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# Data-driven business models for service innovation in small and medium-sized businesses

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Data-driven business models for service innovation  
in small and medium-sized businesses

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Today's world is one of growing data, yet few companies have succeeded in leveraging data as a key resource for novel business models. Meanwhile, a profound shift is likewise taking place in the dominant logic of how companies create value for customers. Established processes for business model innovation are helpful for validating and implementing an initial vision. However, little guidance is available on how to systematically envision using data in service innovation.

This thesis aims to explore how value can be drawn from Big Data in the Service Design Thinking process with a specific focus on business models. For this purpose, the thesis introduces, on the one hand, the Data Canvas as a new method for considering data resources systematically in the development of business models and, on the other hand, the Data-Need Fit as a conceptual basis for the established business model innovation process.

According to Design Science Research as an overall academic framework, Data Canvas and Data-Need Fit were built and evaluated applying Lean Design Thinking in a mindset of the service logic. Within Design Science Research, processes and methods from Service Design Thinking are a good fit with their iterative nature and their focus on early prototypes as artifacts.

Combining approaches from different theoretical and practical frameworks, a structured yet flexible approach to data-driven business model innovation is proposed. In the case study evaluation, this approach has proven simple to use. An understanding of available data sources through the use of a Data Canvas facilitates targeted user research and helps to identify relevant customer jobs that could benefit from that data. Such a Data-Need Fit is a vital basis for a compelling value proposition. Integrated into a Service Design Thinking process, Data Canvas and Data-Need Fit may help companies to leverage data as a resource in business model innovation.

Keywords: Big Data, Business Model, Value Proposition, Service Design

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## 1 Introduction

Worldwide data volume increased tenfold between 2006 and 2012 to reach 2.500.000.000.000.000.000 bytes of data (BITKOM 2012.). Between 2000 and 2002 alone more data was generated than in the 40.000 years prior (BITKOM 2012). And this is just the beginning. The catchword ‘Big Data’ sums up developments in information technology that the amount of data is growing at a faster pace than the technology with which to process data. This data will enable novel opportunities for new products and services and changing business models (BITKOM 2012.; Sathi 2011.).

Yet, in a report published by German Federal Association for Information Technology, Telecommunication and New Media (BITKOM), 76% of companies admit that they have not yet concerned themselves with Big Data (2012). Data requires new technological skills, but managerial and cultural challenges are even greater. In another study, a lack of understanding of how to extract business value from data was named as the primary concern (LaValle, Lesser, Shockley, Hopkins & Kruschwitz 2011).

Service Design is “the design of the overall experience of a service as well as the design of the process and strategy to provide that service” (Moritz 2005, 39). Service innovation does not only involve designing the service but also its business model (Edman 2009), which can be defined as the “the rationale of how an organization creates, delivers, and captures value” (Osterwalder & Pigneur 2010, 14). A “*business model that relies on data as a key resource*” (Hartmann, Zaki, Feldmann & Neely 2014, 6) will be referred to as a ‘data-driven business model’ throughout this thesis. Only with a profitable business model can innovation become success. Depending on the chosen business model, the outcome can vary greatly. Indeed, many innovations fail because of their business models (Chesbrough 2010; Teece 2010).

Several process models can be found for business model innovation (Osterwalder & Pigneur 2010.; Sinfield, Calder, McConnell & Colson 2012.) and for Big Data projects (BITKOM 2013.). These established process models are helpful to validate and implement an initial vision of a business model in the marketplace. For organizations, however, the challenge is more in how to systematically envision new offerings.

When it comes to using data in business model innovation, academic and practice-oriented research is scarce (Hartmann et al. 2014). Existing literature is focused on business model types (Van’t Spijker 2014.; Hartmann et al. 2014.; Otto & Aier 2013.; BITKOM 2015.) and using data for measuring service quality (Arslan, Casalegno, Giusti, Ileri, Kurt & Ergüt 2013.) rather than designing the business model.

So far, success stories on data-driven business models are largely anecdotal (Nagle & Sammon 2014; Hartmann et al. 2014). Only 4% of companies already use Big Data in value creation and as basis for new business models (BITKOM 2012). In order to replicate their success, Nagle & Sammon (2014) point to the necessity of developing value creation patterns around Big Data.

### 1.1 Objective

To address this gap, this thesis sets out to explore how value can be drawn from Big Data in the Service Design process. As a critical element of service innovation, a specific focus of this thesis is on business models. Overall, it aims to present reusable knowledge on developing data-driven business models.

In order to use data for service innovation, managers must first understand what kind of data is available in their organizations. For the most part, businesses and corporations are stuck in a dilemma: Employees and departments of companies that do have an overview of available data are usually not involved in the development of new business models. Conversely, those who are entrusted with the design and development of business models are only rarely capable of understanding the available data. This thesis aims to create a tool that provides a common language to discuss data resources with diverse stakeholders.

With the understanding of available data, the Service Design Thinking process can be initiated. Service Design Thinking generally starts with exploring the needs of users. However, as long as neither audience nor value proposition of a new business model are defined, organizations are faced with the dilemma of how targeted user research can be initiated and carried out. The goal of this thesis is to explore how available data can inform user research and support more targeted research.

Insights from user research consequently serve to match available data with user needs. If data sources available to an organization relate to relevant needs, an area for service innovation is found. With the help of that data, organizations are then able to support customers' processes. This thesis explores how a fit between data and user needs can be identified.

The research objectives can be summarized in the following research questions:

1. What does a tool that helps managers understand available data sources look like?
2. How can data set the scope for needs research?
3. How can a fit be identified between available data sources and identified user needs?

Altogether, these research questions lay out a process model for data-driven business model innovation. The purpose is to provide guidance for small and medium-sized businesses to leverage their data resources and experiment with new business models. By designing and evalu-

ating an approach, this process model is intended to reduce the high complexity of the assignment for other companies to follow and to lower their perceived risk.

## 1.2 Delimitation

The focus in developing value creation patterns is clearly on the process rather than the outcome. Designing a sound process model for data-driven business innovation requires several iterations. It needs to be applied in different contexts and refined based on the lessons learned. This thesis covers only the initial design phase and its application in a single case study.

During the work on the thesis, the first steps were identified as most critical to data-driven business model innovation. Further steps are adequately described in literature. Therefore, this thesis focuses on the first steps of the process including understanding data and identifying a fit between data and user needs. Further steps are left out of the scope of the empirical work and are described in theory only.

Zolnowski & Böhm have identified six different objectives of business modeling: Classification and analysis, innovation, performance measurement, business model theory, modeling theory, and reconfiguration of the value chain (2011, 3). This paper focuses on the use of business models in the innovation process. At the same time, it aims to add a systemic data-driven modeling process to the business model theory.

Already in 2005, Weber published a book titled “Data-Driven Business Models.” Using database techniques, his process describes customers and their behavior and adjusts business models accordingly. Insights from data are used for business model innovation. Because Weber (2005.) does not further address data as a resource, his approach and understanding of data-driven business models is not further included in this thesis.

Even though this thesis aims to make a contribution, which is generally applicable in a large range of businesses worldwide, its focus was specifically on small and medium-sized businesses (SME) with up to 250 employees (European Commission) in Germany.

## 1.3 Structure

This thesis consists of a theoretical and an empirical part. This first chapter establishes why the chosen topic is worth researching. Objectives and research questions are set. The second chapter introduces the reader to the study context. It describes the topic of Big Data in more detail and outlines the ExCELL research project, which served as a case study for the evaluation in the empirical part of the thesis.

Value creation and business model innovation form the theoretical background that is relevant for the empirical part of the thesis. The third chapter firstly explores the concept of value creation first in relation to Big Data. Secondly, it looks into how service-dominant logic and jobs-to-be-done have profoundly changed the concept of value creation in recent years. Lastly, because value is most often created by more than one actor, service systems are characterized. Effectuation and Lean Startup are introduced as two approaches to business model innovation. As established tools in business model innovation, Business Model Canvas, Lean Canvas, Value Proposition Canvas, and Service Logic Business Model Canvas are explained. The fourth chapter introduces Design Science Research as the academic framework for this thesis and Service Design Thinking as the methodology used within this framework. It further outlines the process of the empirical part of the thesis.

The case study is presented in the fifth and sixth chapters. First, insights from expert interviews and existing work from a literature review are summarized. Subsequently, steps for developing and testing the Data Canvas as a tool for understanding data are reported. The sixth chapter describes how the Data Canvas was applied in the case project and how it narrowed the scope for user research. Insights from pilot user research are presented along with information about how identified needs match data available in the research project. The next steps beyond the scope of this thesis are explained in theory.

The process model for data-driven business model innovation is summarized in the seventh chapter. Based on insights from the evaluation, further changes to the process model are proposed. Lastly, the potential impact of this research is presented together with opportunities for further research.

## 2 Study Context

With a special focus on business models using data, it is necessary to introduce Big Data in more detail. This chapter provides a definition of Big Data and outlines types of data that are commonly used in business models. Furthermore, it introduces the case project, which provided a challenge related to data-business model innovation and served as a case study in which the process model was evaluated.

### 2.1 Big Data

Big Data can be defined as “data that pushes the limits of common technology available at that time” (Nagle & Sammon 2014, 395). It is commonly characterized by three dimensions: volume, variety, and velocity (BITKOM 2012; Sathi 2011). Volume refers to terabytes and more of data that is more than humans or traditional software can process. Velocity implies that most of that data is time-sensitive and needs to be made available in real-time. Variety means that Big Data exists in different formats. A particular challenge is the mix of structured

and unstructured data such as comments in social networks or audio protocols from which meaningful information needs to be extracted first.

Jaokar, Jacobs, Moore, and Ahvenainen (2009) distinguish between two types of digital footprints: Passive footprints based on customer behavior and active footprints based on information that users consciously share themselves. Kerry Bodine presented a more detailed picture during the Service Design Network Conference 2013. She subdivides active footprints into created and mutual data and passive footprints into received and recorded data (Bodine 2013.). Created data is consciously authored by the individual, for example in the form of communication through e-mails, chats and calls, posts in social networks, or office documents. Mutual data generally consists of shorter pieces of information such as profile data, preferences and order history that are created or shared with providers. Received data in turn is not created by individuals but sent to them by organizations. This type of data includes digitized documents such as invoices. The last category of recorded data is recorded and calculated from users' behavior. For example, cookies are used to track visitor behavior on websites. Preferences and demographics can be used for profiling, and scores can be calculated from credit records or from social network activity. Another source of recorded data is in machine-to-machine (M2M) communication or the so-called 'internet of things' (IoT). Radio-frequency identification (RFID) chips, sensors, and the like gather a high volume of data.

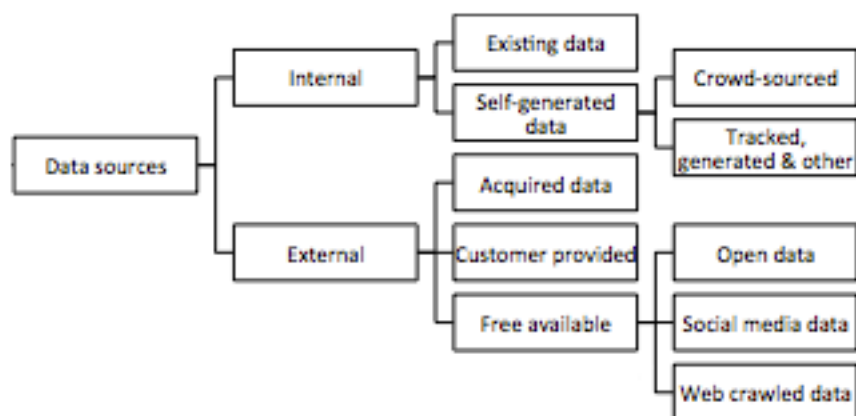


Figure 1. Taxonomy of data sources in data-driven business models  
(Hartmann et al. 2014, 11)

Hartmann et al. (2014.) divide data into internal and external data sources as shown in Figure 1. Internal data is not limited to be pre-existing data. Rather, companies can either crowd-source data or generate additional data during use of a product or service. In addition, they can also leverage external data. While some external data such as open data, social media

data, and web-crawled data is freely available, other data needs to be paid for. Customers or partners may be able to provide additional data that is not available to the larger public.

## 2.2 Case project

This thesis was carried out in collaboration with FELD M - a service provider for digital marketing with about thirty employees based in Munich. FELD M reflects current research in their development of innovative practical solutions. They are involved in the research project ExCELL - Real-time analysis and crowdsourcing for a self-organized city logistic. Other project partners include amongst others Munich University of Technology, Dresden University of Technology, Beuth University of Applied Sciences Berlin, ENTIRETEC, and Ming Labs among others. This project is set to run for three years from January 2015 and is co-financed by the German Federal Ministry of Economy and Energy (BMWi) within their technology program Smart Data - Innovation from Data.

The objective of the ExCELL project is the development and piloting of a platform that enables integrated mobility services for small and medium-sized businesses. The platform will integrate existing routing concepts of seven current practice partners. Their geo data, data on traffic situation, and operation data will be enriched with heterogeneous mass data from the crowd. To this end, scalable technics of text and data mining respectively algorithms for the handling of geo data will be adapted and developed further. *Crowd* refers to all potential service providers in Germany and their clients who use mobile devices and the web to communicate with mobility service providers collectively. A crowdsourcing approach is applied in order to guarantee decentral organization, flexibility, and actuality. Through the platform, practice partners will be able to bundle their existing mobility services by means of service engineering and encourage the provision of additional data through clients.

Within the project, FELD M is in the lead for identifying user needs as well as for developing the service concept. In the work package "Concept of value and cash flow" they will develop business models for the crowdsourcing platform. For this purpose, they plan to apply the Business Model Canvas and Lean Startup methodology to experiment with various business models. Special attention will be paid to the potential and limitations of the existing data set for the development of business models.

While FELD M is experienced both in handling data as well as developing business models, they realized a need for an adjusted approach to data-driven business modeling. The ExCELL project served as a case study to evaluate a generally applicable process model for this purpose.

### 3 Theory

In this chapter the focus turns from the study context to the theoretical framework of this thesis. Different concepts of value creation are firstly introduced followed by business model innovation processes and lastly tools.

#### 3.1 Concept of Value Creation

Already in 1985, Porter & Millar recognized that technology opens new opportunities for companies at a faster rate than the companies are able to imagine uses of the technology. They introduced the value chain as a framework for analyzing how information technology impacts strategy (Porter & Millar 1985). The value chain shows company processes in nine distinct activities that affect each other through linkages. It is visualized as a linear chain of activities in which value is added over time and finally exchanged with customers. Suppliers provide input to the value chain, and the resulting product serves as an input to the value chain of buyers. In this representation, service is limited to an auxiliary role at the end of the value chain.

Big Data is one such information technology that has a profound impact on businesses. Hui (2014), for example, argues that the Internet of things requires a mindset shift in terms of value creation and value capture. This chapter first presents an adapted value chain for Big Data. In the following subchapters, service logic is introduced as an alternative perspective on value creation, as in the past decade there has been a shift from a goods-dominant logic represented by the value chain toward a service-dominant logic. The jobs-to-be-done framework, which focuses on desired outcomes, can be combined with service logic. Finally, as value is rarely created by one company alone, service systems are introduced as a concept for understanding the wider ecosystem around a service.

##### 3.1.1 Big Data Value Chain

BITKOM (2013) argues that data changes traditional value chains as introduced by Porter & Millar (1985). They present a Big Data value chain from the perspective of project managers. Nagle & Sammon (2014) present a similar information value chain from a socio-technological perspective.



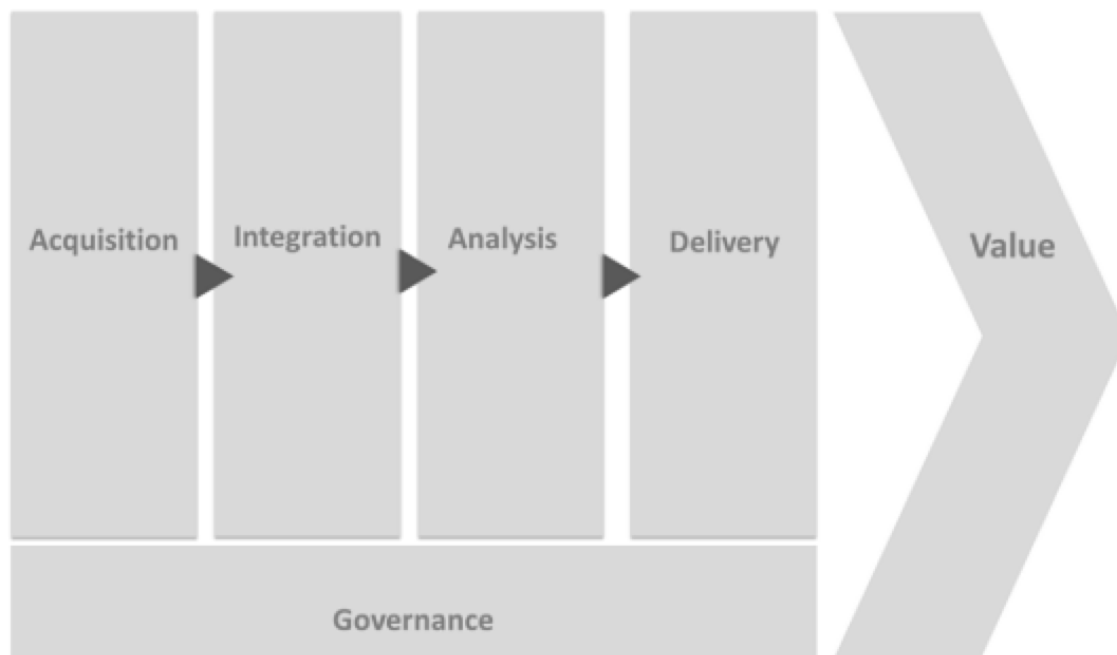


Figure 2. Information Value Chain  
(Nagle & Sammon 2014, 397)

Acquisition of data is the first step of the value chain represented in Figure 2. Without data, no other steps can follow. The majority of data is unstructured and so far largely unexplored (Nagle & Sammon 2014). BITKOM (2013) mentions among others the digitalization of analog information as a form of acquisition. Following the acquisition of data, it needs to be integrated with existing data sets. For this purpose, data needs to be consolidated and managed. Only when it is analyzed in a next step can value be extracted from data (Van't Spijker 2014). BITKOM does not include analysis in their value chain from a perspective of project managers. Instead, they introduce a discrete step for data aggregation. Nagle & Sammon, on the other hand, stress the growing need for managers to understand and communicate data capabilities. For delivery, BITKOM (2013.) highlight the differences among selling data through data marketplaces, using data to create products and services, and data visualization. While BITKOM (2013) sees quality management as part of data integration, Nagle & Sammon view it as an ongoing process.

The notion of value at the end of the information value chain explains the major difficulty of creating value from data. An understanding of how data can be processed is required in order to determine possible offerings.

### 3.1.2 Service logic

“Like all humans, business managers are socialized into a *dominant logic*-shaped by the attitudes, behaviors and assumptions that they learn in their business environments” (Prahalad & Ramaswamy 2004, 37). For decades, a goods-dominant logic has shaped thoughts and actions.

In that logic, value is added in a linear value chain and exchanged with the customer in the end (Porter & Millar 1985.).

In recent years, goods-dominant logic has been gradually replaced by service-dominant logic (Vargo & Lusch 2004) and the similar Nordic school view of service logic (Grönroos 2006). This logic no longer draws a distinction between tangible goods and intangible services.

Rather than a category of offerings, service is seen as a perspective on value creation with goods as value-supporting resources and services as value-supporting processes (Grönroos 2006.). Lusch, Vargo, and Wessels (2008) point out that by using the term ‘service’ in singular the process is accentuated. Vargo & Lusch define service as “the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself” (2004, 2). Service is the primary unit of exchange, and all economies are service economies. Physical goods are viewed merely as distribution mechanism for service provision, while knowledge is the fundamental source of competitive advantage.

In a goods-dominant logic, value is in the control of companies and realized as value-in-exchange. Value embedded in a physical good is exchanged with customers in a single transaction. In the service-dominant logic, in contrast, customers always form part of a service. They are seen as an operant resource (Lusch et al. 2008) and value is the “outcome of *co-creation* between suppliers and customers“ (Gummesson 2007, 5). Lusch et al. define value as “composite of benefits or burdens (or costs) that unfold as the customer integrates the firm-provided resources, often over time” (2008, 10). Vargo & Lusch (2004.) introduce the concept of ‘value in use’ to express that value is evolving over time and determined by beneficiaries through use. Further, value is contextual because customers have a unique access to resources, may require different resources in different situations, and have unique prior expectations (Bettencourt, Lusch & Vargo 2014.). Service-dominant logic acknowledges the contextual nature of value creation by extending the concept of “value in use” to “value-in-context” (Vargo, Maglio & Akaka 2008). This notion is not shared by the service logic, which finds the notion of value-in-use sufficient as value-in-use naturally depends on context (Grönroos & Gummerus 2014).

Grönroos and Gummerus (2014.) clarify that co-creation in service-dominant logic is to be understood as a metaphor for which value experienced by customers depends not only on potential value-in-use offered by providers but also on actions of customers. Not in all cases, providers create value together with customers. Three spheres of value creation can be distinguished: (i) a provider sphere in which providers create potential value-of-use independent from customers, (ii) a joint sphere in which providers and customers directly interact and create value together, and (iii) a customer sphere in which customers alone create value in-

dependent of providers. Only in the joint sphere do providers and customers directly interact with each other and create value collectively. While in the service-dominant logic the provider remains in charge and drives value creation, service logic views customers as drivers of value creation.

Vargo & Lusch (2004) argue that when customers determine value-in-use, providers are restricted to proposing value. Grönroos (2006), in contrast, criticizes the concept of value proposition as being influenced by goods-dominant logic. Within the service logic, providers are not restricted to proposing value. In the joint sphere when directly interacting with customers, they are also able to influence value fulfillment. Thus, a value proposition for a service should be seen as presenting a potential value-in-use and then mobilizing the resources to facilitate value fulfillment when customers accept the value proposition (Grönroos 2006.; Lusch et al. 2008).

Resources are central to service provision. Though they are not intrinsically valuable, they possess capabilities that give them value potential. Rather than producing, companies engage in resourcing, turning “a potential resource [...] into a specific benefit” by creating resources, integrating resources, and removing resistances (Lusch et al. 2008, 8). Resources become useful only when they are connected to other resources, can be used without resistance, and the beneficiary is able to integrate them to create value (Vargo & Lusch 2011; Bettencourt et al. 2014). Through service, resources of a provider are combined with resources of customers in order to facilitate their processes (Grönroos 2006).

