, which are highly interlinked. Only in the long term, the BM element Monetization is expected to be affected by implementing SAP HANA. The exact definition of the time periods - short, medium and long term - largely depends on the respective firms. No correlation between the year of implementation and the amount of BMI can be determined. Company 3, for example, already stated plans for future BM changes concerning the BM element Customer Sensing after two years. Company 4 however, does not anticipate similar BM changes within a time horizon of four years. Company 3 is a service company within the sports and entertainment industry, and company 4 is a manufacturing company belonging to the automotive industry. This makes it reasonable to assume that contingency factors like type of business or industry are reasons for the discrepancy. Next to these two, also another possible contingency factor could be the involvement of the management (Arnold, 2012). However, the definite determination of the influencing factors is not the focus of this study and will therefore not be discussed in more detail. Nevertheless, as explained above,

regardless of the different time horizons, it can be concluded that all case companies follow a similar pattern of BMI affected by the implementation of SAP HANA.

The y-axis represents the growing importance of SAP HANA within the respective BM elements, accompanied by an increase in data-driven BMI. As fig. 4-1 shows, the progress and change within the single BM elements does not terminate after one successful (or unsuccessful) project. Every organization is already planning subsequent BMI projects that often build upon the previous ones. The technological innovation - SAP HANA - will become increasingly relevant as the complexity of the projects increases. The interviewees stated that several current BMI projects supported by SAP HANA could have been also realized with other technologies. Moreover, some of the BM changes within the BM element VCL, for example, are rather considered positive side effects of implementing the technology (e.g. faster reportings). However, the case companies unanimously confirmed that these current BM changes are not the final goal and expectation that the companies have towards SAP HANA. SAP HANA is regarded as the basis for more complex BMI projects related to Big Data, which are anticipated in the future. This becomes also apparent by the finding that, often, BMI within one BM element, is expected to subsequently trigger or reinforce BMI in another BM element. One example of that would be the segmentation efforts in the BM element Customer Sensing, which are reinforced by new services or products (i.e. CE) that provide new customer data. Another example is the connected car (i.e. CE) that provides new information about the product and usage, which can be utilized to optimize production processes (i.e. VCL). In the framework in fig. 4-1, this is being depicted by the recurring increase of the slope at the transition to the next BM element. The fact that the four BM elements affect each other, makes it reasonable to assume that technology-driven BMI within a company happens in an ongoing series of interlinked and iterative BMI. However, an assumption like this can not be empirically confirmed at this point in time and can only be determined by subsequent research.

5 Discussion

The goal of the underlying study was to answer the research question: *How do Big Data related technological innovations impact a firm's business model?* After answering the four working hypotheses in chapter 4.2, it can be concluded that Big Data related technological innovations like SAP HANA impact a firm's BM on various levels. Except for the BM element Monetization, which only provides evidence for future BMI, current and future BMI was identified for all other BM elements (i.e. CE, CS and VCL).

5.1 Implications for Practice

The growing importance of Big Data has therefore become very apparent throughout the course of this study. Although the term might still provoke exaggerated expectations, both management and academic literature agree upon the fact that Big Data is not just a fashionable topic, but an important subject today and in the future. In fact, every industry and business function will, to a lesser or greater extent, be affected by Big Data and the changes it brings about. This is confirmed by Jürgen Fitschen's (Co-Chairman Deutsche Bank) statement that data will become essential for offering adequate products or services to customers, and sees tech-giants like Google or Microsoft as tomorrow's main competitors of the Deutsche Bank. (Buhl et al., 2013)

"Because of their huge data base do these companies know much more about their customers' needs than we will ever know as banks, and can therefore offer highly targeted services." (Jürgen Fitschen in Reuters, 2012)

Unlike Carr (2003) suggested in his paper about the role of IT in business, the *digital future* has apparently not arrived yet. During the last decade, IT was seen solely as an infrastructural technology that would soon become a commodity, instead of a value creating asset. Only forward thinking companies could derive a real competitive advantage from IT, when it could still be owned like a proprietary technology. As the affordability increased due to packaged software, desktop computers, networking standards, and a decrease in prices (of data-storage, -processing, and -transport), IT did in fact turn into a commodity. Best practices became widely understood and adopted, until there was no potential for differentiation left. IT then became a prerequisite for many business activities. (Carr, 2003)

