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Influence of Alternative Drive Systems on Automotive Business Models

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Zusammenfassung

Ein fundiertes Geschäftsmodellkonzept ist Grundlage und Voraussetzung für den Erfolg eines Unternehmens. Einflussfaktoren wie Globalisierung und immer schneller werdende Entwicklungszyklen stellen eine große Herausforderung hinsichtlich Geschäftsmodellen dar. Als aggregiertes, ganzheitliches Abbild der Realität sollten sie in der Lage sein die Komplexität dieser Faktoren zu bewältigen und auf sie zu reagieren. Obwohl viele Unternehmen bereits erfolgreiche Geschäftsmodelle vorweisen können, scheitern sie meist bei der Integration neuer Technologien. Betrachtet man die Automobilindustrie, stellt vor allem die zunehmende Bedeutung alternativer Antriebssysteme für Automobilhersteller eine große Herausforderung dar. Hohe Anschaffungspreise, geringe Reichweiten und fehlende Infrastruktur schränken die Kommerzialisierung des batterieelektrischen Autos erheblich ein. Drastische Veränderungen bestehender Geschäftsmodelle werden angeraten, jedoch stellt sich für Hersteller im automobilen Sektor bis dato noch die Frage wie die Komponenten des Geschäftsmodells adaptiert, beziehungsweise reformiert werden könnten. Basierend auf dieser Ausgangssituation, befasst sich die Arbeit mit den drei Bereichen Elektromobilität, Technologieinnovation und Geschäftsmodellinnovation und bringt sie miteinander in Korrelation. Des Weiteren wurde die Veränderung dreier ausgewählter Geschäftsmodellelemente als Folge der sich kontinuierlich verändernden Technologie batterieelektrischer Autos betrachtet und diskutiert.

Als Forschungsdesign wurde eine holistische, qualitative Einzelfallstudie mit dem Automobilhersteller BMW als Analyseobjekt, herangezogen. Um im Zuge der qualitativen Datenerhebung offenbarende Aspekte nicht zu verschließen, dient ein halbstrukturierter Interviewleitfaden als Erhebungsinstrument. Die 4 Interviewpartner wurden sorgfältig ausgewählt und sind mit der Thematik Geschäftsmodellinnovation im automobilen Sektor vertraut. Alle Interviews wurden transkribiert und anhand der Methode der qualitativen Inhaltsanalyse nach Mayring analysiert.

Die Ergebnisse der Forschungsarbeit zeigen, dass eine Innovation der Geschäftsmodellelemente einen wichtigen Anhaltspunkt darstellt, um Automobilhersteller bei der Integration batterieelektrischer Autos in ihrem Portfolio zu unterstützen. Des Weiteren legt die Studie dar, wie wichtig der Fokus auf zusätzliche Services im Zusammenhang mit batterieelektrischen Autos ist. Zusätzlich wird auch die Ertragsmechanik betrachtet, bei welcher klare Vorteile für das Leasen eines batterieelektrischen Fahrzeuges genannt werden. Die Historie von BMW hat gezeigt, dass die Einführung eines weiteren Vertriebskanals, speziell für das i3 Modell, eventuell nicht der beste Weg ist, um die Verkaufszahlen anzukurbeln. Viel mehr wird durch Unsicherheiten in Bezug auf eine neue Technologie der traditionelle, stationäre Handel verstärkt. Abschließend werden Vorteile einer Modulbauweise für Automobilhersteller dargelegt, um sowohl Skaleneffekte als auch eine erhöhte Flexibilität in der Produktion zu erreichen. Basierend auf den Ergebnissen der Masterarbeit wurden Handlungsempfehlungen für Praxis und Wissenschaft abgeleitet.

Abstract

A well-founded business model is crucial to the success of any company. Once it is established, it should be able to evolve constantly, as globalization, faster innovation cycles and a high degree of economic integration have made markets more competitive and above all, more complex. Even though many companies have successful business models, they tend to stumble when faced with the emergence of new technologies. Considering the automotive industry, developments in recent years in the field of alternative drive concepts have demonstrated that the automobile sector has limited capacity to accomplish necessary change processes quickly enough. They especially face the challenge of making the battery electric vehicle attractive to their customers. High prices, low driving ranges, and missing infrastructure still constitute a significant obstacle to commercializing the fully electric vehicle on the mainstream market. Drastically changes in current business models of car manufacturers are suggested but yet there is the question of how to adapt or reform components of a manufacturer's business models. This thesis aims to combine the topics of electric mobility, technology innovation, and business model innovation. It should reveal how business model elements are influenced and change over time due to a continually improving technology.

To study the research question, a qualitative single case study approach was applied analyzing the company BMW as case enterprise. BMW was chosen as it is one of the worlds leading car producers in the premium segment and deals with the challenge of changing their business model in order to maintain their market position. Semi-structured interviews with staff, engaged at the company BMW and aware of the topics electric mobility and business model innovation, were conducted. All interviews were transcribed and analyzed by applying the step-by-step model of Mayring.

The results indicate that innovating the business models in order to revalue the drawbacks of the battery electric vehicle seem to be of great importance for the automotive industry. In that respect this thesis aimed to identify changes in the value proposition, value creation and value capture aspects of the investigated business model as well as the respective change drivers. For example, findings highlight the relevance of additional services. Moreover, results reveal the benefits of leasing in conjunction with battery electric vehicles. The case of BMW shows that adding additional distribution channels might not be the best approach to promote battery electric vehicle sales, as customer's insecurity towards fully electric vehicles rather strengthen the company's traditional stationary sale. Further, modular construction approaches for electric vehicles could hold benefits in terms of value creation due to an increased flexibility and scalability in production. This thesis contributes towards the understanding of business model innovation in relation to technology innovation and electric mobility. By taking the battery electric vehicle as an example, the research demonstrates how technology can influence business models in the automotive industry.

Contents

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Abbreviations

AC	Alternating Current
BEV	Battery Electric Vehicle
BM	Business Model
CFRP	Controlled Free Radical Polymerization
DC	Direct Current
EU	European Union
ICE	Internal Combustion Engine
IT	Information Technology
NEDC	New European Driving Cycle
OEM	Original Equipment Manufacturer
SE	Societas Europaea

Part I.

Research Intent

1. Introduction

As the introduction to the thesis, the initial situation and the research question are outlined. Moreover, section 1.2 explains the research design, before section 1.3 finally summarizes the structure and content of the present thesis.

1.1. Initial Situation and Research Question

In recent years, the terms business model and business model innovation have been increasingly addressed in the areas of technology and innovation management [Teece, 2010, Lecocq and Demil, 2015]. Overall, *"a business model is a representation of how a business creates and delivers value, both for the customer and the company"* [Johnson et al., 2008, p. 52]. Chronologically, its development can be dated back to the 1970s. Konczal (1975) and Dottore (1977) are referred to as pioneers of the business model concept as their understanding of the term is closely related to today's understanding of a business model concept. While the term earlier had mainly appeared in specialist literature, the usage of it increased considerably with the rise of electronic commerce. [Doleski, 2014, p. 3]

Once a business model is established, it should be able to constantly evolve, as globalization, faster innovation cycles and a high degree of economic integration have made markets more competitive and above all, more complex. The evolution and change of business models is mainly referred to the term business model innovation. Business model innovation helps companies to meet changing customer requirements while staying ahead of the competition. [Stähler, 2002, p. 43] Even though many firms have successful business models, they tend to stumble when faced with the emergence of new technologies. [Cavalcante, 2013, p. 285]

Considering the automotive industry, developments in recent years in the field of alternative drive concepts have demonstrated that the automobile sector has limited capability of accomplishing necessary change processes quickly enough. [Barthel et al., 2015, p. 23] Established automotive OEMs (Original Equipment Manufacturer) especially face the challenge of making the battery electric vehicle attractive to their customers as the high price, low driving range and missing infrastructure still constitute a significant obstacle to commercialize the battery electric vehicle on the mainstream market. Drastically changes in current business models of car manufacturers are

suggested but yet there is the question of how to adapt or reform components of manufacturers' business models. Only few researchers have addressed the issue of combining business model innovation and technological innovation on the basis of electric mobility. Latest findings of Bohnsack and Pinkse (2017) do not seem to support this problem as they only shed light on the reconfiguration of the value proposition.

Based on the initial situation, this master thesis has the goal to describe, how a business model framework can be prepared to identify business model changes of a particular manufacturer in the automotive industry. Subsequently, it aims to reveal how the business model of an established automotive OEM has changed over a defined time due to the integration of battery electric vehicles in its portfolio. Therefore, using the case of BMW, this thesis strives to answer:

> How has the battery electric vehicle transformed the value preposition, value creation and value capture of the automotive business models in the period from 2013 until 2017?

The research question should be answered by means of an empirical study. The research design and the reasons for choosing the approach are outlined in the following section.

1.2. Research Design

Despite a growing literature of empirical studies describing the evolution of business models [e.g. Lecocq and Demil, 2015, Teece, 2010, Bohnsack et al., 2014, Bohnsack and Pinkse, 2017], there is still limited understanding of how changes in technology influence the business models of incumbent firms. However, the dominating research design is the qualitative case study approach [e.g. Debye, 2014, Bohnsack et al., 2014]. Quantitative studies are still sparse, justified with the lack of clarity in theory development [Müller, 2014].

Case study research allows for the expansion and generalization of theories by combining the existing theoretical knowledge with new empirical insights [Yin, 2009, p. 15]. This feature is particularly important when studying a topic that has not already been extensively researched [Vissak, 2010, p. 370]. A case study approach is well suited for answering *how* and *why* questions and examining real–life events. In addition, it helps to understand the behavioral conditions through the perspective of the interviewed person. By including both quantitative and qualitative data, case studies help to describe the process and outcome of a phenomenon. [Yin, 2009, p. 19] Since the case study method receives criticism in terms of its lack of robustness as a research tool, crafting the design of case studies is of paramount importance. Overall, Yin (2009) suggests four types of case designs, which are described as follows [Yin, 2009, p. 46]:

1. Single case holistic design: This type of case study is used to test existing literature and is justifiable if the case represents a critical one.

2. Single case embedded design: The single case embedded design requires a single case with multiple units of analysis. It is recommended when investigating for example a large health education program that involves a number of funded projects. The embedded units can be selected through sampling.

3. Multiple case holistic design: The third type refers to the study of multiple cases, each constituting one unit of analysis. It is applied if no logical subunits can be identified or the relevant theory underlying the case study is itself of holistic nature.

4. Multiple case embedded design: The multiple case embedded design refers to the study of more than one case, each consisting of one unit of analysis. All individual case studies have to include a collection and analysis of quantitative data.

In the present master thesis, the qualitative single case holistic design is chosen because this study fits into the definition of a critical case. The phenomenon being studied is a unique one and may differ among automotive companies. The goal thereby is to present a real-life situation and provide a better insight into detailed behaviors. Furthermore, an open research question was formulated arising out of a lack of literature in the field of business model innovation in the context of electric mobility. The research question is formulated as a *how* question and therefore suitable for this approach.

In order to answer the research question, mainly qualitative data is used. The qualitative data is obtained by conducting semi-structured expert interviews. The interviews were analyzed by applying the content analysis proposed by Mayring (2000). The detailed description of the overall research process and reasons for choosing applied methodologies are explained in detail in chapter 6.

1.3. Structure and Content of the Thesis

Figure 1 presents the structure of the master thesis. Overall, the thesis is divided into four parts and ten chapters. The first chapter gives a brief overview of the initial situation, the research question and the objective of the present study. The research design is outlined in section 1.2 and was chosen based on the research question in section 1.1.

Chapters 2, 3, 4 and 5 aim to explain the main theoretical concepts of the thesis. Therefore, chapter 2 addresses topics like the origin of the business model concept, definitions, compositional elements and business model changes. Chapter 3 provides theoretical considerations of the terms

technology and technique. Besides making a distinction between technique and technology, a classification according types of technological change is made. Furthermore, chapter 3 aims to elucidate the correlation between technology and business models. The focus of chapter 4 is set on the battery electric vehicle. Therefore, components and design types are explained. Finally, chapter 5 links the topics of business models and battery electric vehicles.

Chapter 6 explains the research process in detail. Furthermore, the case selection and the empirical phase with data collection and data analysis are described. Moreover, the quality criteria are illustrated to ensure the reliability of the research. Chapter 7 aims to reveal the collected information derived from statistics, brochures and semi-structured interviews related to the investigated case. The single case study focuses on the company BMW in Austria.

The final results are discussed in chapter 8. Moreover, findings are compared with existing literature. Chapter 9 recapitulates the outcome of the thesis. Sections 9.1 and 9.2 summarize the findings of the theoretical considerations and present the main results of the empirical study. Afterwards, section 9.3 points out the limitations and directions for further research.

Detailed information on data collection and data analysis is given in the appendix to this thesis. It provides the interview guide and the coded data.

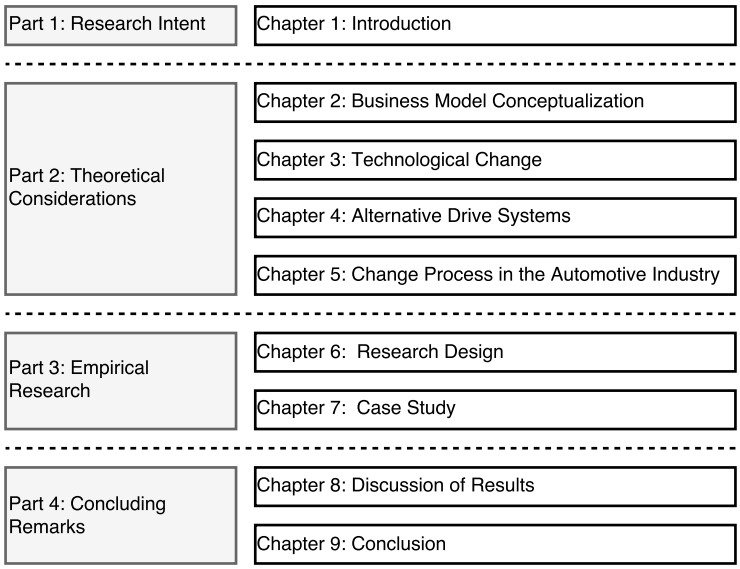

Figure 1.: Structure of the Master Thesis [own illustration]

Part II.

Theoretical Considerations

2. Business Model Conceptualization

The business model is gaining traction in different fields of business but is still criticized for lacking the basis consensus on its definition and correlating elements. Generally, definitions of the business model term are converging around describing how companies can create and capture value for their customers. While these definitions are abstract and generic, business model elements can make the concept more specific and operational. [Fielt, 2014, p. 85ff] A clear business model is crucial to the success of any company and functions also as the foundation of optimizing innovative technology. Once it is established, it should be able to constantly evolve, as globalization, faster innovation cycles and a high degree of economic integration have made markets more competitive and above all, more complex. The increase in importance of the business model approach is therefore closely connected to considerable environmental changes of a company. [Wirtz, 2001, p. 4]

The following chapter addresses topics including the origins of the business model concept, business model definitions, compositional elements and finally the business model change. Therefore, a comprehensive and systematic literature review is used to define the business model framework applied in this thesis. There are limitations to the thesis in terms of it covering all definitions, frameworks and elements.