Vargo and Lusch (2011) distinguish between operand and operant resources. Operand resources, which require an operation to create an effect, are the focus of a goods-dominant logic. In the service-dominant logic, in contrast, value is primarily created through operant resources - knowledge and skills that produce effects. According to them, resources can be retrieved from three sources: Private sources are owned, market-facing resources are acquired through economic exchange, and public sources are collectively accessible. Each resource integration creates additional resources (Vargo & Lusch 2011).

### 3.1.3 Jobs-to-be-done

In professional practice, an approach has developed that is largely consistent with service-dominant logic. The jobs-to-be-done framework builds on the understanding that “[w]hen customers find that they need to get a job done, they ‘hire’ products or services to do the job” (Christensen, Scott, Berstell & Nitterhouse 2007, 38). Apart from functional jobs, customers hire products or services for more profound social, emotional, and personal aspirations (Osterwalder, Pigneur, Bernarda & Smith 2014). Current products and services can be seen as “point-in-time solutions” (Ulwick & Bettencourt 2008, 65) to get jobs done.

A focus on a customer job simplifies identifying latent needs as “thoughtfully selected customers are always able to articulate their requirements for getting a job done better” (Ulwick & Bettencourt 2008, 65). Christensen et al. (2007.) point out that another advantage is that jobs are more stable. Traditional segmentation, on the other hand, is static and does not account for changes in buying behavior. Needs-based segmentation falls short because needs differ in various situations. Jobs-based segmentation aims to understand the situation rather than the customer. As such, requirements remain valid over a longer period of time and are also relevant across cultures. As a consequence, providers generally look at much larger markets than category-defined markets competing also with offerings in other product categories.

Bettencourt et al. (2014) propose a service lens that combines jobs-to-be-done with service-dominant logic. Value creation with the service lens is seen as “helping customers to get one or more jobs done” (Bettencourt et al. 2014, 44). They present four premises of a service lens:

1. “Service is what is always hired to get a job done. [...]
2. The customer always co-creates value to get a job done successfully. [...]
3. All firms and individuals integrate resources to get an entire job done. [...]
4. Value is always specific to the context in which a job is done.”

(Bettencourt et al. 2014, 50.).

Customers apply desired outcomes as unique metrics to judge accomplishment of a job (Ulwick & Bettencourt 2008). The focus on jobs-to-be-done moves the locus of value creation even further ahead in time to when a job is accomplished. “Value-in-achievement” further extends the concept of value-in-use or value-in-context (Bettencourt et al. 2014, 54).

Bettencourt et al. point out that in value co-creation “*customer choice* becomes critical to success” (2014, 54). Rather than addressing a mass market, organizations need to find customer segments that are both willing and able to co-create. Active customer involvement in co-creation may vary. Bettencourt et al. (2014) draw a distinction between an enabling and relieving service. Depending on their ability and willingness to co-create as well as other hiring criteria, customers may be looking for one or the other. Customer involvement is critical in enabling service, whereas relieving services limit involvement to a minimum (Bettencourt et al. 2014.). With regards to the spheres introduced by Grönroos & Gummerus (2014), enabling services take place in a joint sphere and enable customers to create value in customers’ spheres. Relieving services in contrast mainly take place in the providers’ spheres with minimal co-creation in the joint sphere. Especially with enabling services, success depends on many factors beyond the control of a service provider (Bettencourt et al. 2014.).

With a service lens, companies are empowered to create new markets as they consider which jobs customers have that could benefit from firm resources in combination with their own resources. Effectiveness, reliability, convenience, and affordability in getting jobs done creates innovation (Bettencourt et al. 2014).

### 3.1.4 Service systems

In an increasingly interconnected world, value is commonly not created by a single provider (Vargo & Lusch 2011; Wieland, Polese, Vargo & Lusch 2012). Service-dominant logic deflects the distinction between producers as creators of value and consumers as destroyers of value. Instead, “*all social and economic actors are resource integrators*” (Vargo & Lusch 2008, 9) that avail of mutual benefits in the form of indirect exchange (Wieland et al. 2012, 16). Consumers do not destroy value but rather complete or perfect it (Vargo et al. 2008).

Service-dominant logic can be seen as a conceptual foundation for service science (Lusch et al. 2008). In service science, value co-creation configurations are referred to as ‘service systems.’ Maglio & Spohrer define service systems as “value-co-creation configurations of people, technology, value propositions connecting internal and external service systems, and shared information (e.g., language, laws, measures, and methods)” (2008, 18). Service systems are composed of individuals or groups of individuals. Other than in a network, a system is dynamic changing with each action of a stakeholder (Wieland et al. 2012). As shown in Figure 3, actors are connected to each other through value propositions (Maglio & Spohrer 2008), which Chandler & Lusch define as “*invitations from actors to one another to engage in service*” in the context of service systems (2015, 8). If not remaining unnoticed, other service systems may accept or reject a value proposition (Vargo et al. 2008).

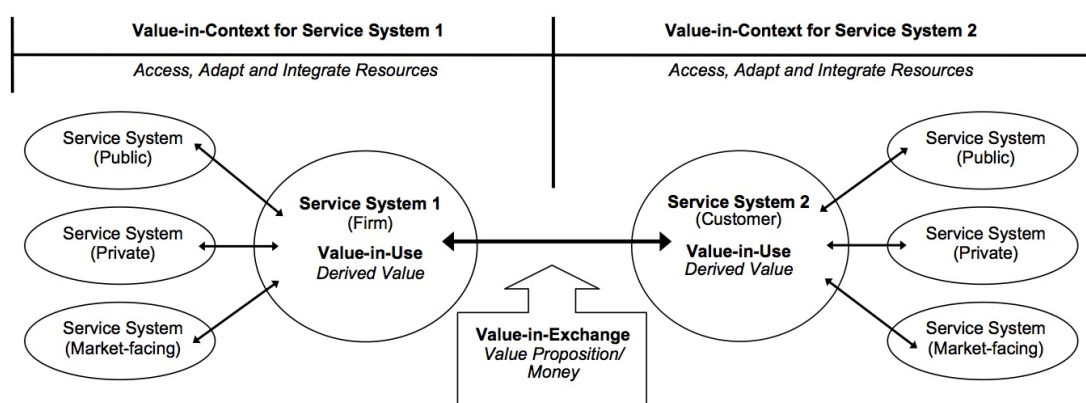


Figure 3. Value co-creation in service systems

(Vargo et al. 2008, 149)

Chandler & Vargo (2011.) stress that access to resources is the reason for actors to interact. Service systems depend on the exchange and application of resources within and among other

service systems to persist and to advance. Whenever these resources cannot be accessed otherwise, they are exchanged for money (Vargo et al. 2008). According to the definition of service systems provided by Maglio & Spohrer (2008.), resources in value co-creation comprise people, technology, organizations, and shared information. They categorize those resources into resources with rights, resources as properties, physical entities, and socially constructed entities. Entities in service systems exchange, to some extent, information, work, risk, and goods. In service system, all actors should contribute and benefit from their engagement (Vargo & Lusch 2011; Immonen, Palviainen & Ovaska 2014). Vargo et al. define value in service systems as “improvement in *system well-being*” (2008, 149).

Configuration of a network of service systems presents opportunities for innovation (Lusch et al. 2008). In order to innovate, service systems need to understand and match their own capabilities with needs of other service systems (Maglio & Spohrer 2008). Both a holistic view as well and a view on individual actors are required. Co-creation requires consonance in terms of compatibility as well as resonance in the form of interaction between actors (Wieland et al. 2012). Each actor must understand his or her role in the system as well as its overall configuration and revenue streams (Bettencourt et al. 2014; Hui 2014).

Stakeholder maps, also known as system maps (Segelström 2010) or ecology maps (Moritz 2005), map the context or the ecosystem around a service (Polaine, Loevlie & Reason 2013). For stakeholder maps, relevant internal and external stakeholders are gathered first. Stickdorn and Schneider suggest the additional inclusion of desk research, as the context may involve stakeholders that an organization is not initially aware of (2010). The collected stakeholders are then prioritized and clustered. Polaine et al. stress the importance of defining boundaries according to the requirements of a project, as stakeholder maps are theoretically boundless (2013.). Although stakeholder maps can take on various forms, a typical representation is a circle in which stakeholders are arranged according to their relative importance from the center of the circle. As all stakeholders exchange value in some form (Polaine et al. 2013), another important element is to visualize how they relate to each other.

Analyzing the context of a service in a stakeholder map helps everyone involved to better understand the context beyond their own organization (Polaine et al. 2013). Through identifying potential points of failure, service providers can determine what stakeholders need in order to be able to provide good service and consequently build resilient services. Even though stakeholder maps are primarily used in early stages of the Service Design Thinking process, reorganizing the relationship of actors also has the potential to trigger new service ideas.

### 3.2 Business Model Innovation approaches

In business model innovation, business models themselves are seen as subject of innovation. Novel business models are systematically envisioned, iterated, and implemented in the market (Osterwalder & Pigneur 2010; Zott, Amit & Massa 2011). This chapter introduces Lean Startup and Effectuation as two similar, yet distinct approaches to business model innovation.

#### 3.2.1 Lean Startup

Lean Startup is an innovation process with a clear focus on the business model. Ries defines a startup as “a human institution designed to create a new product or service under conditions of extreme uncertainty” independent of size or sector (2011, 27). Blank emphasizes that startups are “a temporary organization designed to search for a repeatable and scalable business model” (2013, 5) in contrast to established organizations that execute a proven model. Thus, startups may exist within or independent of enterprises. Through an iterative process, lean startups aim to reduce waste.

Lean Startup starts from the existing vision of a founder or product development team that defines the first product. Startups applying the Lean Startup process acknowledge that their initial idea is solely based on assumptions. Along with product development, they therefore need a process for customer development (Blank 2006.). Along this process, startups reach three stages of fit between their offering and customer needs (Osterwalder et al. 2014.).

- (i) In the *customer discovery* phase, startups test if there is a market for the envisioned service. They identify customer segments and perceived value of the solution. *Problem-Solution Fit* occurs when a value proposition, at least in theory, addresses relevant jobs, pains, and gains of customers.
- (ii) In the *customer validation* phase, startups experiment with different elements of their business model with the goal to find a repeatable model. *Product-Market Fit* is achieved when it can be demonstrated that customers are, in fact, willing to buy.
- (iii) Execution starts with *customer creation*. Once hypotheses are proven and the product is adequately polished, marketing is called in order to obtain a broad user base. *Business Model Fit* is achieved when the value proposition is embedded in a profitable and scalable business model.
- (iv) Ultimately, a startup makes the step to *company building* in which they transition to a company with functional departments. Still, the business model needs to be monitored and constantly adapted.

Especially in customer discovery and customer validation, startups intend to learn if their assumptions stand up to reality. Figure 4 shows the three-step learning process of build-measure-learn applied in Lean Startup.

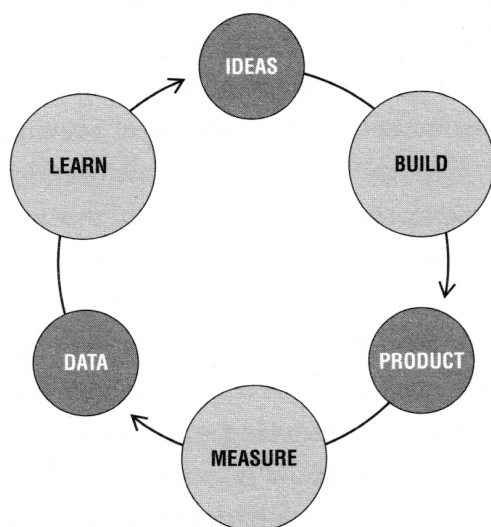


Figure 4. Build-Measure-Learn feedback loop  
(Ries 2011, 75)

Lean startups first translate their ideas into business model hypotheses. They then test their assumptions one by one, ideally starting with the riskiest elements, which Ries calls “*leap-of-faith* assumptions” (2011, 76). Ideas are translated into prototypes, which are derived from what a startup wants to learn and how it will measure success. A minimum viable product (MVP) is “that version of the product that enables a full turn of the Build-Measure-Learn loop with a minimum amount of effort” (Ries 2011, 77). Through interaction of customers with that product, lean startups gain qualitative and quantitative feedback. They focus on a relatively small set of actionable metrics and good-enough rather than complete data.

The ongoing process has no clear starting point. Even before building a product, startups can validate problems and customer segments through interviews (Maurya 2012.). From there, they pivot their initial idea by changing one or more of the assumptions triggering another feedback loop. As validated learning is the unit of progress, the goal is to accelerate this feedback loop. Failing early allows experimenting with different options. This increases the chance to find a viable business model before running out of resources.

### 3.2.2 Effectuation

Another approach that stems from academic entrepreneurship research can be applied for business model innovation. Effectuation is a decision model that is particularly useful for organizations acting under uncertainty. “*Effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means*” (Sarasvathy 2001, 245). Given means comprise physical resources (“Who is the firm?”), human resources (“What does the firm know?”), and organizational resources (“Who does the firm know?”) (Sarasvathy 2001; Bettencourt et al. 2014). In contrast, with the same aspiration, “[c]ausation processes take a particular effect as given and focus on selecting between means



to create that effect” (Sarasvathy 2001, 245). Figure 5 contrasts both decision models, which overlap in many cases.

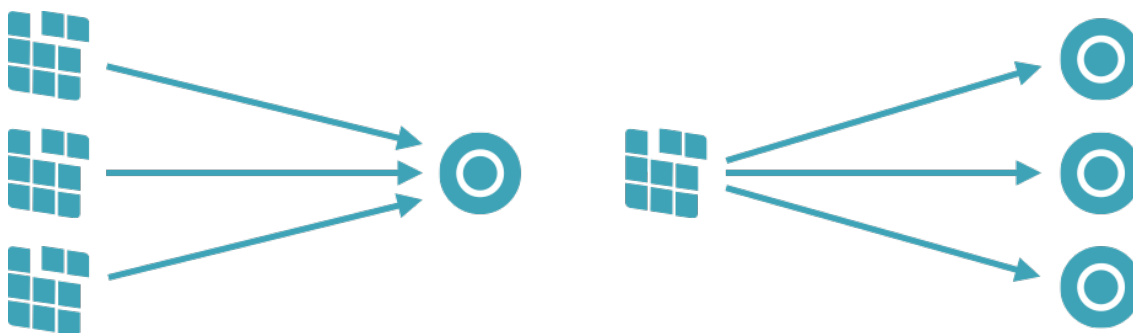


Figure 5. Effectuation compared to causation

Effectuation builds on four principles:

1. “Affordable loss rather than expected returns [...]
2. Strategic alliances rather than competitive analyses [...]
3. Exploitation of contingencies rather than exploitation of preexisting knowledge [...]
4. Controlling an unpredictable future rather than predicting an uncertain one”

(Sarasvathy 2001, 252).

Like in the service-dominant logic, Effectuation focuses on intangible operant resources (Read, Dew, Sarasvathy, Song & Wiltbank 2009). Resources do not inherently possess value but require action to create value. However, resources are not judged. Rather, all means are taken into account as possible inputs in the beginning of the process. In an expanding cycle, each action taken increases the available resources (Read et al. 2009). In this mindset, failure within the boundaries of affordable loss is encouraged, as it creates new knowledge (Chesbrough 2010).

Similarly, all actors are viewed as potential stakeholders in Effectuation. Partnerships are seen as a vital resource. Partners help to reduce uncertainty and heighten barriers for competitors to copy the effects (Sarasvathy 2001). Read et al. (2009.) argue that the value of resources is further increases as co-creation establishes a feeling of ownership both financially and psychologically. The ongoing negotiation of roles and relationships helps each partner to understand his or her role and contribution to value co-creation.

Rather than preselecting a single strategy, a variety of opportunities can be created in different industries. Effects are chosen based on acceptable risk. While effects in causation processes cannot be controlled, Effectuation is actor-dependent. Actors can chose effects by listening to customers and building partnerships (Sarasvathy 2001). With a service lens, strategy emerges with strategic advantage being created by “envisioning service to help customers get

jobs done and then preparing to continually learn and re-shape value propositions over time” (Bettencourt et al. 2014, 60). While causation exploits knowledge to maximize returns in the present, Effectuation is more long-term oriented (Sarasvathy 2001).

Effectuation is distinct from Lean Startup in that it starts with resources rather than an initial idea. It places a greater emphasis on unique values and capabilities. Lean Startup caters to adapting a product, while Effectuation aims to shape the market. On the other hand, both share many similarities. They both value experimentation over planning and accept failure as learning. Incorporating feedback from customers, a viable business is built in iterative steps. In this regard, both approaches complement each other since an initial vision can be developed through Effectuation and then validated through Lean Startup processes. This combination allows companies to experiment with more ideas at a low level of investment.

### 3.3 Business Model Innovation Tools

With the Business Model Canvas, Osterwalder and Pigneur (2010) introduce a shared language for business models. The canvas provides a grammar of where to insert specific information (Osterwalder & Pigneur 2010). Such maps help in considering alternative business models.

Besides the original Business Model Canvas, this chapter describes the Lean Canvas and the Service Logic Business Model Canvas as adaptations in the context of Lean Startup respectively service logic. Further, the Value Proposition Canvas is introduced as an add-on to the Business Model Canvas focusing on customer segments and the value proposition.

#### 3.3.1 Business Model Canvas

In nine building blocks, the Business Model Canvas shown in Figure 6 summarizes how companies intend to operate and generate revenue.

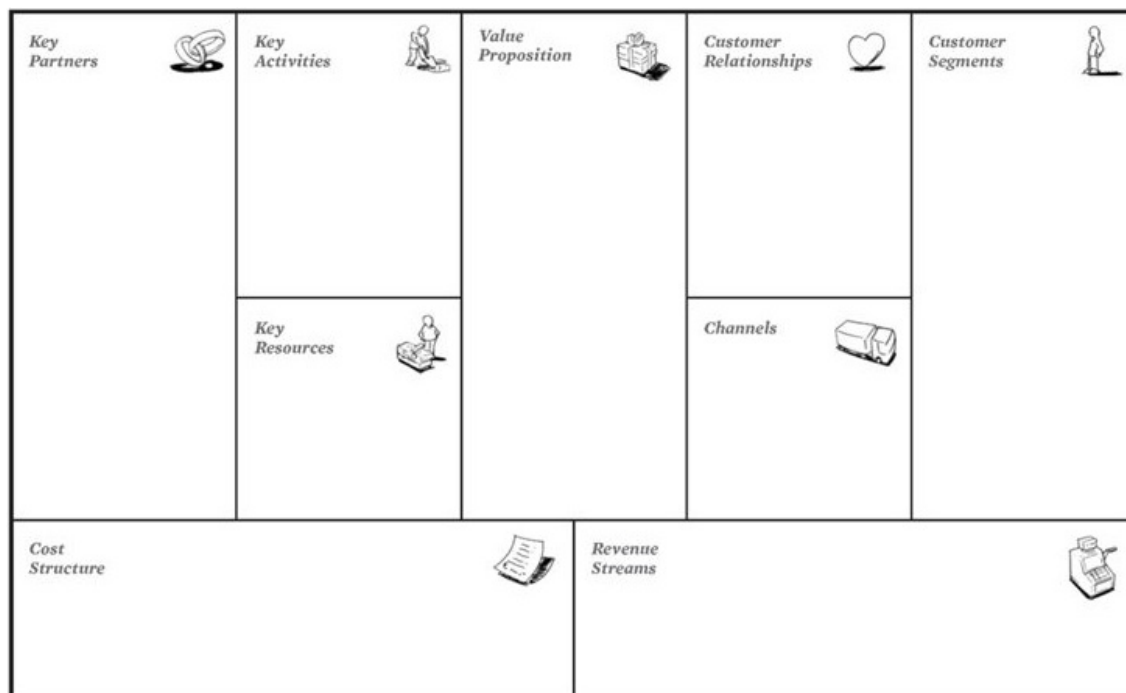


Figure 6. Business Model Canvas  
(Osterwalder & Pigneur 2010, 44)

Customer segments specify the target audience that an organization addresses. According to Osterwalder and Pigneur (2010), organizations must consciously decide whether they serve the mass market without distinguishing between different customer groups or focus on specific customer segments and ignore others.

At the core of the Business Model Canvas is the value proposition that describes the quantitative and qualitative values a business model aims to deliver. For each customer segment, it outlines the combination of products and services that address specific customer needs. Powerful value propositions alleviate customer pains and create unique gains.

Channels specify the touchpoints and the mix of channels used throughout the different phases of the customer lifecycle for communicating with each customer segment and co-creating value with them. Customer relationships describe the type of relationship and the customer experience that customers expect and organizations plan to establish. Relationships can range from personal to automated and are motivated by acquisition, retention, and boosting sales (Osterwalder & Pigneur 2010).

Resources describe the physical, financial, intellectual, and human assets that organizations need to own or acquire in order to realize their business model. The building block of key activities describes the major day-to-day tasks an organization needs to carry out in order to fulfill the value proposition, manage their customers, and earn money. Through partnerships

in the form strategic alliances, coopetition, joint ventures, and buyer-supplier relationships, companies can extend their capabilities, reduce risk, and benefit from economies of scale (Osterwalder & Pigneur 2010).

Critical for the monetization of a business model are its revenue streams. This building block describes how an organization plans to earn money from each customer segment either through one-time or ongoing payments. The cost structure summarizes the expenses that incur for acquiring key resources, carrying out key activities, and recompensing suppliers and partners. Business models fall on the continuum between cost-driven attempting to minimize costs and value-driven with value created being more important than costs (Osterwalder & Pigneur 2010).

### 3.3.2 Value Proposition Canvas

With the Value Proposition Canvas, Osterwalder et al. (2014.) introduce an add-on to the Business Model Canvas for aligning an offering with customer jobs, which is largely based on the jobs-to-be-done framework. The Value Proposition Canvas shown in Figure 7 is composed of two elements. The customer profile on the right side describes a customer segment. Jobs, gains, and pains are based on customer insights or empathy and can hardly be influenced by providers. The left side, in contrast, can be designed and thus controlled by providers.

