BUSINESS MODEL TRANSFORMATION PATTERNS OF DATA-DRIVEN INNOVATIONS

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Recommended Citation
Zolnowski, Andreas; Christiansen, Towe; and Gudat, Jan, "BUSINESS MODEL TRANSFORMATION PATTERNS OF DATA-DRIVEN INNOVATIONS" (2016). Research Papers. 146.
http://aisel.aisnet.org/ecis2016_rp/146

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BUSINESS MODEL TRANSFORMATION PATTERNS OF DATA-DRIVEN INNOVATIONS

Research

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Abstract

Driven by advances in information and communication technologies (ICT), manifold business opportunities emerge in diverse industries. In this development, data plays an important role as an essential element of change and economic growth. As a consequence of this development, the analysis of service business models and the role of data in these models has become a focus of interest in practice and research. This paper focuses on international companies that implemented successfully data-driven innovations and aims, in particular, at the analysis of the effects of data-driven innovation on companies’ business models. Based on a multiple case study method, this paper proposes four different transformation patterns: (1) cooperative value innovation, (2) customer-centric value innovation, (3) cooperative productivity improvement, and (4) company-centric productivity improvement. These patterns show that data-driven innovations enable a transformation from product to service-oriented offerings. Furthermore, an optimization of internal and external processes and thus, of the productivity is possible.

Keywords: service, data-driven business models, case study, transformation pattern.
1 Introduction

Driven by advances in information and communication technologies (ICT), like e.g. sensor networks and faster processing, manifold business opportunities emerge in diverse industries (Buhl et al., 2013). In this development, data plays an important role as an essential element of change and economic growth (Manyika et al., 2011). Based on the analysis of a large amount of data, knowledge can be obtained that helps managers to improve decision making and performance (McAfee et al., 2012), to optimize customer relationships (Schmidt et al., 2014), and to enable the development of innovative service business models (Zolnowski and Böhmann, 2013b; Engel et al., 2014; Demirkan et al., 2015).

The development of such innovative service business models is based on accurate knowledge about the customer (Demirkan et al., 2015), and hence needs data as source of potential value. When data are exploited as main resource for innovative service business models, they are called data-driven business models (Manyika et al., 2011; Hartmann et al., 2014). As a consequence of this development, the analysis of service business models and the role of data in these models have become a focus of interest in practice and research (Demirkan et al., 2015; Manyika et al., 2011; Zolnowski and Böhmann, 2013b). In this set, ICT with its multi-sided nature, fosters the integration of customers, and partners as active partners (Evans, 2003). Hence, with its opportunities to actively integrate participants in value creation, ICT is a key driver for the emergence of service business models.

In the last years, companies have recognized the potential of data as a basis for data-driven innovations (Leveling et al., 2014). According to market forecasts, the development and implementation of data-driven business models in the years 2011-2016 will grow annually by 46.6% (Bitkom, 2015). Many companies plan to expand their current IT infrastructure to Big Data solutions. However, companies have to revise plans for the strategic development of the organization and to identify the specific benefits of the data in its own context (Gartner, 2014; Schmidt et al., 2014). Effects of data on the strategy and the business model of a company are also often underestimated, as the innovative theme is elusive and not established in best practices (Roland Berger Strategy, 2013; Schmidt et al., 2014).

Because of the broad impact of data on the business model on a company and thus, the change in the way how value is generated and captured (Zolnowski and Böhmann, 2013a), this paper aims at the analysis of the effects of data-driven innovation on the companies’ business models. The innovation results in a business transformation that enables optimized processes or innovative value propositions. Hence, this paper answers the question: “What effects have data-driven innovations on service business models of companies and which transformation patterns can be identified?” Answering this, the paper presents transformation patterns that depict recurring solution structures, comprising effects and changes of data-driven innovations on business models. Thus, this paper adds to service research by fostering the understanding of ICT driven change in business models. Based on this knowledge, it is possible to create, shape, and improve tools and methods to foster service innovation and the design of data-driven service business models. Furthermore, this paper adds to research on data-driven business models by presenting transformation patterns and potential value of data for companies.