2.1. Approaching the Business Model Term

The business model concept has developed over an extended period of time. [Wirtz, 2013, p. 6] During its phase of development, the concept was multiply characterized by different streams of research, reaching from the business model adjusted to electronic business to its categorization as a management tool in the context of strategy. To get an overview of the different theoretical approaches as to the derivation of the business model concept, following section outlines the historical development of the business model and presents a selected number of definitions for the term business model.

2.1.1. Origins of the Business Model

There is no single definition of a business model concept as a variety of authors from different research fields have dealt with the term and fostered its development. Literature provides a wide range of approaches regarding the business model concept. The historical development of the business model concept functions thereby as assistance or rather an approach on the terminology. Figure 2 summarizes the course of the development phases of the business model which are subsequently explained in more detail. [Wirtz, 2013, p. 30]

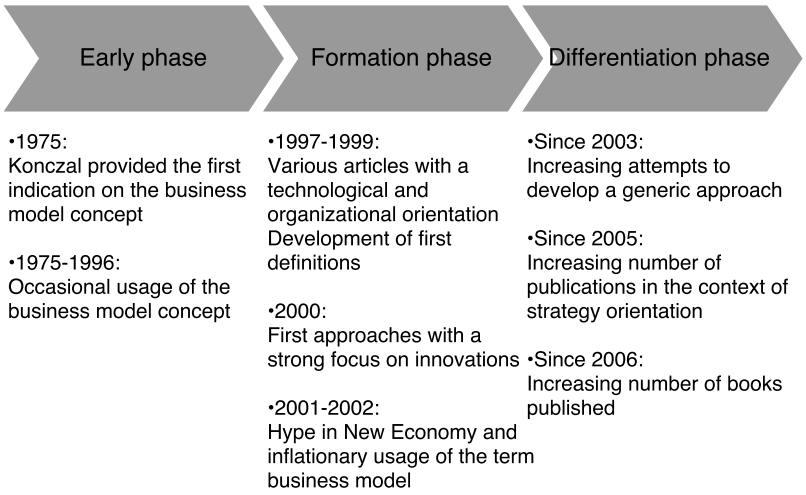

Figure 2.: Development Phases of the Business Model Concept [according to Wirtz, 2013, p. 30]

Early phase in the conceptualization of the business model term
Chronologically, the development of the business model concept starts with the concept-forming phase. Konczal (1975) and Dottore (1977) can be referred to as pioneers of the business model concept as their understanding of the term is closely related to today's understanding of a business model concept. In the years from 1975 to 1996 various scientific papers containing the term business model were published. However, there was neither a common research focus nor a common understanding. [Wirtz, 2013, p. 10]

Formation phase of the first business model concepts
Tracey and Wiserma (1997) specified the first organization-oriented approach. The strategic pillars of this attempt contain the components of cost leadership, product leadership and customer partnership. Concurrently, Shaw, Gardner and Thomas (1997) concentrated on the topic of electronic commerce and appraised business models in this context for the first time. In the period 1998 to 1999 further papers were published which can be classified as technology- and organization-oriented. [Wirtz, 2013, p. 30] Furthermore, the second phase is shaped by the growing significance of electronic business. With the establishment of the internet, the business model

concept gained interest and popularity for companies. While the term earlier had mainly appeared in specialist literature, the usage of it increased considerably with the rise of electronic commerce. It was also seen as central aspect of a company for firms of the so-called new economy. [Doleski, 2014, p. 3] In 2000, Hamel introduced the first business model approach with a focus on business model innovation and is therefore designated as pioneer. [Wirtz, 2013, p. 31].

Differentiation phase of business model concepts
In 2003, there was still no common usage of the business mode concept in research and practice. Therefore, Hedman and Kalling (2003) set their focus on business models from an information technology perspective, while at the same time, some authors like Pateli and Giaglis (2004) examined the current status of business model research. In 2005, authors like Lehmann-Ortega, Morris and Linder dealt with the business model in the context of strategy. All of them agreed that strategy and business model are not equal. [Wirtz, 2013, p. 31]

According to Wirtz (2013) the fact, that there is still no common usage of the term business model, can be explained due to the different authors who have attempted to define it. Only a few universal explanations exist so far as most frequently they refer to certain branches or single components of business models. [Wirtz, 2013, p. 14]

Drucker (2009) points out that companies should regularly question their assumptions related to their business concept in order to guarantee the future prosperity. According to his theory, the business model concept of a company is composed of following three key assumptions:

- *Environment*: The environment defines how a business can make money.
- *Mission*: The mission is characterized by what a company can give of their best to society.
- *Core Competence*: Core competences are needed for the transformation of the mission.

However, the establishment of a coherent business model concept has to correspond to reality and should be openly communicated in the entire organization. The constant development is a result of changes in society, markets, consumers and technologies. Moreover, it is important to continually analyze the behavior of non-customers. [Drucker, 2009, p. 143-157]

As can be seen, a consensus concerning the term business model concept has not yet been reached. Therefore, the next section provides a deeper insight into the different definitions on business models.

2.1.2. Definitions of the Business Model

"Business models matter. A better business model often will beat a better idea or technology." [Chesbrough, 2007, p. 12]

According to Chesbrough (2007), every company makes use of a business model, whether they articulate it or not. Though, this outlines the importance of a business model, it is still not clear how a business model is defined. [Chesbrough, 2007, p. 12]

To approach an appropriate definition of the term business model, one could start by splitting it up into the word components *business* and *model*. A business is a company which is aiming to generate profit. A model is a simplified representation of the reality, consisting of elements and connections. Therefore, the composition of the abstraction leads to the conclusion that a business model is a simplified representation of a company which is aiming to generate profit and consisting of elements and their correlations. [Meinhardt, 2009, p. 7]

Furthermore, it is important to make a distinction between strategy and business model in order to find an appropriate definition. According to Teece (2010), a business model is more generic than a business strategy [Teece, 2010, p. 179]. Zott et al. (2011) state that a strategy concentrates on the competition, whereas the business model is rather focused on cooperations, partnerships and a common value creation. Moreover, they postulate that the main focus of a business model is the customer and the customer's value creation. [Zott et al., 2011, p. 1031] Schallmo (2013) states that a strategy is prerequisite for the identification and selection of an applicable business model. Depending on the business model, different tactics are necessary in order to implement it. Figure 3 gives an overview of the connection between strategy, tactics and business model. [Schallmo, 2013, p. 37]

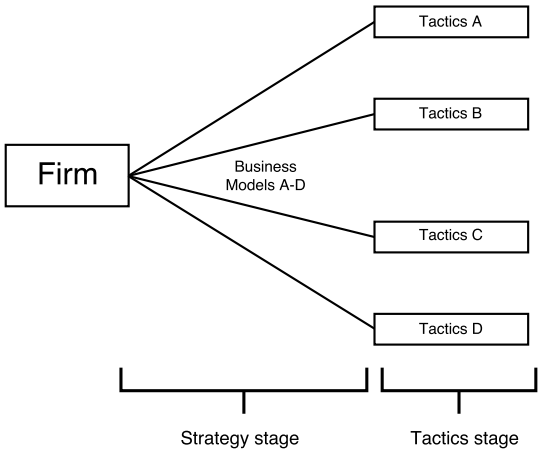

Figure 3.: Correlation between Strategy, Tactics and Business Model [according to Schallmo, 2013, p. 37]

Besides the composition of the words business and model and the differentiation of the term business model to strategy and tactics, literature provides a wide set of definitions. Table 1 shows a selected number of definitions referring to different authors.

Table 1.: Definitions of the Business Model

Author	Definition
Timmers (1998)	*"An architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues."*
Magretta (2002)	*"A good business model answers [...] [the] questions: Who is the customer? And what does the customer value? [...] How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost? [...] Business models describe [...] how the pieces of a business fit together."*
Chesbrough and Rosenbloom (2002)	*"The functions of a business model are to:* *– articulate the value proposition, that is, the value created for users by the offering based on the technology;* *– identify a market segment, that is, the users to whom the technology is useful and for what purpose;* *– define the structure of the value chain within the firm required to create and distribute the offering;* *– estimate the cost structure and profit potential of producing the offering, given the value proposition and value chain structure chosen;* *– describe the position of the firm within the value network linking suppliers and customers, including identification of potential complementors and competitors;* *– formulate the competitive strategy by which the innovating firm will gain and hold advantage over rivals."*
Morris et al. (2005)	*"A business model is a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets."*
Johnson et al. (2008)	*"A business model, in essence, is a representation of how a business creates and delivers value, both for the customer and the company."*
Johnson, Christensen and Kagermann (2008)	*"A business model, from our point of view, consists of four interlocking elements that, taken together, create and deliver value. The most important to get right, by far, is the customer value proposition. The other elements are the profit formula, the key resources and the key processes."*

Teece (2010)	*"A business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value."*
Casadesus-Masanell and Ricart (2010)	*"Business model refers to the logic of the firm, the way it operates and how it creates value for its stakeholders."*
Osterwalder and Pigneur (2010)	*"A business model is nothing else than a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams. A business model has to address product innovation, customer relationship, infrastructure management and financials."*

Based on the existing definitions, provided in table 1, four functions of a business model could be identified:

1. Articulation of the value generation
   [Osterwalder and Pigneur, 2010, Teece, 2010, Johnson et al., 2008, Margetta, 2002]
2. Identification of target markets, target customer segments
   [Chesbrough and Rosenbloom, 2002, Morris et al., 2005, Margetta, 2002, Timmers, 1998]
3. Description of the revenue mechanism
   [Johnson et al., 2008, Chesbrough and Rosenbloom, 2002]
4. Formulation of the competitive strategy
   [Casadesus-Mansall and Ricart, 2010, Chesbrough and Rosenbloom, 2002]

Moreover, it is described as *"logic"* [Margetta, 2002, p. 4], *"architecture"* [Timmers, 1998, p. 4] and *"concise representation"* [Morris et al., 2005, p. 727].

Summing up, a distinction must be made between strategy and business model. A strategy can be seen as essential precondition and reference framework for a business model. Moreover, it can be stated, that the term business model is often used in theory but has no single definition yet. However, Johnson et al. (2008) describe it as *"a representation of how a business creates and delivers value, both for the customer and the company"*. Additionally, business models contain a set of functions and elements. To get a better understanding and finally define the business model framework used in this thesis, the following section determines the main elements.

2.2. Elements of the Business Model

The various definitions provided in literature according the topic business model describe almost the same amount of different business model components. The parts of a business model are patiently crafted and connected with each other. [Lecocq and Demil, 2015, p. 4] In order to decide on final elements of the business model applied in this thesis, four structures of business models and its elements are outlined and compared to each other.

In 2010, Osterwalder and Pigneur published the book "Business Model Generation" with a focus on the structure of the business model and business system. Their so–called business model canvas is built up of nine elements (see figure 4), which together give an approximation to a holistic view on the business model of a company. Their approach is widely applied and will therefore be outlined more detailed. [Osterwalder and Pigneur, 2010, p. 14–17]

Customer Segment: The customer segment is instrumental for a company's survival and success and is defined as a compartmentalized part of the business model.

Value Proposition: Osterwalder and Pigneur define the value proposition as "*the bundle of products or services that create value for a specific customer segment*". It is the output of a company. The value can either be quantitative like performance or qualitative like design and might be weighted differently among the customer segments.

Channels: The channels describe how a company communicates with its customers and reaches them in order to deliver the value proposition.

Customer Relationship: The customer relationship is defined as the interaction between the company and its customers.

Key Resources: Resources are means that a business needs to perform and thus can be human, financial, intellectual or a physical asset.

Key Activities: Key activities describe the actions of a company which have to be undertaken to achieve the value proposition. They are further categorized into problem solving related, production related and network related.

Key Partners: The strategic partners are a list of other external companies, suppliers and parties a company may need to achieve the key activities and value delivery to the customer.

Revenue Stream: The revenue stream is defined as the way a business converts the value proposition into financial gain.

Cost Structure: The cost structure includes all costs incurred in the business model. It

considers economies of scale, variable and constant costs and profit advantages.

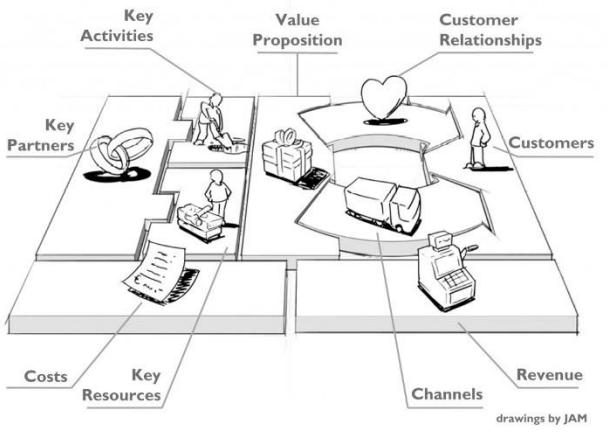

Figure 4.: The Business Model Canvas [according to Osterwalder and Pigneur, 2010]

Johnson, Clayton, Kagermann and Christensen (2008) define, that a business model consists of four interlocking elements that, taken together, deliver and create value. [Johnson et al., 2008, p. 52ff] They are featured in figure 5 and also described in more detail.

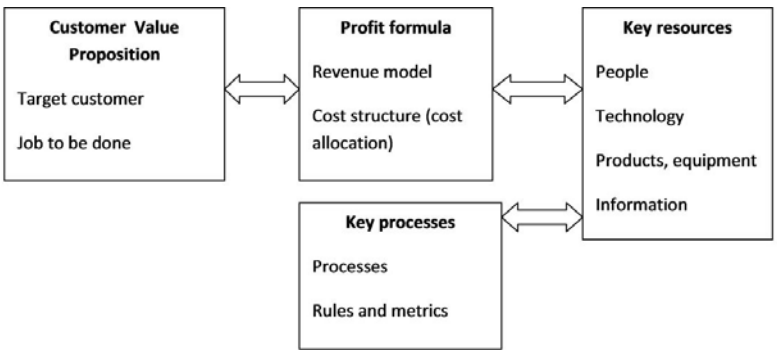

Figure 5.: Business Model Framework [according to Johnson et al., 2008]

Customer Value Proposition: This element describes an offering that helps customers to solve an important problem in a more effectively, conveniently or affordable way.

Profit formula: The profit formula defines how the company will create value for the shareholders and itself. It specifies the cost structure, revenue model, target unit margin and resource velocity.

Key resources: The focus of the key resources is on the key elements and how they interact. Key elements can be people, technology, products, services or channels.

Key processes: Key processes include for example training, design, performance metrics or marketing. They are crucial for companies in order to repeat and increase their sales.

Chesbrough and Rosenbloom (2002) highlight technological innovations in their business model and by which way they create value. They make use of six functions in their business model framework. [Ropo, 2014, p. 18]

Value proposition: The value proposition is the value created for the customers by offerings based on respective technology.

Market segment and revenue generation: The market segment and the revenue generation mechanism describe the users to whom the technology is useful and for what purpose it is used.

Value chain: The value chain is defined as the structure within the firm which is required to distribute the offering and determine the complementary assets needed to support the company's position.

Cost structure and profit potential: The fourth function is the estimation of the cost structure and profit potential of producing the product or service.