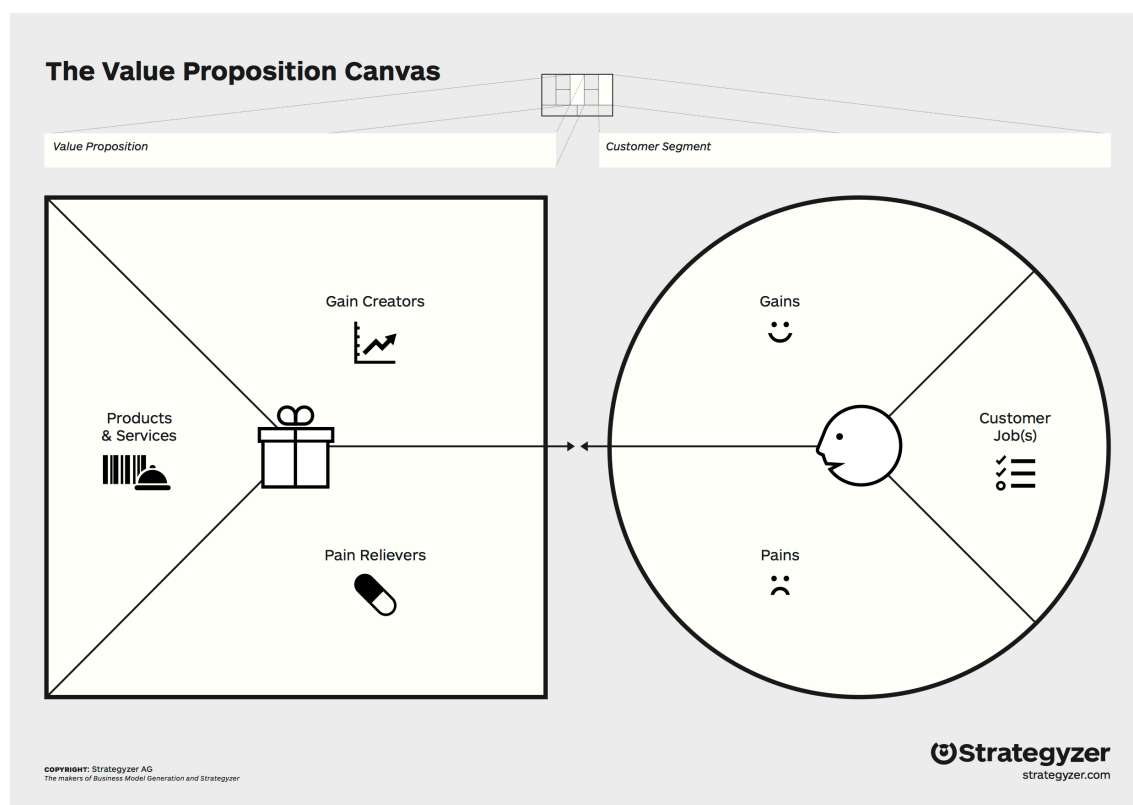


Figure 7. The Value Proposition Canvas  
(Osterwalder et al. 2014, 61)

The customer profile portrays a specific customer segment in terms of jobs-to-be-done, pains, and gains. A customer job “is the fundamental problem a customer needs to resolve in a given situation” (Christensen et al. 2007, 38). Customer jobs describe functional tasks but can also be aspirational with social as well as personal and emotional targets (Osterwalder et al. 2014; Christensen et al. 2007). Ulwick and Bettencourt (2008.) stress the importance of mapping what customers are trying to get done rather than mapping current processes that are often not ideal. They argue that all jobs are processes and advise to map the steps in order to find opportunities for innovation. Customer pains stand for obstacles met in the process of completing these jobs or things that prevent customers from completing a job at all. Osterwalder et al. (2014.) identify the differences among undesired outcomes, obstacles, and risks. Gains specify the desired outcomes in terms of utility, social gains, emotions, and cost savings. They can be required, expected, desired, or unexpected by customers. Depending on which insights customer profiles are based on, they need to be validated throughout the process.

In contrast, the value map is outlined from the provider’s point of view. It lists products and services a provider offers for a specific customer segment. Pain relievers specify how those products and services ease one or more customer pains while gain creators detail how they create desired outcomes.

According to Osterwalder et al. (2014.), the goal of the Value Proposition Canvas is to achieve a fit between both sides. Problem-solution fit occurs when pain relievers and gain creators created by products and services match real customer jobs, pains, and gains. The resulting value proposition requires further testing and refinement to achieve product-market fit and consequently needs to be embedded in a business model.

### 3.3.3 Lean Canvas

Inspired by the Business Model Canvas, Maurya (2012.) presents a Lean Canvas tailored more specifically to the search for new business models. The Lean Canvas shown in Figure 8 focuses on the problems a startup has identified and solutions to alleviate those problems. It serves as a tool to document learning along the process and to derive next steps from. Maurya (2012.) recommends filling the initial canvas in less than 15 minutes and leaving blocks blank if necessary. In line with the decision model of Effectuation, Maurya (2012) advises thinking in the present based on current means.

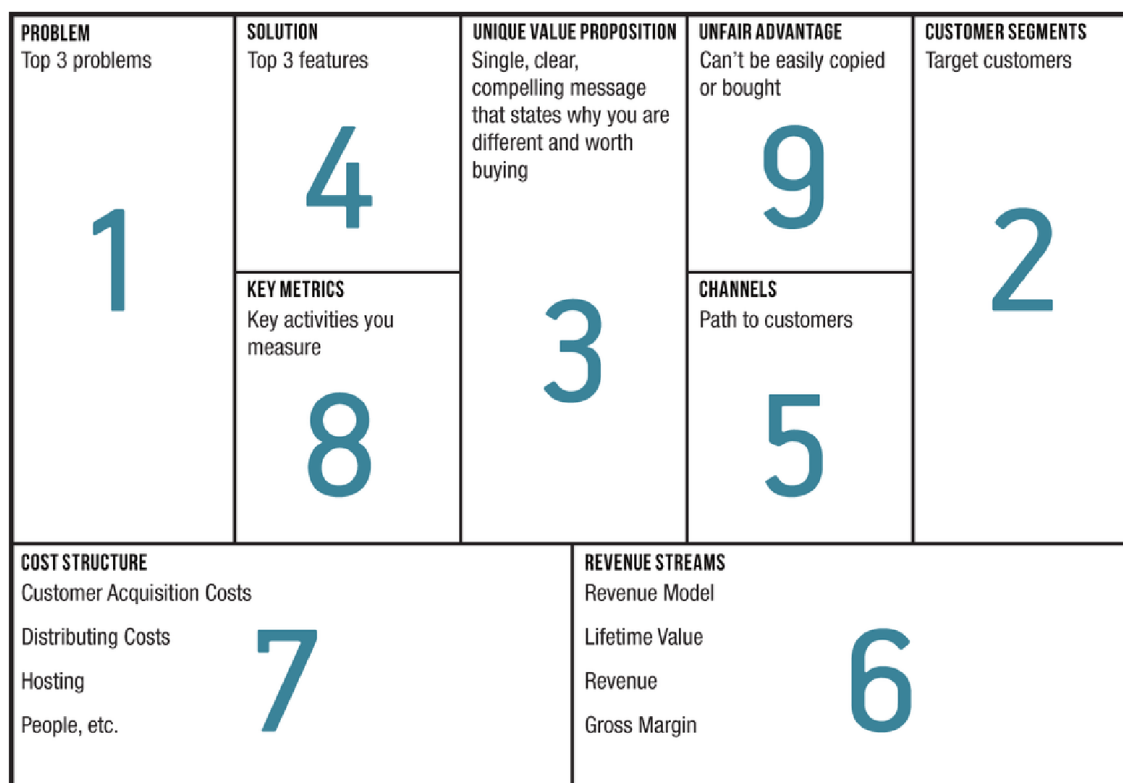


Figure 8. Like the Business Model Canvas, the Lean Canvas is composed of nine building blocks (Maurya 2012, 46)

Maurya recommends a customer-centric approach. He advises starting with the “problem-customer segment” (2012, 58). In line with the jobs-to-be-done framework, the three most pressing problems are listed in the leftmost column of the canvas. Maurya (2012) also includes existing alternatives, which in the Business Model Canvas are not part of the canvas itself but rather belong to the business model environment (Osterwalder & Pigneur 2010). In the right-most column, customer segments are listed. In contrast to the Business Model Canvas, the Lean Canvas places a greater focus on early adopters or earlyvangelists. A new product will not be technically mature and able to cover all features that would be required by mainstream customers. Early adopters have the problem, are conscious of the problem, are actively seeking solutions, have built a provisional solution, and have the budget for a better offering (Blank 2006). For such customers, the problem is so pressing that they are willing to use an early version of a product and they appreciate the ability to influence further development with their feedback (Ries 2011).

As in the Business Model Canvas, value proposition is at the heart of the canvas. The Lean Canvas focuses more on the unique aspects of the value proposition. Maurya defines unique value proposition as the reason “[w]hy you are different and worth [...] getting attention” (2012, 29).

Activities and resources do not have a place in the Lean Canvas. Instead, the solution is described which consists of resources and activities. Maurya (2012) recommends not putting too much effort in defining the solution in the beginning, as problems evolve with lessons learned. He advises to “[b]ind a solution to your problem as late as possible” (Maurya 2012, 32). Key metrics list the key numbers that measure performance of the startup commonly with metrics from the categories acquisition, activation, retention, revenue, and referral (Maurya 2012.).

Channels, as in the Business Model Canvas, address how customers can be reached. Maurya (2012) highlights the value of selling manually first because of learning through direct interactions with customers and automating later. In the place of customer relationship in the Business Model Canvas, the Lean Canvas features unfair advantage, something that cannot easily be acquired by competitors. Interestingly, the examples listed by Maurya (2012) mostly refer to either knowledge and skills as a resource or differentiation through exceptional customer relationships.

As in the Business Model Canvas, the bottom of the canvas is dedicated to financial issues. Maurya (2012.) advises not postponing pricing but charging already for a minimum viable product. Not only is price a quality indicator and determinate for the customer segments, but customers willing to pay are also a strong validation for a product. Rather than calculating costs into the future, Maurya (2012) recommends focusing on the next steps, the cost of interviews, and the minimum viable product.

In contrast to the Business Model Canvas, the Lean Canvas has a stronger external orientation, incorporating elements from the business model environment such as existing alternatives and focus on differentiation. Interestingly, despite the rising significance of value networks discussed in chapter 3.1.4, partners have no place in the canvas. However, the Lean Canvas focuses much less on the entire business of a single actor than the Business Model Canvas. With its focus on solutions, it can be used in cross company teams in search for new business models.

#### 3.3.4 Service-Logic Business Model Canvas

The Business Model Canvas is useful both for physical products as well as for services. Zolnowski & Böhman (2011) argue that its focus on value creation can support the transition from products to services. However, they criticize that “current approaches to business modeling do not provide explicit support for service-related aspects” (Zolnowski & Böhmman 2011, 6).

The Business Model Canvas was developed in the mindset of a goods-dominant logic before the service-dominant logic was introduced. Osterwalder, Lagha & Pigneur (2002) refer to the

value chain framework (Porter & Millar 1985) for value creation in business models. Figure 9 shows how the Business Model Canvas can be visualized in the form of a traditional value chain in which value is created by the company at the left-hand side for customers at the right-hand side. Partners are seen as suppliers and customers as consumers with revenues flowing from customers to the company to suppliers (Lüftenegger 2014). Goods-dominant logic is also evident through the use of terminology (Ojasalo & Ojasalo 2015).

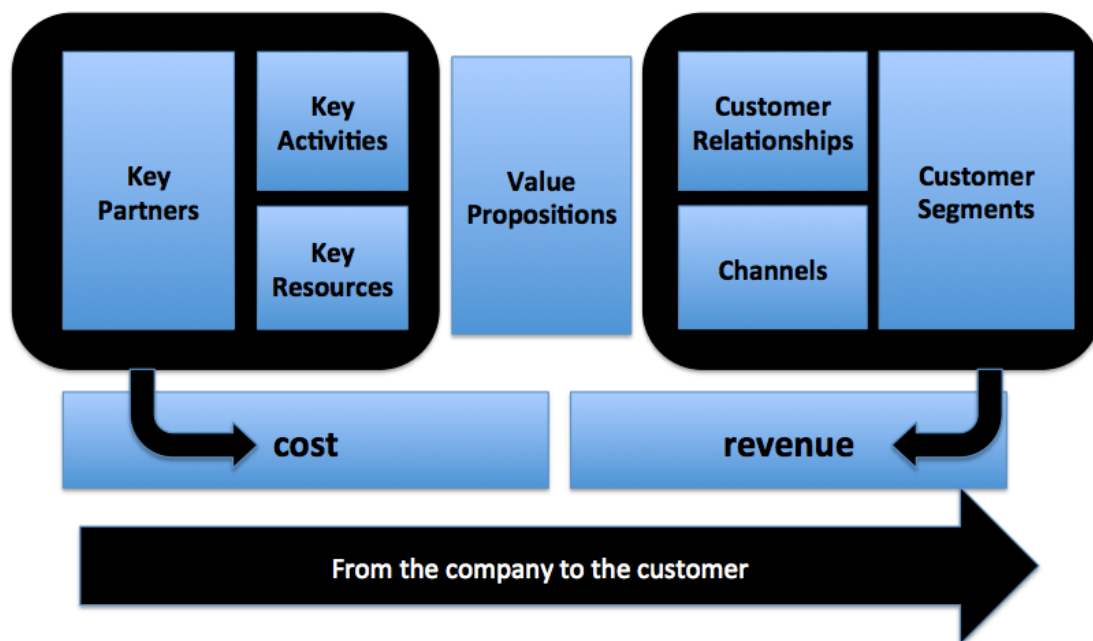


Figure 9. The Business Model Canvas visualized as value chain  
(Lüftenegger 2014, 99)

In the Business Model Canvas, co-creation is considered as a category of customer relationships (Osterwalder & Pigneur 2010). However, impact of customers and partners on other parts of the business model are hard to map in this structure (Zolnowski, Weiß & Böhm 2014; Lüftenegger 2014). Zolnowski et al. (2014), therefore, propose an adapted Business Model Canvas for services. Their visualization shown in Figure 10 moves customers to the top and partners to the bottom of the canvas, encompassing all other building blocks. Each building block is considered both from the customers' and from the partners' perspective. This representation highlights the influence customers and partners may have on any element of a business model but changes the structure of the Business Model Canvas.



	<b>Customer</b> (Customers in the business model)					
Customer perspective	(Costs borne by customers)	(Resources provided by customers)	(Activities carried out by customers)	(Value proposition for customers)	(Contribution of customers to maintain the relationship)	(Revenues captured by customers)
Company perspective	<b>Cost Structure</b> (Costs borne by the focal company)	<b>Key Resources</b> (Resources provided by the focal company)	<b>Key Activities</b> (Activities carried out by the focal company)	<b>Value Proposition</b> (Value propositions of the focal company)	<b>Channels</b> (Channels provided by the focal company)	<b>Revenue Streams</b> (Revenues captured by the focal company)
Partner perspective	(Costs borne by partners)	(Resources provided by partners)	(Activities carried out by partners)	(Value propositions for partners)	(Contribution of partners to maintain the relationship)	(Revenues captured by partners)
	<b>Key Partner</b> (Partners in the business model)					

Figure 10. Adapted Business Model Canvas for services (Zolnowski et al. 2014, 720)

Ojasalo & Ojasalo (2015.) take a different approach. Over more than two years and with more than 100 persons involved, they have refined the Business Model Canvas to reflect service logic. In their Service Logic Business Model Canvas shown in Figure 11, customers are considered in every building block. Trigger questions address both the providers’ as well as the customers’ point of view.

<p><b>Key Partners</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• Who are our key partners?</li> <li>• What are the roles of our partners?</li> <li>• What resources do we need from our partners?</li> <li>• How do the partners benefit from the cooperation?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• How does the customer experience our partners?</li> <li>• What kind of partnerships does the customer have and how should they be taken into account?</li> </ul> <p style="text-align: center;">⑦</p>	<p><b>Key Resources</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• What skills and knowledge do we need?</li> <li>• What other material and immaterial resources and tools are required?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• What skills and knowledge is required from the customer’s side?</li> <li>• What other customer’s material and immaterial resources and tools are required?</li> </ul> <p style="text-align: center;">⑥</p> <p><b>Mobilizing Resources and Partners</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• How do we coordinate multi-party value creation?</li> <li>• How do we utilize and develop partners and resources?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• How can the customer utilize and develop partners and resources?</li> </ul> <p style="text-align: center;">⑧</p>	<p style="text-align: center;">321</p> <p><b>Value Proposition</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• What value are we selling?</li> <li>• What are the elements of our offering?</li> <li>• What is unique in our offering?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• What value is the customer buying?</li> <li>• What are the elements of the customer needing?</li> <li>• Which of the customer’s challenges and problems need to be solved?</li> </ul> <p style="text-align: center;">②</p>	<p><b>Value Creation</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• How is our offering embedded in the customer’s world?</li> <li>• How can we facilitate the customer to reach their goals?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• How does the value emerge in customer’s practices (also from mental and emotional experiences)?</li> <li>• How are customer’s long-term benefits accomplished?</li> </ul> <p style="text-align: center;">③</p> <p><b>Interaction and co-production</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• How can we support customer co-production and interaction between us and the customer?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• What are customer’s activities during the use and different use contexts?</li> <li>• What are the customer’s mental models of interacting with us?</li> </ul> <p style="text-align: center;">④</p>	<p><b>Customer’s World and Desire for Ideal Value</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• How do we get a deep insight and holistic understanding of the customer’s world (context, activities, practices, experiences), their future strategies, and their own customers’ world?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• Why does the customer buy?</li> <li>• What kind of benefits does the customer desire?</li> <li>• Functional</li> <li>• Economic</li> <li>• Emotional</li> <li>• Social</li> <li>• Ethical</li> <li>• Symbolic</li> </ul> <p>• If there were no limits, what would be the customer’s desire for the ideal situation and world?</p> <p style="text-align: center;">①</p>
<p><b>Cost Structure</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• What are the costs inherent in our business model?</li> <li>• What are our other sacrifices?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• What costs and other sacrifices are required from the customer?</li> </ul> <p style="text-align: center;">⑨</p>			<p><b>Revenue Streams and Metrics</b></p> <p><b>From our point of view:</b></p> <ul style="list-style-type: none"> <li>• What is our earnings logic and how is our financial feedback generated?</li> <li>• How can we apply customer value-based pricing?</li> <li>• What else valuable do we get other than money?</li> <li>• What are the key performance metrics of our business success?</li> </ul> <p><b>From customer point of view:</b></p> <ul style="list-style-type: none"> <li>• For which benefits is the customer actually willing to pay and how?</li> <li>• What is the financial value to the customer?</li> <li>• What are the key performance indicators of the customer’s business and how are we following them?</li> </ul> <p style="text-align: center;">⑤</p>	

Figure 11. The Service-Logic Business Model Canvas (Ojasalo & Ojasalo 2015)

The right-hand side of the Business Model Canvas is dedicated to customers and value. More than mere customer segments, the block *Customer’s World and Desire for Ideal Value* cap-

tures customers' lives beyond the business in terms of context, activities, practices, and experiences. This deep understanding of customers is vital because service logic views customers as operant resources in value creation (Lusch et al. 2008). Similar to jobs-to-be-done, it considers functional, emotional, social, and other benefits. Interestingly, strategies applied by providers to get insights are noted in this block. The block for relationships is renamed to *value creation* and addresses the questions of how a service is embedded in the customer's world and what providers can do to support customers in accomplishing their jobs. Instead of channels, *interaction and co-production* cover the interaction between providers and customers in different phases of a service.

The *value proposition* remains in the center of the canvas. The Service Logic Business Model Canvas specifically highlights that the value proposition should be inspired from customer insights and correspond with their jobs-to-be-done (Ojasalo & Ojasalo 2015). On the left-hand side of the canvas that addresses internal processes and efficiency, customers are also more explicitly addressed. In *key partners*, partnerships of customers and their perception of partners are taken into consideration. *Key resources* capture especially operant resources required from customers. In the place of key activities, *mobilizing resources and partners* describes how resources are integrated. *Revenue streams* and *cost structure* also take into account other sacrifices and earnings beyond money. Like the Lean Canvas, it further takes into account metrics to measure success from the point of view of both provider and customers.

With their approach, Ojasalo & Ojasalo (2015) preserve the structure of the Business Model Canvas. They suggest starting with the customers and their needs first and a value proposition second. However, they recognize that blocks may be revised in a different order. With a structured set of questions, this approach helps to build a business model around customer needs.

## 4 Research Framework

This thesis follows a case-study design with Design Science Research as an overall academic framework and Service Design Thinking as an approach to problem-solving in the case study. This chapter introduces both Design Science Research as well as Service Design Thinking and explains the resulting thesis process in more detail.

### 4.1 Design Science Research

Two research paradigms can be distinguished: Natural or behavioral sciences and design sciences. Hevner & Chatterjee (2010.) argue that natural sciences are effective for existing phenomena when researchers have a hypothesis that they can prove or disprove. For 'wicked organizational problems,' however, they argue in favor of a design science approach. Wicked problems are unique problems that cannot be solved by applying past strategies. Each solu-

tion creates other problems and it does not become clear at which point the problem is solved (Martin 2009). Rather than starting with a given hypothesis, design science aims to solve identified problems and create knowledge through the creation and evaluation of artifacts. These can either be problems that are not solved yet or more effective or efficient solutions to solved problems (Hevner, March, Park & Ram 2004). Design Science Research can be defined as “a research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artifacts, thereby contributing new knowledge to the body of scientific evidence. The designed artifacts are both useful and fundamental in understanding that problem” (Hevner & Chatterjee 2010, 5). Osterwalder & Pigneur (2013) argue that the process and knowledge of designing artifacts in design science can be applied in designing strategic artifacts such as business models.

Three research cycles shown in Figure 12 are, according to Hevner et al. (2004), required in any design research project. In the relevance cycle, the environment sets the requirements of the research and determines the utility of an artifact when applied in the environment. In the rigor cycle, researchers draw from the existing knowledge base but also add new knowledge through their research. The design cycle consists of iterations between building and evaluating an artifact.