This paper is organized as follows. We first introduce our conceptual foundations with regard to data-driven innovations and service business models. Then we explain the research methodology and introduce the used sample. This is followed by presenting the identified patterns of the effect of data-driven innovations and discussing the results. The paper ends with a conclusion and an outlook.

2 Foundation

2.1 Data-driven Innovation

The intensification of developments in the field of Machine-to-Machine communication (M2M), Internet of things (IoT), sensor technology and Cloud and Platform solutions, drives the further digitiza-
tion of companies in particular regarding their services (Arbeitskreis Smart Service Welt, 2014; Manyika et al., 2011). With those enabling technologies, companies can exploit data from their customers and in their own company environment allowing them to generate new profitable know-how based services (Zolnowski and Böhmann, 2013b; Engel et al., 2014).

Many different technical terms describe the latest evolution of data related business transformations (Demirkan et al., 2015), e.g. Big Data, Data Science, or IoT. The various definitions of those concepts often lead to different understandings of the constitutive discussions. For that reason, a business innovation, based on the use of data and analytics to innovate for growth and well-being, is defined as data-driven innovation (OECD, 2014; Jetzek et al., 2014).

To understand the concepts that constitute the term data-driven innovation, the reader should comprehend its various aspects. Historically, data-driven innovations were highly associated with the definition of Big Data, that is described by the “3Vs”, high volume, high velocity, and high variety (Laney, 2001). Big Data has a huge potential to transform businesses (Bitkom, 2015; Gloster, 2015). Data-driven innovations extend the existing definition of Big Data because new technologies have emerged and are readily used by early adaptors for innovations (Gartner, 2014), e.g. M2M and IoT. Hence, additional aspects need to be investigated. Data-driven innovations include the acquisition of data, its subsequent aggregation, the analysis of data and possible automated assignments, and actions that are triggered (Bakshi, 2012). Not all of those aspects have to be present to justify the correct classification of a data-driven innovation. The cases analyzed in this survey, however, do cover the aspects to a large extend and therewith have a high degree of innovation. Nevertheless, even if data-driven innovations are fostering business transformation to service, service innovations are a combination of technical, social-organizational, and business model innovation (Demirkan et al., 2015).

2.2 Service business models

Considering business models, there is a variety of different understandings and definitions (Fielt 2011; Zolnowski and Böhmann 2011; Zott et al. 2011). Due to the lack of definitional clarity, alternative conceptualizations of business models exist (e.g. (Afuah and Tucci, 2001; Al-Debei, 2010; Zott and Amit, 2007)). This conceptual diversity results in a variety of ontologies and representations. Three of the most common ontologies are e3-value Ontology (Gordijn, 2002), the Business Model Ontology (BMO) (Osterwalder, 2004), and the Resource-Event-Agent Ontology (McCarthy, 1982). Representations can be distinguished in two research streams. The first research stream comprises a more flow-oriented perspective on business models. A prominent example for this stream is the e3-Value method (Gordijn, 2002). The second research stream comprises, however, a system-level holistic view on the business logic of an economic entity or offering (Zott et al., 2011). The most prominent example for this stream are the Business Model Ontology (BMO) (Osterwalder, 2004) and the Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010).