Value network: The value network links the company to the customer. It is important to describe the position of the company within the value network.

Competitive strategy: A strategy is important to gain and hold advantage for rivals.

In contrast to the three outlined approaches, Gassmann, Frankenberger and Csik (2013) put a strong focus on reoccurring principals for innovation. Their methodology is based on the central finding that 90 % of all business models are a recombination of existing business model elements. To describe the business model, they employ a conceptualization consisting of four central dimensions, illustrated in figure 6 what they call a "magic triangle". [Gassmann et al., 2013, p. 1ff]

Who: This element is in the center of the framework and refers to the customer. It takes into account that a successful business model requires an exact understanding of the relevant customer segments.

What: The value proposition is described as what is offered to the target customers in order to satisfy their needs.

How: The How refers to the process an organisation runs to deliver their goods and services.

Why: This dimension is seen as the revenue model and thereby explains why a business model is financially viable. It comprises aspects like the cost structure and the revenue streams.

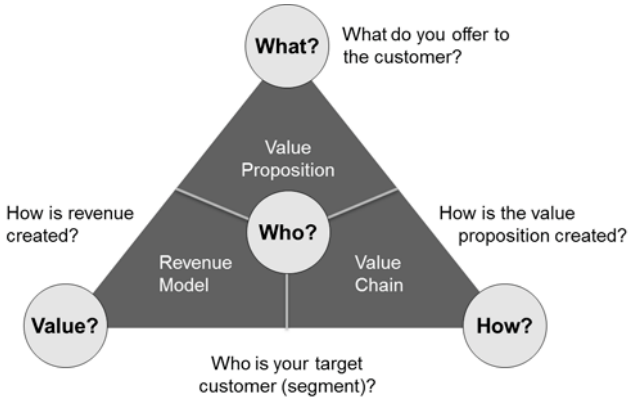

Figure 6.: The Magic Triangle [according to Gassmann et al., 2013]

Comparing the four approaches to each other, several similarities can be found. In all four business model frameworks the element value proposition is a pivotal design theme and will therefore be also considered in this thesis. Gassmann et al. (2013) define their business model as a set of four dimensions including who the customers are, what is sold, how a product or service is produced and how revenue is generated. Their framework can be seen as general approach comprising and summarizing also the elements of the other three outlined approaches. Gassmann et al. (2013) indicate the element customer segment which can be linked to Johnson's (2008) element customer value proposition and further to the two blocks value proposition and customer segment of Osterwalder's and Pigneur's (2010) approach. Furthermore, the revenue model can be assimilated to the profit formula of Johnson et al. (2008) and can also be compared to revenue streams and cost structure. Chesbrough and Rosenbloom (2002) define revenue generation together with the customer segment and see it as one merged element. What Johnson et al. describe as key resources can be coupled to the blocks key resources, channels, key partnerships and customer relationships of the business model canvas. Chesbrough and Rosenbloom (2002) define the value network function as a company's relationship with its customers and partners and can thus be linked to the customer relationship and key partnership element of Osterwalder and Pigneur (2010).

It can be concluded, that a single business model framework hasn't been reached yet. The four exemplary presentations of business model approaches provide their own set of elements and interpretations. However, a core can be identified where the elements overlap. To take up the identified interfaces between the frameworks, the business models were compared to each

other. Moreover, three components are derived from the outlined approaches in order to maintain simplicity for the business model framework and related elements used in this thesis (figure 7). Generally, it can be stated that Gassmann et al. (2013) employ a conceptualization that reduces the business model to four dimensions to make the concept more easy to use. Therefore, their approach serves a basis for the business model framework illustrated in figure 7. Furthermore, all four approaches fall in line when it comes to the element value proposition, hence, it is also taken as crucial element in this thesis. Originated from the outlined approaches, revenue sources and pricing play an important role in determining how a business model captures value. Therefore, the author of this thesis uses value capture as umbrella term for the economic structure of a business model. Value creation is considered as the third component. The simplification is essential to demonstrate the changes in each component. In order to provide clarity, the three selected business model elements are described in more detail in the following sections.

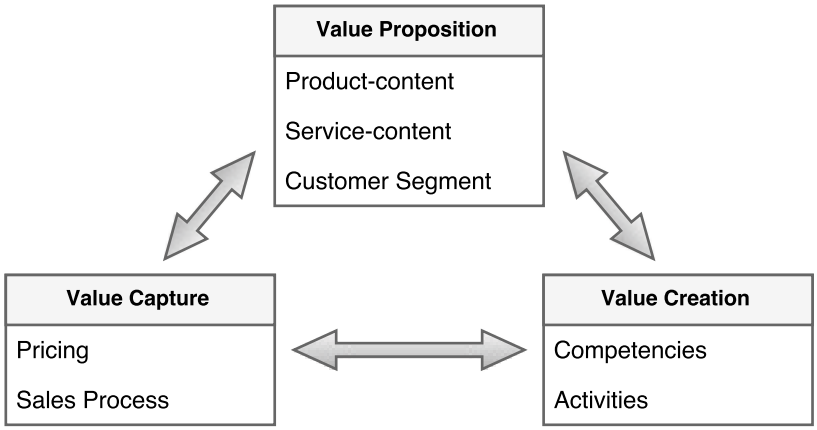

Figure 7.: Reformed and Simplified Business Model Framework [own design]

2.2.1. Value Proposition

The value proposition reflects the value of a product or service created for the customers and their needs. It can be seen as the key to a successful business model and is further the determining factor for a customer to turn to a company. [Müller, 2014, p. 67] According to Chesbrough and Rosenbloom (2002), the process of articulating the value proposition starts with the definition of the product offering and the form the customer may use. Moreover, it should specify the customer group or a market segment, which will be attracted by the proposition. There is no single value for a product as it offers a different value when developed in a different way. They further see value as an economic concept measured by what a customer is willing to pay for a product or service. [Chesbrough and Rosenbloom, 2002, p. 7–8]

Johnson (2008) goes further by postulating that the value proposition is the starting place of every business model. According to him, the central question to answer is "*Why should anyone want to buy anything from you?*". He described the term value proposition on the example of IKEA. Generally, the company IKEA sells furniture but more basic, they fulfill an important need. The value proposition they offer is to sell furniture at a low price which can be therefore easily changed when the urge arises. [Johnson et al., 2008, p. 58]

Müller (2014) identified sub–elements applying to the value proposition. These sub–elements are products, services and offerings. In her doctoral thesis, she makes a distinction between project–based offerings and pre–designed (scale)-based offerings. In this context, project–based offering relates to tailor–made products or services for a specific purpose or need of a customer. The process itself in such businesses has to be flexible in order to adapt to changes in customer needs. On the other side there are the pre–designed offerings, which are characterized by products manufactured by scale–based processes and machines. These offerings only allow little flexibility in reaction to customer needs. [Müller, 2014, p. 67–68]

Business models require a clear and comprehensible formulated value proposition. The better it is defined, the more it is understood by the customers. [Stähler, 2002, p. 43]

However, Bohnsack and Pinkse (2017) identified three tactics that companies use to reconfigure their value proposition. Illustrated in table 2, the compensating, enhancing and coupling tactics can be further characterized among the effect on the business model.

Table 2.: Reconfiguration Tactics [referring to Bohnsack and Pinkse, 2017]

Dimension	**Compensating tactics**	**Enhancing tactics**	**Coupling tactics**
Focus of tactic	Emphasis on points of inferiority	Emphasis on points of superiority	Emphasis on points of untapped value
Process	Bringing the disruptive technology on par with the incumbent technology by shouldering risks or providing low–key hybrid versions.	Exploit the advantages of the technology for the job to be done. Differentiating the productor service throughout changes in the value network.	Serve a job to be done that has previously not been served by the incumbent technology. Often experimental in character.
Effect on the business model	Little influence on existing business model causing only moderate changes.	Strong influence on business model causing substantial changes in the value network.	Potentially strongest influence business model causing a deviation away from the economic logic.
Logic	Required to achieve confidence and trust in disruptive technology of users against incumbent technology.	Necessary to increase perceived value for a large share of potential customers. Source of differentiation and positioning in the market	Potential to create additional value for specific use cases. Over time coupling tactics can become more dominant in the value creation process.

Compensating tactics are the most intuitive choice for the reconfiguration of a product. The tactic is chosen if a technology is perceived as performing not good enough and the mainstream market doesn't accept it. The main objective is to ensure that mainstream customers see a disruptive technology as a reasonable choice. As outlined in chapter 3, disruptive technologies are defined as technologies with the potential to reinvent a product by providing it with new attributes that become a key source of competitive advantage. [Bohnsack and Pinkse, 2017, p. 15]

Enhancing tactics are more ambitious and aim to break new ground by offering value–added services or creating new value. They go beyond the status quo and provide the possibility to change the current business model of a firm through product differentiation. Nevertheless, it must be mentioned, that such tactics are difficult to implement since they make modifications on the existing business model. [Bohnsack and Pinkse, 2017, p. 15]

Coupling tactics are concerned with an entirely new and different product or service to the one beforehand. These tactics use disruptive technology to tap into new markets by exploiting new combinations of services and products. They do not change the business model but create the possibility to redefine markets. However, companies using coupling tactics pursue a very risky

strategy. [Bohnsack and Pinkse, 2017, p. 16]

In this thesis, the value proposition is seen as the promise of a company to provide value to their customers, either in form of a product or service. It includes the three sub–components product content, service content and customer segment. In order to differentiate themselves, companies aim to offer a value proposition with distinct characteristics. Finally, the three tactics help to understand how companies reconfigure their value proposition through product and service attributes.

2.2.2. Value Capture

Value capture is a core element of every firm's business model. It is frequently used in order to describe the economic model of a company. According to literature, the term has a variety of definitions and sub-elements.[Buliga, 2014, p. 8]

Johnson et al. (2008) describe the value capture as profit formula. The profit formula is defined as blueprint that specifies in which way a company creates value for itself while offering value to the customer. As illustrated in figure 8, it includes the revenue model, the cost structure, the target unit margin and how quickly resources need to be used to support the target volume. The sub–element revenue model is obtained multiplying price and volume hence it describes how much money can be made in sales. The margin model serves a useful tool for clarifying how a low margin business model can still be profitable. It further describes the contribution needed from each transaction to achieve desired profits. Direct, indirect and overhead costs are pooled in the cost structure. All in all, Johnson et al. (2008) use the profit formula to define the value capture for the company and its shareholders including the four outlined elements. [Johnson et al., 2008, p. 60]

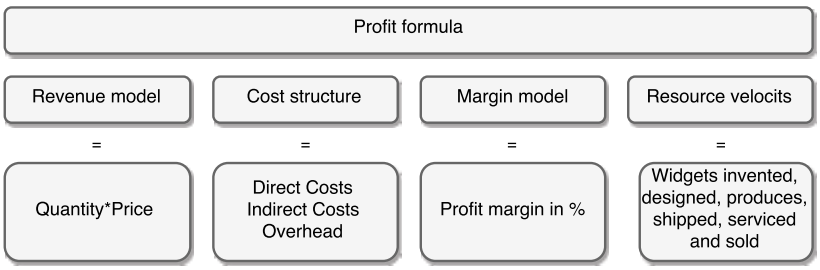

Figure 8.: Profit Formula [according to Buliga, 2014, p. 11]

Similar to Johnson's approach Osterwalder and Pigneur (2010) describe the value capture by the cost structure and the revenue streams. The building block cost structure represents all the costs incurring in a business. Moreover, they categorize the cost structure into cost–driven and value–driven. A cost–driven business model is focused on reducing costs. Companies that make use this business model create a lean cost structure through offering cheaply priced value propositions and a high degree of automation. Costly functions are outsourced. The other extreme is the value–driven

business model which sets its focus on the creation and delivery of a high value. An example for a value–driven approach would be the Hyatt, a luxury hotel. They put lots of effort into creating an experience for the customers by responding to the specific wishes of their guests. Furthermore, the cost structure is characterized by fixed costs, variable costs, economies of scale and economies of scope. In Osterwalder's and Pigneur's (2010) business model canvas, the revenue streams describe the cash a company generates. Types of revenue streams are, for example, usage fee, licensing, asset sale and subscription fee. [Osterwalder and Pigneur, 2010, p. 40]

Related to the two outlined descriptions, it can be concluded, that there are different ways of picturing the term value capture. Nevertheless, it is oftentimes referred to as the core element of a business model that is dedicated to generate revenues and profits. In this thesis, the value capture defines how a company captures value from its product and service offers in order to sustain the business, including the sub-elements pricing and sales process.

2.2.3. Value Creation

Besides the value proposition and the value capture, a business model performs another important function: the value creation. According to Chesbrough (2007), the value creation is defined as a series of activities, beginning with the production of the raw materials to satisfy the customer's demands and ending with the new product or service. The value is thereby created throughout the various activities. [Chesbrough, 2007, p. 12]

Schumpeter (1934) links the topic of value creation to technological change by postulating that new value is created by the process of technological innovation. According to him, technological development happens discontinuously and is a result of innovation. Besides that, he identified different sources of value creation including new production methods, new sources of supply, the creation of new industries and the reorganization of industries. Schumpeter (1934) considers new combinations of resources as the foundations of new production methods and products which might lead to economic development. [Zott and Amit, 2001, p. 495]

Porter's (1985) value chain analyzes value creation at the company level. The value chain is thereby used to visualize value creation and to identify the firm's activities. To study the economic implications of the activities, following two questions, the value chain framework addresses, can be framed [Zott and Amit, 2001, p. 500]:

1. What activities should a company perform and how?
2. What is the configuration of the company's activities that would allow it to add value to their product and to compete in their branch?

Moreover, Porter (1985) distinguishes between primary activities and support activities. While

first are defined by directly affecting the value creation, the second category is affecting the value merely through their effect on the primary activity's performance. As illustrated in figure 9, the primary activities comprise the creation of physical products and contain inbound logistics, operations, outbound logistics, marketing and sales, and service. The support activities cover firm infrastructure, human resource management, technology development and procurement. Overall, the value is created by differentiating along every single step of the value chain. The relating activities thereby result in products or services that address customer's needs and raise the buyers' performance. [Porter, 1995, p. 37]

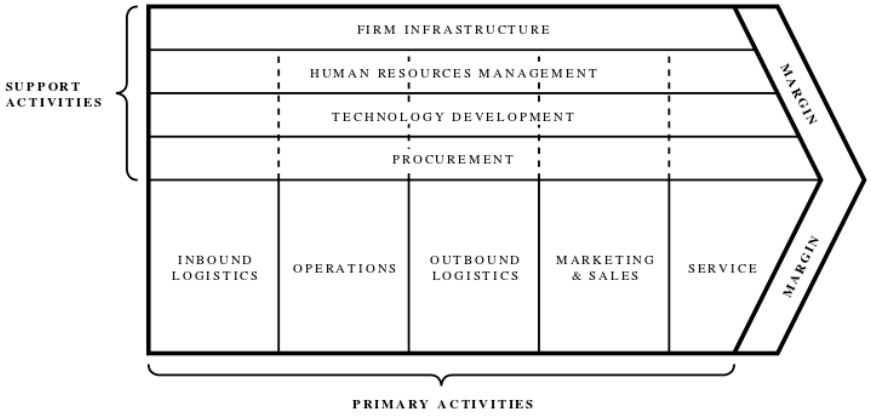

Figure 9.: The Generic Value Chain [referring to Porter, 1995, p. 37]

The theory of core competencies bases a firm's optimal use of unique competences, skills and capabilities. The result of these variables is vertical integration and value creation. [Teece, 2010, p. 10] However, a core competence is defined by the following three key requirements [Zott and Amit, 2001, p. 496]:

1. It results in customer benefits.
2. It is hard to imitate.
3. It aligns competitive dynamics to market dynamics.

It is important to continually renew competencies in order to address changes in the business environment. The process of seizing, seizing and transforming competencies is referred to the term dynamic capabilities. While *dynamic* refers to the capacity needed to renew competencies, the term *capability* defines the adaption, integration and reshaping of skills, resources and competencies. Dynamic capabilities are the primary building block of a company's competitiveness. Together with strategy, they enable to refine the business model. [Teece, 2017, p. 10]

To conclude, literature offers several mechanisms of value creation. Schumpeter (1934) postulates that value can be created through technological innovation while Porter (1985) links value creation

to the reconfiguration of the value chain. Teece (2010) associates it with the exploitation of a company's specific core competencies. Moreover, it is important to continually renew competencies in order to create a defensible business model.