To a certain extend, the same can be expected for Big Data, as it takes IT as an infrastructural technology simply to the next level (e.g. with real-time speeds). In the future, the Big Data infrastructure as well as basic analytic tools will most likely become the standard for many (if

not all) businesses, similar to the Internet (Arnold, personal interview, August 26, 2015). This assumption is also being supported by the growing adoption of Big Data infrastructure like Hadoop (Leopold, 2014), by the increasing supply of packaged software like Tableau (Pringle, 2015), as well as by Gartner's current Hype Cycle for Emerging Technologies (Gartner, 2014). Big Data - similar to Cloud computing and In-memory databases - has just passed its hype peak and will, to some extent, become a commodity within the next five to ten years. The Hype Cycle also confirms the case studies' finding that firms firstly concentrate on larger volumes of data (mostly customer data) before focusing on advanced analytics or digital business (Internet of Things is just at its hype peak while Prescriptive Analytics and Data Science did not yet reach their peak).

5.1.1 Big Data entry strategy

Because of the commoditization of Big Data, firms need to decide now if they want to pioneer in this field or behave as followers. Both approaches have their advantages and disadvantages. Although pioneering firms can run the risk of locking themselves into a technology, they can also gain important advantages. As demonstrated by the preceding IT revolution, these range from marketing or operating advantages, to leapfrogging the competition in a particular process or activity (e.g. Federal Express), fundamentally changing an industry (e.g. eBay), or through scale economies or brand recognition (e.g. Dell Computers) (Carr, 2003). Following a hesitant approach poses the risk of falling behind, however, Moore's Law does also guarantee that "the longer you wait to make an IT purchase, the more you'll get for your money. And waiting will decrease your risk of buying something technologically flawed or doomed to rapid obsolescence" (Carr, 2003, p. 48). A hesitant approach also creates the opportunity of adopting a dominant design as it emerges, which can lead to superior firm performance (Arnold, 2012). Which strategy is best for a firm depends on many factors like the firm itself, the industry, or the competition's approach (Markides & Sosa, 2013). Nevertheless, the "window for gaining advantage from an infrastructural technology is open only briefly" (Carr, 2003, p. 43) and firms can still gain competitive advantages while the widespread deployment of Big Data is developing rather slow (Schroeck et al., 2012; Buhl et al., 2013; Deloitte, 2014; Capgemini Consulting, 2015).

Today, it is still about gathering and analyzing the data that is already available, using simple algorithms. Although other cheaper solutions than HANA can handle this task just as well, this first step is about creating the foundation for the future. The findings show that it serves as the basis for all successive Big Data projects. For that, a high performance analytical database like SAP HANA is essential. It is therefore advisable to invest only once instead of

having to transfer all processes to yet another system a few years later. (Geißler, personal interview, June 23, 2015)

5.1.2 Top management support

As the investment is not insignificant, this first step (i.e. integrating the old BW into HANA), needs special support by the management and decision-makers. One key problem the case studies reveal, was that many of the more traditional companies are lead by a top management without a technical background, which can hinder or postpone such investments. It is therefore imperative for the company to train IT and Big Data related skills in their executives. Furthermore, the top management needs to prioritize topics like Big Data and engage in the process early on. Strategic decisions concerning the degree of innovation and the change of a business model have an important influence on a company's performance after such technological developments. (Arnold, 2012)

Since the - usually non-technical - managers often still consider Big Data a challenging topic rather than a value adding opportunity, a convincing argument for the internal Big Data 'promoters' to gain support for investments like HANA was identified by this study. One interesting aspect to consider is the fact that the implementation of HANA is occasionally accompanied by the redesign of larger BPs (e.g. the NPD of company 3). The reason for this is that both, the implementation of HANA and the process redesign, require an extensive adjustment of the IT architecture. The internal promoter can propose this to the upper management as a chance for them to tackle and solve two issues at the same time. That is, creating the infrastructural foundation for future Big Data efforts, while simultaneaoulsy inducing eventually long anticipated fundamental process changes in the company.