Fostered by a service based change in value creation (Grönroos, 2008; Lusch and Vargo, 2014), business models are also discussed in service research (Bouwman and Fielt, 2008; Fielt, 2012; Zolnowski and Böhmann, 2011). Service business models are different from product-based business models because of the specific characteristics of service. Considering service definitions, service is defined as “[...] the application of specialized competences (operant resources - knowledge and skills), through deeds, processes, and performances for the benefit of another entity or the entity itself” (Vargo and Lusch 2004; Vargo and Lusch 2008). A comparable definition is proposed by Grönroos (2008). He defines service as “[...] a process that consists of a set of activities which take place in interactions between a customer and people, goods and other physical resources, systems and/or infrastructures representing the service provider and possibly involving other customers, which aims at assisting the customer’s everyday practices” (Grönroos, 2008). Both definitions emphasize the service as a process between interacting parties for the benefit of another party. Especially, the interaction is of high relevance. Known as value co-creation, it is one key aspect of service (Grönroos, 2012; Vargo and Lusch 2014). Because of this aspect, the value of service depends on the actors. This means that service value
has a unique and phenomenological character (Edvardsson et al., 2010; Lusch and Vargo, 2014). Furthermore, the interaction of service results in a mutual integration of resources and activities. Possible resources that have to be integrated are e.g. skills, knowledge, physical resources and decisions (Grönroos and Ravald, 2011; Moeller, 2008). Based on a service specific perspective, “one-sided approaches are theoretically incomplete and misleading as management models and guidelines” (Grönroos and Helle, 2010, p. 567). Hence, adapted business model representations are necessary.

The Service Business Model Canvas (SBMC) (Zolnowski, 2015) is an adaptation of the BMO (Osterwalder, 2004) and the BMC (Osterwalder and Pigneur, 2010), which enables a service oriented perspective on business models (Figure 1). The SBMC allows the representation and understanding of partner and customer contributions to co-creation and resource integration. For this, the SBMC is divided into a company, a customer, and a partner perspective, which are each characterized by the following seven dimensions. These are value proposition, activities and resources (infrastructure), relationships and channels (interface), as well as revenues and costs (finance). The value proposition shows the value of a service offered to a customer. Activities and resources represent the essential infrastructure components, which are necessary for service provision. Relationships and channels describe the respective contributions to the management of the relationship between the actors through defined channels. Costs and revenue illustrate the cash flows in the business model.

Because of the service based character of data-driven business models, the SBMC facilitates a comprehensive representation of their business logic. This enables us to conduct a structured analysis of data-driven innovation on the business model of a company. Hence, the SBMC is applied as the theoretical framework during the analysis of the data.

![Service Business Model Canvas (SBMC) (Zolnowski, 2015)](image)

**Figure 1:** Service Business Model Canvas (Zolnowski, 2015)

### 3 Methodology

#### 3.1 Research methodology

In order to analyze and design possibilities for data-driven innovations on existing business models, the multiple case study method was selected (Yin, 2014). This method allows to study contemporary phenomena in real life context, and thus to conduct exploratory research. Hence, this methodology can be applied in research context where theory seems to be inadequate or incomplete (Yin, 2014). Multiple cases studies are necessary to overcome limitations in the generalizability of the results (Eisenhardt, 1989).
3.2 Sample

This research focuses on international companies that implemented successfully data-driven innovations. For this, the selection of the cases was guided by Pettigrew (Pettigrew, 1990), which recommend to chose cases that replicate and extend an emergent theory (Eisenhardt, 1989). To obtain a rich source of information, polar cases were identified according to the industry and the business case of the data-driven innovation. Furthermore, we examined, if a suitable data basis exists. For this, we prioritized projects which are operationally in use and where knowledgeable contact persons are available at the consulting company. The identified cases cover (1) the improvement of the customer orientation, (2) process optimization, (3) better profitability and an optimization of resource planning, and (4) the collection of information to complement and accelerate decisions.

In total, 20 cases from seven industries were selected and analyzed. Thirteen cases were identified from rich data of a consulting company and seven cases were derived from literature and public information. The chosen cases cover data-driven innovations in different industries (Table 1).