2.3. Business Model Change

In reality, business models aren't static constructions. The growing globalization increases the competitive pressure for companies. Therefore, organizations often have to rethink their business models in order to keep in line with changes in the environment. Changes in business models can be initiated by internal and external influences and further be small or radical. They can affect either parts like the value proposition or the whole business model. [Wirtz, 2013, p. 3] Moreover, they often go hand in hand with technological innovation which may also result in the creation of a new industry. [Teece, 2010, p. 183]

Following sections will provide an overview of characteristics, forms and drivers of business model change. Additionally, mechanisms and strategies will be outlined.

2.3.1. Characteristics and Types of Business Model Change

In literature, the process of new and further development of a component or the whole business model is defined as business model innovation. Business model innovation serves the purpose of fulfilling individual customer requirements even better than before while differentiating from the competition. [Stähler, 2002, p. 43] Changes in the business model have tremendous influences on the whole business because they change how the company works. Moreover, change activities often face headwinds in form of resistance from within the company. Especially big companies have greater difficulties due to the involvement of numerous departments. [Gassmann and Sönke, 2011, p. 199] However, compared to a product or process innovation, the decisive advantage of a business model innovation is that it is hard to imitate [Lindgardt, Z. and Reeves, M. and Stalk, G. and Deimler M., 2009]. An example for a very successful business model innovation is Dell Computer's direct-to-use business model. Dell handled to offer personal computers for a significantly lower price than its competitors by working directly with the users and implementing innovations in the distribution system. [Barjak, Franz and Niedermann, André and Perrett, Pieter, 2014, p. 11] In this thesis, the terms business model innovation and business model change are equal and therefore have the same meaning.

Changed or innovated business models have several characteristics, like [Mast, 2017, p. 115]:

a) a modified range of products and services,

b) a restructuring of distribution and payment,

c) a realignment of the value chain,

d) a restructuring of the business activities and internal processes,

e) a intensification of the integration of consumers in value creation and

f) a changed usage of resources.

Furthermore, the degree of change and the degree of novelty are used to differentiate business model innovation types (see table 3). [Stampfl, 2015, p. 39] According to the degree of innovation, a business model can either be characterized by an evolution, transformation or by departing from the current one in order to develop a completely new model. [Wedeniwski, 2015, p. 265]

Evolution has only very minimal extent of change and concentrates on the development of the product portfolio and the penetration of new markets by selling products. The company process stays the same and has thereby high chances of success. However, the possibility for innovation is limited and the effect on the business orientation of product sales might hardly change. [Wedeniwski, 2015, p. 265]

Transformation makes a step towards a new business models. It is defined by business model innovations of areas within the business while still being restricted by the goals of the existing business model. Furthermore, transformation allows a business to develop new business models with manageable level of risk. An example therefore serves Daimler. They developed new digital products which enable customers to do without a vehicle. [Wedeniwski, 2015, p. 265]

Creation or *Reshaping* is the highest degree of change to the business model. It manifests itself through new business models and is usually shaped by the establishment of a new company and the constant striving towards optimization. Moreover, it replaces the underlying business logic while offering new products and services. In the case of established companies it is referred to a balancing act as the brand identity might change and therefore result in irreversible irritations among the company's customer segment. Google, known for its internet services, is an example for a company that has redesigned its business model. They entered the automotive industry although it is not their core competence. [Wedeniwski, 2015, p. 265]

According to the degree of novelty, new-to-the-world business models have become rather rare species. New business models are usually a recombination of existing ideas, patterns and concepts [Stampfl, 2015, p. 39]. Based on Gassmann et al. (2012), 90 % of the new business models are rooted in either an adoption of business model patterns from other domains, a transfer of successful patterns to foreign domains or a combination of both. However, business models that are new to the company might not be sufficient to create sustainable competitive advantage. [Stampfl, 2015, p. 39]

Table 3.: Types of Business Model Innovation [referring to Stampfl, 2015]

Differentiation Criterion	Business Model Innovation Type
Degree of Change	*(1) Evolution* *(2) Transformation* *(3) Creation*
Degree of Novelty	*(1) Business model is new to the world* *(2) Business model is new to the industry or market* *(3) Business model is new to the company*

Moreover, several characteristics could be identified that enable companies to innovate. Table 4 provides an overview of key characteristics, companies successful in the field of innovation show. [Sniukas, 2012, p. 3ff]

Table 4.: Key Characteristics of Innovative Companies [according to Sniukas, 2012]

Dimension	Characteristics
Culture	– *Questioning attitude* – *Rewards success and failure, punishes inaction* – *Tolerates mistakes* – *Welcome changes* – *Supports risk taking and change* – *Supports teamwork and collaboration*
Structure	– *Fast and flat* – *Small units* – *Encourages collaboration* – *Autonomous teams at the front line*
Process	– *Fast and unbureaucratic* – *Decentralized decision making* – *Support idea generation, experimentation and execution*
System	– *Supports the process of strategic innovation* – *Enables collaboration* – *Enables the use and creation of knowledge* – *Rewards risk taking and action* – *Used to create relationships with customers*
People	– *Variety (internal and external)* – *Collaboration* – *Educated in regard to strategy and skills*

Referring to table 4, it becomes obvious, that startups tend to match these characteristics rather than established companies. Especially the flat hierarchies, simple organizational structures, risk-taking attitudes and fast, unbureaucratic processes make them more flexible. [Stampfl, 2015, p. 47] Although incumbent firms have bigger financial resources compared to startups, they tend to struggle when it comes to business model innovation. Overall, the challenges can be categorized into (1) business model innovation challenges, (2) organizational challenges and (3) individual challenges. [Stampfl, 2015, p. 48]

(1) Business model innovation challenges
Innovating the business model can be challenging. In general, companies cannot simply transfer the product innovation related know-how and correlating processes, which have been developed over decades, to business model innovation. Most firms are lacking essential expertise and experience regarding business model innovation. Therefore, the outcome of business model innovation projects is to a large extent unforeseeable. Experimentation might be a key to overcome business model innovation challenges. [Stampfl, 2015, p. 48]

(2) Organizational challenges
A barrier, especially incumbent firms have to overcome, are existing corporate structures that impede companies to develop new business models. Established companies need to simultaneously orchestrate the existing and the new business models. This ambidexterity of parallel business models constitutes a main challenge as the new business model might not comply with existing company structures. [Stampfl, 2015, p. 48]

(3) Individual challenges
The strategic configuration of a company is defined by prevailing mental maps and corporate culture [Stampfl, 2015, p. 48]. For employees as well as for managers it is hard to overcome habit patterns, especially when it comes to value creation and value capture. [Sniukas, 2012, p. 13]. According to Chesbrough (2010), “cognitive barriers” lead to an inability of managers to remain receptive for changes on established business models [Chesbrough and Rosenbloom, 2002].

2.3.2. Drivers of Business Model Change

There are different types of triggers that cause changes to a firm’s business model [Foss and Saebi, 2015, p. 152]. Literature provides a set of different change drivers: costs and cost reduction [Christmann, 2000, p. 663], sales and profit margin [Porter and Linde, 1995], risk and risk reduction [Schaltegger and Wagner, 2011], reputation and brand value [van Marrewijk, 2003, p. 2], attractiveness as employer [Ehnert, 2009, p. 214] and innovative capabilities [Schaltegger and Wagner, 2011, p. 222]. Depending on the circumstances, other change drivers like market entry or development can play a major role too [Porter and Linde, 1995, p. 97]. Wirtz (2010) has a more generic view on the key drivers of business model change. He identified three main business model

change drivers: technology, market and regulation.

Technology is one of the most relevant drivers for business model change and therefore also more closely examined in Chapter 3. It is seen as a crucial issue when it comes to business models, since the continuous technological progress puts market players under enormous pressure to adapt their business models. Neglecting this fact, crucial and economic disadvantages can occur. Furthermore, disruptive technologies need to be taken into consideration (see section 3.2). They make old products obsolete by replacing them. [Wirtz, 2013, p. 243]

According to Wirtz, the second driver is *market and competition*. New competitors can have an immense influence on a company's business model. This occurrence can be observed by taking the traditional bookseller as example. Amazon entered the book market by providing an online bookstore. Thereby, they put extreme pressure on the traditional booksellers as many people now tend to buy their books online. [Wirtz, 2013, p. 243]

The third change driver is *regulation*. In this context, it describes governmental intervention that can influence the business model and the competitive environment. While it can cause an entire change in the foundation of a business model, it can also be seen as an opportunity and basis for a new model. [Wirtz, 2013, p. 244]

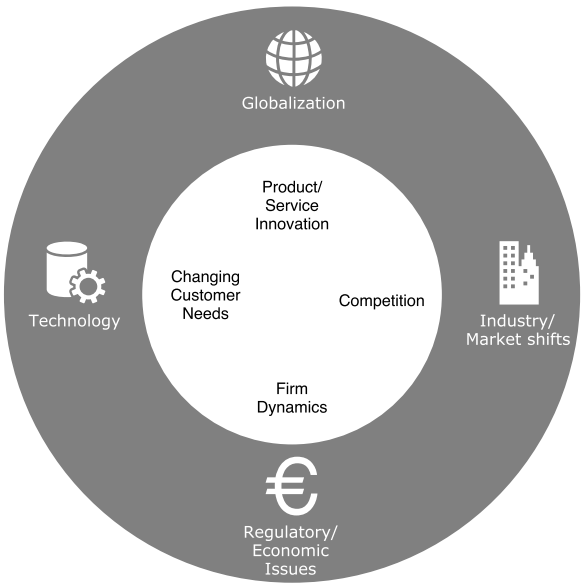

Figure 10.: Macro-level and Micro-level Dimensions[according to Wirtz and Daiser, 2017, p. 19]

Wirtz and Daiser (2017) serve another approach in subdividing possible influences on a business model. Figure 10 illustrates their concept, consisting of a macro-level and a micro-level dimension. The macro-level perspective includes the elements technology, globalization, economic issues and

market shifts, whereas the micro-level dimensions include changes in customer needs, product and service innovation, competition and firm dynamics. Overall, these factors are seen as vital triggers for a business model change. [Wirtz and Daiser, 2017, p. 19]

Bucherer et al. (2012) identified a set of four different origins of a business model innovation. The innovation can be either triggered by an internal opportunity like an improvement of internal processes or due to changes in key technologies. Changes in key technologies are thereby classified as external opportunities. Moreover, there are internal and external threats. Internal threats refer to outsourcing activities or investments in new capabilities. External threats are competitive threats, market shifts or legal changes. A combination of more dimensions might also cause a business model innovation. [Bucherer et al., 2012, p. 183ff]

To provide a clearer understanding of business model change drivers, the outlined approaches are combined. By taking the condensed representation illustrated in figure 11, change drivers are placed at different levels. In the center of this approach is the current business model of a company. The internal business factors include resources, competencies and capabilities available within a firm. External origins of business model innovation include competition and macro environment. Competitive and cooperative forces involve suppliers, potential new entrants, rivals and the customer group which can be also a wholesaler ore retailer. Technological trajectories, ecology, legislation and society make up the macro environment.

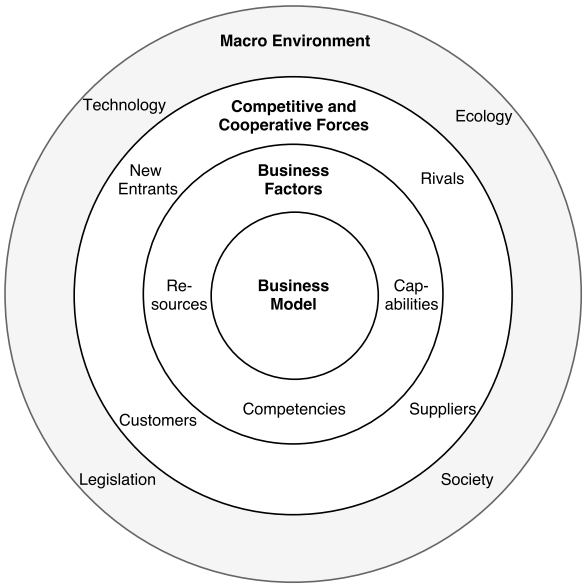

Figure 11.: Selected Business Model Change Drivers [based on Wirtz and Daiser, 2017, Wirtz, 2001, Bucherer et al., 2012]

2.3.3. Mechanisms and Strategies of Business Model Change

According to Mast (2017), six mechanisms and strategies concerning the development of business model changes can be identified. All six mechanisms are different in their complexity in terms of development, execution and scaling. [Mast, 2017, p. 115] In the following, these six are listed and illustrated (see figure 12).

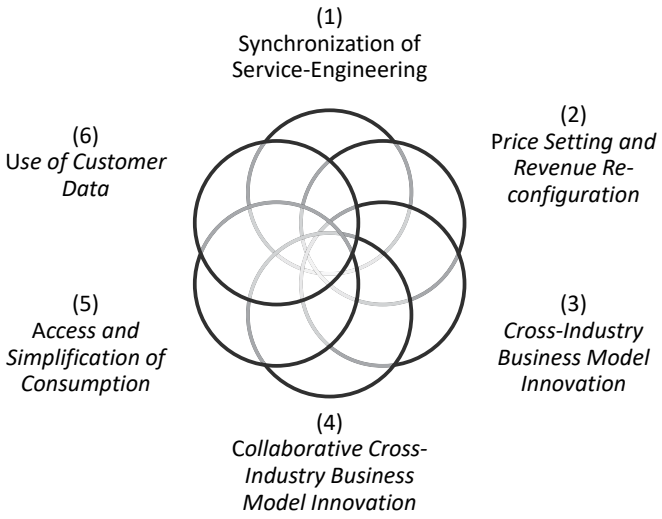

Figure 12.: Mechanisms and Strategies of Business Model Change [referring to Mast, 2017, p. 118]

The first one, *synchronization of service-engineering*, implicates the ability of a company to put forth both the product and the supplementary service simultaneously. It enables the company to offer both components within the scope of a smart and harmonized business model. [Jansen and Mast, 2014, p. 27] In conjunction with the synchronization of service-engineering, there is also another term which elucidates the interaction of service and product, the so called product–service system. This concept serves an alternative to companies that want to develop further as nowadays many of them struggle with increased competition [Barquet et al., 2011]. The fact, that different authors, such as Jansen and Mast (2014), Barquet et al. (2011) and Tan et al. (2009), are dealing with this topic underlines its importance. Furthermore, the product–service system concept might be helpful in order to classify the gathered data regarding changes in the automotive industry in chapter 7.