Furthermore, the importance of top management support becomes apparent, when considering the case study finding that single BMIs often trigger subsequent projects. In order to get the most out of each undertaking, they have to be coordinated and aligned with each other and the overall firm and Big Data strategy. For that, an integrated BMI approach across all functions is necessary to develop mutually supportive Big Data initiatives. For instance, new analytics can make proper use of data that can be retrieved from new offerings or services to refine segmentation efforts, which can then again be used for NPD. (Porter & Heppelmann, 2014)

5.1.3 Organizational challenges

Furthermore, the top management of a data-driven business does not only need to be aware of new opportunities, but also of legal uncertainties, and new roles Big Data brings about (Buhl et al., 2013; McAfee et al., 2012). 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.

Moreover, it became apparent during the interviews that gathering new expertise (data scientists, mathematics etc.) is going to be necessary in the future. Advanced methodological and statistical knowledge will be needed to further improve data analyses, as more data does not automatically lead to better decisions, insights or success (Buhl et al., 2013). Therefore, firms need to address the issue early on, as a shortage of such expertise is being predicted (Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh & Byers, 2011). This challenge can be overcome through close collaborations with universities, building in-house expertise or bridging the talent gap through open innovation and new strategic partnerships (including collaborative R&D, joint ventures, license agreements etc.) (Ahalt & Kelly, 2013; Culpan, 2014). Similar statements of many interviewees led to an interesting implication for SAP SE itself. SAP can fulfill a supportive role concerning the attraction of new talent for their customers using SAP HANA. The interviews reveal that SAP is often viewed by young professionals as a rather old fashion software company, making it less attractive for developers to specialize in this technology. It is therefore highly advisable for SAP to improve on their image in that respect with further initiatives like the redesigned User Experience (i.e. SAP Fiori) or cooperations with startups (SAP SE, 2015b).

Companies also need to create awareness among the employees, especially concerning legal uncertainties. A broad understanding of privacy issues concerning for example customer data can decrease the risk of legal issues and increase the speed of project implementation, as legal uncertainties pose one of the main barriers (PwC, 2014a). This is also confirmed by the interviews, as many interviewees were unsure about the current legal possibilities, since Germany has one of the world's most restrictive privacy laws (i.e. Datenschutzgesetz) (Lüber, 2014). Firms should, however, not become paralyzed by this fact but instead try to see this situation as a challenging opportunity. In fact, the same was valid for the stricter environmental regulations for the German car manufacturers opposed to, for example, the US-based manufacturers. This turned out to be beneficial for the compulsorily fuel efficient German cars, as ecological awareness increases worldwide (Buhl et al., 2013). Hence,

“constraints can actually serve as a fertile stimulus for innovative, customer oriented and value creating solutions“ (Buhl et al., 2013, p. 67).

5.1.4 Holistic approach

Besides changes concerning the IT infrastructure or the BPs, the case studies also confirm that SAP HANA has an effect on the BM itself. However, it was observed that once the foundation for Big Data is established (i.e. SAP HANA), BMI within the firms happens rather iteratively with many smaller projects and little prior holistic planning of the company’s future BM. One reason for this is the problem stated by some interviewees that the internal Big Data promoters perceive the urge to generate immediate results, rather than initiating an extensive and usually time-consuming strategy development. This is being done in order to convince the managers and departments of Big Data’s value, to gather initial support for the investment, or to legitimize the investment afterwards by demonstrating its value through new projects. This problem became especially apparent when discussing longer term BMI concerning the BM element Monetization, or the fact that almost all firms praised the efficiency gains of SAP HANA (e.g. for reporting processes), instead of imagining how the increasing ease of access to information may fundamentaly change the role of the management in the firm (Arnold, personal interview, August 26, 2015). This should be seen as quite unsettling, since “findings indicate that companies need to focus on all areas of their BMs in a holistic fashion, and not just change isolated elements“ (Kindström, 2010, p. 479). Companies are in need of a well-founded DDBM that creates value for the customer (Buhl et al., 2013), since the inertia of BMs and BMI when confronted with such technology shifts, can in fact be lethal for firms. (Arnold, 2012; Tongur & Engwall, 2014)