<table>
<thead>
<tr>
<th>Industry (number of companies)</th>
<th>Companies</th>
<th>Brief description for implemented data-driven innovations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive (3)</td>
<td>Companies</td>
<td>Two German automotive manufacturer &gt; 70,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One from the automotive parts industry &gt; 30,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Predictive Maintenance by expansion of sensors on assets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimization of processes by data integration</td>
</tr>
<tr>
<td>Manufacturing (7)</td>
<td>Companies</td>
<td>Three German companies &gt; 6,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two German companies &gt; 63,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two American companies &gt; 80,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Predictive Maintenance by expansion of sensors on assets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Service innovation and use of Internet of Things</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimization of processes by data-driven forecasting</td>
</tr>
<tr>
<td>Logistics and transportation (5)</td>
<td>Companies</td>
<td>One joint venture, 51-200 employees (2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Four companies, 1800-5,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Coordination of infrastructure by real time data of players</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tracking of assets by expansion of sensors</td>
</tr>
<tr>
<td>Retail (2)</td>
<td>Companies</td>
<td>One German retail company &gt; 17,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One Swiss food company &gt; 300,000 employees (2013)</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Optimization of disposition by analysis of market data</td>
</tr>
<tr>
<td>Insurance (1)</td>
<td>Companies</td>
<td>One American start-up, 201-500 employees</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Product innovation in car insurance by use of Internet of Things</td>
</tr>
<tr>
<td>Energy (1)</td>
<td>Companies</td>
<td>One German electric utility company &gt; 50,000 employees (2014)</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Predictive Maintenance by expansion of sensors on assets</td>
</tr>
<tr>
<td>Telecommunication (1)</td>
<td>Companies</td>
<td>One Swiss telecommunication provider &gt; 20,000 employees</td>
</tr>
<tr>
<td></td>
<td>Data-driven innovation</td>
<td>Coordination of infrastructure by data of passenger traffic</td>
</tr>
</tbody>
</table>

Table 1: Brief description of the case studies and their use of data-driven innovations
3.3 Data collection

Because of the explorative character of this research, the data collection was conducted with multiple methods of enquiry. For this, four different sources were selected: (1) Internal project documents of an international consulting company, (2) semi-structured interviews, (3) additional literature on data-driven innovations, and (4) public information on the websites of the companies. Based on these sources, a triangulation of the data was possible (Yin, 2014).

The internal project documents comprise successfully implemented projects of data-driven innovation. These documents comprise a detailed description of the project target, a description of the information technology architecture, and the lessons learned. This information was enriched by semi-structured in-depth interviews with project managers from the consulting company. The interviews lasted 2-3h and were structured according to the dimensions of the SBMC. After the interview, the results were verified by the interviewee. In addition to the documents and interviews, literature on data-driven innovations was considered. With respect to the identified cases from the consulting company, additional matching cases were selected from literature. Lastly, all cases were enriched by public information from the companies.

Based on the analysis of the case studies, a total of 120 effects of data-driven innovations on the business model dimensions were identified. Because of the high amount of identified effects, in the next step, the effects were consolidated to 50. For this, in cooperation with an expert from the consulting company, the effects were analyzed with regard to their similarities (Kleining, 1982).

3.4 Identification of transformation patterns

A transformation pattern is defined as a recurring solution structure in a defined format (Deigendesch, 2009). To identify patterns in data-driven innovations, a morphological analysis was conducted. Using this method, it is possible to identify possible configurations and possible patterns of a complex problem (Ritchey, 2002).

In this context, the morphological box can be used as a tool for business model analysis to identify unique transformation patterns (Narasimhalu, 2013). For this, the dimensions of the SBMC act as variable and the identified effects in the SBMC dimensions were clustered as value (Ritchey, 2002). Because of the complex character of the patterns, the building blocks (finance, infrastructure, value proposition, and interface) of the SBMC were analyzed. This allows the comparison of the identified patterns between all cases. For the visualization of the identified patterns, colored lines are drawn into the SBMC.