Tan et al. (2009) and Manzini and Vezzoli (2003) define the product–service system as an innovation strategy. They mention the change of focus from contributions in kind to services and further highlight the paradigm shift from selling products to the fulfillment of customer requirements. Schenkel et al. (2013) emphasize the complexity and dynamics for planning and managing a product–service system within an innovation process.

Overall, the shift to a product–service system allows companies to create new sources of added value and competitiveness by fulfilling client's needs in a customized way, building relationships with clients and innovating faster since following client's needs. Most product-service system definitions refer to the "sale of use" instead of "selling the product". Moving towards service can be time–consuming and complex for companies with established business models. [Tukker, 2004, p. 246] The implementation of a product–service system implies major changes on business operations. Figure 13 illustrates the development from a mere producer into an all-round service-provider. The level of service orientation as well as the customer relationship and the sales contribution increase along the transformation–line. [Schuh, Günther, 2017, p. 3] Based on the different degrees of service, three types and eight subcategories of a product–service system business model can be identified. According to Tukker (2004), the three main categories are product–oriented services, use–oriented services and result–oriented services. [Tukker, 2004, p. 246]

- The *product-oriented services* involve the sale of a product in the traditional way, including the after–sales service to ensure the functionality and durability of a product. The customer is the owner of the product. [Barquet et al., 2011, p. 791]

- *User-oriented services* still set the focus on the product, whereby the ownership remains with the provider or producer. The use or function of a product is sold. [Schenkel et al., 2013, p. 39]

- *Result-oriented services* involve the sale of a result rather than a product. Results are thereby defined as a mix of personal services. [Barquet et al., 2011, p. 791]

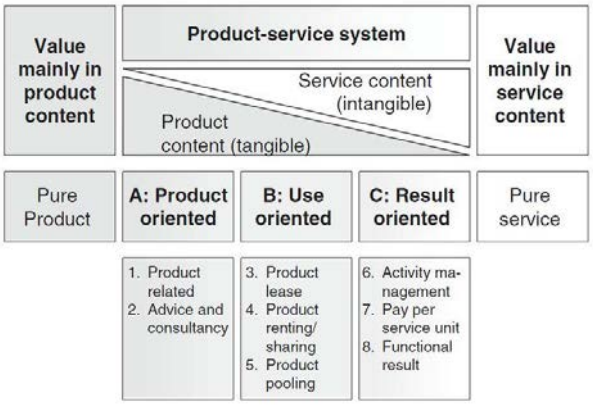

Figure 13.: The Product Service System [according to Tukker, 2004]

The second mechanism is *price setting and revenue re-configuration*. Literature provides a variety of examples according changes in the payment process of business models. Price differentiations, billing based on time consumption and performance are offered in order to generate added value for existing and potential customers. Low-cost airlines, such as Ryanair, use this strategy by focusing

rather on the core service than on additional services. [Mast, 2017, p. 117]

Cross-industry business model innovation is the third mechanism. It includes an acquisition of either a single or all elements of a business model within an industry to generate a new one within another sector. Additional value for a (new) customer segment might be created. [Mast, 2017, p. 117]

In the fourth mechanism, *collaborative cross-industry business model innovation*, a new business model within an industry is generated due to the convergence of different, not compulsory related systems. The single business model systems of different sectors are matched, linked or overlapping each other. Thereby, complex solutions in form of business model innovation can be generated to overcome incorporate challenges by a systematic, complete solution. [Mast, 2017, p. 117]

The fifth mechanism, *access and simplification of consumption*, focuses on the non-consumption of services and products due to difficulties in the accessibility. The improved awareness of new customer groups results in a business model innovation. New customer segments increase the dissemination of products and services and therefore lead to higher revenue of a company. [Jansen and Mast, 2014, p. 28] The non-profit organization ColaLife uses this strategy by taking up the existing logistics of the company Coca-Cola to distribute medicine in poorly accessible areas of Africa. [Scheuerle et al., 2015, p. 117]

The sixth mechanism is the *use of customer data*. The usage of customer data leads to a consistent focus on customer requirements and a higher level of individualization. An intelligent management of customer data is therefore indispensable. The usage of customer data is often referred to the term Big Data. [Mast, 2017, p. 118]

2.4. Summary Chapter 2: "Business Model Conceptualization"

The business model concept has developed over an extended period of time and is characterized by different streams of research. Several approaches were attempted for defining and understanding business models. Generally, definitions of the business model term are converging around describing how companies can create and capture value for their customers. While these definitions are abstract and generic, business model elements can make the concept more specific and operational. Section 2.2 shows a reformed and simplified business model framework, consisting of the elements value proposition, value creation and value capture. The framework is used to identify changes on business models of companies operating in the automotive industry. Moreover, a literature review on drivers and types of business model changes was considered to be important. According to section 2.3.2, change drivers can be placed at different levels and thus might lead to an evolution, transformation or creation of a new business model.

3. Technological Change

Today, economies are drastically changing, triggered by the development in emerging markets, accelerated rise of new technologies, sustainability policies and changing consumer preferences [McKinsey, 2014]. A growing interest in pursuing so-called radical innovations in environmental technologies has been observed to ameliorate the problems of global change [Slocum and Rubin, 2008, p. 1]. Applied to the automotive industry, disruptive technology-driven trends like the electrification of the drive train and resulting new business models are revolutionizing how players of this branch are responding to changing customer behavior and the development of partnerships. [McKinsey, 2014]

A theoretical consideration of the technological change might be an expediently approach to critically evaluate the impact of electric mobility on automotive business models. This chapter begins by making a distinction between the terms technique and technology. Afterwards, a classification of types of technological change is made before section 3.3 elucidates the correlation between technology and business model.

3.1. Technology and Technique

In literature, the terms technology and technique are not used uniformly. The origins of both notations can be traced back to the Greek word “technikos” which means artistic, professional. However, they are different in content. [Schuh and Klappert, 2011, p. 33]

In general, the term technique is meant to be a display of practical abilities that allow one to perform a given activity easily and efficiently. Furthermore, technique is used as a collective noun, indicating procedures that have proven useful for obtaining certain results, like producing particular objects, performing certain operations and attaining intended goals. [Agazzi, 1998, p. 2]

Technology implies skills, methods, and processes used in the production of goods, services or in the accomplishment of objectives, such as scientific investigations. It is defined as the knowledge of techniques and processes. Technique is thereby seen as subsystem and therefore defined as material manifestation of technology. [Schuh and Klappert, 2011, p. 33]

Besides the outlined definitions, the system's approach serves another possibility to distinguish between the terms technique and technology. As illustrated in figure 14, the approach proposes a distinction between knowledge base (input), problem-solving path (process) and solution (output). Transferred to the treated notations, both designate the problem solution as well as the problem-solving path. However, the knowledge base is exclusively identified as technology. According to Bullinger (1994), technology includes the knowledge to represent scientific-technological constellations to solve technical problems. Therefore, technology serves a baseline for the development of products and processes. The results are termed as technique and constitute specific applications of one or several technologies for a concrete problem solution. [Bullinger, 1994, p. 1ff]

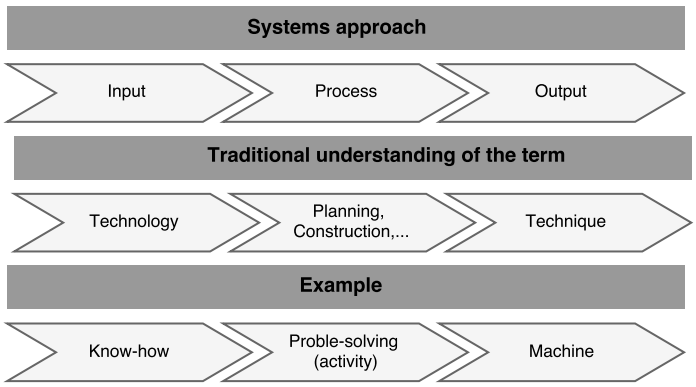

Figure 14.: System's Approach of Technology and Technique [according to Bullinger, 1994]

Referring to Wermke et al. (2009), the separation of the terms technology and technique has to be questioned as each technique, for instance in form of a machine, is based on one or more technologies and therefore embodies their practical application. In addition, a conceptual distinction is only used in fields of German scientific research. In current language, the terms are used interchangeably. [Wermke et al., 2009]

Apart from the variety of definitions relating to the term technology, Schuh et al. (2011) summarized different existing classification approaches for the terminus. They suggest a systematic subdivision by means of different criteria, including fields of application, functions, interdependencies between technologies and the application range in different industries. As technologies are subject to constant and ever–faster change, the life–cycle phase is used as criteria for systematization. Life–cycle models are based on the assumption that various maturity stages are passed through in the process of developing a technology. An example therefore serves the model of A.D. Little. It visualizes technologies throughout their whole life–cycle and classifies them into pacemaker-, key-, basis- and displaced technologies. [Schuh and Klappert, 2011, p. 35]

In conclusion, an analysis and classification of an applied technology within a company helps to draw conclusions regarding its significance. As this thesis aims to identify changes on the business model induced by technological changes, the next section treats different types of technological

innovation.

3.2. Classifications of Technological Innovation

Technology-intensive companies face increasing international competition and rapid technological changes. Innovation is critical for these firms in order to gain sustainable competitive advantages. [Hui and Qing-xi, 2006, p. 327] Technological innovation is defined as the process by which new products and processes are created and launched on the market. It further describes significant technological changes on products and processes. [Stonemann, 1998, p. 733] Discussing about technological progress and innovation, it must be noted that technology is not an amorphous mass, where each part of it is moving ahead at the same rate. New technologies emerge continually, while others vanish. Often a new technology does not arise until certain previous ones have matured sufficiently. Thus the technological progress has been identified as a dynamic one. [Venuvinod, 2011, p. 195]

In general, many kinds of innovation can be identified. The classification varies according to the objective of innovation and includes categories like the innovation of ecosystems, business models, processes or organizations. Furthermore, classifications differ regarding the drivers of change or the intensity. [Norman and Verganti, 2014, 78ff] However, it has also been noted that one can differentiate technological innovations regarding the degree of innovativeness. While some employ a strong degree of innovativeness, others involve only weak changes to an existing design. [Kotsemir and Abroskin, 2013, p. 26] Table 5 illustrates the classification of innovation types. In the following, the types are described in more detail.

Table 5.: Innovation Types [according to Kotsemir and Abroskin, 2013, p. 26]

Degree of Innovation	**Type of Innovation**
Weak Innovation	– *Incremental innovation*
Medium Innovation	– *Architectural innovation* – *Modular innovation* – *Sustaining innovation*
Strong Innovation	– *Radical innovation* – *Disruptive innovation*

Incremental and Radical Innovation

Christensen (1997) defines incremental innovation as *"a change that builds on a firm's expertise in component technology within an established architecture."* According to Smith (2010), this type of

innovation rather refines an existing design through improvements in components than radically altering them. However, incremental innovations are the most common ones. [Smith, 2010, p. 53] This relies on the fact that already small changes on a product help to improve its performance while being lower in costs and enhancing its desirability. [Norman and Verganti, 2014, 82f]

Radical innovation implies much more than improvements to an existing design. This innovation type calls for a whole new design, using a configuration of new components. Henderson and Clark (1990) define that *"radical innovation establishes a new dominant design, and hence a new set of core design concepts embodied in components that are linked together in a new architecture."* In a technological sense, radical innovations are defined as changes on existing technologies which were not able to evolve through improvements or modifications. [Lipsey et al., 2005] According to Chandy and Tellis (2000), they are based on different engineering principles and include a different core technology to the previous one. Moreover, Ahuja and Lampert (2001) state that radical innovation commonly describes changes that serve as the basis for many subsequent technological developments. Finally, it has been described in terms of the profound impacts it has on industries and markets. Schumpeter (1942) argued, that *"creative gales of destruction destroy the foundation of large, established firms' competitive advantage by rendering their technology and past investments obsolete."* However, this definition should be used with discretion as the impact of a particular technology will depend on a particular firm's characteristics. Meaning, a technology might be radical to one firm, but not to another one. [Slocum and Rubin, 2008, p. 9ff] Moreover, Rothwell and Gardner (1989) estimate that only 10 % of innovations can be categorized as radical. [Smith, 2010, p. 54]

In order to make a clear distinction between incremental and radical innovation, Dahlin and Behrens (2005) suggested three criteria, which will be also used throughout this thesis. While the first two criteria refer to the radicalness of the technology, the third one relates to the success. [Norman and Verganti, 2014, p. 82]

1. The invention must be completely new, hence, it needs to be different from prior inventions.
2. The invention has to be unique. It needs to be dissimilar from previous inventions.
3. The invention has to be adopted and thereby needs to influence the content of future inventions.

However, some experts have argued that the classification of technological innovation into just incremental and radical misses many nuances in practice [Venuvinod, 2011, p. 197]. Therefore, literature provides several other types of technological innovations [Garcia and Calantone, 2002, p. 110ff].