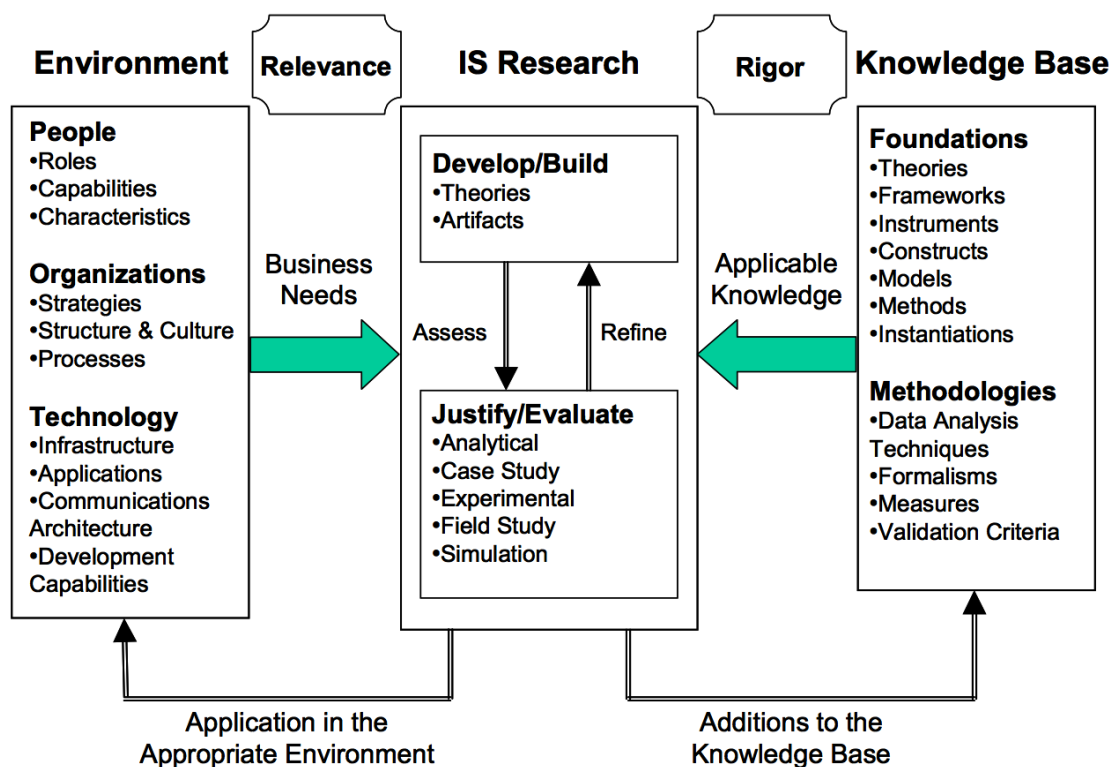


Figure 12. Information Systems Research Framework  
(Hevner et al. 2004)

Artifacts do not exist naturally but are constructed by humans. For instance, artifacts within the field of information technology can be:

- “Constructs (vocabulary and symbols)
- Models (abstractions and representations)
- Methods (algorithms and practices)
- Instantiations (implemented and prototype systems)
- Better design theories”

(Hevner & Chatterjee 2010, 6).

The design science process is described by Hevner & Chatterjee (2010.) in six steps: (1) The first step is to identify the research problem and to demonstrate the motivation for a solution. (2) Second, researchers define how they plan to solve this problem with an artifact. (3) The third activity addresses the design and development of the artifact. (4) Once built, its utility is demonstrated for example through a case study. (5) Following this, it can be evaluated whether the artifact meets the objectives set in phase two. Researchers may decide to iterate steps three to five in order to improve the artifact based on feedback or to move to step six. (6) In the last step, research is communicated in order that it can be applied by others or used for new knowledge creation. Hevner et al. (2004) suggest communicating both to a technology-oriented as well as a management-oriented audience.

#### 4.2 Service Design Thinking

Design Thinking, the practice of applying “design tools to other problem-solving-contexts not directly related with the appearance and functionality of artefacts, but with the form of businesses, services and processes” (Tschimmel 2012, 2), balances the creative design approach with rational business thinking.

Design Thinking and service-dominant logic complement each other (Edman 2009). Even though some of the vocabulary differs, many overlaps can be identified. While service-dominant logic stems from a theoretical background and is more descriptive, Design Thinking has developed out of practice and may provide tools for the implementation of services. With Service Design as an interdisciplinary approach, services are designed applying methods from different disciplines. What is common, however, is the way of thinking. Therefore, the term ‘Service Design Thinking’ is commonly used for example by Stickdorn & Schneider (2010). No standard process for Service Design Thinking exists. Every designer tackles a design challenge differently (RED Design Council 2005). In fact, Stickdorn and Schneider argue that “the very first step of a service design process is to design the process itself” (2010, 126). Even though processes differ in level of detail and wording, Stickdorn and Schneider (2010) accentuate the role of Service Design Thinking as shared mindset, language, and process. Common to Service Design Thinking processes are a stage of inspiration, ideation, and implementation

(Tschimmel 2012, 5.). The four-step process of the Double Diamond developed by the British Design Council shown in Figure 13 visualizes the alternating divergent and convergent stages of the process.

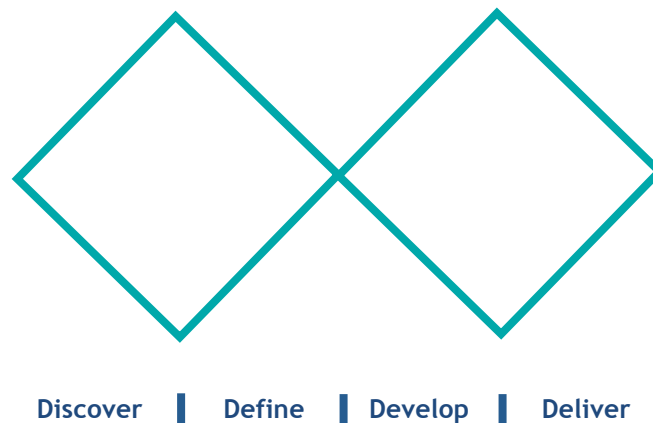


Figure 13. The double diamond design process  
(adapted from RED Design Council 2005).

While traditional service development often starts with service strategy and concept development, Service Design embarks on creating an understanding of both customers and providers as well as contexts and relationships first. In handling wicked problems, understanding the problem itself is more important than the envisioned solution (Martin 2009.). User research is employed to identify problems and user needs and to gather inspiration (Stickdorn & Schneider 2010; RED Design Council 2005; Moritz 2005). After a broad exploration of the problem area, the define phase aims to converge the set of options into a creative brief. Issues are prioritized, and the scope is set according to objectives and allowances. Research data is visualized and analyzed to derive insights (Stickdorn & Schneider 2010; RED Design Council 2005; Moritz 2005).

Once the design challenge is defined, broad idea generation is initiated. Designers apply abductive and integrative thinking. Abductive thinking is “thinking in new and different perspectives and about future possibilities, which do not fit into existing models” (Tschimmel 2012, 3). Instead of choosing from opposing ideas, they create a superior model, which is inspired by existing models (Brown 2009; Martin 2009). In the ideation stage, a broad spectrum of choices is created within a limited timeframe through ideation techniques such as brainstorming, brainwriting, or brainsketching. In this step, judgment is deferred and quantity of ideas is valued over quality. Restricting time stimulates intuitive ideas over rational reflection, and visual thinking stimulates a common understanding even of complex ideas (Tschimmel 2012.). Participants are encouraged to build upon the ideas of others. Often sticky notes are used. They are perfectly sized to capture a single idea that may be moved around or away throughout the process (Brown 2009; Tschimmel 2012).

Only then are the most promising ideas selected. With the mindset that ideas cannot be validated in theory but only through application in a real context, prototypes are used to test ideas early and iterate based on feedback (Brown 2009, 89; Martin 2009). Failure is an essential part of the process. Service Design Thinkers do not seek approbation of their ideas but learning through constructive feedback. In this phase, cost of failure is still low compared to after launch. This allows for testing of several ideas in parallel and further development into a validated solution (Stickdorn & Schneider 2010; RED Design Council 2005; Moritz 2005).

Finally, the winning ideas are finalized and launched. Detailed business plans, processes, and touchpoints are worked out and changes are implemented by providing training or guidelines (Stickdorn & Schneider 2010; RED Design Council 2005; Moritz 2005). Stickdorn, Schneider, Schmid, Schwarzenberger, Hormess & Lawrence (2012, 39) argue that early involvement of stakeholders through co-creation nurtures the acceptance of changes by employees.

Mueller & Thoring (2012.) contrast Design Thinking with Lean Startup. They stress that both share many similarities with differences in terminology. Both propose an iterative process for user-centered innovation. They are distinct in that the Design Thinking process includes ideation while Lean Startup starts from a given idea. In Lean Startup, a unique focus is on the business model. While Design Thinking applies mostly qualitative methods, Lean Startup additionally aims to test hypotheses applying quantitative methods. Consequently, Mueller & Thoring (2012) propose Lean Design Thinking as a model that integrates aspects of both approaches.

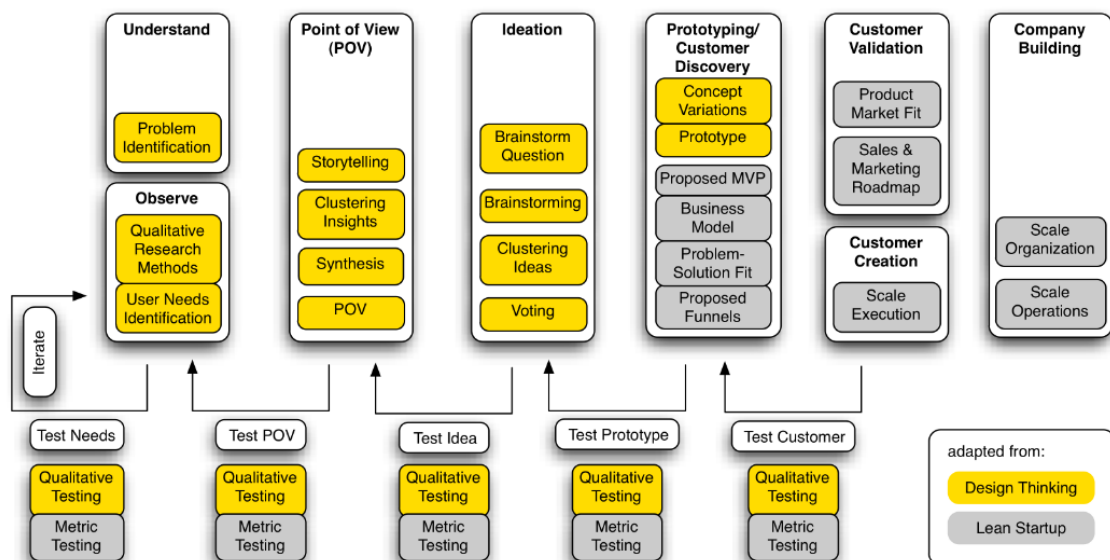


Figure 14. Lean Design Thinking Process Model  
(Mueller & Thoring 2012, 10)

In this model shown in Figure 14, Design Thinking is primarily applied in the beginning of the process to understand the problem and to ideate solutions. Subsequently, envisioned solutions are validated with the Lean Startup approach. Along the process, testing is carried out using both qualitative and quantitative methods. Similarly, Lusch et al. (2008.) stress resourcing as a learning process in which hypotheses can be tested with value-in-exchange as a signal that a value proposition is accepted. Lean Design Thinking integrates strengths of both approaches and maps the complete process from the initial problem over an idea for a solution to a validated business model.

### 4.3 Thesis process

Data-driven business innovation can be seen as a wicked problem for which the current knowledge base provides little guidance. Design Science Research is applied in this thesis as an overall academic framework. The two basic iterative activities in any design science research are the building and evaluating of a “design artifacts.” Following Design Science Research, (i) requirements were elicited to ensure real-world relevance for the developed artifacts, (ii) the iterative development of the artifacts was grounded with the help of Service Design Thinking and (iii) the artifacts were evaluated within a real-world project setting applying mostly qualitative methods.

The artifacts were built and evaluated applying Lean Design Thinking in a mindset of the service logic. Within Design Science Research, processes and methods from Service Design Thinking are a good fit with their iterative nature and their focus on early prototypes as artifacts. Service Design Thinking is particularly useful in the beginning of the process for exploring the problem space and ideation. As visualized in Figure 15, the double diamond is run through for the building of the Data Canvas as an artifact and once again to evaluate the artifact in the ExCELL project.

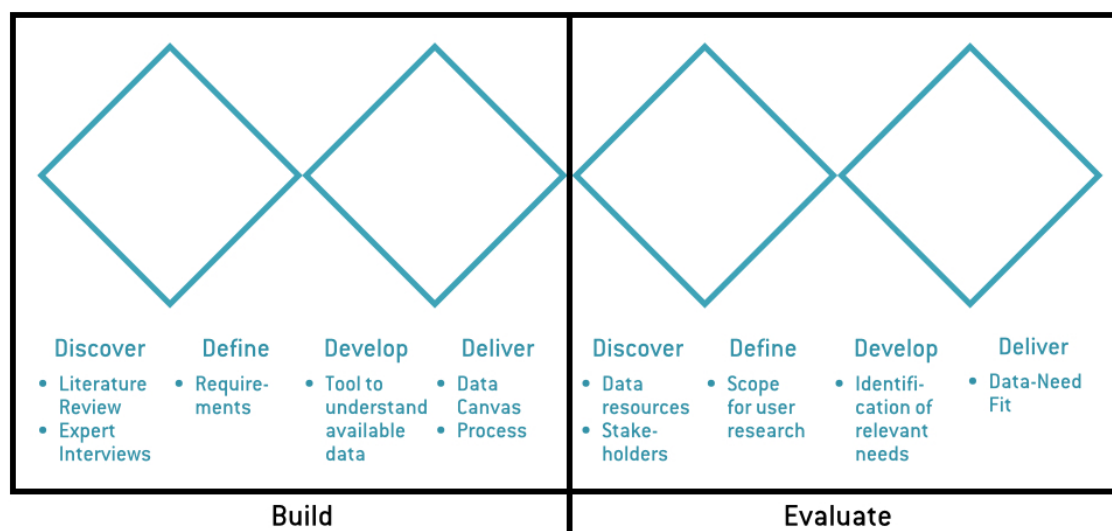


Figure 15. Thesis process

Prior to ideation, the problem space was explored through literature review and expert interviews. Visual thinking and timeboxing were applied in the joint development of the Data Canvas as an artifact. Through a combination of collecting individual ideas and building on the ideas of others, a broad spectrum of choices was created before selecting a concept to be continued with. The artifact was tested and finalized before being applied and evaluated in the case study. In the evaluation phase, the Data Canvas as an artifact helped to explore available data and set the scope for targeted user research. Matching data with user needs served as a starting point for ideas that can subsequently be validated applying Lean Startup.

## 5 Development of Data Canvas

This chapter and the following discuss the empirical part of the thesis: The development and evaluation of a Data Canvas the fit between data and user needs. A process model for this type of challenge was developed in the context of the ExCELL project. Prior to the official start of the project, this laid the groundwork to start their process.

### 5.1 Discover: Existing processes and obstacles

Prior to initiating the field work, the problem space was explored. Because the artifact is aimed to be generally applicable, experts were interviewed and literature was reviewed in order to understand current processes and obstacles beyond the case project.

#### 5.1.1 Barriers to data-driven business model innovation

As long as business models are still sufficiently profitable, there is a prevalent reluctance to leave the comfort zone. Chesbrough (2010) notes that organizations tend to ignore information that is not in line with their 'dominant logic,' which is influenced by their established business models. Managers tend to resist business model experimentation that challenges this status quo.

Practitioners have developed a progress making forces diagram in the context of jobs-to-be-done shown in Figure 16 (Spiek 2012.). The diagram presents the conflicting forces when customers chose a new service.



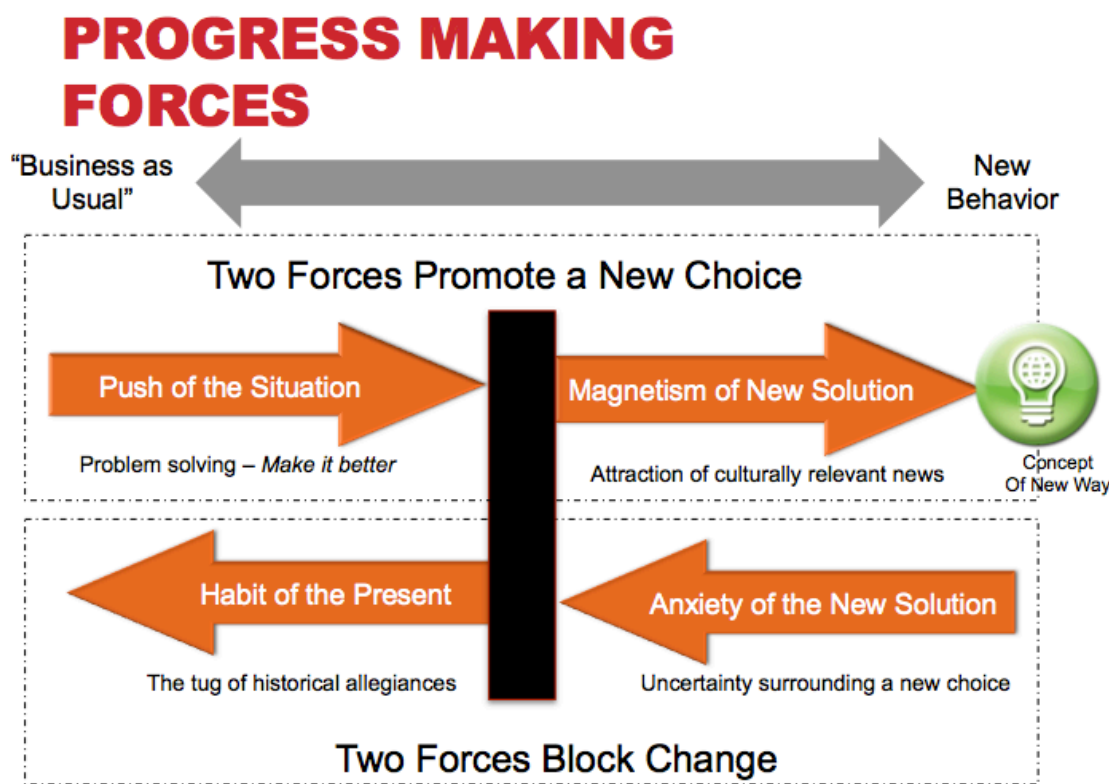


Figure 16. Progress making forces diagram  
(Spiek 2012)

Two forces stimulate change: push and pull. Push is the gradual realization that the current situation is not satisfactory. A new solution creates pull by appealing to the imagination of what could be. On the other hand, two converse forces hinder change: habit and anxiety. Uncertainty of a new solutions creates feelings of anxiety. Habits are comfortable, and emotional energy is involved to change them. The struggle created by these conflicting forces can be seen as fundamental to innovation (Spiek 2012). In terms of business models, the forces diagram suggests that companies are likely to take the risk of changing their established models only when the push in terms of declining profits becomes stronger than the habit of present business models. In terms of new solutions, an established process for business model innovation reduces uncertainty and reinforces magnetism.

In terms of data-driven business model innovation, a major difficulty is that companies are only slowly becoming aware of the value of their data (BITKOM 2015; Immonen et al. 2014). Other central problems are silo thinking and unclear responsibilities. Introducing new business models needs to be headed by a person with the necessary authority, as it requires interaction between several divisions (Chesbrough 2010). It is not commonly agreed on which role is responsible for business model innovation (Chesbrough 2010).

Once new business models are envisioned, organizations are faced with the question of how to integrate those with existing business models. “It takes courage and determination to leave an existing and well-known business model in favor of a new and unproven model” (Van’t Spijker 2014, pos. 1503). When new business models are run along with established ones, the question of allocation of resources arises (Chesbrough 2010). Bettencourt et al. argue that a service lens is able to remove the “mental barriers that misdirect resource allocation towards protecting and enhancing what the firm already makes when new service offerings would be better” (2014, 52).

For managing multiple business models, Osterwalder & Pigneur (2010.) discuss the opportunities for integration, autonomy, and separation. When the nine building blocks are similar and potential for conflicts is low, the strategy depends on their potential for synergies. Osterwalder & Pigneur suggest integrating business models when potential for synergies is high and opting for autonomy when potential for synergies is lower. Similarly, BITKOM (2015.) advises integrating business models when they amplify existing products and services. When conflict between business models is high due to large differences in the building blocks, it can be better to run them separately. A spin-off also makes sense if a business model is able to sustain itself. A later re-integration of a separate business model can be an option.

#### 5.1.2 Business model innovation in service systems

As a barrier, the lack of a business ecosystem could also be identified (Immonen et al. 2014). BITKOM (2015.) distinguishes among three types of partners in data-driven business models. Data partners provide additional data as a resource. Technology and know how partners provide resources for example in the form of infrastructure and tools. Partners for access to customers facilitate access to certain customer segments.

Otto & Aier (2013.) have found the constellation between actors as the greatest discriminating factor among business models. In their case study research in the field of business partner data, they have identified three patterns for value constellations presented in Figure 17.

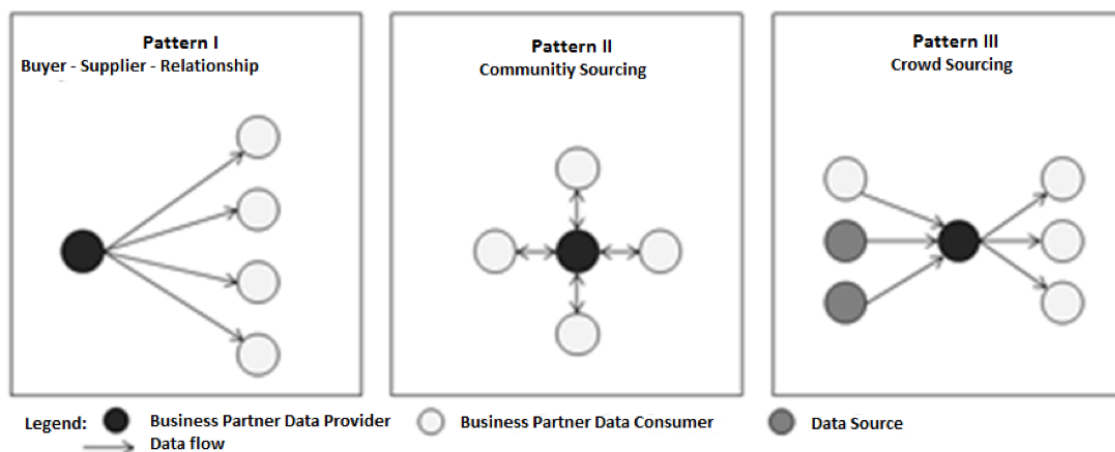


Figure 17. Actor relationships  
(Otto & Aier 2013, 483)

In the first pattern, data providers and data consumers are discrete roles. The flow of data and money is unidirectional. In the second pattern, *Community Sourcing*, data consumers supply data in return, which affects the amount of money that they pay. Van't Spijker (2014.) claims that the reciprocity of new data generated by consumers strengthens a business model by continuously adding more unique data to resources. In the third pattern, data is crowdsourced both from data providers as well as data consumers. This pattern is more critical in terms of data quality (Otto & Aier 2013).