4 Results of the analysis

4.1 Effects of data-driven Innovation on business models

Data-driven innovations have manifold effects on companies’ business models, including its customers and partners. For 20 cases we have identified and systematically classified those effects. The results are presented in Figure 2. The effects are symbolically illustrated by gray boxes and grouped if being similar with bold titles describing aggregated types of effects. We identified 28 different effects on the company, 22 on the customer’s perspective and 21 effects on the partner’s perspective. The effects of data-driven innovations on the customer's perspective can be explained by a continuous shift of companies towards more service-orientation, which gains in importance due to the ongoing digitization (Vargo and Lusch, 2008; Grönroos, 2011).
Figure 2: Identified effects of data-driven innovations on business models

Most of the effects are identified for the dimensions value proposition, revenue streams and key activities. Nevertheless, also costs structure, key resources, channels and relationship can be influenced by data-driven innovations. The value proposition is the central component of the business model. The use of data allows to optimize processes, reduce assets, increase customer satisfaction or develop new services (value proposition), which reduces costs and increases revenues (costs structure and revenue streams) by reduction of inventory (key resources). Pre-conditions to reach those values are new data, systems and sensors (key resources) and key activities like monitoring and interpreting data (company perspective), data-based actions (customer’s perspective) or extended use of sensors (partner’s perspective). The relationships between company, customers and partners can be affected positively because of a better understanding via data exchange, as well as negatively through asymmetric control of data. The use of new channels like RFID based systems, support the changes of the relationships. In general, most identified effects relate to aspects of data.
4.2 Identified transformation patterns - based on the value proposition

Based on the value proposition, the cases were classified according to the identified transformation patterns. The results, in Table 2, describe four patterns that are also visualized in Figure 3 - Figure 6. In these figures, each color represents a specific case. The dots depict a specific impact, where the links depict associations between the building blocks of the SBMC. When several cases have similar changes, the links between the dots are grey.

<table>
<thead>
<tr>
<th>Transformation pattern</th>
<th>Cooperative value innovation</th>
<th>Customer-centric value innovation</th>
<th>Cooperative productivity improvement</th>
<th>Company-centric productivity improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimization of internal processes and resources</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Improvement of customer satisfaction</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creation of new markets or development of new services</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of cases</td>
<td>10</td>
<td>2</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2: Classification of the cases according to transformation patterns - grouped by value proposition

The following discussion of the results are structured by three perspectives and the four aggregated building blocks (1) finance, (2) infrastructure, (3) value proposition and (4) interface of the business model. The occurrence of the four different transformation patterns differs highly. Interdependencies between effects and the changing roles of the perspective can be identified.

Ten of the cases, and thus the majority of all cases, realize the transformation pattern of cooperative value innovation (Figure 3). Those cases all generate extensive effects on all perspectives.

Example: an intralogistics company developed a new service that enables the prediction of failures of material handling equipment (Predictive Maintenance). Because fewer extraordinary failures appear, quality and customer satisfaction can be increased.

The customer-centric value innovation pattern deals with a change to new business models or with the generation of new services and for this reason with the creation of new markets. Only two companies match this pattern (Figure 5). In comparison to the cooperative value innovation pattern discussed above, this pattern does not examine company internal process or resource optimizations. The effects of this pattern can be far-reaching and diverse, as both customers and partners may be integrated.

Example: a telecommunication company offers a new service providing geolocation data of travelers allowing governments to prevent traffic jams without using the data for internal purposes.

The cooperative productivity improvement pattern is realized by 7 of the 20 cases (Figure 4). No new business models are established nor are new services created. Companies direct their efforts to address internal needs. Those efforts have the positive side effect to create additional benefits for the companies’ customers and hence increase customer satisfaction. No changes of marketing strategies are perceived, few new revenues are generated and no active customer integration takes place.

Example: An automotive company accelerates the company’s internal processes by integration of machine and other data. The customer benefits from a faster execution of individual orders, however the simultaneous increase of customer satisfaction is secondary.
The company-centric productivity improvement pattern is only implemented by one case (Figure 6). Innovative projects applying to this pattern exclusively affect the internal and partner perspective.