One practical example in this regard can be taken from the early IT development, mentioned above. As an illustrative case serves a fictional bookstore manager during the 1990s who tries to make his store ready for the digital age step by step (giving it a website and an ERP system etc.). Although forward thinking, in hindsight these efforts might seem pointless compared to the BMI of Amazon.com. The same can apply with regards to Big Data today. Car manufacturers like company 3 need to deal with new competitors like Google, who are likely to approach the automotive industry with a completely different BM. (Amazon, 2015; Bradberry, 2015)

To counteract this isolated thinking and promote a more holistic perspective that aligns „IT infrastructure, BPs, applications as well as the business model focusing on the customer“ (Buhl et al., 2013, p. 67), BMI needs to be approached in a more structured and process

oriented way (Halecker, Bickmann & Hölzle, 2014). It is therefore recommended to conduct workshops that promote a longer term perspective like Design Thinking (SAP SE, 2015a) or the St. Gallen Business Model Navigator™ (Gassmann, Frankenberger & Csik, 2013), in which also the top management should engage (Arnold, 2012). In a next step, a combination of different (newer) technologies and the resulting impact on current and future BMs should be investigated, as the interviewees mentioned several potential application scenarios combining SAP HANA with other systems and technologies. For this, techniques like the BM roadmapping are advisable, as they take various BM domains (i.e. service, technological, organizational or financial) into account and work towards a more integrated goal (De Reuver et al., 2013). This will also take the pressure off the employees to generate immediate results with their Big Data efforts and encourage them to think more creatively about possible HANA applications.

Summarizing, the following recommendations should be taken into account by incumbent companies, as Big Data can not guarantee the firm's success, but can only be taken as its basis (Buhl et al., 2013).

- Train IT and Big Data related skills in the firm's executives and ensure early top management support and engagement, for example in Big Data related workshops
- Decide for a Big Data entry strategy by evaluating the respective advantages and disadvantages of pioneering and following
- Adress the impending talent shortage through collaborations with universities, building in-house expertise or bridging the gap through open innovation and strategic partnerships
- Create internal awareness and educate the employees about the legal situation, like the privacy law, and find creative ways to cope with it
- Holistically develop a clear and long term Big Data strategy to either improve upon the current BM or develop a whole new BM approach, using methods like Design Thinking or the St. Gallen Business Model Navigator™ (Gassmann et al., 2013) respectfully
- This strategy should integrate all BM elements, business funtions as well as financial and organizational factors, and different (complementing) technologies, in order to coordinate and align the various projects and BMIs, using methods like BM roadmapping (De Reuver et al., 2013)

5.2 Limitations & Future Research

As stated above, this case study is based on the first study of this joint research project in which a conceptual framework for structuring this research has been developed. The underlying case study was thus conducted accordingly, using Cavalcante's (2011; 2013) and Baden-Fuller & Mangematin's (2013) concepts as its main theoretical foundation. Since these concepts are simply two specific perspectives based on which one can analyze BMs, this study does not claim that this approach is the only and best one there is. Therefore, the deployment of other perspectives can be considered as valuable contributions for future research on this topic. Furthermore, the relation between the observed BP changes and respective effects on the BM elements are subject to the author's own interpretation, leaving room for possible subjective bias.

Moreover, the level of analysis or granularity, especially for the BPs, was not clearly specified before the conduction of the interviews. As it could be anticipated from the beginning of the research project that the response rate for the interviews will turn out rather low, it did not seem adequate to limit the research early on in the process. Another reason, why the level of analysis for the research was not defined, was that - to the author's knowledge - no such research does yet exist and could have served as a guidance on what kind of level to investigate BMIs. Therefore, an exploratory and qualitative research approach was chosen, striving to find new and unexpected results. Future research can thus focus on this aspect, by identifying the optimal granularity for studying BPs and BM elements, for which this study can serve as a first starting point. Additionally, this research does not address different degrees of the impact SAP HANA can have on a firm's BM, but focusses on the mere quantity of effects. Hence, subsequent research could distinguish between high and low impact, or radical and incremental BMI.