In terms of business models, each actor in a system has his or her own business model (Immonen et al. 2014). The Business Model Canvas is a useful tool for representing and analyzing the business model of a single firm; however, it lacks the holistic view of how business models of individual actors in a service ecosystem are connected to each other (Zolnowski & Böhmman 2013). Van't Spijker (2014) makes an attempt to illustrate intertwined business models as shown in Figure 18.

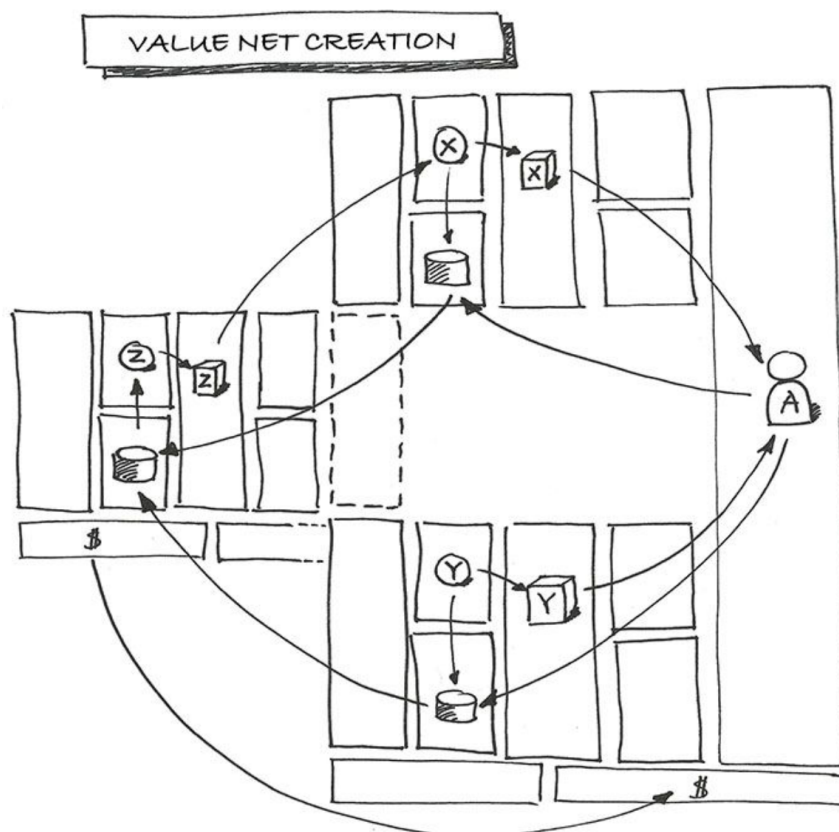


Figure 18. Multi-actor business model representation  
(Van't Spijker 2014, pos. 1420)

Companies that serve the same customers, either along the same value chain or independently, can benefit from exchanging data to optimize their processes. However, this visualization may quickly become confusing with a growing number of partners and connections.

### 5.1.3 Data-driven business models

Data-driven business models have to date received scant attention. Most publications examine examples rather than providing generally applicable patterns. For example, Muhtaroglu, Demir, Obali & Girgin (2013) explore business models of Big Data applications in exemplary location based services, medical services, and retail services.

Hartmann et al. analyzed publicly available qualitative data on 100 random start-up companies. Through coding and clustering the identified six common business model types shown in Figure 19:

- “Type A: ‘Free data collector and aggregator’
- Type B: ‘Analytics-as-a- service’
- Type C: ‘Data generation and analysis’
- Type D: ‘Free data knowledge discovery’
- Type E: ‘Data-aggregation-as-a-service’

- **Type F: ‘Multi-source data mash-up and analysis’** (2014, 19).

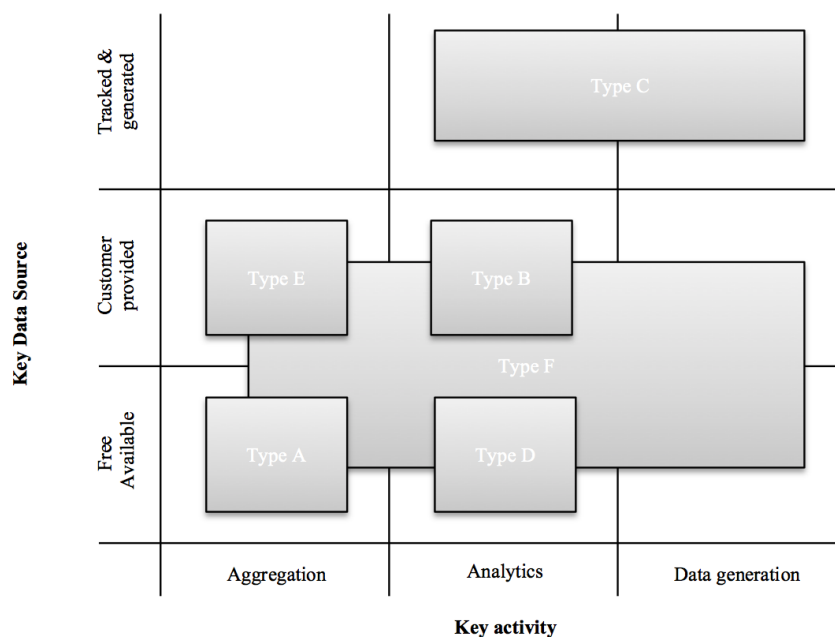


Figure 19. Data-driven business model types  
(Hartmann et al. 2014, 19)

However, these business model types focus on data resources and activities and do not take into account other dimensions of business models.

Hartmann et al. (2004) and BITKOM (2015) present a morphology or framework of data-based business models in which they list possible characteristics of Big Data business models. Both differentiate between data, information or knowledge, and products or services as value proposition. The morphology presented by BITKOM (2015) further lacks a user perspective with a clear focus on value created for the company rather than for end users.

BITKOM (2013) categorizes business models using data into four groups. The categories in Table 1 suggest that existing data can merely be used for optimization of existing business and additional revenue streams. True business model innovation is only possible when existing data is combined with new data. Therefore, it is an important step in the process to consider additional data sources and partners who are able to provide data.

<b>New business</b>	Monetization	Breakthrough
<b>Existing business</b>	Optimization	Revaluation
	<b>Existing data</b>	<b>New data</b>

Table 1. Four categories of business models using data  
(Translated from BITKOM 2013)

For monetization, Van't Spijker (2014.) presents five patterns for value creation based on data. In the most basic form, data produced through core processes in the organization is sold to third parties. This turns otherwise unused data into a source of revenue for the company. In return, it requires considerations around data quality, continuity, and interference with other processes. Product innovation describes the approach to create additional products that draw on usage data of the core product or service. Similar to product innovation is the third pattern of commodity swap. In that pattern, usage data from a commodity product is used to create a new offering. In contrast to the former pattern, this new product is inseparably connected to the commodity offering and serves as a differentiating factor. While patterns one to three focus on a single organization, patterns four and five take the service system into account. In the pattern value chain integration data is shared with partners in the same value chain in order to realize cost savings for both parties. When companies are not part of the same value chain but nevertheless serve the same customer, they can use data for value net creation. In that pattern, multiple organizations exchange data to optimize offerings and processes. Data comes both from core processes of the companies involved as well as from usage of the customers. These patterns relate mostly to monetization and optimization in Table 1 respectively revaluation through the combination of partner data. With a focus on leveraging existing operational data, they do not account for breakthrough innovation that can be accomplished through the combination with other types of data.

#### 5.1.4 Data-driven business model tools

Outside of academics, different approaches related to data-driven business model innovation could be found. Service Design agency Redfront (2014.) proposes a design tool called Data Loop.

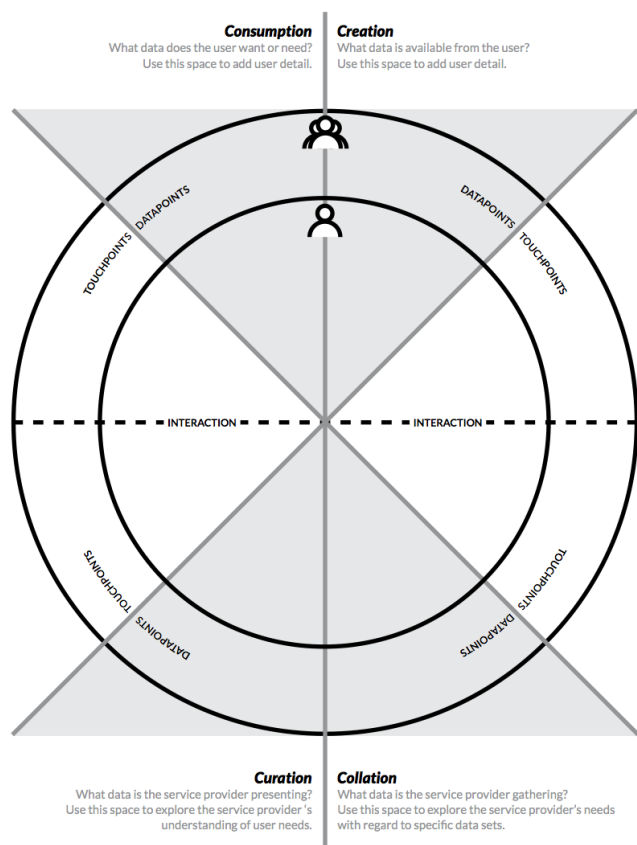


Figure 20. Data Loop design tool  
(Redfront 2014)

The tool shown in Figure 20 is divided into four stakeholder segments. Like in a service blueprint that maps customer processes against business processes (Bitner, Ostrom & Morgan 2008), a line of interaction divides the user perspective at the top from the provider perspective at the bottom. The user perspective addresses data consumed and created by customers, whereas the provider perspective addresses data curated and collated by providers. Each segment is further divided into touchpoints and datapoints—that is occasions in the service process in which data is involved. The outer circle is designated to aggregate data while the inner circle represents data from a single person. Different colored markers or sticky notes are recommended for different data sets. On the outside of the circle, context such as partnerships for additional data, potential barriers, and security issues can be specified. Redfront suggests that by starting at the bottom of the canvas, potential uses for existing data can be explored.

French Data Business Designer Nicolas Terpolilli and Data Transition Designer Jean-Baptiste Trichot have adapted the Business Model Canvas for Open Data from a data provider perspective shown in Figure 21.

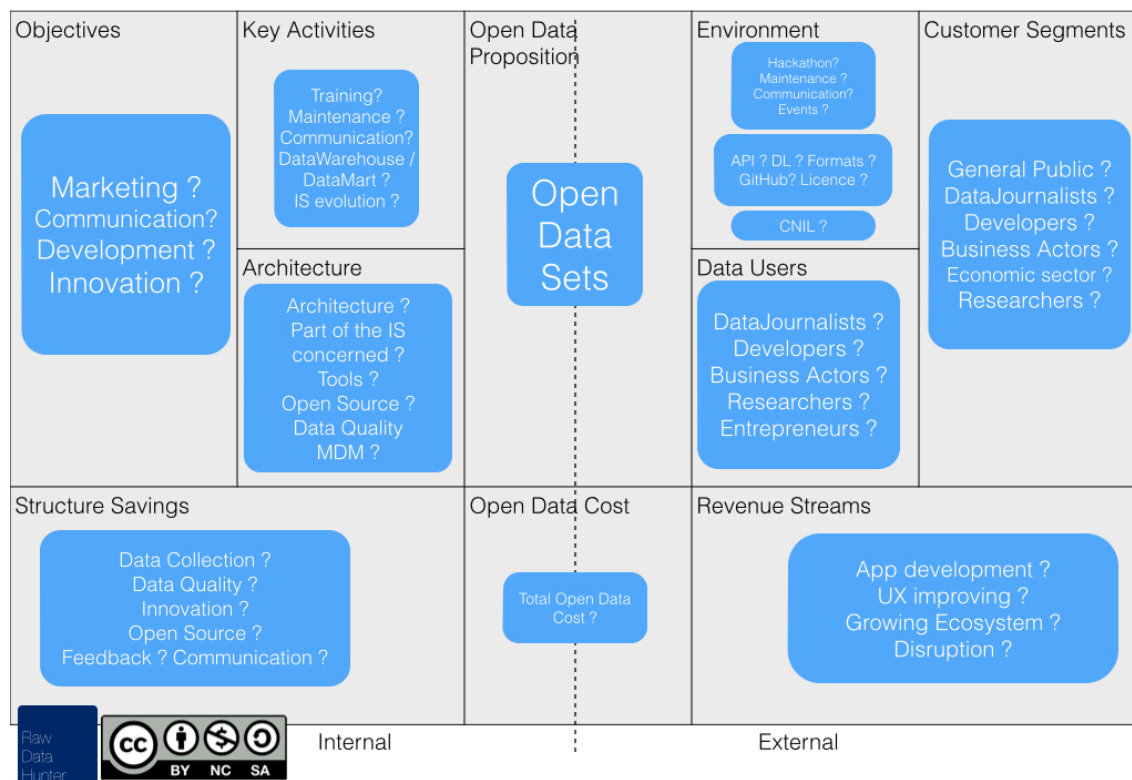


Figure 21. Open Data Canvas  
 (Terpolilli & Trichot 2014)

Terpolilli and Trichot (2014.) view open data as interface between an organization and its environment. Data users are the ones who bring value to end customers, thus they take over the role of the channel. It is crucial to create an environment that enables them to create value with open data. Interestingly, they distinguish between open data cost and structure savings. The ability to collect additional data or to improve data quality is an advantage for companies. Return of investment (ROI) is positive when structure savings and revenue streams are greater than open data cost.

#### 5.1.5 Data-driven business model innovation

There is no common starting point for business model innovation. Osterwalder & Pigneur (2010.) stress that innovation can come from any nine of the building blocks. They distinguish among four epicenters of business model innovation. Typically, Service Design Thinking applies customer-driven innovation building on customer needs. In resource-driven innovation, resources and partners are the drivers of change. Offer-driven innovation starts with ideas for



a value proposition. Finance-driven innovations focus on revenues and costs. Innovation can also be driven by multiple of those epicenters.

According to Zolnowski and Böhmman, business models are created “based on a free creative process” (2011, 5). Without a clearly defined process, they list two approaches that help in the process. Most often, business model innovation is supported with the help of a questionnaire that guides through a discussion of relevant dimensions. The second, less common approach is the use of a graphical structure.

For business model experimentation, “the pursuit of growth through the methodical examination of alternative business models” (Sinfield et al. 2012, 85), a template or map is helpful. Chesbrough (2010) stresses that mapping tools allow experimentation with different combinations of elements. As the final model cannot be envisioned in the beginning, it can only be developed through experimentation. In addition, they provide a good overview of potential changes in business models. As they help to assess implications, they reduce uncertainty.

The Business Model Canvas is one such mapping tool that has become widely adopted in businesses. Its advantages are assumed to be its simplicity and guidance. Its visual representation is easy to understand and thus provides a common language for inter-departmental collaboration (Zolnowski & Böhmman 2013). However, the tool can be applied to different levels such as a whole company, a division, or a single offering, which may lead to misunderstandings (Zolnowski & Böhmman 2013). As explained above, there are different starting points. A clear vision is required for at least one of the building blocks in order to explore possible variations.

#### 5.1.6 Expert interviews

In addition to the literature review, several experts were interviewed. Interviews are useful to uncover insights that cannot be found through secondary research. They are especially effective in revealing goals and attitudes of people. Listening to first-hand experiences fosters empathy (Eriksson & Kovalainen 2008; Stickdorn & Schneider 2010; Portigal 2013). The objective of the interviews was to find out about current processes and methods as well as triggers and obstacles in those processes.

The interviews were carried out as semi-structured interviews. Such interviews follow a pre-planned outline that does not need to be followed rigorously. Researchers are free to vary in wording and sequence and to explore topics in more depth that come up during the conversation (Eriksson & Kovalainen 2008.). Compared to structured interviews, results become harder to compare. On the other hand, interviewees may feel more at ease in such a more informal conversation. In qualitative interviews, depth is more important than sample size (Portigal

2013). With typically small sample sizes, these interviews do not produce statistically significant results but rather create in-depth insights.

The goal was to recruit four to six business people who have used or have considered using Big Data to refine or innovate business models. For recruiting of interview partners, potential multipliers such as individuals at Siemens Management Consulting, Deutsche Telekom, Open Knowledge Foundation, and the Special Interest Group Big Data at Baden-Württemberg: Connected/bwcon were reached out to. Their consistent feedback was that the research sounds very intriguing and that it is definitely something they need to start thinking about. However, most were not able to connect to someone with experience in that field. According to Portigal (2013), this feedback can be seen as data. It can be interpreted that the topic is relevant but still rather novel.

Because of the small number of experts on the topic who are located in diverse geographical areas, interviews had to be conducted over the phone. A total of three interviews were carried out in the time between 16 January and 19 February 2015. Each interview lasted between 30 and 45 minutes. Interview questions were inspired by the jobs-to-be-done framework. They intended to reveal thoughts and experiences along the decision journey (Bettencourt & Ulwick 2008.; Christensen et al. 2007).

The first interviewee started his company around three years ago from an idea he had developed throughout his doctoral studies. Data is at the core of their business model. At first, he planned to develop software but soon realized that he had to dismiss his initial idea. For a second business idea, he applied a more structured approach but identified a lack of channels and willingness to pay. He then turned towards a third idea and applied a more user-centered approach with early prototypes and continuous user feedback. They apply Lean Startup as a structured approach that forces them to tackle uncomfortable questions. He values the tool mostly as a checklist of which questions to ask as a founder and how to handle them. At the moment, their service uses self-generated data only. They have looked into integrating other sources but found it difficult to gain access to valuable data as a startup. Therefore, they have decided to build up their own data first so that they will have something to offer in return.

A second interviewee whose company develops software for clients largely views Big Data from a technological perspective. His company develops software according to client requirements and does not consider business aspects. In his opinion, volume is only an issue in large corporations and not so much in small and medium-sized businesses yet. So far, he sees variety and velocity as the biggest challenge for these clients but expects data volumes to grow with rising significance of sensors. Big Data is relevant for their own business develop-

ment. New technologies enable them to develop faster, which becomes a competitive advantage over bigger competitors. Their process for Big Data projects does not differ from other projects.

The third company also started with application development for clients five to six years ago. However, from October 2013 they have reinvented their business model and have adopted a data-based approach in order to develop their own products. They combine Design Thinking as an approach for idea generation and Lean Startup methodologies for validation. Only when a simple landing page for an idea gains traction do they start developing an application. According to them, this approach works well. Clients like to be listened to, and with more than 80 ideas already tested, they know from their experience which ideas to pursue based on metrics. The downside to relying on data are that odd ideas may prevail and some promising ideas may be rejected too early. Even though they continuously test their ideas, realization of whether cash flow is positive comes rather late in the process.

Even though requirements for interview partners had to be loosened due to the novelty of the topic, interviews illuminated the use of Big Data in companies from different perspectives and revealed helpful insights. Certainly, all three interview partners are extreme users. As young founders or members of staff, working in small teams, they have the agility to experiment with new approaches. In all three cases, data has had a profound impact on their business models. The second example shows that companies need to be able to bring in their own resources in order to gain access to relevant data to integrate with. Therefore, especially for startups, data accessibility therefor is crucial in data-driven business model innovation. Two participants use Lean Startup as a process. The structured, question-led approach helps them to consider all relevant questions. They have an early focus on user validation and use data to validate their business ideas quantitatively. The interviews have shown that companies either view Big Data from a technological perspective or use it in business-driven approaches. However, there seems to be little interaction between both perspectives.

**5.2 Define: Requirements for a process model for data-driven business model innovation**  
Expert interviews and the literature review clarified the requirements for a process model for data-driven business model innovation. Established processes for business model innovation such as Lean Startup serve as guidelines and reduce anxiety for founders. That no such process exists for data-driven business model innovation can be seen as a potential hurdle to explore the potential of data for novel business models.

For the systematic development of new business models leveraging data as a resource, ideation is an important part of the process. For this type of challenge, Effectuation is well suited for a start for two reasons. First, the effect of innovation is not always apparent in the begin-

ning. Effectuation allows organizations to experiment with different effects than can be created with their given sets of means, especially in form of data and partnerships. Openness towards a variety of outcomes might create opportunities that were not within imagination. Second, data is a typical operand resource that becomes valuable only in combination with knowledge and skills. With data as a relatively new epicenter of business model innovation, organizations are unable to exploit existing knowledge. Instead, they need to create knowledge themselves by taking experimental action (Chesbrough 2010) and exploiting contingencies.

Bettencourt et al. (2014) argue that possible effects can only be evaluated once given means are sufficiently understood. In the Business Model Canvas, given means are mapped in building blocks key resources and key partners in the left-hand side of the canvas. Only then are companies able to identify customer segments that, on the one hand, have jobs-to-be-done that could be supported by a firm's resources. Customer segments need to be chosen by their willingness and ability to co-create (Bettencourt et al. 2014). Users to the right-hand side of the canvas are another central component of data-driven business models, because in the service logic they drive value creation. As such, data-driven business model innovation can be seen as multiple-epicenter driven combining a resource-driven with a customer-driven approach visualized in Figure 22.

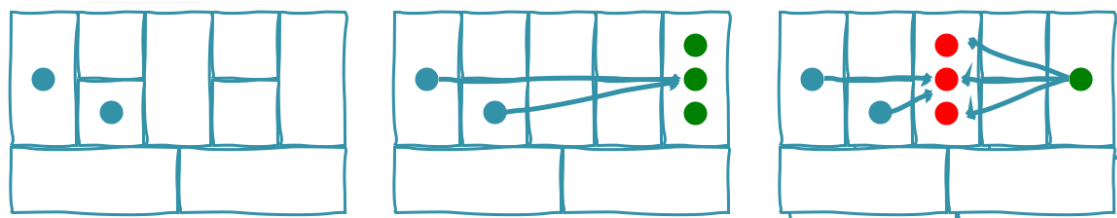


Figure 22. Epicenters of data-driven business model innovation in the Business Model Canvas

The major difficulty for data-driven business models is understanding what data and partners are available and identifying relevant customer needs. Thus, the core question for data-driven business model innovation boils down to identifying a fit between data and needs. Partners can be analyzed, for example, with stakeholder maps, and user research can be summarized, for example, in personas, customer profiles, or jobs statements. However, a lack of an established tool to understand data sources could be identified. While there is no dedicated process for business model innovation, a questionnaire most often guides through a discussion of relevant dimensions. A prototype of a tool that similar to the Value Proposition Canvas can be used in conjunction with the Business Model Canvas was developed in the next step. With trigger questions and a visual representation, this Data Canvas serves to explore data as one aspect of the business model.