Example: an electric utility company implements sensor technology connecting wind turbines. The solution enables failure and defect prediction. As the energy price formation is complex and does not depend on the energy generation, the customer does not gain direct benefits.

4.3 Analysis of the transformation patterns of the value proposition

4.3.1 Company perspective

The results of the previous section show that the impact of data-driven innovations on the company’s perspective is multifaceted and can partially have extensive effects on many building blocks of the SMBC.

In particular the cooperative value innovation pattern exhibits all possible changes to the business model and therefore highlights the strong influence of data on the companies.

A closer look at the infrastructure building block of all transformation patterns reveals that effects on resources and activities take place everywhere. The effects of new ownership of sensors & systems and the changed handling of data are independent of the value proposition and can be found in all transformation patterns. In contrast, the internal changes of processes, adjusted resource utilization (reducing resources, elimination processes), and the optimization of marketing are dependent on the value proposition.

The customer-centric value innovation pattern has fewer internal resource changes in the infrastructure building block (reducing resources, elimination processes). Furthermore, the pattern cooperative and company-centric productivity improvement do not require to optimize the marketing approach, because no new service is advertised. Contrary, for the cooperative and customer-centric value innovation pattern, optimization of the marketing takes place.

Example: An automotive company offers its customers a new service and advertises it with an adapted marketing strategy. A production company increases its product quality and customer satisfaction by internal process optimization, without advertising its internal process advancement.

Dependencies can be found between the effects in the building blocks value proposition and finances (cost structure and revenue stream). The cooperative and company-centric productivity improvement pattern generate no revenues from the sales of new services. The two other transformation patterns cooperative and customer-centric value innovation do, however, generate revenues from the sales of new services and possibly also from the sale of data to third parties, indicating a direct dependence. Revenue streams through customer’s benefit cannot be identified at the company-centric productivity improvement pattern. Despite an existing relation to a customer, an increase in revenue is not mandatory with existing customer satisfaction.

Example: An airplane manufacturer achieves higher safety standards by tracking its tools. This help increase the sense of responsibility through employees and avoids occurrence of abandoned aircraft tools. This leads to an increase of customer confidence and eventually to an increase in sales.

All cases exhibit internal optimization (value proposition). Almost all cases also exhibit acquisition and operating costs, because the purchase of sensors, new data and systems is required.

The building block interfaces in the company’s perspective does not allow for any significant insight. All patterns have both positive impacts on the interfaces, as well as controlling relationships.

4.3.2 Customer’s perspective

Customers play a central role in innovative service business models. Often, data-driven innovations are conducted in order to improve the relationship to the customer. In order to achieve this target, a company can optimize value creation processes or develop new services. Especially in data-driven
innovations, this requires the integration of the customer as a co-creator and co-producer. This is also reflected by the results of the analysis, which detected effects in the customer's perspective in 19 out of 20 cases.

The most extensive effect on the customer can be found in the cooperative value innovation pattern, where the customer is integrated actively as a co-creator and co-producer in a new service. Within the cooperative productivity improvement pattern, there are fewer effects on the customer. In this pattern, the customer is only affected passively (e.g. by an increase in satisfaction). The active and passive roles of the customer are mainly reflected in the building blocks value proposition, infrastructure, and interfaces.

Example: Through optimized ordering processes, a food retailer achieves a higher freshness for his offered food. Since the customer has no direct knowledge of the data-driven innovation, this advantage is only perceived subconsciously by the customer.

Overall, the customer’s value proposition is diverse. The effect of increasing the own satisfaction depends mutually on the customer satisfaction (value proposition of the company). Other causal relationships cannot be identified.

Comparison of the building blocks infrastructure and interfaces for the pattern cooperative and customer-centric value innovation shows a high integration of the customer. Especially the effects use, analyze and monitor data of the infrastructure underlines the active role of the customer as a co-producer in the context of data-driven innovation projects. The cooperative productivity improvement pattern has almost no infrastructure or interface changes at the customer’s perspective.