Modular and Architectural Innovation

Any technology or process has components configured in a certain manner. A technology is thereby said to be new, if some of its components are new or the configuration is new. This insight leads

to the matrix illustrated in figure 15, and provides two further types of technological innovation. [Venuvinod, 2011, p. 199]

According to figure 15, incremental innovations are exceeded through minor revisions of existing components and radical involve entirely new ones. [Venuvinod, 2011, p. 199] Architectural innovation is defined as a technological change, whereby configurations are conducted on the system as new linkages are instituted. Components and associated design concepts remain almost unchanged. Only small refinements are made on some components by the manufacturers, while the function doesn't change within the new re-designed system. [Slocum and Rubin, 2008, p. 18ff] In contrast to the architectural innovation, modular innovation uses the design of the existing system of an established product while employing new components with different design concepts. As with incremental innovation, modular innovation doesn't include a complete redesign. However, it does involve new or at least significantly distinct components. [Smith, 2010, p. 57]

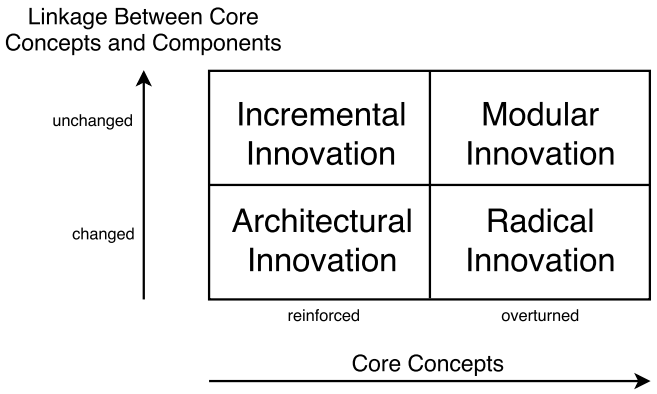

Figure 15.: Typology of Innovations [according to Smith, 2010, p. 51]

Disruptive and Sustaining Innovation
Christensen (1997) makes a clear distinction between disruptive and sustaining technologies. A sustaining technology retains the industries' rate of product performance improvement along a dimension of performance that mainstream customers have historically valued. [Slocum and Rubin, 2008, p. 19] According to Janke and Meißler-Behr (2015), a sustainable innovation is characterized by a high market orientation. All sustainable innovations aim to reduce negative impact, hence, they have the same environmental aspect. Furthermore, they are setting new green standards to a firm. [Janke and Mißler-Behr, 2015, p. 216]

In contrast, a disruptive technology brings along a very different value to the market. This category of technology will initially under-perform established technologies in a mainstream market and will further have features that only an edge market segment will value. Due to increasing demand for these new features, a disruptive-based technological innovation redefines the performance

trajectories. Though they are often referred to as radical innovations, disruptive technologies don't need to be radical in nature. In fact, Christensen (1997) writes *"generally disruptive innovations were technologically straightforward, consisting of off-the shelf components put together in a product architecture that was often simpler than prior approaches."* According to Christensen's theory, disruptive technologies focus on the value a technology brings to the market and whether or not it is a dimension customers have traditionally valued. [Slocum and Rubin, 2008, p. 19]

In order to clarify when to speak about disruptive innovation, three criteria are used in this thesis. These fundamental characteristics are found to be generally present in disruptive technologies and are exclusive to them. [Hardman et al., 2013, p. 15443] For a technology to be designated as disruptive it must meet at least two of the following three criteria:

1. Disruptive to market structures: Adner (2002) identified, that disruptive technologies are able to impact market structures in different ways, including a decreasing market share of established firms, new markets, new business models and new value networks. [Janke and Mißler-Behr, 2015, p. 216]
2. Disruptive to end users: Technologies that are seen as disruptive provide greater than equivalence of service over incumbent technologies, meaning they are disruptive to the customer by changing the way in which the technology is used. [Hardman et al., 2013, p. 15444]
3. Disruptive to the infrastructure: Disruptive technologies require either different infrastructure than the incumbent technology or negatively affect the existing one. [Hardman et al., 2013, p. 15444]

3.3. Technology in the Context of Business Model Development

In recent years, the terms business model and business model innovation have been increasingly addressed in the area of technology and innovation management [Bullinger et al., 2016, p. 1264]. Respective literature regarding business models and their changes are outlined in section 2.3. While authors like Johnson et al. (2008) describe the subject of business models as a new innovation type complementing the traditional innovation types of product and process innovation [Johnson et al., 2008, p. 43], Chesbrough and Rosenbloom (2002) define business models a new approach which lifts the value potential of innovative ideas and technologies to convert them into corresponding market results [Chesbrough and Rosenbloom, 2002, p. 12]. However, it is important to clarify how business models and technology interact.

According to Wirtz (2013), technology is one of the most relevant drivers for business model innovation. It is seen as a crucial issue when it comes to business models, since continuous technological progress puts market players under enormous pressure to adapt their business

models. Neglecting this fact, crucial and economic disadvantages can occur. [Wirtz, 2013, p. 243] Therefore, Schallmo (2013) identified three specific characteristics to consider technologies in the context of business model development:

1. *Technology as supporter for a business model:* Technologies serve the purpose of supporting certain business model elements. Applied to the customer channel, a technology could be adopted to enable the contact to the final consumer. An example therefore is the contact between a company and its customers via website. [Schallmo, 2013, p. 171] Technology can be also applied in a process to make it more efficient, as can be observed in the business model of car2go. The car rental company car2go, subsidiary of Daimler AG, provides carsharing services in the area of Europe and North America. They increased the efficiency of their process by offering apps for mobile devices, which allow the user to locate, reserve and see the car's fuel gauge or battery's state of charge. [car2go Deutschland GmbH, 2017]
2. *Technology as enabler for a business model:* On this occasion, the business model is not workable without the respectively technology. [Schallmo, 2013, p. 171] Practically applied to the previous example of car2go, this would be the RFID-technology for opening the doors of the vehicles. [car2go Deutschland GmbH, 2017] Other examples are the business models Amazon or eBay, which wouldn't be viable without the associated web-technology for the distribution of their products. [Schallmo, 2013, p. 171]
3. *Business model as enabler for technology-marketing:* Here, the technology is defined as the viewing subject. In doing so, the business model acts as enabler for the technology's commercialization. An example therefore serves the business model of Better Place. Their approach was to enable the production and selling of different electric vehicles separately from their standardized batteries, the same way that conventional vehicles are sold separately from their fuel. They covered areas around cities with battery switching stations enabling drivers to potentially have electric cars with an unlimited driving range for long distance trips. [Schallmo, 2013, p. 172]

Technology and industry development are linked to each other. While some technologies are industry-specific, others, like the information technologies, are capable or transforming almost all industries. New market needs spur the development of new technologies and will thus lead to new business models. Hence, technology change and business model change are closely linked. [Venuvinod, 2011, p. 195] Chesbrough and Rosenbloom (2002) support the view, that business models and technology are directly dependent on each other. They assume that new technologies are the source of business model innovation. According to them, innovative business models unlock the value potential embedded in new technologies, commercialize them and create market value. [Chesbrough and Rosenbloom, 2002, p. 533] Thus, technological innovation and business model innovation co-evolve while interacting with each other. [Shin, 2014, p. 302]

In conclusion, both, technological innovation and business model innovation are crucial to a company in order to gain a differentiated, competitive advantage. Furthermore, new technologies

often go along with a business model change and thus may lead to the creation of a new industry. [Vorbach et al., 2017] Section 2.3 has shown, that business model innovation has several characteristics, like a modified range of services and products [Mast, 2017, p. 115]. Moreover, the change of a business model can be differentiated according the degree of change and novelty [Stampfl, 2015, p. 39]. Connecting these two facts along with Schallmo's assumption that technology functions as supporter for a business model [Schallmo, 2013, p. 172], the author of this thesis assumes that a new technology leads to a change in the product or service content of a company. Offering new services or products results in a change of the element value proposition as defined in section 2.2.1 and thus can already be defined as business model evolution.

3.4. Capturing the Impact of a New Technology on Companies

As outlined in chapter 2, scholars have defined the term business model in different ways and acknowledged that they change over time. Even though many firms have successful business models, they tend to stumble when faced with the emergence of new technologies [Cavalcante, 2013, p. 287]. Selecting, adopting or integrating a new technology within a company is a complex process. Besides technological alternatives, the process must also be based on organizational strategy and social system considerations. Moreover, it is generally recognized that technology must be matched with the problem to be solved. [Baden-Fuller and Haefliger, 2013, p. 419ff]

In order to analyze the potential impact of new technologies, firms make use of a variety of approaches, as listed in table 6. The aim of most of these approaches is to acquire an overview of the market in terms of potential competitors. However, it must be added that they do not specifically analyze how the novel technology might affect the organization internally. [Cavalcante, 2013, p. 289]

Table 6.: Approaches for Analysing the Impact of Technologies

Approach	Definition
PESTEL analysis	*To estimate future developments, a company could start by identifying external change drivers forcing the prospective trends. Therefore, a PESTEL analysis serves as an appropriate tool for successfully monitoring and responding to changes. It takes political, economical, social, technological, environmental and legal aspects into consideration. This analysis enables companies to differentiate from the competition and create a competitive advantage. [Yüksel, 2012, p. 52]*

Scenario analysis	*A scenario analysis is a forecasting method that is used to generically analyze possible future environments and strategic thinking on possible consequences in a context of uncertainty. The method is applied to strategy and policy, especially when technological changes involve public affairs. [Ho and Chen, 2009]*
Delphi technique	*The delphi technique uses questionnaires to collect opinions from a group of experts in order to derive a consensus. [Cavalcante, 2013]*
Technology roadmapping	*A technology roadmap is a time-based layered chart which can be used for different purposes, such as product planning, strategic planning and knowledge-asset planning. [Cavalcante, 2013]*

3.5. Summary Chapter 3: "Technological Change"

This chapter presents a theoretical consideration on technological change on the basis of business model evolution. In general, different types of technological innovation could be identified. While some employ a strong degree of innovativeness, others involve only weak changes to an existing design. Moreover, it was found that technological innovation and business model innovation are interdependent. Both are crucial to a company in order to gain competitive advantage.

4. Alternative Drive Systems

The automotive industry is seen as one of the most complex, technologically advanced industries. The creation of a new car involves multiple phases, from the design to the servicing. [Wedeniwski, 2015, p. 7] However, during the past few years, this industry has gone through major technological transformations. In order to cope with the limited fossil fuel availability and increasing CO_2 emissions, a shift to environmental friendly transport modes has taken place. The revolution from the conventional gasoline-powered vehicle to alternative drive concepts has been characterized by excitement, promises and disappointment and has not yet reached its zenith. Alternative drive concepts refer to electric vehicles with an electric motor as primary source of propulsion. There are several alternatives under development which differ from common combustion engines due to their storage solutions and sources of propulsion. [Slowik et al., 2016, p. 3] In fact, alternative drive technology involves hybrid electric vehicles, range-extended electric vehicles, battery electric vehicles and fuel cell electric vehicles. In order to meet the demand of their potential customers, car manufacturers are designing various new electric cars with high energy-efficiency and new driving systems. [Karle, 2017, p. 26ff]

This chapter aims to give an overview about electric vehicles. It should further function as a general knowledge base for the identification of changes in the elements of automotive business models. The focus is set on battery electric vehicles. Therefore, components and design types will be discussed. For the sake of completeness, other alternative drive concepts will be described too, though in limited detail.

4.1. Battery System

In general, a battery is an energy storage device. They convert chemical into electrical energy by means of electrochemical reactions. Basically, the electrochemical storage element is a cell. The batteries in electric vehicles are commonly based on lithium-ion technology. Lithium-ion batteries represent a group of battery chemistries that employ several combinations of cathode and anode materials. Each combination has different characteristics in terms of cost, performance and safety. However, the most common technology for car applications are lithium-nickel-cobalt-aluminum, lithium-nickel-manganese-cobalt, lithium manganese spinel, lithium titanate and lithium-iron phosphate. [Boston Consulting Group, 2017]

Although, the battery systems of electric vehicles improve continually, there are still challenges lithium-ion battery technology has to overcome. [Deng, 2015, p. 30] Downsides include the costs of the batteries which are based on energy stored per unit. Nevertheless, the advances in battery technology have come a long way in cutting prices of electric cars over the past few years (see figure 16). According to estimations from Bloomberg New Energy Finance, average costs of battery packs for vehicles have dropped from 1000 $ per kWh in 2010 to around 30 $2 per kWh within a year. The major impact of the dropping battery prices can be observed on the most popular car in the U.S., Tesla Model S. It has a battery capacity between 75 and 100 kWh. In 2016, a 100 kWh battery had a price quotation of 23000 $ which is a notable cost reduction of 77000 $ during a six years period. Falling prices are a decisive reason for people to switch to cleaner energy systems. Figure 16 provides evidence and shows that 25 % of potential electric vehicle buyers in the U.S. and Germany named it as the major hurdle for purchasing an electric car. [Statista, 2017] Moreover, a main challenge is the capacity fade. Capacity fade is depending on several factors like average discharge and cell temperature and is responsible for the limited lifetime of the battery system. Another issue that comes with charging and low temperature is the safety factor and the weight. Protective circuits help to avoid overcharge and thermal runway while having the downside of adding weight burdens and decreasing energy density of the whole battery package. [Deng, 2015, p. 30]

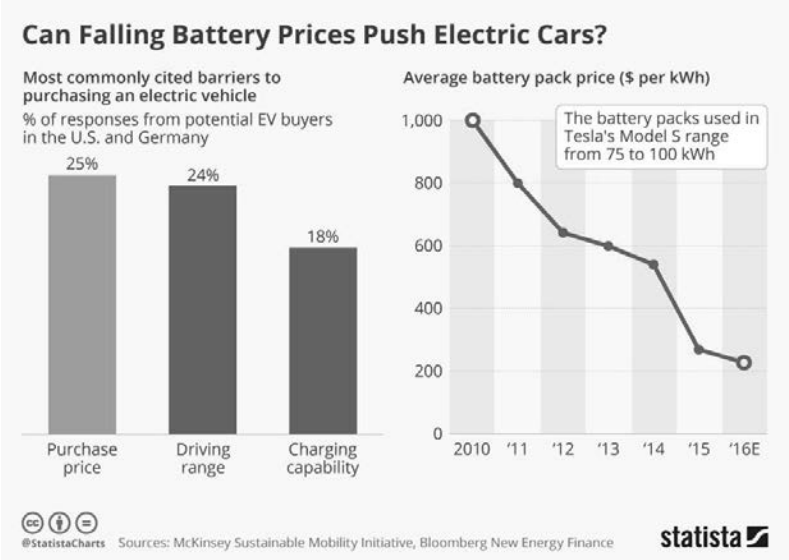

Figure 16.: Battery Prices [according to Statista, 2017]

In summary, the improvements of lithium-ion batteries are significant, though further research is required to overcome current challenges.

4.2. Overview of Changed Car Components

Electric and conventional vehicles have different key components. In the production of electric cars, previous auto components of vehicles with internal combustion engine get obsolete, are modified or are being replaced. The grade of change in the value chain is further dependent on the design. While the so-called conversion design only applies adjustments to a conventional vehicle, the purpose design indicates a complete redevelopment and rearrangement of components. [Seeberger, 2016, p. 72ff]

In the following section, new as well as no longer required components of electric vehicles will be discussed. Moreover, the two primary design types are outlined.

4.2.1. New and Obsolete Car Components

The technological transition of the automotive branch to electric mobility is said to change companies' value adding activities for both conventional and new products. In modern economies with high competition, fewer parts will be needed because innovative products usually cannot be offered at a higher price than the previous products. Therefore, products have to become simpler and should be produced on a more modular basis with decreasing complexity and higher standardization. [Proff et al., 2015, p. 23]

In the transition to electric vehicles, the value added per car changes. First of all, vehicles become simpler since fewer parts and modules are used. Internal combustion engines and exhaust systems are no longer needed; axles, gear systems and drive shafts are modified. [Seeberger, 2016, p. 73] As reported previously in section 4.1, new components include particularly the electric engine as central drive unit and the battery. The third new integral part is the power electronics, which regulates the interaction between the engine and the battery. [Kampker, 2014] The complete set of obsolete, modified and new components is illustrated in table 7.

Table 7.: Technological Changes in the Electric Vehicle [according to Seeberger, 2016]

	Components
Obsolete Components	– *Internal combustion engine* – *Injection system, fuel tank and fuel pump* – *Drive shaft, differential* – *Exhaust system* – *Clutch* – *Alternator, starter*

Modified Components	– *Gearbox* – *Engine cooling* – *Climate control* – *Insulation* – *Wheels, wheel suspension, breaking and steering system* – *Chassis, chassis electronics*
New Components	– *Electric engine* – *Energy storage system*

4.2.2. Design Types

In addition to the change in components of electric vehicles, two design types could be identified: conversion design and purpose design.