### 5.3 Develop: Data Canvas prototype

Due to the lack of a structured approach for the understanding of data sources, a workshop was planned prior to a sighting of available data within the ExCELL project. The goal of the workshop was to co-design a prototype of a compact visualization of data sources in order to subsequently explore their potential for innovative value propositions.

A 2,5-hour workshop was held at the premises of FELD M in Munich on 10 February 2015. Participants were two experienced data analysts from FELD M with backgrounds in information technology and statistics and two doctoral candidates at TUM Graduate School who have business backgrounds and are involved in the ExCELL project. For half an hour, participants introduced themselves and the author introduced her work. The author took part in the workshop herself to introduce prior considerations on an equal level with other contributions.

#### 5.3.1 Description of data sources

The first question participants dealt with was, “How might we describe data sources in order to explore their potential for new products and services despite Big Data does not have a common structure?” For ten minutes, participants engaged in a Post-Up (Gray, Brown & Macanuso 2011). Silently, they put down their thoughts on single sticky notes and posted them to the wall. This guaranteed that every participant had his or her share of thoughts communicated, and visibility of ideas sparked new thoughts (Gray et al. 2011.). During half an hour, attributes were then collectively grouped into clusters and further thoughts were added as they arose in the discussion. As shown in Figure 23, this resulted in the seven clusters volume, temporal behavior, structure, reliability, privacy, availability, and origin.



Figure 23. Ideation results on description of data sources.

Interestingly, clusters partly overlap with the three dimensions of Big Data as introduced in chapter 2.1. Data volume was seen as an own cluster. Velocity formed a cluster labeled ‘temporal behavior,’ which included aspects such as frequency of data, actuality, and obsolescence as well as seasonality both in frequency and values. An important distinction in terms of time is between a static data batch, a timeline, or a continuous stream of data. As a static batch, data is distributed once, in a timeline data is distributed in regular intervals, and as a continuous stream, data is distributed steadily.

The dimension variety was represented through the cluster structure. Data can be quantitative or qualitative and structured or unstructured with different data types such as numbers or text. Possible values can range from very few (e.g. five possible values with a five-star rating) to a very large amount of values (e.g. with free text). Another aspect is whether data is flat or hierarchically nested.

In addition to these three dimensions, further relevant clusters were identified. Reliability was seen as a central aspect. Even with machine-generated data, a certain deviation needs to be taken into account. It is further important to understand who authors the data. While, for example, open government data can be seen as a reliable source, ungoverned social media posts are highly subjective and may not always reflect the truth. As a central limitation, data

privacy was seen as an own cluster. One issue is whether data is personal or anonymized. Data may also be legal to use only when processed and not as raw data. Participants agreed that not only legal but ethical aspects as well are relevant for this cluster. Use of data may be legal but still not ethically correct or consistent with corporate values.

For business models, availability of data is an important prerequisite. Participants agreed that non-available data can be left out of the visualization, as it cannot be used as basis for business model innovation. An important distinction should be made between internal and external data. While internal data is permanently in full control of a provider, limitations by external data providers may put a business model to risk. Availability of external data includes aspects such as its license model, whether data is free or costs money, available formats and interfaces, and whether usage caps apply.

### 5.3.2 Visualization of data sources

In a second step, participants were then asked the question, “How might we visualize that description of (big) data sources in a compact form in order to be able to develop and share this description even with people without deeper technological skills?” Participants were challenged to quickly sketch three rough conceptions on a piece of paper. After three minutes, the papers were passed to the next person, who then had the task to build upon the ideas and further refine them. This procedure was repeated until each participant had worked on every paper once. This brainwriting approach ensured that all team members contributed equally. Ideas were further developed before judged by others, and a feeling of joint authorship was created (Gray et al. 2011.). 75 rough ideas shown in Figure 24 were finally presented on the wall.

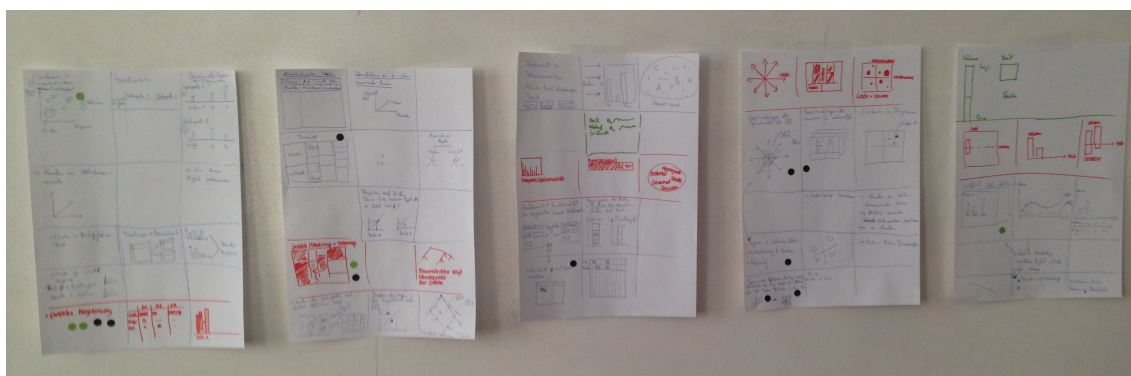


Figure 24. Results of the ideation for a compact visualization of (big) data sources.

Each participant was given three dots to freely vote for their favorite approach. The three ideas receiving the most votes were:

1. Matrix visualization
2. Treemap visualization of each data source

### 3. Spiderweb visualization

As winning approach, the matrix visualization was further refined during forty minutes. For each cluster, ideas for visual representation were collected. The two axes would be reserved for the two most important clusters or respectively the two clusters that differentiate data sources the most. Structure and reliability were favored to be displayed on axes during most of the discussion. Data sources could be positioned in the rectangular space formed by the two axes depending on their significance of the dimensions. In favor of a correct placement on the axes, clusters would need to be quantifiable.

Each data source could be represented by a circle with its size indicating volume. Data sources would be labeled either inside or outside of the circles to distinguish different sources from each other. Dotted outlines could further indicate restrictions in terms of data privacy and availability. Coloring could be used, for example, with green for trusted sources and red for ungoverned data sources. Lines could be drawn around similar sources such as data from different social media channels for a grouping of sources. For a greater level of detail within clusters, added marks could be used inside or on the border of the circles. For example, a legal icon could stand for legal restrictions, a single user or a group of users could represent single or aggregated data, or a euro sign could label data sources with costs. Depth could be added to distinguish flat from nested data sources.

In this process, it became clear that it would be difficult to visualize all seven clusters with all of their aspects in one single diagram. Too many details would risk clarity of the visualization and make it hard to interpret. One approach to this issue could be to split the visualization into two or more representations. However, it would then no longer serve as a complete overview. A digital interactive representation could help to visualize more dimensions through a three-dimensional space and movements. While this can be an appealing addition, an interactive representation is not as accessible and cannot easily be co-created in a workshop. Alternatively, a prioritization was discussed.

One realization was that for business model innovation, availability and reliability are most important as a starting point. At this point of the process, it can be assumed that data can be analyzed independent of its volume and variety. These aspects become relevant in a second step when modeling the other building blocks of the Business Model Canvas because they influence effort, IT and human resources, and thus, costs. In a next step, compatibility between data sources also needs to be analyzed. Through combination of data sources, legal and ethical problems may arise that can hardly be anticipated when analyzing data sources separately. Thus, a data privacy audit needs to be an ongoing activity throughout the process.



### 5.3.3 Workshop summary and conclusions

The workshop clarified which characteristics of data sources need to be taken into account for business model innovation and proposed a rough visual representation of the most important dimensions. Before they left, participants were asked to leave their feedback to the approach. A four-field matrix on a flipchart was used for this purpose:

What I like most	What I do not understand yet or would like to know
What I like least	Further ideas

Table 2. Feedback matrix.

Participants noted that they liked most the ability to structure complex data. They valued that many dimensions are integrated, which enables a complete overview as basis for decision-making. On the other hand, criticism addressed that seven dimensions may be too many to display in one diagram. One issue that remained unsolved was that dimensions can be subjective and metrics need to be defined. Participants also questioned the applicability of the approach to derive business models from this kind of visualization. In order to improve the visualization, ideas were to prioritize the dimensions or to alternatively test the spiderweb visualization. Two participants again suggested an interactive visualization that was discussed in the workshop.

Even though no complete prototype could be developed in the time set, the workshop resulted in a variety of ideas that could hardly have been created by one person alone. The mix of technology-oriented with more business-oriented participants proved to be valuable. A designer would have been of avail for an improved visual representation. The participation as an author can be seen as ambivalent. On one hand it was difficult not to leave too big of a mark on the group work, but on the other hand, several aspects could be added due to prior considerations and the exploration of related work. As these issues were not brought up by other participants spontaneously, the result would have been less complete without these contributions.

#### 5.3.4 Finalization of prototype

Based on the results of the workshop, different visualization options were experimented with. Even though business models can likewise be highly complex, Osterwalder & Pigneur (2010) succeeded in reducing their complexity to be displayed on a single page. The strength responsible for the large success of the Business Model Canvas is that it is a visual tool that is simple and intuitive to use. Therefore, a visual representation on a single page was preferred over a separate diagram for each data source or dimension. The target use of the visualization is to explore potential of data for new business models and to spark a group discussion. From this perspective, it can be argued that it needs to be simple to create in a workshop setting and that accuracy with clearly defined metrics is negligible in this step of the process.

According to Few (2013), spiderweb or radar graphs are closely related to bar graphs but are less effective. A spiderweb graph is usually composed of a number of quantitative scales. In this case, however, most dimensions are nominal rather than interval scales. For this reason, it was decided to continue with the matrix visualization as it fulfills these criteria most efficiently.

In the workshop, permanent availability was seen as most crucial element for the basic feasibility of business models. Hartmann et al. (2014) similarly draw a basic distinction between internal and external data in their taxonomy of data sources shown in Figure 1. Thus, control over data was chosen as one axis. For the other axis, two dimensions were considered that largely influence business model innovation. One possibility would be to distinguish between structured and unstructured data on the second axis. Unstructured data commonly is more laborious to analyze. While this effort may be worthwhile for internal data sources, investing high effort into unstructured external data involves a high risk, as there is no guarantee for continued use of that data. A second option for the second axis is temporal behavior. While the distinction between structured and unstructured data is commonly made with Big Data, especially in relation to technological issues, this takes a different perspective that might be even more beneficial for the purpose of business model innovation. For Hui (2014), recurring revenues are the path to profit in business models that involve data from the internet of things. With static batches of data that are rarely updated, recurring revenues are much harder to generate than with continuous streams of data. During the workshop, it was discussed that for business model innovation it can at this step be assumed that data can somehow be analyzed no matter its volume and structure. Therefore, it was decided to continue with the temporal behavior on the second axis as potential for recurring revenues.

In order to allow for a more detailed distinction on the axes, a third matrix was considered as shown in Figure 25. Vargo & Lusch (2011) distinguish between private sources in internal control, market-facing sources controlled by partners, and public sources with communal access.

In a trusted partnership, the level of control over partner data is presumably higher than with other third party data sources. Data as a timeline lies between a static batch and a continuous stream of data. Potential for recurring revenues are higher with data as a timeline compared to a batch but lower compared to a stream of data. Depending on the context, the second or third variation shown in Figure 25 may be most effective.

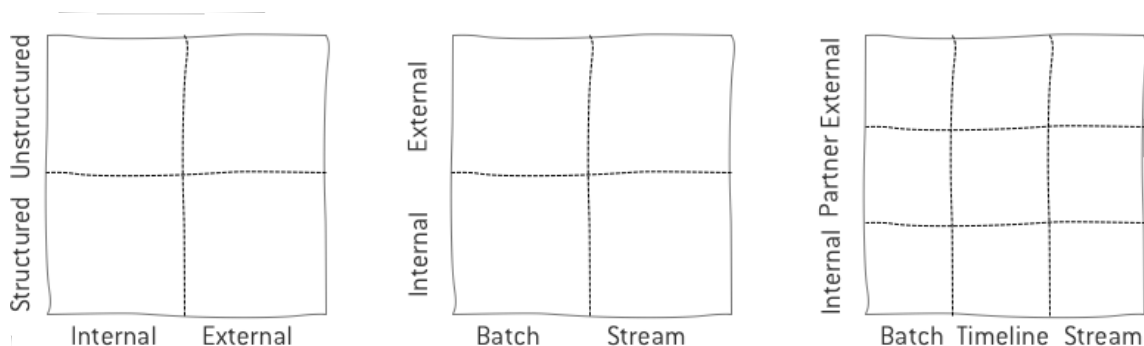


Figure 25. Three variations of the matrix visualization.

In the beginning, the use of different bubble sizes to represent data volume was considered. Different shapes could also be used for further distinction, for example, with rectangles for structured data and circles for unstructured data. However, the use of sticky notes is common in ideation processes such as for the Business Model Canvas. Using sticky notes is integrative, as it is easier to create especially for participants who are uncomfortable with drawing. Data volume is dispensable in favor of ease of use as data streams will presumably point to higher volumes compared to data batches. Different colored sticky notes could indicate reliability of data both in terms of content and accuracy. Sticky notes in different shapes are relatively rare but could be valuable to use when available.

Subsequent to the workshop, it was realized that one important piece is missing. A label was designated for the name of the data source, but no further information was given with regards to content. This could be briefly recorded under the label as either a topic such as mobility or in more detail such as traffic count and velocity of traffic. One idea is to use a 'hashtag,' as it is commonly used with social media platforms such as Twitter to mark topics of tweets. As discussed in the workshop, marks could be added for greater level of detail within clusters. They could be added to the sticky notes as a small note, a hand-drawn icon, or as pre-produced stickers; However, the set of marks should be limited in order not to confuse participants. Another possibility is presenting participants with a larger set of marks to choose from or allowing participants to use their own marks for individual characteristics. A challenge is identifying relevant data sources, so trigger questions were developed to guide through that first step.

### 5.3.5 First test and refinement of prototype during Open Data Hackathon Freiburg

Prior to a data sighting workshop within the ExCELL project, the prototype was tested during the Open Data Hackathon in Freiburg on 14 and 15 March 2015. The idea was shortly presented on the beginning of the first day. Two participants decided to join the team. They were shortly introduced to the findings of the exploration phase and the status of the prototype.

In a first step, the Data Canvas with filled with data sources available to Open Data Hackathon participants in Freiburg as shown in Figure 26. Because of the wide perspective from the general point of view of participants, partners differ from group to group. Therefore, the 2 x 2 matrix visualization was used at this occasion. The Data Canvas was drawn on a piece of flipchart paper. Because only one shape and color of sticky notes was available to use, structured data was not further distinguished from unstructured data. For unverified data, coloring was used in the added marks. A legend for the added marks was shown at the right hand side of the canvas.

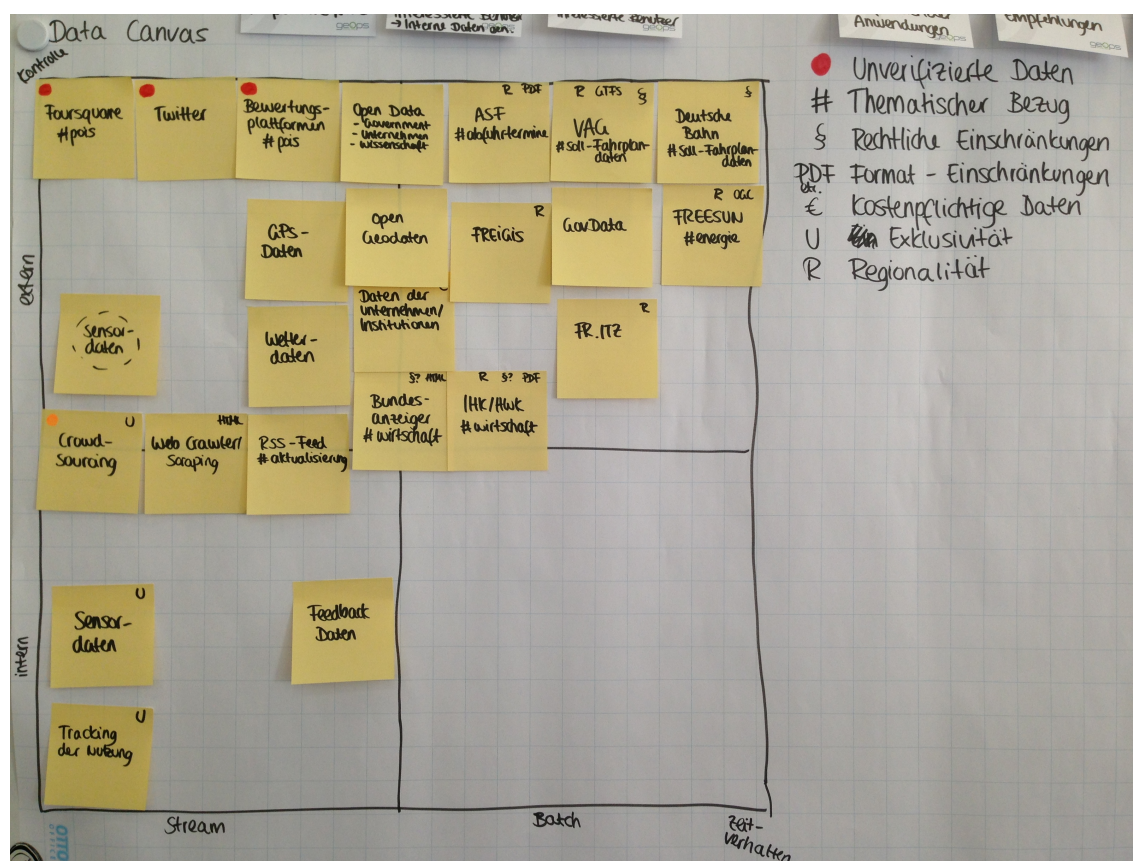


Figure 26. Data Canvas at Open Data Hackathon Freiburg.

It was decided to first look at the data at a high level. For example, the city of Freiburg provides around 800 data sets to the public in their online data service FR.ITZ. This data is batch data with most of it updated on a yearly basis. For this reason, FR.ITZ was viewed as one data source containing data on a variety of topics.

On this level of detail, many data sources were placed on the axes. Data acquired from other companies for example could be both stream or batch data. Another possibility would be to split those data sources into one for external stream data and one for external batch data. On the other axis, a few data sources were identified as both internal and external. For example, data is made internal through the process of scraping. However, it remains mostly external, as it is available to anyone to use and can be taken off at any time. Crowdsourcing also generates internal data but is dependent on the contribution of externals. Equally, internal data is created through combination of external data with internal data.

Subsequent to filling the Data Canvas, it was discussed how the canvas could be analyzed and which strategies could be applied for data-driven business model innovation. In the team, it was agreed that internal stream data has the highest potential for profitable business models. Providers are in full control of internal data and stream data allows for recurring revenues. In contrast, external batch data has the lowest potential for business models. This data alone can only be monetized at regular intervals. Competitors equally have access to the same data.

For the combination of data sources, further increments were discussed. A combination of unique internal stream data with any data sources in other quadrants was identified as highest potential. The second highest potential was attributed to a combination of external stream data with internal or external batch data. A weak point in this combination is the dependency on a third party for this more valuable data. A combination of internal with external batch data was attributed the second lowest potential. In that case, the market for this kind of insights would need to be large enough in order to generate sufficient revenue on a rotational basis. The lowest potential was seen in a combination of purely external batch data. With batch data, recurring revenues can hardly be generated and the business is constantly at risk to be copied by competitors.

Most data sources available to hackathon participants are external batch data. To a lesser extent, external stream data such as GPS or weather data is available to use. Three different strategies were discussed. First, providers could opt for exclusiveness building upon the high value of internal stream data. However, if no internal stream data is available yet, gathering this kind of data will most likely take a considerable upfront investment. A second viable strategy is to opt for time-to-market instead. Drawing upon external stream and batch data, new products and services can quickly be launched. Providers are able to gain a lead, but as external data is available to anyone to use, they are always at risk to be overtaken by competitors. For long-term survival, these providers would surely benefit from building their own data with the generated funds. As a third strategy, scalability was discussed. Building applica-

tions on data that is only available regionally limits the scope of the application. Rather than looking at data available at a certain location, a better starting point would be data that is available in many other cities countrywide or even worldwide. For this reason, regionality was introduced as added mark.

Naming of axes led to some confusion. Participants commented that ‘control’ is a strong word. Different naming such as ‘primary’ and ‘secondary’ was discussed. It was agreed on that ‘origin’ is better than ‘control’. One developer mentioned that stream data is often technologically processed as batch. To address this issue it was decided to use ‘rotational’ and ‘continuous’ rather than ‘stream’ and ‘batch.’

Many discussions in the working group and beyond helped to further develop the Data Canvas prototype. The discussion on the relative value of data sources alone and in combination helped to clarify how the Data Canvas can be analyzed. Strategies derived from this discussion provide a starting point for the next steps. Some suggestions such as a clearer naming of the axes and regionality as an added mark led to an iteration of the canvas itself.

#### 5.4 Deliver: Data Canvas prototype

In a first workshop, dimensions for the understanding of data sources were collected. From these dimensions, trigger questions were developed as a guide through the discussion. A visual representation was proposed as an overview of available data sources with their most relevant dimensions for business model innovation.

Drawing on the results and discussion of the workshop, a first prototype was finalized and tested during an Open Data Hackathon. This first application of the prototype led to relevant insights that served to develop the Data Canvas further.

It did not come as a surprise that in both occasions, participants were not yet able to visualize the whole process after a short workshop. This feedback, however, points to the necessity of an accompanying explanation on how to proceed with the result of the tool.

At this point, it remained to validate whether the Data Canvas is easy to understand and apply by outsiders and whether it really helps to innovate compelling value propositions based on available data.