Changes in the finance (costs and revenues) of the customers are mostly found in the cooperative and customer-centric value innovation patterns. The acquisition costs depend on the use of new services and mostly have to be purchased. The customer will benefit from a reduction in costs, which primarily result from the optimization of processes or resources in the value proposition.

4.3.3 Partner’s perspective

The role of the partner in a data-driven innovation depends on the overall goal of the data-driven innovation. As illustrated in Figure 3 - Figure 6, partners are mostly affected by the cooperative and customer-centric value innovation pattern. In contrast, the effect in the company-centric and cooperative productivity improvement pattern is negligible.

Generally, this effect can be differentiated between a positive and active and a negative and passive integration of a partner. In the positive and active integration, the partner has an active part as a co-producer of value. As active partner, he experiences a variety of effects on its own role in the service business model. Changes in the value creation process, its activities and used resources reflect these effects. Driven by the data-driven innovation, partners can have significant advantages of an internal optimization, an increase of sales, as well as cost and revenue benefits. Overall, this type of pattern aims strongly on an increasing service-orientation.

Nevertheless, despite of the manifold advantages, there is also a major drawback for the partner. So, partners can be also affected by monitoring and loss of control.

Example: Doctors, the partners of the pharmaceutical companies, provide an active implementation of patient monitoring. Thus, they can timely adjust a therapy if an inadequate intake of medicine occurs. The collaboration between the company and a doctor allows the generation of innovative value.

5 Discussion

The value proposition is fundamental to the business model (Zolnowski and Böhmann, 2013a; Zott et al., 2011). This survey has shown that the effects of data-driven innovations are directly in relation to companies’ goals, presented by the value proposition.
The complexity of data-driven innovations determines the transformation patterns. Limited transformations do result in the company-centric productivity improvement pattern that has no direct relation to customers (Figure 6). Those patterns feature effects on infrastructure, activities, and costs of a company. The cooperative productivity improvement pattern (Figure 4) exhibits a comparable transformation focus, though featuring an increased number of variations due to implications for the customers deriving from the innovations but also possible changes of interfaces and revenues. Data-driven innovations cause many transformations in the customer-centric value innovation (Figure 5) pattern. In particular, the cooperative value innovation (Figure 3) pattern exhibits many variations. In general, the interaction of the different dimensions in the service business model results in an increased complexity of the patterns with an increase of the amount of proposed values.

Transformation patterns for customer-centric value innovation only exist in relation with an increase in customer satisfaction, because new customer-centric service offerings always serve the companies’ customer. However, it was observed that data-driven innovations are not exclusively carried out with the aim to increase the customer satisfaction. The Bitkom survey (Bitkom, 2015) and the interviewed experts stress the importance of having to concentrate on the internal resource or process optimization potentials, and also to focus on the customer relation. Data-driven innovations can unify both aspects in single projects. Together, both transformation patterns map 17 out of 20 cases of this survey (Figure 3, Figure 4). The identified and described transformation patterns vary in their importance and their recommendation for adoption by other companies. It especially depends on the internal needs and their intention to integrate the customer. Exceptions to this conclusion are an energy (company-centric productivity improvement), an automotive and a telecommunications (both customer-centric value innovation) cooperation.

Another important lesson learned, as expressed by the interviewed experts, is that data-driven innovations with solely focus on the customer are generally possible, but not advisable. There are several reasons for this statement. Firstly, gained data from customers allows internal improvements and the development of competitive advantages and even the evolvement of data control and its possible utilization (INT-C-A, 2015). Secondly, it is not advised to drive data innovations with a solely company focus, because the role of the customer gains in importance during the digital transformation where companies evolve service-oriented business models (Vargo and Lusch, 2008).

Improvement in service-orientation and productivity are possible fundamental objectives of corporations. For the discussed cases, we have further investigated whether the companies’ focus of their data-driven innovations is service-oriented or rather aims for the improvement in productivity. The results of the analysis are shown in Table 3.