The conversion design strategy is featured by the modification of a conventional vehicle. The internal combustion engine is exchanged by an an electric engine to create an all-electric vehicle. A representative example for a car with conversion design is the Mitsubishi i-MiEV. The car was launched in 2010 and is Mitsubishi's first series produced electric car. It is based on the Mitsubishi i which was launched in 2006. Similar developments can be observed at Volkswagen. They also applied the conversion design for their VW e-up!, based on the VW up!. A main advantage of using this strategy is the fact that the automotive OEM isn't forced to build up a new production line. The electric vehicles can be integrated into an existing production process. Moreover, vehicles require shorter development times and producers can respond more quickly to changes in their highly competitive environment. Besides of the advantage, that the conversion design strategy is relatively low-risk, there are also downsides. Concurrent models with an internal combustion engine aren't optimized for electric motors which is resulting in limitations when fitting new components. [Wallentowitz and Freialdenhoven, 2011, p. 160ff]

The automotive industry is shaped by emotions. Customers want to express a certain lifestyle and their identity through a car. Therefore, automotive OEMs need to offer electric vehicles which set a statement and express their environmental friendliness. [Seeberger, 2016, p. 46ff] This factor led automotive OEMs to apply a purpose design for electric vehicles where the chassis design is optimized to the features of the battery, drive motor and the control units. However, the process of development needs to be adjusted to the new requirements, new features and technologies. [Bargende et al., 2017, p. 136] Only few renowned manufacturers uptake the purpose design strategy, like BMW with the BMW i3. The best way to describe the i3 is that it is radically different to the conversion designed cars. For example, its design uses carbon fiber reinforced plastic.

4.3. Types of Electrified Powertrains

Electrification of the drive train is a potentially powerful alternative to lower fuel consumption and greenhouse gases. [Wang, 2016, p. 7] It comes in various forms, starting from the simplest stop-start systems with only an augmented alternator, to more complex hybrid systems that supplement the engine with an electric drive, to purely battery electric vehicles and fuel cell systems. [Tober, 2016, p. 1ff]

In order to enable a better insight into the topic of electric vehicles, this section will discuss two different concepts in more detail. The focus is thereby set on the battery electric vehicle, as it provides the basis for the assessment of the present study.

4.3.1. Hybrid Electric Vehicle

The basic concept of a vehicle system is defined by a power train, which usually consists of an energy source, an energy converter and the necessary connector parts from the energy converter to the transmission. In conventional cars with internal combustion, the energy storage is the fuel tank, the energy converter is the internal combustion engine and the connector is the transmission. Like conventional vehicles, hybrid electric vehicles use an internal combustion engine but have a second drive train. In most cases, this is an electrical power train using an electrical motor as the final energy convertor. [Ehsani et al., 2013, p. 633] They aim to combine the benefits of a conventional engine and an electric motor while circumventing their specific disadvantages. They have an internal combustion engine for long-distance travels, and can drive short distances of around 50 km “locally emission-free” with the electric propulsion system. As hybrid cars are twin powered, the gasoline engine is much smaller as compared to single engine powered cars. Therefore, the combined power is often less. Furthermore, they have structural disadvantages due to the additional weight through the second drive train. However, the biggest drawback might still be the high costs of hybrid cars. [Ehsani et al., 2010, 376ff]

Overall, there are three possible configurations for a hybrid electric vehicle, depending on the role and capability of the battery and the electric motor. Micro hybrids are defined by a starter generator system coupled to a conventional engine. An electric motor provides stop-start operation of the engine and usually regenerative breaking to charge the battery. The electric engine does not supply additional torque while running. The mild hybrid provides additional torque to the internal combustion engine when peak power is needed but still doesn’t use an electric motor as a sole source of driving power. Like a micro hybrid vehicle, the system features start-stop technology and regenerative breaking. Full hybrids serve a high electrical output of the electric motor as it can be used as the sole source of propulsion for shorter distances. They require larger capacity batteries and larger electric motors compared to the two other types. An example for a full hybrid vehicle is the well–known Toyota Prius. In addition, plug–in hybrid electric vehicles can be plugged into the

national grid to recharge batteries. They still require a conventional engine to extend their range as their battery is smaller compared to those installed in pure battery electric vehicles. [ETSAP, 2010]

4.3.2. Battery Electric Vehicle

Battery electric vehicles have a simplified power train as they don't require a fuel tank. They are propelled by electric engines which can either function as an electric motor or a generator. Traditionally, the engine is a form of brushed DC (Direct Current) electric motor. More recent electric cars include a variety of AC (Alternating Current) motors which are simpler build and additionally have no brushes that can wear out. The power of battery electric vehicles comes from chemical energy stored in rechargeable battery packs. This high-voltage battery functions as the only source of energy for propulsion and offers about 100–200 kilometers in range. The driving range varies with the capacity and the state of charge of the battery. Recharging the battery of an electric car can take as little as 30 minutes or up to 12 hours. The charging time depends on the size of the battery and the speed of the charging point. To serve an example, a typical electric car like the Nissan Leaf 30 kWh takes 4 hours to charge from an empty state using a 7 kWh home charging point. This fact points out, that they might be more practical for journeys within a single battery charge than long journeys. The main advantages of battery electric vehicles is that they allow local emission free traveling, meaning emissions are shifted to the location where the electricity is generated, and a high energy efficiency. It needs to be added that the efficiency depends on the weight of the car, the engine power and the charging time. Moreover, the way electrical energy is generated is an important factor. Electricity generation based on a renewable energy source, such as hydro, sun or wind, have near zero greenhouse gas emissions, while generation based on a fossil source, such as coal or fuel oil, have the highest greenhouse gas emissions. [Wallentowitz and Freialdenhoven, 2011, p. 11] However, they have the potential to significantly reduce city pollution. That might also be the reason why they are expected to have a major impact on the auto industry. [Karle, 2017, p. 28f]

4.3.2.1. Models

As of August 2017, there are more than 30 models of battery electric vehicles for retail sales, mainly in the US, China, Japan and Western European countries. An increasing number of automotive OEMs offer vehicles which are purely electrically driven. This can be explained due to the facts that firstly, legal regulations force the change towards new mobility solutions and secondly, because today's customers favor cost-effective and sustainable ways to travel. These factors encourage the development of battery electric cars. In that regard, battery systems and charging technologies improve continually, as outlined in section 4.1, which leads to extensions in the ranges and portfolio

of battery electric vehicles. The market offers everything from electrically driven family to sports cars and small vans. [Smatrics, 2017]

Table 23 (see appendix C) provides an overview of battery electric vehicles, currently available on the European market, stating to the manufacturer, model name and year of establishment. However, it must be noted that only battery electric vehicles launched from 2010 onwards are considered. Aside from the vehicles listed in table 23, there are several other electric car models which were released on the market but have not been able to succeed in the market like Mia ELR or VW XL1. Therefore, they are not taken into account.

Given the fact, that different websites offer various disclosures regarding range and price of battery electric vehicles, it was considered necessary to compare the collected data to each other. In total, four websites with information about electric vehicles currently on the European market and the car manufacturer's websites were pulled up for the comparison. Furthermore, attention was paid to the date of the stocktaking of the different websites. "Grünesauto" and "GoingElectric" indicate that the data about electric vehicles is constantly actualized. "Autorevue" published the status review on the 24.11.2016 and "Greangear" on March 2017. Paying attention to the release date of the website's tables is important as section 4.1 proves that cars tend to get cheaper every year, for example due to decreasing battery prices. As of September 2017, 32 battery electric cars are available on the European market. However, even the four subject-area specific websites differ in terms of the stated numbers of vehicles. Therefore, the possibility cannot be ruled out that all electric vehicles were recorded.

Looking at the listed driving ranges outlined in table 24 (see appendix C), great similarities can be found on the different websites. It is notable, that automobile manufacturers tend to advertise with higher ranges compared to the viewed websites, as can be seen on the example of BMW i3, Citroen e-Mehari, Nissan Leaf and Peugeot iOn. VW and Renault place the NEDC value on their website, which is the short form of New European Driving Cycle. The test was last updated in 1997 and originally designed for petrol-based road vehicles. Nowadays it is also used for the estimation of the electric power consumption and the driving range of battery electric vehicles and hybrids. However, the NEDC rate is not realistic. Operation mode, additional loaded weight and the usage of auxiliary units like air conditioning or other comfort functions are not taken into account. [Rahimzei, 2016, p. 3]

In contrast to the range, the price quotation shows a higher variance (see Tabe 25, appendix C). Basically, prices are orientated on the German market as the websites are too. The price difference might be a result out of the different times of consideration. Moreover, the tables on the websites don't show information regarding the performance of the battery of the respective car. Divergences in this area might also be a reason for the varying price information. Also the question whether the base price is considered in each case is not clear. In general, it cannot be said that car manufacturers tend to either postulate higher or lower prices on their website. Citroen, Mitsubishi and Nissan with the en-V200 model indicate higher prices compared to the tables of Grünesauto, GoingElectric and

Greangear whereas Hyundai and Peugeot iOn provide lower base prices on their websites. BMW and Mercedes don't publish the prices, prices are preserved on request. There is a fairly general agreement on the price when it comes to Renault Twizy and the VW e-up! as three out of four websites show a similar price quotation.

4.4. Summary Chapter 4: "Alternative Drive Systems"

An alternative fuel vehicle refers to any technology of powering an engine that does not involve solely petroleum such as battery electric cars and hybrid electric vehicles. Because of a combination of factors like high oil prices, environmental concerns and the potential for peak oil, the development of advanced power systems for vehicles has become a high priority for automotive OEMs. However, the focus of this chapter is set on the battery electric vehicle. Battery electric vehicles are electric vehicles whose main energy storage is in the chemical energy of batteries. They are defined as being zero emission vehicles because they produce no tailpipe emissions at the point of operation. Battery electric vehicles come in two design types, the conversion design and the purpose design. The conversion design strategy is featured by the modification of a conventional vehicle. Thereby, the internal combustion engine is exchanged by an an electric engine to create an all-electric vehicle. For the purpose design for electric vehicles, the chassis design is optimized to the features of the battery, drive motor and the control units.

5. Change Process in the Automotive Industry

Today's automotive industry is drastically changing, triggered by new technologies, emerging markets, sustainable policies and changing customer demands. Due to latest developments in the field of alternative drive concepts, electric mobility is said to play an important role in the upcoming years. [Feeney, 2009, p. 1ff] However, adopting or integrating a new technology within a company is said to be a complex process (see chapter 3) [Baden-Fuller and Haefliger, 2013]. Moreover, developments in recent years have demonstrated that the automobile sector is limitedly capable of accomplishing necessary change processes quickly enough. To overcome conventional patterns of thought, new business model concepts and actions are indispensable. [Barthel et al., 2015, p. 23]

This chapter begins by examining the disruptive potential of battery electric vehicles. The second section analyzes external change drivers forcing the prospective trends towards electric mobility. In the third section modifications automotive manufacturers carry out on their business model elements are presented.

5.1. Disruptive Potential of the Battery Electric Vehicle

Disruptive technologies have the capability to reinvent a product or service by introducing new attributes that could become a key source of competitive advantage. However, breaking into the mainstream market represents a challenge. Disruptive technologies seem to underperform regarding established attributes customers presently value. [Bohnsack and Pinkse, 2017, p. 79] As was discussed in section 3.2, two out of the three stated criteria have to be fulfilled in order to identify a disruption. In following, the three point criteria is illustrated using the case of the battery electric vehicle.

1. *Disruptive to the market structures*
   In the case of the battery electric vehicle, the disruption applies to the component suppliers. Power train components such as exhaust systems and gear boxes are presently received from engine suppliers. However, parts for electric vehicles come from the electric industry.

The new market entrants cause a reduction in the market share of established companies. [Hardman et al., 2013]

2. *Disruptive to end users*
   Disruptive technologies are disruptive to the consumers as they cause a change in the way they interact with them. [Hardman et al., 2013] With regard to the battery electric vehicle, the aspect of disruption to the end users was observed by a long-term study from the EURO Working Group on Transportation. They evaluated changes in user's driving behavior, mobility and charging routines. Results have shown that participants using a battery electric vehicle have altered their everyday routines. Drivers stated that their driving style has changed in terms of less speeding and less aggressiveness; hence, they applied a more economic driving style. Additionally, all of the participants pointed out that they charge at home and have therefore modified their home electric system. [Rolim et al., 2012, p. 706f]

3. *Disruptive to the infrastructure*
   An increasing share of battery electric vehicles would lead to a massive disruption of the petroleum industry and the infrastructure. Currently, charging stations are still sparsely distributed. Therefore, most drivers use electricity supply from buildings resulting in noticeably longer charging times compared to a fast-charging station. [Hardman et al., 2013]

Looking at the criteria above leads to the conclusion that battery electric vehicles have the potential to disrupt the automotive industry. However, scholars have argued that companies can overcome the associated difficulties of technology's initial underperformance and disruption through business model innovation [Bohnsack and Pinkse, 2017, p. 79]. With this in mind, companies might have to reconfigure their business model components.

5.2. Change Drivers in the Automotive Industry

As reported in section 3.4, the PESTEL analysis was purposed to identify external change drivers pushing the automotive industry towards the production of battery electric vehicles. In the following, this concept will be applied on the example of the automotive industry. Therefore, political, economic, social, environmental and legal aspects driving the change will be identified.