The analyzed sample organizations are all incumbent firms, each from a different industry. On the one hand, this circumstance decreases the internal validity of this case study research, but on the other hand it increases the generalizability for incumbent firms. The secondary case studies where chosen accordingly to support this effect. Nevertheless, the sample size, with four case companies and four secondary case studies, turns out to be relatively small, which has an impeding effect on the study's generalizability. However, this study strongly encourages similar research within other industries, such as the healthcare sector, to increase the empirical foundation of this topic. This study also reveals a discrepancy concerning a the time frames of BMI for each company, therefore, further research could study the possible contingency factors, like type of business, industry or

management. For future research it would also be interesting to focus on startups that work with SAP HANA (SAP SE, 2015b). More radical approaches can be excepted from them, as they do not have such rigid organizational and IT structures or an already existing BM, like established firms.

For qualitative research, the results depend highly on the interviews, or more precisely on the interviewees. This was found to be very true during the course of this project, as the answers were really dependent on the role of the employee. Interviewees with a more practical background provided more detailed and technical insights, whereas upper echelons provided broader answers and more strategic insights. This detail may in fact have an impact on the research's validity. Further research can therefore address this issue by taking into account which employee (business owners, upper echelons or others) is the most suitable for such interviews.

Because of various factors, it appears certain that the same research conducted in the near future (e.g. in 2 to 5 years), would yield very different results. Until then, more S/4 HANA applications can be expected, new expertise will be acquired by the firms, and more Big Data techniques will be elaborated, thus providing more possibilities to transform a BM. In combination with the underlying study, future findings could also constitute an interesting, longitudinal comparison. By means of such longitudinal studies, for example, BMI can likely be identified within all four BM elements, including Monetization. Thus, ongoing joint advancements of research and practice can deepen our understanding of the interlink between BMI and technological innovation and further develop the here presented framework of technology-driven BMI. These new insights could also support or neglect the assumed ongoing series of interlinked BMI, as described in chapter 4.3.

6 Acknowledgements

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Finally, would I like to state my gratitude to the participating companies and interviewees as well as the experts for the insights and support they provided.

Appendix

Appendix 1: Interview - Company 1

Please contact the author.

Appendix 2: Interview - Company 2

Please contact the author.

Appendix 3: Interview - Company 3

Please contact the author.

Appendix 4: Interview - Company 4

Please contact the author.

Appendix 5: Declaration of consent - Lars Geißler

Einverständniserklärung zur Durchführung eines Interviews

1. Das Interview dient dem folgenden Zweck: Interview für eine Masterarbeit an der UT Twente, TU Berlin, Universität Potsdam
2. Verantwortlich für die Durchführung und wissenschaftliche Auswertung des Interviews sind: Nina Spiri und Tobias Schoder

   Die Auswertung wird von der Universität im Rahmen der Masterarbeit betreut. Die Verantwortlichen tragen dafür Sorge, dass alle erhobenen Daten des Interviews streng vertraulich behandelt werden und ausschließlich zum vereinbarten Zweck verwendet werden.

3. Der Interviewte erklärt sein Einverständnis mit der Tonbandaufnahme und wissenschaftlichen Auswertung des Interviews.
4. Die Tonbandaufnahme ist nur der unter Punkt 3 genannten Personen zugänglich.
5. Zu Auswertungszwecken wird von der Aufnahme ein schriftliches Protokoll angefertigt.
6. Der Interviewte erklärt sein Einverständnis in der Masterarbeit namentlich aufgeführt zu werden.
7. Kurze Ausschnitte können aus dem Protokoll in der Masterarbeit / Forschungsarbeit zitiert werden.

Ich kann diese Erklärung jederzeit ganz oder teilweise widerrufen, ohne dass irgendwelche Nachteile für mich entstehen.