<table>
<thead>
<tr>
<th>Value proposition transformation pattern</th>
<th>Quantity</th>
<th>Strategic goal</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperative value innovation</td>
<td>10</td>
<td>Service-orientation</td>
<td>12</td>
</tr>
<tr>
<td>Customer-centric value innovation</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative productivity improvement</td>
<td>7</td>
<td>Improvement in productivity</td>
<td>8</td>
</tr>
<tr>
<td>Company-centric productivity improvement</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Clustered pattern by their aim

The correlation seems obvious but is not self-evident: only companies with the cooperative and customer-centric value innovation pattern strategically strive for enhanced service-orientation while companies with company-centric and cooperative productivity improvement patterns want to improve their productivity.

This study shows that data-driven innovations can support companies to transform from product-oriented companies to service-oriented ones. Whether this is an active decision or a consequence of the innovation depends on what triggered the innovation. According to IoT experts, successful data-
driven innovations are more like driven bottom-up and triggered by employees who are very familiar with the companies’ existing IT landscape. This could be an indication that such transformations happen rather implicitly. However, we have shown that in particular companies with cooperative and customer centric value innovation strive for service-orientation. And those, new business models are rather likely top-down management decisions and therewith actively trigger innovations and their necessary invest.

The role of the customer in the value chain has been continuously subject to change (Grönroos, 1994, 2011). Customers demand a higher degree of customization of their products while companies at the same time are confronted with increased customer expectations that have to be matched to make them satisfied. In this study, these trends are reflected by the customers’ perspective and the dimensions interfaces and infrastructure. The implementation of new services allows for vertical integration, therewith enabling enhanced product life cycles and strengthening customer ties. Attracting new customers is expensive, such that in particular the latter aspects can help to increase profitability (Tödtmann, 2008). Primarily, improving or developing products have not been the trigger for data-driven innovations (Bitkom, 2015), but possibly the innovations enriched product development processes with new insights into customer needs.

Six out of the 20 analyzed cases integrate partners. All partners significantly help drive the change to more service orientation and vertical integration. Furthermore, the study shows that no partners have been completely eliminated through the introduction of data-driven innovations. On the contrary, joined company partner relations based on data-driven innovations have strengthened both their positions in the market.

6 Conclusion

This survey analyzes the effect of data-driven innovations in emerging service business that will likely transform the way corporations think and operate substantially. Data-driven innovations essentially constitute to the implementation of the industrialization 4.0 which is the major trend that motivates corporations to re-think and adjust their strategies. Success stories in this field are yet limited and often subject to business secrets. This survey presents a systematic analysis of observations that can serve as guidance for other companies to innovate and to proceed with their industrialization 4.0 efforts.

As our results show, companies can improve the value propositions and processes in their service business models, fostered by the application of data-driven innovations. Aligned with these targets, we identify four different transformation patterns: (1) cooperative value innovation, (2) customer-centric value innovation, (3) cooperative productivity improvement, and (4) company-centric productivity improvement. The first both patterns enable a transformation from product to service-oriented offerings. Within the third and fourth pattern, an optimization of internal and external processes and thus, of the productivity is pursued.

These results help service research by fostering the understanding of ICT driven change in actual business models of companies. Based on this knowledge, it is possible to create, shape, and improve tools and methods to foster service innovation and the design of new data-driven service business models. Furthermore, it has been shown that the SBMC is a suited method to systematically analyze the development of business models regarding their service orientation. Thereupon, this paper adds to research on data-driven business models by presenting patterns of change and thus, depicting effects on and the potential value for companies. Practitioners can utilize these results in order to improve data-driven innovations in their companies. Moreover, they can anticipate possible effects on their ongoing business and better intercept potential problems.

The driving forces in the organization of a corporation that initiate data-driven innovations are worth investigating in future research. Benchmarking the success of innovations would allow drawing conclusions of important strategic recommendations.
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