## 6 Evaluation of Data Canvas in the ExCELL project

The ExCELL project served to evaluate the Data Canvas prototype in practice and to further develop the process model. First, the Data Canvas prototype was applied in a data sighting workshop to explore available means in terms of data and partners in the research project.

The second part moves on to explaining how insights from that workshop informed user research. Insights from pilot user research are introduced in the third part. Finally, it is exposed how a first fit between data and user needs was identified in the ExCELL project.

#### 6.1 Discover: Data sources and stakeholders in the ExCELL project

On 16 March 2015, the Data Canvas prototype was applied in a 3-hour workshop with three employees of Dresden University of Technology. The chair for traffic management system and process automation (VLP) operates the platform Traffic-Analysis-Management-Optimization-System (VAMOS) by order of the Civil Engineering Office in Dresden. The goal of the workshop was to understand actors and data sources involved in the platform in order to provide an initial overview for all project partners and to subsequently derive further ideas to be handled in the ExCELL project. Further, it provided an opportunity to test the Data Canvas in a real project.

##### 6.1.1 Stakeholder Map

Following an introduction of previous steps and goals of the workshop, participants were asked to list actors involved in VAMOS. A stakeholder map template was attached to a whiteboard. Participants were shortly introduced to the tool, and it was explained to them that the inner circle stands for actors essential for the system, important actors are placed in the middle circle, and the outer circle is reserved for beneficial actors.

Stakeholders named by participants were noted on small sticky notes and assigned to the corresponding circles as shown in Figure 27. Connections between actors were marked on the paper with small icons for what is exchanged. In addition to current stakeholders, ExCELL partners were added in blue color and optional actors in green color. To the right of the stakeholder map, the meanings of icons and colors were documented.



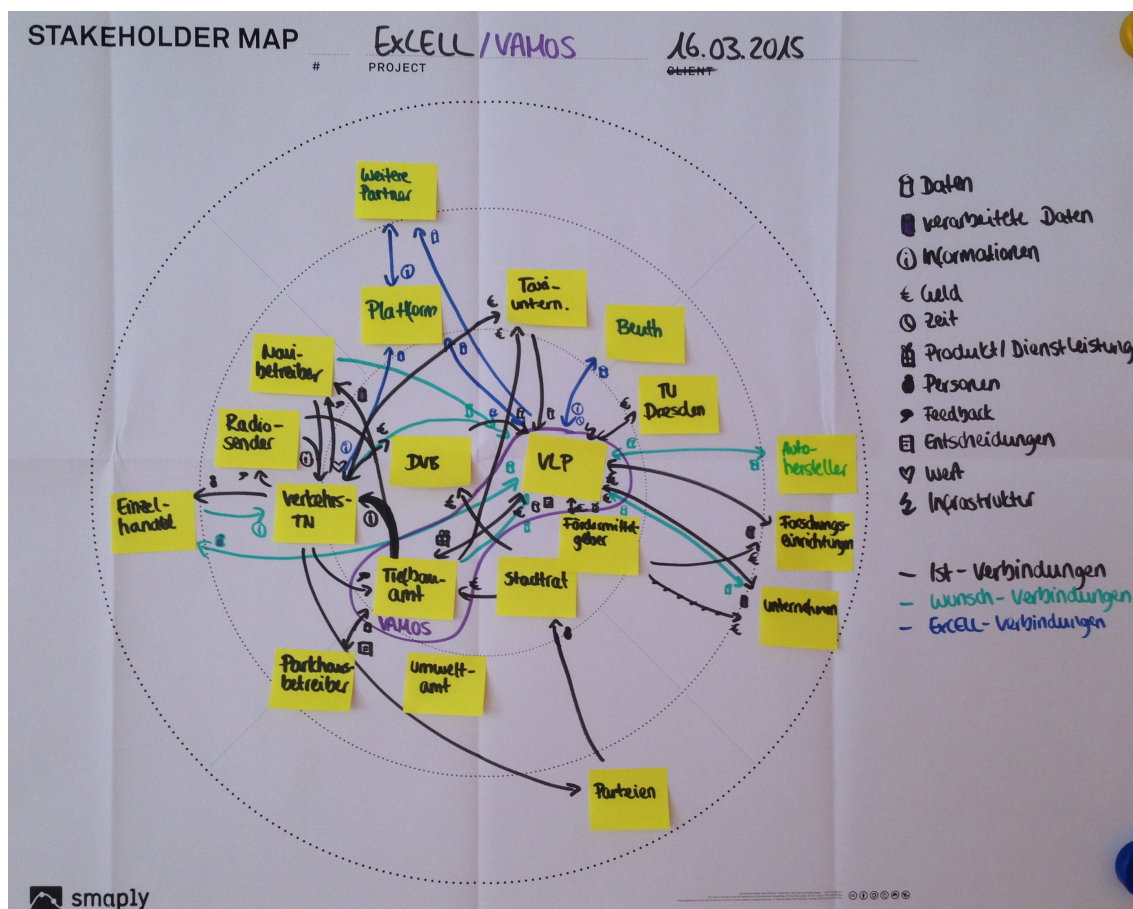


Figure 27. Stakeholder Map for VAMOS portal and ExCELL project.

This exercise helped to clarify relationships and dependencies between actors. One issue is that all data contained in VAMOS belongs to the Civil Engineering Office in Dresden. VLP operates the system but requires authorization for each use of the data. Feedback from traffic participants, however, does not reach VLP directly, which makes it hard to further optimize the system. VLP hopes to be able to establish a more direct relationship with traffic participants in the future.

Workshop participants noted that the stakeholder map could be continued further, for example, by including citizens of Dresden who for some reason do not participate in traffic. However, they agreed that the map in Figure 27 shows the most relevant stakeholders.

### 6.1.2 Data Canvas

As a second exercise, the Data Canvas prototype was used to collect and classify data available in VAMOS. The Data Canvas outline was drawn on a piece of flipchart paper and attached next to the stakeholder map. Drawing on insights from the Open Data Hackathon, continuous and rotational was used as labels rather than stream and batch. Again, the 2 x 2 matrix was used because those who provide external data are mainly partners. Sticky notes in two different shapes and three different colors had been prepared for the workshop. It was explained



to participants that round sticky notes stand for unstructured data and square sticky notes for structured data. As intended, green sticky notes meant reliable data, yellow partly-reliable data, and orange unstructured data.

In the beginning, one participant suggested using data types rather than data sources, for example, switching status rather than traffic light sensor. It was agreed upon to proceed with that suggestion. Underneath each data type, its origin was noted. All data types in VAMOS relate to traffic. The types themselves represent a more detailed topic.

One participant noted that much of the data is derived from base data. It was decided to collect base data first. Derived data was then added with another marker color. With a third marker color, data that participants viewed as valuable addition to existing data was noted in the canvas. The predefined added marks were not relevant in this context. Instead, partial coverage and retention were suggested as added marks. Many data types are only measured at certain positions in the city. Some data such as camera images is only used for analysis and is not permanently stored.

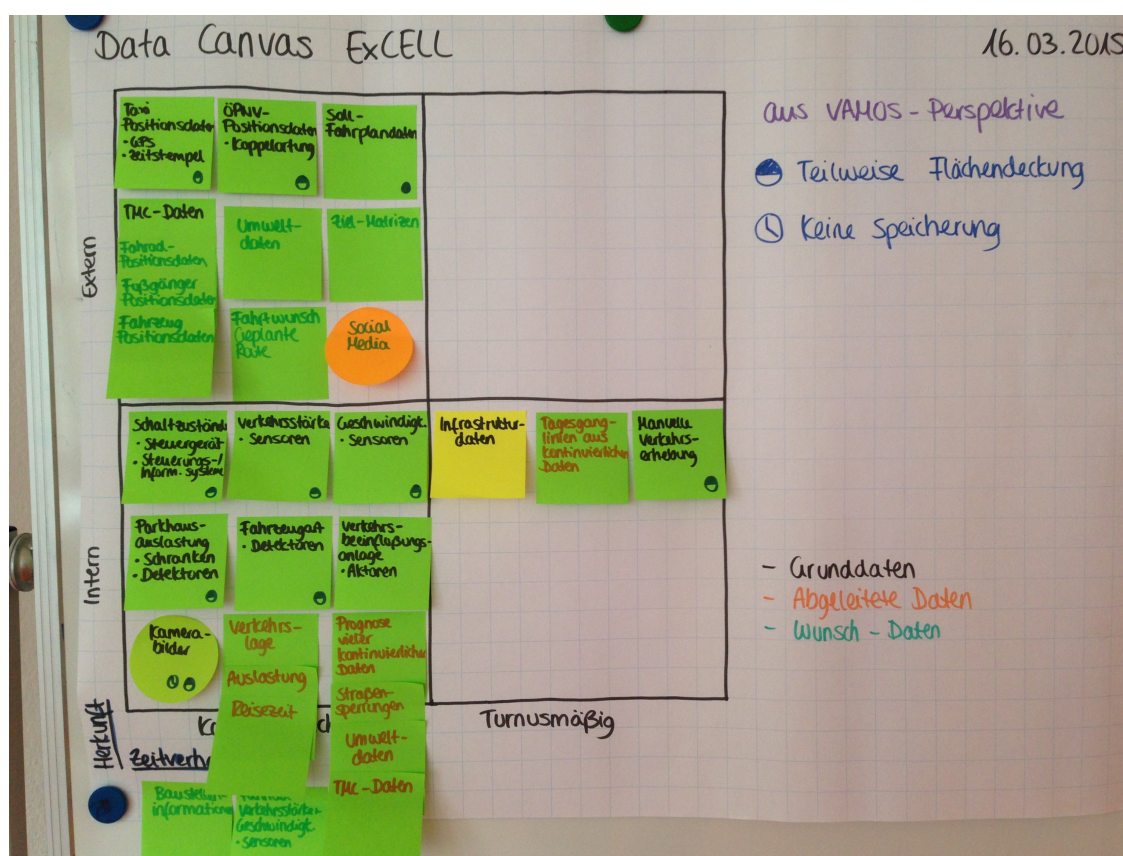


Figure 28. Data Canvas for the VAMOS portal and ExCELL project.

As shown in Figure 28, VAMOS contains mostly internal and external continuous data. Most data sources are structured. So far, no external rotational data is used. With the strategies

outlined in chapter 5.3.4, it can be argued that their data has a high potential for business model innovation. However, there are three important limitations. As realized in the stakeholder map, all data is owned by the Civil Engineering Office. They will need to authorize each use of the data. Most of the data is only partly available, for example, with sensors in different streets where traffic jams are common. When traffic jams occur on other streets, they cannot be taken into account. Another limitation derived from the Data Canvas is that all data concerns the city of Dresden. As a forerunner in the field of traffic data business models based on that data will have a limited scalability.

Some additional data sources were named by participants and recorded in the canvas. Desired data concerns continuous data exclusively and thus augments existing strengths. For some of the desired data, new partnerships would need to be formed. VAMOS would need to offer value in return for collecting data. Further, one opportunity could be to explore what kind of external rotational data is available and whether relevant combinations can be formed with that data.

#### 6.1.3 Lessons learned in the data sighting workshop

Applying the stakeholder map and Data Canvas in the data sighting workshop proved to be efficient. Even though participants were not familiar with this way of working, they quickly understood the tools and engaged in a vivid discussion. However, at any time they stuck to the topic. Thus, the structured approach allowed getting an extensive overview on given means in a limited timeframe.

In the final discussion, all three participants expressed their favor for the Data Canvas. They valued the analytical rather than intuitive approach. For them, it was valuable to think about these issues in a different way. Seeing the connections in the stakeholder map was perceived as even more valuable for them than the Data Canvas. In their opinion, the structured overview provides a valuable basis for the start of the ExCELL project. They expressed the hope that the insights derived in the workshop will be used throughout the project.

All participants found the Data Canvas clear to use with the short explanation provided in advance. Participants argued for flexibility on which axes to use in a particular context. Added marks were found to be a good way for additional information. A number of four or five marks were mentioned to be easy to differentiate. It was discussed that labels of axes could be understood differently. When relying on much continuous data, sources updated daily could already be seen as rotational, whereas in other cases, rotational data is understood as yearly data. It is useful to come to an understanding of this distinction at the beginning of each workshop.

Using data types rather than data sources in the Data Canvas worked well. In this case, data types are presumably more tangible for a non-technical audience. Equally, different marker colors for derived and additional data proved to be efficient. The Data Canvas gives a complete overview of current and potential data sources. Through the use of colors, additional data can easily be distinguished from existing data. In this case, it was made relatively little use of shapes and colors of sticky notes. Where they were used, however, they allowed adding more detail. Axes with the new labels were clear to participants. In the future, space could be foreseen to note the shared understanding of labels in the beginning of a workshop.

However, participants expressed doubts that the tool may be too abstract for some people. As seen before, participants were not yet able to envision what could be derived from the Data Canvas in detail.

For the author, the network of partners and available data sources became clear through participation in the workshop. Results of the workshop were passed on to other project partners accompanied by a short report of the discussion and important insights. Feedback was that this documentation provided a good first overview prior to the start of the project. Desired partners, ideas for additional data, and weaknesses of data uncovered through the Data Canvas provide a valuable starting point to unlock further data and to inform user research in the ExCELL project.

#### 6.1.4 Further feedback on the Data Canvas

To gather further feedback, the Data Canvas was introduced at OpenUp Nürnberg, an unconference focusing on innovation, business, and technology without pre-assigned speakers. On March 26, a session around the Data Canvas was proposed in the plenum. Because some participants were not able to participate on that first day, the session was again proposed on March 27. On both days, participants were introduced to the preliminary considerations and the status of the tool in around 20 minutes. Around ten participants in total joined one of the sessions. The presentations were followed by a 20-minute discussion.

In general, participants valued the Data Canvas as an alternative approach to business model innovation. They addressed the common problem of which building block in the Business Model Canvas to start with. Design Thinking and the Value Proposition Canvas were named as methods for developing initial ideas. Participants confirmed that few tools exist to develop business models from existing resources. Existing tools are mostly concerned with human resources. One participant shared his experience of developing business models for consulting using employee's skills as a starting point. Especially in the context of the internet of things, participants appreciated data as a valid starting point.

Apparently, use of the tool was put across to all participants. They were able to quickly pick up elements of the canvas in the discussion. Only on one occasion had one participant missed the explanation of an element and required clarification. In one session, one participant explicitly asked for trigger questions, which were not part of the introduction. In the other session, their need also became apparent. For one participant, the notion of data was not tangible. In her area of work there is a lot of qualitative and sensible data. It can be assumed that trigger questions and working with team members more experienced with data would help her understand which data is available to her company.

In the discussion, participants challenged the choice of dimensions, shapes, and colors. One participant noted that in the Business Model Canvas each building block is indispensable. He was not sure if each element in the Data Canvas is equally indispensable yet or if others would be even more effective. One idea that developed in the discussion was to use value potential as a combination of quantity and reliability on one axis rather than frequency. Colors would then no longer be needed for reliability and could be used for example to highlight potential combinations similar to using different colors for different customer segments in the Business Model Canvas. However, many different combinations may be considered and rejected. Thus, they are less stable than customer segments and other notions such as drawing lines between data sources may be more meaningful for combinations. Like in stakeholder maps, additional information could be recorded along with lines such as legal restrictions that arise from combinations. In the second session, it was considered that colors are valuable for a heatmap view. One participant suggested using multiple variations of the canvas, one with coloring for reliability, a second with coloring for combinations, and further ones with coloring for other aspects. This would allow for a quick view on the most valuable data, possible combinations, and issues that still need to be addressed.

In terms of strategy, participants brought up the idea that time-to-market can also be increased by using low-quality data, which is often easier to acquire at a lower cost. Data quality can then be gradually improved. This is an interesting idea as low data quality may be sufficient to test business ideas with a Lean Startup mindset. Another strategy that was discussed was opening internal data. Third parties are thus enabled to build solutions based on that data and respectively data can be monetized. Especially for organizations that do not have the resources themselves to build solutions, this can be a viable approach that may provide additional value to end customers. However, an important consideration would need to be how relevant data sources are for others and which are worth the effort to open. One insight of using the Data Canvas could also be that there is not enough data available for business model innovation yet and that additional data needs to be acquired first.

## 6.2 Define: Scope for user research through partners and data

Stakeholder map and Data Canvas created in the data sighting workshop were able to inform user research in terms of target group and topic. Optional actors in the stakeholder map and desired data types in the Data Canvas provided a valuable starting point for user research.

Small and medium-sized businesses were chosen as the target group for a first pilot study. Both stakeholder map and Data Canvas have shown that those companies are not only relevant as data users but could also provide additional data through their vehicle fleet. However, currently they are placed in the outer circle of the stakeholder map with no direct interaction with the VAMOS system.

As all data currently contained in VAMOS relates to traffic, the topic of city mobility was set for the user research from the beginning. Insights from the Data Canvas however helped to further narrow down the scope for user research. For companies, it can be assumed that they are be willing to use a service through which they are able to lower their costs or increase their revenues. Companies who have jobs-to-be-done that are somehow related to mobility were chosen as it can be assumed that willingness to co-create rises with the priority of mobility.

More specifically, data in VAMOS informs on traffic volume and routing. Questions aimed to reveal customer jobs when away on business within city boundaries. They were targeted to explore which means of transportation are currently used by small and medium-sized businesses. Satisfaction and frustrations with these point-in-time solutions were addressed as well as alternatives that have been considered. Questions on their vehicle fleet as well availability and use of technology pointed at companies' abilities to co-create.

The ExCELL project aims to create scalable business models, which cannot only be applied in Dresden but also in other cities in Germany and beyond. Therefore, the pilot study was not restricted to the city of Dresden. Current mobility solutions can be expected to differ from city to city depending on factors such as availability of public transport, bike lane infrastructure, or risk of traffic jams. According to jobs-to-be-done, these can be seen as point-in-time solutions while the underlying jobs are similar. In addition, few users are currently aware of the wealth of data collected and processed in Dresden.

## 6.3 Develop: Insights from needs research

Between 23 April and 28 April 2015, a total of five potential customers were interviewed to find relevant needs. As a pilot for a larger user research in the ExCELL project, it allowed for tests on a small scale. Further, it served to test the ability of the Data Canvas to inform user research.

For access to businesses in a wider geographical area, four interviews were conducted by phone. One interview was held in-person. This interview had the advantage that it could be carried out as a contextual interview in their office. In their familiar environment, interviewees feel more comfortable and body language can more easily be observed. Each interview lasted between 15 and 45 minutes. Subsequent to each interview, the main insights were transferred from the field notes to the customer profile of a Value Proposition Canvas shown in Figure 29. Insights were then prioritized according to explicit or implicit mentions during the interviews. Essential insights were underlined to highlight them.

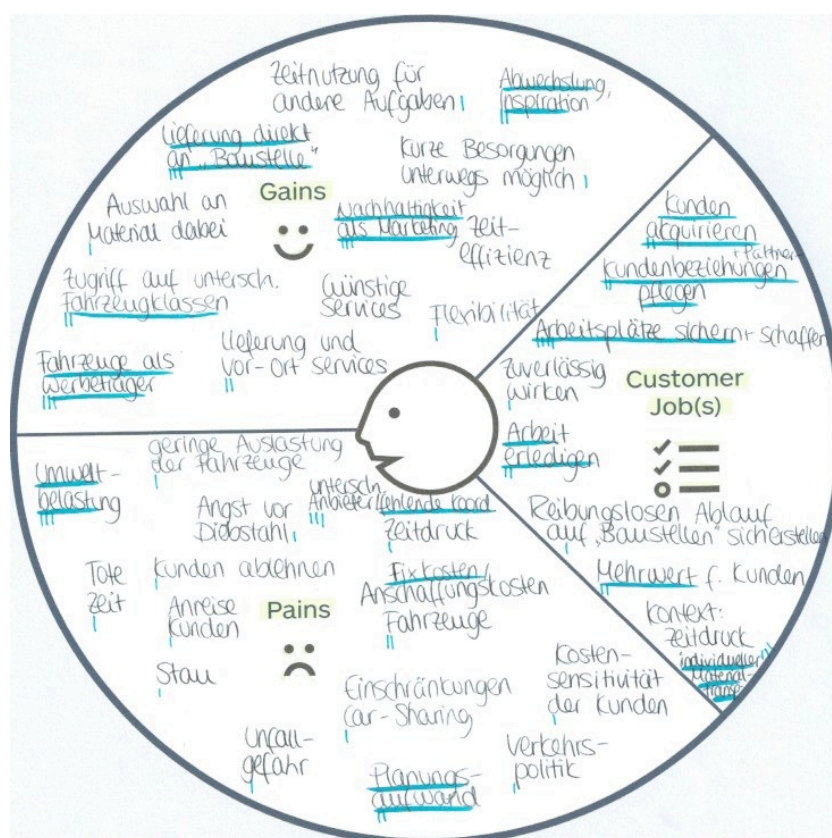


Figure 29. Customer profile from user research.

Already with a few participants, certain patterns could be identified. Mainly companies need to be mobile to get their work done and to transport the material possibly needed for work assignments. Important jobs are also to acquire new customers and to nurture existing relationships with clients and partners in order to secure ongoing business and jobs of employees. In some cases, mobility is an added value that helps companies to differentiate themselves from competitors.

All surveyed companies make use of delivery services to their office or directly to their clients. However, thresholds vary. While some companies value saved time over the cost of de-

livery, other companies are most cost-sensitive and tend to perform jobs themselves if services are too costly. Interestingly, the majority of companies is interested in e-Mobility to save operating expenses and for marketing reasons. Vehicles are also highly relevant as advertiser. Even though this was not an initial question, advertising was a recurring topic. Two companies were pleased with the ability to create awareness through their fleet. For a third company, this was even named as main reason to consider buying a company car. For different jobs, various classes of vehicles may be needed. Companies enjoy diversion and inspiration when away on business.

For small businesses, fixed costs are a major barrier to vehicle purchase. Several businesses have considered purchasing additional vehicles but have postponed their purchases. Especially for very small businesses, carsharing is an attractive alternative, as it helps to keep fixed costs and, thus, risk low. Multiple companies criticized a lack of coordination between mobility offerings. At the same time, they reject the effort of planning involved with certain offerings such as using public transport rather than their own vehicles. Effort of planning can be seen as a critical hurdle for a platform to be created in the ExCELL project. Only a solution that seamlessly integrates with existing workflows will be routinely used.