Kontaktadresse für Widerruf: schoder.t@gmail.com oder spirinina@gmail.com

Mit den oben genannten Punkten erkläre ich mich einverstanden. Ich habe eine Ausfertigung dieser Erklärung erhalten.

Berlin, den 14.09.2015
Datum

webXells GmbH
Am Luftschiffhafen 1
14471 Potsdam

Unterschrift

Appendix 6: Declaration of consent - Thomas Weber

Einverständniserklärung zur Durchführung eines Interviews

1. Das Interview dient dem folgenden Zweck: Interview für eine Masterarbeit an der UT Twente, TU Berlin, Universität Potsdam
2. Verantwortlich für die Durchführung und wissenschaftliche Auswertung des Interviews sind: Nina Spiri und Tobias Schoder

   Die Auswertung wird von der Universität im Rahmen der Masterarbeit betreut. Die Verantwortlichen tragen dafür Sorge, dass alle erhobenen Daten des Interviews streng vertraulich behandelt werden und ausschließlich zum vereinbarten Zweck verwendet werden.

3. Der Interviewte erklärt sein Einverständnis mit der Tonbandaufnahme und wissenschaftlichen Auswertung des Interviews.
4. Die Tonbandaufnahme ist nur der unter Punkt 3 genannten Personen zugänglich.
5. Zu Auswertungszwecken wird von der Aufnahme ein schriftliches Protokoll angefertigt.
6. Der Interviewte erklärt sein Einverständnis in der Masterarbeit namentlich aufgeführt zu werden.
7. Kurze Ausschnitte können aus dem Protokoll in der Masterarbeit / Forschungsarbeit zitiert werden.

Ich kann diese Erklärung jederzeit ganz oder teilweise widerrufen, ohne dass irgendwelche Nachteile für mich entstehen.

Kontaktadresse für Widerruf: schoder.t@gmail.com oder spirinina@gmail.com

Mit den oben genannten Punkten erkläre ich mich einverstanden. Ich habe eine Ausfertigung dieser Erklärung erhalten.

Berlin, den 27.08.2015 — Dortmund

Datum

Unterschrift

Appendix 7: Declaration of consent - Dr. Heinrich Arnold

Einverständniserklärung zur Durchführung eines Interviews

1. Das Interview dient dem folgenden Zweck: Interview für eine Masterarbeit an der UT Twente, TU Berlin, Universität Potsdam
2. Verantwortlich für die Durchführung und wissenschaftliche Auswertung des Interviews sind: Nina Spiri und Tobias Schoder

   Die Auswertung wird von der Universität im Rahmen der Masterarbeit betreut. Die Verantwortlichen tragen dafür Sorge, dass alle erhobenen Daten des Interviews streng vertraulich behandelt werden und ausschließlich zum vereinbarten Zweck verwendet werden.

3. Der Interviewte erklärt sein Einverständnis mit der Tonbandaufnahme und wissenschaftlichen Auswertung des Interviews.
4. Die Tonbandaufnahme ist nur der unter Punkt 3 genannten Personen zugänglich.
5. Zu Auswertungszwecken wird von der Aufnahme ein schriftliches Protokoll angefertigt.
6. Der Interviewte erklärt sein Einverständnis in der Masterarbeit namentlich aufgeführt zu werden.
7. Kurze Ausschnitte können aus dem Protokoll in der Masterarbeit / Forschungsarbeit zitiert werden.

Ich kann diese Erklärung jederzeit ganz oder teilweise widerrufen, ohne dass irgendwelche Nachteile für mich entstehen.

Kontaktadresse für Widerruf: schoder.t@gmail.com oder spirinina@gmail.com

Mit den oben genannten Punkten erkläre ich mich einverstanden. Ich habe eine Ausfertigung dieser Erklärung erhalten.