#### 6.4 Deliver: Data-Need Fit

From the perspective of data-driven business model innovation, it can be argued that there is another stage before problem-solution fit. *Data-Need Fit* can be defined as having identified a fit between jobs, pains, and gains that are relevant for customers on the one hand and data that is available to an organization on the other hand. Only when data available to organizations can be used to help customers get one or more of their jobs done more effectively, reliably, conveniently or affordably, solve their problems, or create value in other ways is it able to support customers in realizing their desired outcomes. On the basis of a Data-Need Fit, a compelling value proposition can be designed.

The Value Proposition Canvas is an effective tool for identifying Data-Need Fit. By filling the value map - the left part of the Value Proposition Canvas - with data sources rather than products and services as done in Figure 30, it can be determined which pains can be relieved and which gains created with the help of this data. Data-Need Fit occurs when those pain relievers or gain creators relate to important pains and gains of customers found in user research.



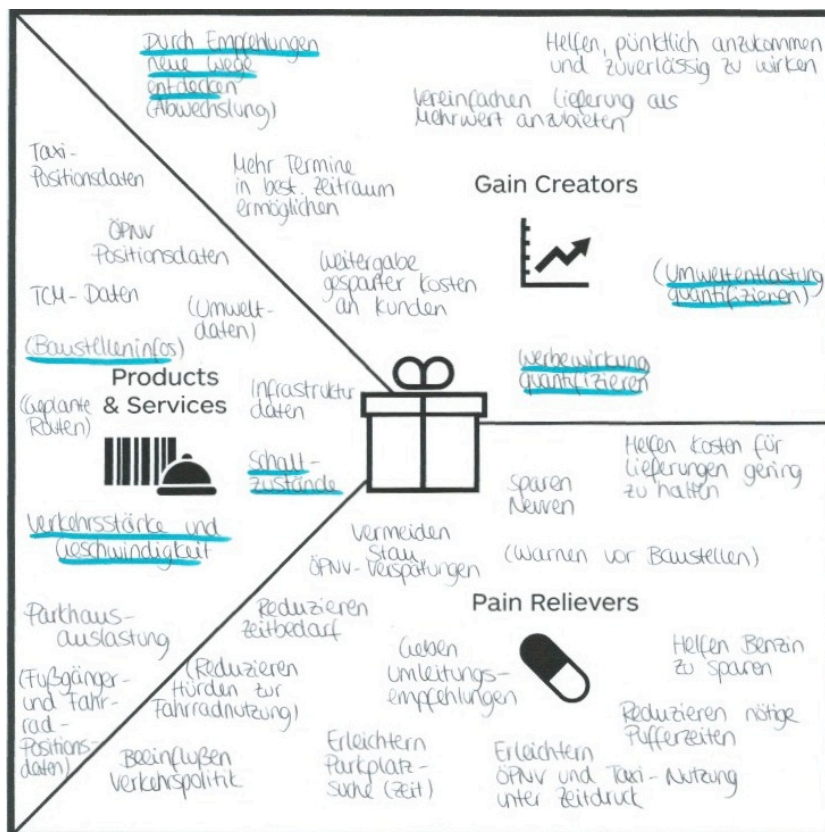


Figure 30. Value map with ExCELL data.

The value map in Figure 30 shows that some data types available in the ExCELL project have a greater value for users in relation to their needs. Especially the current traffic situation is of interest to users. Data on roadworks would be a relevant addition. Businesses typically reserve a certain amount of time for their mobility-related jobs. Whenever a potential work assignment exceeds that time limit either because of distance or changes in traffic situation, clients are declined and business missed.

ExCELL data currently mostly relieves pains. However, none of the pain relievers relate to important pains found in the interviews. Moreover, it does so unconsciously. Most often, traffic participants are not aware of traffic optimizations based on data. They do not know how much worse the situation would be without the systems in place. Thus, data currently reduces annoyances more than it creates positive emotions.

However, potential for gain creation was also spotted through this exercise. Following recommended routes brings diversion from routine. Members of staff are able to discover their cities in a different way. Due to the high relevance of vehicles as advertisers, an opportunity could be to look into the potential of data in the ExCELL project to quantify effects of advertising. For companies, this could be an incentive to provide additional data back to the system. Similarly, reduction of environmental impact could potentially be quantified.



With the customer-side of the Value Proposition Canvas already validated, Data-Need Fit is similar to Problem-Solution Fit. However, it represents an earlier stage or a subpart of Problem-Solution Fit. Once a Data-Need Fit is identified, a solution first needs to be developed.

### 6.5 Next steps

Designing a compelling value proposition embedded into a viable business model and validating that business models with users will be carried out in the ExCELL project beyond the scope of this thesis.

The pilot study served the project team as a starting point for a more extensive user research in the ExCELL project. Additional interviews were carried out, mainly with small business owners in Munich and Dresden. In addition to interviews, additional user research methods such as shadowing or diary studies were considered. Based on this user research, users were segmented and personas were created describing, among other things, the role of mobility in their private and professional lives and their attitudes on digitalization and data privacy. Common scenarios were analyzed in more detail. For each persona, a separate Value Proposition Canvas could be created. Depending on their priorities, Data-Need Fit will differ for each customer segment.

In the coming months, Design Thinking will be applied to envision solutions for the opportunities with Data-Need Fit that have been identified in user research. Ideas will be documented in a (Service Logic) Business Model Canvas or Lean Canvas. Companies participating in the research project form a service system that proposes value to other service systems. Project partners will contribute human resources such as know-how on data analysis and application development and will be responsible for certain key activities. Planning to apply a crowdsourcing approach will add additional data as a resource and more value to existing data. Costs will incur especially for additional resources, activities carried out by other service systems, and access to channels. Project partners will need to agree on how to divide costs and revenues among them.

One critical question is how a consistent user experience can be provided with many actors in a service system. Service Design tools such as service blueprints may help internal and external stakeholders to understand their role and expectations. The envisioned solution will be tested with users with the help of a minimum viable product.

### 6.6 Lessons learned from the case study and suggested changes to the process model

In the case study, it has shown that the newly developed Data Canvas is easy to understand both theoretically and practically. After a short introduction, participants engaged in a vivid

theoretical discussion in the data sighting workshop, at the Open Data Hackathon, and the OpenUp camp. As it draws from a variety of established frameworks, naturally it is easier to understand for those who are familiar with established business model innovation processes and tools.

However, participants in the data sighting workshop were also able to practically apply the tool after a short introduction although they are accustomed to a goods-dominant logic and are not familiar with the Service Design Thinking or business model innovation process and tools. The applied process has proven to be effective to understand the service system and available data in the data sighting workshop in a limited timeframe.

In the first version of the Data Canvas, internal data was placed to the bottom of the Canvas to indicate the degree of closeness to the organization. However, given the potential of data sources it is more meaningful to place internal continuous data with the highest potential in the top right quadrant indicating growth as shown in in Figure 31.

# The Data Canvas

Project \_\_\_\_\_ Iteration \_\_\_\_\_ Date \_\_\_\_\_

<p><b>Internal rotational data</b> Data that is owned by your organization and updated at certain points in time</p>	<p><b>Internal continuous data</b> Data that is owned by your organization and available in a continuous stream</p>
<p>What kind of data is already available in your organization? What kind of data could you track through product/service usage of your customers? What kind of data could your customers actively provide?</p>	
<p><b>External rotational data</b> Data that is owned by third parties and updated at certain points in time</p>	<p><b>External continuous data</b> Data that is owned by third parties and available in a continuous stream</p>
<p>What kind of data could your partners provide? What kind of partnerships could you form to acquire data? What kind of open data is available to use? What kind of data could you crawl from the internet? What kind of data is available to buy?</p>	



The Data Canvas is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. To view a copy of this license visit <http://creativecommons.org/licenses/by-nc-sa/4.0/>



Use in conjunction with the Business Model Canvas, Stakeholder Map and the Value Proposition Canvas [www.katrin-mathis.de/en/data-canvas](http://www.katrin-mathis.de/en/data-canvas)

**KATRIN MATHIS** <sup>+</sup>  
DIGITAL CONCEPTS WITH ADDED VALUE

Figure 31. Iterated Data Canvas

Depending on the context, understanding of dimensions may vary. When rotational means yearly updates, daily updated data sources can already fall under continuous data. With lots of data updated second by second in contrast, daily updates can rather be seen as rotational data. It may be beneficial to provide space in the canvas to encourage organizations to discuss and document their definition of dimensions. In the data sighting workshop, the need to further distinguish data by base data, derived data, and desired data emerged. The use of different marker colors worked well for this purpose.

## 7 Conclusion

This last chapter summarizes the proposed process model for data-driven business model innovation and how it is anchored within the established process model as described by Osterwalder et al. (2014). Subsequently, findings and implications of this thesis are discussed and opportunities for future research are pointed out.

### 7.1 From Data-Need Fit to sustainable service provision

The Data-Need Fit complements the established business model innovation process as described by Osterwalder et al. (2014.) and Mueller & Thoring (2012.). As shown in Figure 32, it adds three preliminary steps. First, an effectual approach and Design Thinking are applied to create choices, which are consequently validated applying Lean Startup methodology.

Following an effectual approach, available means in terms of key resources and key partners are reviewed in a first step. They are thoroughly discussed with the help of the newly developed Data Canvas and a stakeholder map. These means set the scope for user research. The Value Proposition Canvas supports studying customers and value proposition in depth. Depending on the context, various user research methods can be applied to find potential users who have jobs-to-be-done that could benefit from available data. It is important to choose customers who are both willing and able to co-create. Customers are segmented by their jobs-to-be-done, use context, desired outcomes, and barriers. For each user segment, insights from user research can be documented in the customer profile of the Value Proposition Canvas and prioritized according to their importance to customers. Rather than considering products and services, data can be used in the value map of the Value Proposition Canvas to reveal how data could relieve pains or create gains for customers. These steps can be iterated with data sources added or removed to the Data Canvas. Each change in the Data Canvas sets a different scope for user research. In this manner, user research can be repeated until a Data-Need Fit is identified.

Not before a Data-Need Fit is identified between available data and customer needs is a solution envisioned in terms of how service based on that data could be proposed to customers. Depending on the customer segment, they may require a different level of service based on their ability to co-create. For example, developers may be happy with access to raw data as an enabling service while less skilled end users will need a larger level of processing into information or data visualizations as a relieving service. This level can also depend on their willingness to co-create in a given context.

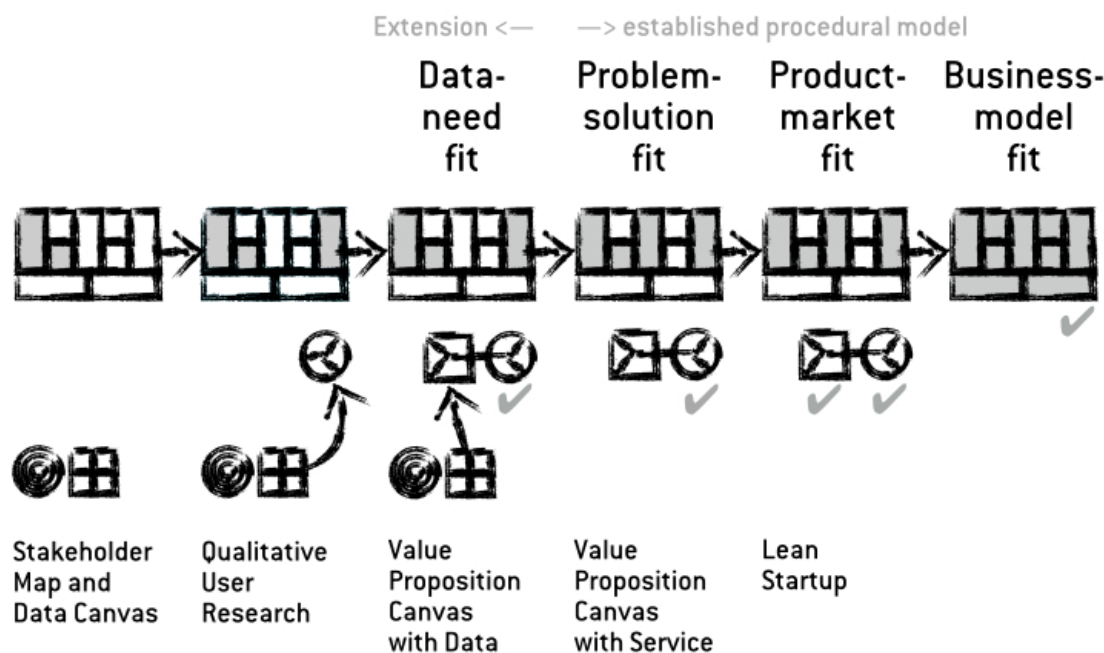


Figure 32. Data-Driven Business Model Innovation Process

(adapted from Osterwalder et al. 2014, 242-243).

Subsequent steps are thoroughly described by Osterwalder et al. (2014.), Maurya (2012.) and others. Through the use of a second value map with an envisioned service leveraging data, the service can be checked for product-market fit. When the service addresses relevant customer jobs, relieves some of their pains or creates gains, problem-solution fit is achieved.

When the value proposition is embedded in the Business Model Canvas, some of the remaining building blocks naturally unfold from the value proposition such as the key activities to provide that value proposition to customers. Other building blocks are influenced by the chosen customer segment. For example, availability and use of technology in a given context will determine interaction and channels through which a service is provided. Value creation and relationships with customers also depends on their willingness to co-create and whether an enabling or a relieving service is requested. Other building blocks can more freely be experimented with. For example, different revenue models can be envisioned for the same service. The business model morphology presented in **Fehler! Verweisquelle konnte nicht gefunden werden.** is an example of a valuable source for ideas around experimentation. Sinfield et al. (2012.) point out that possible combinations are not endless. Choices for one element may influence other elements. Company values and goals further narrow down the consideration set.

Since the Business Model Canvas is initially based on assumptions, early feedback from users is required to learn which of the assumptions hold true. Established processes, such as Lean

Startup, offer a systematic approach for validated learning. In each step, hypotheses need to be extracted and prioritized. For each hypothesis, tests are designed and run and lessons learned are captured (Osterwalder et al. 2014.). Through interactions of users with a minimum viable product, businesses gain qualitative and quantitative feedback. Once business-model fit is achieved, a company can be built that executes the validated business model. In order to survive and to evolve, companies constantly need to monitor and adapt their business models.

Throughout the process, the Business Model Canvas serves to document a potential business model that evolves in each step. More than one canvas can be used to document different directions. Applying the Service Logic Business Model Canvas brings together the perspectives of customers and providers and considers customers with their needs in every building block.

In cases in which service providers directly interact with customers, they are able to influence value fulfillment beyond value propositions. For the purpose of understanding which actions are required from the provider in order to efficiently support the customer journey, Service Design provides useful methods such as service blueprints. These methods should be applied along the business model innovation process so that organizations understand what is required of them and are consequently able to keep promises made by value propositions.

## 7.2 Limitations and further research

The Data Canvas has shown to work best with diverse data sources. When data sources are similar in terms of the chosen dimensions such as the FR.ITZ data at the Open Data Hackathon, it produces limited insight. There is a vast amount of external data sources available to buy or to use for free. Similar to creating stakeholder maps, it is vital to define criteria beforehand to limit the scope. Desk research may be required to uncover relevant data sources. Even with data sources identified, the difficulty remains to envision what information can be generated from that data. Multi-disciplinary teams are needed to thoroughly discuss data from different perspectives.

This thesis focused on developing compelling value propositions. Other factors such as costs were not taken into account in the first steps. It would be beneficial to study how far this approach also improves the financial outcome of business model innovation. Data as a resource is little valuable for itself without the knowledge to convert data to insights. Another possible area of future research would therefore be to investigate data in a combination with other, mainly human resources. In this thesis, the Data Canvas has been used in conjunction with a stakeholder map to set the scope for user research. It would be worth trying to find a Data-Need Fit with the help of a Data Canvas when needs had been identified first. One profound issue remains that public authorities and other organizations struggle to determine

which of their data is most valuable for others. It would be beneficial to study whether the Data Canvas can help to better assess the potential of data sources for third parties.

One open question relates to the visualization of service systems in the Business Model Canvas so that each actor understands his or her role and revenue streams between network partners. For the moment, there seems to be no better solution than creating one canvas for the service plus one canvas per actor.

As an outcome of one single workshop, it is important to bear in mind that the newly developed Data Canvas largely depended on the contribution of participants in that workshop. For this reason it would be a more thorough approach to repeat this workshop several times and see if the same dimensions are chosen every time. Involving visual designers might result in a better visual representation. In this thesis, the Data Canvas was only practically applied in one project. It will be necessary to test the tool and the process in more projects and contexts.

### 7.3 Findings and implications

To date, little guidance is available to organizations on how to use data for business model innovation leveraging data as a resource. This thesis makes a contribution to developing the necessary operant resources to leverage data for business model innovation. Combining approaches from different theoretical and practical frameworks, a structured yet flexible approach to data-driven business model innovation is proposed.

Both a tool and a process model are introduced. The Data Canvas provides trigger questions and a visual representation that fosters a common understanding of available data sources. Thus, it becomes possible to assess potential and risks of data sources for innovative business models. This understanding facilitates targeted user research. The case study proved that Data Canvas and Stakeholder Map are able to inform user research. Through a thorough understanding of available data sources and actors in a service system, it is possible to narrow down actors who are most likely to benefit from the available data as well as topics to address in research. Linking insights from user research to data explored in the Data Canvas reveals a Data-Need Fit. The ability to support relevant jobs of users with available data is a viable basis to subsequently design compelling value propositions. Embedded into the established process of business model innovation, Data-Need Fit triggers the Lean Startup process that is consequently applied to validate the envisioned value proposition and the entire business model.

By proposing an evaluated tool and process model, the results of this thesis provide guidance to organizations and thus remove resistances to integrate data resources. The Data Canvas

offers the necessary flexibility to respond to a constantly changing value potential of data resources. Data Canvas and Data-Need Fit are intended to spark a discussion on available data in organizations among diverse stakeholders. It thus has the capacity to provide a common language that may bridge the existing gap between a technology and a business perspective.

Setting out to explore the potential of data sources before ideating solutions is well in line with Service Design Thinking. The concept of a Data-Need Fit is introduced to highlight that a fit between data and user needs ensures a value proposition that is relevant and compelling to target users.

In line with the principles of Design Science Research, this research has been and will be communicated both through lecturing at relevant conferences and by publishing articles on the matter. The Data Canvas is available for download along with a quick guide under a Creative Commons License. This allows organizations to use the tool and the process in their business model innovation. Based on their feedback, it is planned to develop this approach further.



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## Abbreviations

BITKOM	German Federal Association for Information Technology, Telecommunications and New Media
BMWi	German Federal Ministry of Economy and Energy
IoT	Internet of things
M2M	Machine to machine
MVP	Minimum Viable Product
RFID	Radio-frequency identification
ROI	Return on Investment
SME	Small and medium-sized businesses or enterprises
VAMOS	Traffic-Analysis-Management-Optimization-System
VLP	Chair for traffic management system and process automation at Dresden University of Technology



## Appendices

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## Appendix 1: Interview field guide

In my MBA thesis in Service Innovation and Design, I explore data-driven business model innovation. I understand data-driven business models as business models that rely on data as a key resource. In the next 45 minutes, I would like to talk to you about your experiences on the topic. I have some questions, and I am interested in your thoughts.

- First tell me a bit about you and your work
  - Which methods do you regularly apply in your work?
- In which context did you innovate business models based on data?
  - Who initiated the project?
  - What was the reason for the project?
  - When did you first think about it? What was the trigger to start? When? With whom?
- How did you proceed?
  - Which was your first step? What did you do next?
  - Which existing concepts did you consider? Why did you use or not use them?
  - How did you feel? What were your concerns and frustrations?
  - Who was involved in the process?
  - Who did you ask for advice?
  - How did this process differ from your usual work?
- What did work well?
  - How do you assess success of the process?
  - How was the feedback of other people involved?
- What did not work well?
  - What did you perceive as the hardest part of the process?
  - What would you do differently next time?
  - Which questions do you still not have an answer for?
- Do you have anything to add?

Appendix 2: Data Canvas workshop agenda

**Data Canvas Workshop, 10.02.2015**

13:00 - 13:30 Introduction

13:30 - 13:45 Brainwriting

13:45 - 14:15 Affinity diagram

14:30 - 14:45 Ideation visual representation

14:45 - 15:00 Dot voting

15:00 - 15:30 Elaborate visual representation

15:30 - 15:45 Wrapup

### Appendix 3: Data Sighting workshop agenda

#### **Data Sighting Workshop, Dresden 16.03.2015**

09:30 - 10:00 Introduction

10:00 - 11:00 Stakeholder Map

11:00 - 12:15 Data Canvas

12:15 - 12:30 Wrap-up

#### Material

- Stakeholder Map printed on A1
- Flipchart paper A1 for Data Canvas and Feedback Matrix
- Small sticky notes for Stakeholder Map
- Rectangular and round sticky notes in green, yellow and orange
- Whiteboard Marker

## Appendix 4: User research field guide

### Introduction

- What does your company do? How many employees do you have?
- When were you last away for business within the city? For which purpose? With which means of transport? Where? With whom? Is this example typical for your company?
- How often are you away for business within the city? When? With whom?
- For which purpose are you away for business within the city? Why?

### Means of transport

- When you are away for business within the city, when do you use which means of transport?
- What do you like about it? What bothers you?
- Which alternatives have you considered? Why have you decided against them?
- How many journeys do you have per day/week/month within the city?
- Which distances do you typically cover within the city?
- Which service providers do you use? Why do you use them? Which have you considered using? Why have you decided against them?

### Cargo

- What do you transport or carry along when you are away for business within the city?
- To what degree is your capacity utilized in terms of time and cargo hold?

### Administrative issues

- How do you plan routes, journey time and parking?
- How often do you use the same routes?
- How long in advance do you plan the journeys? How often do plans change later?
- When do you change routes during the journey?
- How do you organize business journeys within your company?

### Technology

- Which devices are available in your company?
- How often do you use these devices for business? Why/Why not?

### Conclusion

- What bothers you when you are away for business within the city?
- What makes you happy when you are away for business within the city?
- What would be the perfect city mobility solution for your company?

## Appendix 5: User research participants

<b>ID</b>	<b>Business</b>	<b>Employees</b>	<b>Approximate city size of headquarters</b>
U1	Construction	50 - 55	3.800 inhabitants
U2	Speech Therapist	10	20.000 inhabitants
U3	Event Agency	3	1.800.000 inhabitants
U4	Painter and Varnisher	7	7.700 inhabitants
U5	Dry Cleaner	25	229.000 inhabitants