Berlin, den 26/8/2015
Datum


Unterschrift

Appendix 8: Interview guide

HPI Hasso Plattner Institut

Interview-guideline

Universität Potsdam

1

a) Use of SAP HANA by the interviewee

- What is your role/position within the company?
- In what way are you dealing with HANA? Do you actively use the technology or its outcomes?
- Since when have you been using HANA and for which tasks?

b) Use of SAP HANA by the company/departments

- In what way has HANA been integrated into the existing system (Business Warehouse or Business Suite)?
- Which applications currently run on HANA? Which departments are using it?
- What are your experiences with HANA so far, concerning for example financial or human resources?

2

a) Identification of core business processes

- What are the core business processes in your company?
- Which of these processes involve HANA or are somehow connected to HANA?
- Have business processes been significantly changed, discarded or newly created due to the implementation of HANA?
- Which potential process changes can you anticipate due to HANA in the near future?

b) Identification of business model elements

- Which business model elements have been significantly changed, discarded or created due to the implementation of HANA?
  Please consider the following business model elements:
  - customer identification - customer engagement - monetization - value network

3

Potential future impact of HANA on business models with regards to existing megatrends (see next page)

- Which megatrends do you regard as relevant for your company and why? How do these trends influence the core business processes in your company and in what way is HANA involved?
- What impact could this potentially have on the business model(s) of your company?
  Please consider the following business model elements:
  - customer identification - customer engagement - monetization - value network

IME

Remark: Some interview questions might not be applicable to interviewees, regarding their particular role within the company.

Appendix I: Megatrends & selected examples 1/2

1 Personalization

A product or service is tailored to the individual wishes or needs of a specific customer.

Hana Oncolyzer

In cancer research, a tremendous amount of data is generated by analyzing tumor cells and tissue. The HANA Oncolyzer is a mobile App offering the real-time analysis of this data for a specific patient during a consultation. The duration of the analysis can be reduced from 3-4 days to some seconds.

2 Cloud Computing

IT-resources are increasingly available online instead of operating on a company-owned data center.

Collaboration

L'ORÉAL

Applying a cloud CRM-solution, L'Oréal could optimize the internal communication and coordination between different departments. By means of an own corporate social network, employees can exchange the latest trends and tips or plan upcoming events collaboratively.

3 Internet of Things

Implementing mini-computers and -sensors into physical devices makes these increasingly 'smarter' and virtually accessible. They provide information and support people in their activities.

OM

OM-Signal produces sportswear with embedded sensors that constantly measure the person's heartbeat, breathing and other physical activities. Via an integrated 'smart box', the data is then directly transferred to the person's smartphone.

4 Volatile economy

The fast analysis of tremendous amounts of data enables a shorter response time to rapidly changing market conditions.

ZARA

Analyzing trends and customers' buying behavior in real-time, enables Zara to quickly respond to actual customer needs. Consequently, Zara could offer a dress which the popstar Beyoncé was wearing at the opening show of her tour at the end of the tour already in their shops.

Appendix I: Megatrends & selected examples 2/2

5 **Business Mashups**

New interfaces between industries and markets are being created.

SmartGrid Technologies

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 so-called smart grids are, therefore, based on the close integration of power and data networks.

6 **Management of complexity**

Companies are increasingly complex, diverse and multi-dimensional. To optimize their productivity and efficiency, they have to find ways to simplify processes or structures and manage this complexity.

TEAM USA *Visualization*

As humans recognize patterns better than computers do, the visualization of data based on several dimensions provides new insights into important connections and trends. The US Olympic team analyzes various sensor generated data. Based on this, the athletes adapt their training and daily habits, to naturally increase their performance.

further **Simplification**

- Improved usability
- Clear and direct lines of communication

Digital culture

- Web 2.0 & 3.0 (social media)
- Digital technologies pervading and connecting all aspects of daily life
- Greater differentiation between digital lifestyles
- Digital natives: New forms of social communication,
- participation and organization

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.

I am aware that the thesis in digital form can be examined for the use of unauthorized aid and in order to determine whether the thesis as a whole or parts incorporated in it may be deemed as plagiarism. This thesis was not previously presented to another examination board and has not been published.

For the comparison of my work with existing sources I agree that it shall be entered in a database (e.g. Turnitin) where it shall also remain after examination, to enable comparison with future theses submitted.

Berlin, September 22, 2015

SIGNATURE

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