Politics
Political factors play an important role and have a direct impact on the profitability of the automotive industry. Taxes on the luxury vehicles and fuel guzzlers have grown higher. Therefore, electric vehicles became a focal point of interest for the automotive industry. They ensure the sustainability and future of the automobile system while maintaining value creation and employment in European countries. Electric vehicles are also receiving higher government support for their low environmental impact. As such, the government's rules and regulations heavily affect the revenues

of the vehicle brands. [Bozem et al., 2013, p. 91] However, the sensitiveness of the performance of automotive OEMs to these governmental incentive programs can be observed on the example of Tesla. For many years, electric vehicles in the territory of Hong Kong were exempted from the heavy taxation, conventional cars suffer from. In April 2017, the local government of Hong Kong decided to change incentives and scrap a tax break for electric vehicles. [Clean Technica, 2017] According to The Wall Street Journal, the government's decision had a dramatic effect on Tesla's sales figures. Data analysis from "The Journal" has shown that no newly purchased Tesla Model S sedans or Tesla Model X sport-utility vehicles were registered in April 2017. [Wall Street Journal, 2018] Moreover, only a limited number of five privately owned electric cars were registered in the month of May. [Fox Business, 2017]

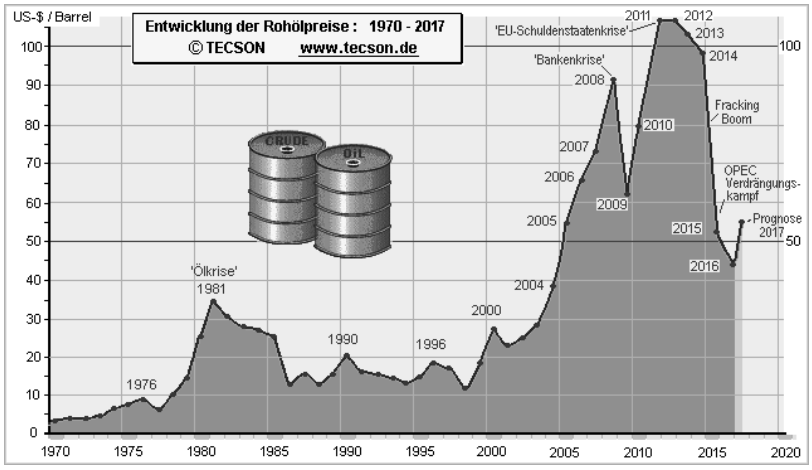

Figure 17.: Development of the Oil Price [according to TECSON, 2017]

Economics

Economic forces are of great importance in the context of the automotive industry. When economic conditions are not good, the sales of vehicles fall. Moreover, the demand for luxury or high priced cars is affected poorly during poor economic conditions. Taxes on luxury vehicles are high in several markets. If the economic conditions are good, the sales of vehicles can remain high. However, sales are generally higher in the developed countries. In the under-developed and developing markets, they are comparatively low. [Wallentowitz and Freialdenhoven, 2011, p. 16] In literature, economical triggers in the context of electric mobility usually refer the shortage of crude oil. Increasing demand for oil leads to a rapid rise in the price of the oil. The term "peak oil" has been applied to describe this phenomenon. It is the point in time, when the maximum rate of extraction of petroleum is reached and after which it is estimated to enter terminal decline. [Schumann, Rolf, 2012, Interview] As a consequence, conventional cars become increasingly unattractive. Although figure 17 shows that the described situation has eased, experts assume that the oil price will rise again in the near future. Reasons for the temporal decline in prices can be argued with the surplus of oil which occurred due to American companies that sensed how

lucrative the deal with oil is. However, the dominance of oil products can't be neglected. Only a few companies, like Tesla Motors and their customers are slightly less dependent on oil than the average car manufacturer. Other major economic factors that affect the automobile industry in Europe include excess capacity and pricing pressure. Excess car production increases marketing revenue as well as the design of new products. Surplus capacity and products proliferation lead to pricing pressure. [Wedeniwski, 2015, p. 250]

Society
Socio-cultural factors are just as important as the other factors. They can have a major influence on the demand and supply of certain products. Social factors that affect the automobile industry in Europe include culture and demographics as indicated by the buying pattern and capacity of consumers. In the market, the automobile industry targets, there are changes in fashion, taste and consumers' buying patterns. Customer predictions change as they want vehicles with high fuel efficiency and reduced emissions. [Wedeniwski, 2015, p. 248] Moreover, the trend is increasingly shifting towards flexible mobility solutions. Growing environmental awareness has led to various forms of shared mobility usage. The systems include the classical car rental and car sharing. Basically, car sharing is quite similar to car rental. Electronic systems provide customers with unattended access to the car. This characteristic and the fact, that gasoline and insurance are included, distinguish it from traditional car rental. Even big car manufacturers like BMW and Daimler have embraced the sustainable concept with *car2go* and *DriveNow*. [Leal Filho and Kotter, 2015, p. 311]

Technology
Technology and innovation have become important determinants of market share in the automotive industry. The more innovative the company, the higher is its market share. Given this fact, major players like Toyota, Hyundai and Ford make high investments in research and development. They started producing low emission and environment friendly vehicles. [Wedeniwski, 2015, p. 249] Due to continuous improvements in battery technology and cost (see Section 4.1), electrified vehicles are expected to gain more and more market share from conventional vehicles. [Wallentowitz and Freialdenhoven, 2011, p. 18f] In that sense, one of the most successful companies represents Tesla Motors. The model Tesla Roadster, launched in 2008, unveiled their cutting-edge battery technology. The company could manage to design cars which combine safety, performance, efficiency and the longest range of any electric vehicle. As of March 2017, global sales passed the 200.000 unit milestone. [Tesla, 2017b] Another example for technological development is Kreisel, an Austrian company. Their core business is the development of power trains, charging technology and software in collaboration with industrial partners. They managed to produce highly innovative batteries featuring an advantage of 20 % more usable capacity available compared to Tesla. With a weight of only 4.1 kg and tiny volume, the Kreisel's battery solution reaches an outstanding power density. [Kreisel, 2017]

Environment
Growing concerns about the environmental impact of current road transport systems foster the

interest in alternative drive train systems. Global warming can be seen as one of the biggest challenges today. Impacts such as record high temperatures, rising seas and severe flooding are already increasingly common. Conventional vehicles with internal combustion engine are thereby a major pollution contributor, producing significant amounts of nitrogen oxides and carbon monoxide. To address these causes, many automotive companies have already started offering electric vehicles in their portfolio. [Bozem et al., 2013, p. 66f]

Legislation
Law is another important factor that gets to affect the profitability and performance of the vehicle brands. Vehicle sales in the international market are subject to laws related to product quality and safety. Moreover, pollution laws have grown stricter. Especially the introduction of national emission ceilings force manufacturers to considerably improve emission values. To comply with the strict guidelines, car manufacturers have to include alternative drive technologies in their portfolios. If not, they might face financial penalties or damage to the company's image. In the end, car manufacturers are indirectly forced by legislation to invest in alternative drive concepts. [Wallentowitz and Freialdenhoven, 2011, p. 11]

5.3. Characterization of Business Model Elements in the Automotive Industry

This section aims to demonstrate modifications, manufacturers in the automotive branch carry out on their business model elements in order to cope with the challenges of the electrification of the drive train. In section 2.2, a framework was proposed consisting of the three elements value proposition, value capture and value creation. As illustrate in figure 7, the value proposition is the promise of value to the customer, either in form of a product or service. The value capture element is dedicated to generate revenues and profits. Applied to the automotive business models, it includes pricing and sales processes. Moreover, the value creation concentrates on core competencies and activities, as specified in section 2.2.3.

5.3.1. Value Proposition of Automotive OEMs

According chapter 4, battery electric cars have different driving characteristics compared to conventional vehicles. Distinguishing features are the torque, sound and the immediate availability of power. However, the relatively low energy density of the batteries reduces their driving range. Finally, electric vehicles depend on a wide coverage of charging stations. Creating an added value for battery electric vehicles to make them comparable to conventional vehicles constitutes a main challenge for automotive OEMs [Chesbrough and Rosenbloom, 2002]. With regard to electric vehicles, automotive manufacturers need to reassess their value proposition in order to address

infrastructure and battery issues to trigger customer's willingness to buy. However, car makers face the question whether to focus on products or services. [Bohnsack et al., 2014] Following list provides an overview of selected products and services, automotive companies offer in order to reconfigure their value proposition and to make critical attributes like driving range or charging time more equal to conventional vehicles.

Product-content:

- Charging Devices
- Range Extender

Service-content:

- Battery Service
- Infrastructure and Charging Service

As the driving range is seen as one of the most salient points of inferiority [Bohnsack and Pinkse, 2017], automotive companies produce battery electric vehicles that come with different drive modes. With regard to table 24, the driving range of battery electric vehicles of the 32 battery electric vehicles on the European market varies between 50 kilometers (Renault Twizy) and 540 kilometers (Tesla Model 3). Moreover, car makers offer range extenders which can almost double the driving range [Bozem et al., 2013, p. 96].

Due to cost issues regarding the electric vehicle's initial purchase price, car manufacturers like Nissan or Renault offer to separate the battery ownership from car ownership. Nissan offers as an option, while Renault obliges customers to rent the car's batteries. Renting the batteries is beneficial for the customer as the warranty of the battery is remarkably longer when rented (10 years instead of 2 years). Smart provides battery rental together with their "sales and care concept". [Renault, 2017, Nissan, 2017, Smart, 2017]

To extend the service offers and also address the charging time and infrastructure issues, automotive OEMs provide fast-charging connection points for electric vehicles. This tool enables to recharge batteries for approximately 80 % in 30 minutes. Charging cables for regular sockets are available on the market. The drawback is, that the charging process can take up to 12 hours to completely recharge. To make home charging possible, several manufacturers offer home charging stations. Some of them also involve a load-management system in order to reduce the charging rate when heavy household electricity consumption is detected. An example therefore is Tesla's home-charging station, the PowerWall, which enables the driver to recharge over night when energy rates are lowest [Tesla, 2017a].

5.3.2. Value Capture of Automotive OEMs

The financial service domain aims to promote the sales of the vehicles. It includes everything from leasing to financing offers. In order to strengthen the sales-oriented part of the business model, car manufacturers have built up their own banks. Examples therefore are Daimler Financial Services and BMW Bank. Toyota Credit bank focuses on financing and insurance for vehicles. However, pioneers in linking banks to producers were American car manufacturers. They noticed the possibility of paying in installments already in the year 1926. Vehicle sales considerably increased due to the offer of optional leasing as many customers do not have the liquidity to pay the whole sum at once. [Wedeniwski, 2015, p. 178] Nowadays, the lease construction used in the car industry is either provided by the automotive OEM or separate lease firms [Bohnsack and Pinkse, 2017].

Regarding battery electric vehicles, several new financing concepts were established. Still, costs for the battery system make up a major part of expenses of the battery electric vehicle, though prices are declining. [Frost and Sullivan, 2014] Due to these technological challenges and cost issues, firms try to decrease the negative perception of the high price and offer warranties, initial price reduction and payment constructions [Bohnsack et al., 2014].

As illustrated in figure 18, there are three ways to sell a car– direct, indirect or online. Furthermore, auto manufacturers rely solely on selective distribution. That way, they limit the amount of distributors in the indirect retailing and further ensure consistency. Moreover, a qualitative and a quantitative selection has to be fulfilled by the retailers. [Diez, 2012, p. 3]

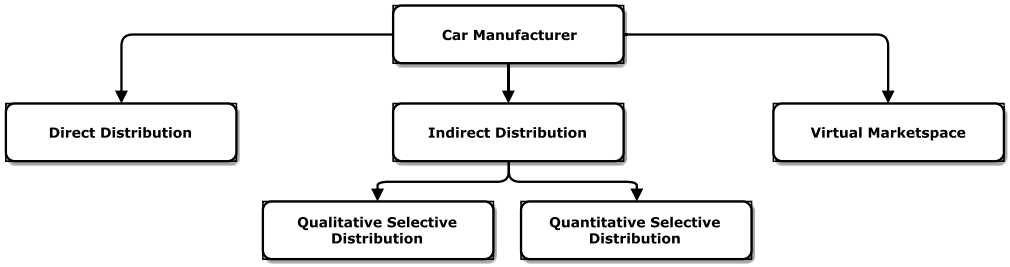

Figure 18.: Car Retailing [referring to Diez, 2012, p. 3]

Direct retailing is characterized by the manufacturers' exclusive sales organization. Auto manufacturers use this network to develop relationships with their customers. This is especially important to producers of premium brands like Mercedes or Audi. There are several advantages of direct retailing besides building customer relationships, like direct control of the distribution, creating mark's image and avoidance of trader margin. Disadvantages thereby are high investment costs. Therefore, volume brands tend to use indirect distribution channels to establish broader market coverage. [Diez, 2012, p. 6]

Indirect retailing is the main distribution format in the automotive industry. It includes the distribution by franchised dealerships. Hereby, the dealer is independent but has a contract with the manufacturer or distributor. The dealer is the owner of the product and takes the market risk. Furthermore, there are multi-franchised dealers which offer a wide range of brands. Compared to own retail, the control and management possibilities are limited for car manufacturers. Indirect retailing can further be distinguished in four operating types– traditional car dealership, authorized workshop, automotive dealer group and automotive dealer group with specialized retail outlets. [Diez, 2012, p. 7]

Nowadays, the established distribution channels in car industry are profoundly affected by changes in the product content and the major impacts of information technology. Dealers contemplate using the internet as distribution channel. Moving online is cost efficient and has the potential to intensify the customer relationships. Furthermore, car manufacturers are setting up virtual showrooms and use the internet to offer information and new services. [Selz and Klein, 2000, p. 2]

It can be stated, that new financial services have particular significance for the realization of new growth opportunities in the business domain of today's automotive OEMs. The value capture element can't be seen as long-term solution and should therefore be able to constantly evolve. New value-adding financial services have to move away from the regulated financial services in order to remain profitable [Wedeniwski, 2015, p. 180].

5.3.3. Value Creation of Automotive OEMs

Over the past century, the automotive industry was shaped by the complexity of the internal combustion engine and the amount of engineering put into the engine and the numerous ancillary systems. However, the emergence of battery electric vehicles as a dominant market segment causes major changes. Electric vehicles have distinctive characteristics such as the simplicity of the vehicle structure. [Bozem et al., 2013, p. 15ff] As a consequence of technological change, old and new competencies have to be developed. [Proff et al., 2015, p. 20]

The skills of young professionals who will be needed in the field of research and development will alter significantly. Competencies in the areas of mechanical engineering and mechatronics will shift to the fields of chemicals and battery technology (see figure 19). According to Proff (2015), the share of mechanical engineers and mechatronics specialists in research and development will decrease by 32 %, while the percentage of chemical engineers will increase by 100 % and of electrical and electronic engineers by as much as 900 %. This will lead to a shift in the amount of industrial engineers in Europe by 2030. However, the development of new competencies takes time. Therefore, the European automotive industry is in urgent need to development new skills in order to compensate the loss of value added for battery electric vehicles. [Proff et al., 2015, p. 35]

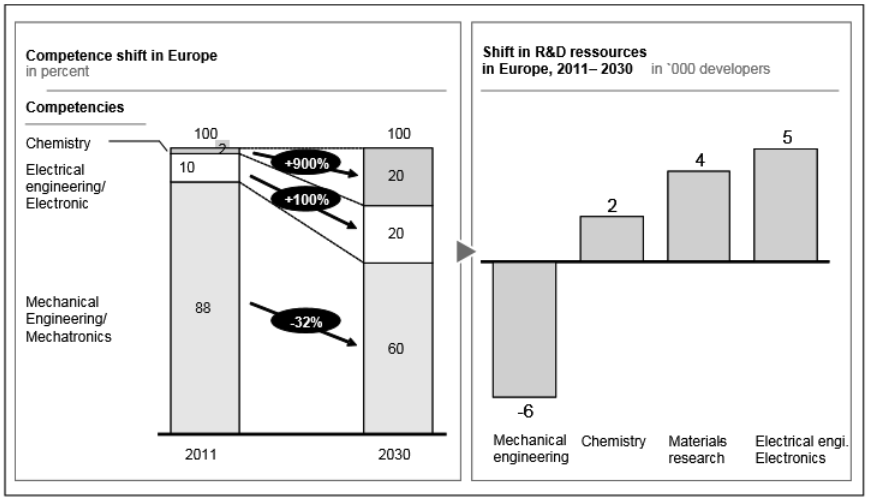

Figure 19.: Competence Shift in the Automotive Industry [according to Proff et al., 2015, p. 35]

The electrification of the drive train is expected to increase outsourcing activities as new products and parts are needed. Automotive companies tend to use specialist suppliers instead of developing the novel technologies in–house. Outsourcing as well as the technological changes themselves reduce the existing competence base. [Proff et al., 2015, p. 23]

It should be noted that the number of changing competencies is high, thus making it very hard to give a complete overview in the course of this thesis. Moreover, competence and resource losses due to technological change are difficult to limit [Teece, 2010, p. 10].

5.4. Summary Chapter 5: “Change Process in the Automotive Industry”

This chapter highlights changes in the automotive industry. Different factors force companies in this branch to include electric vehicles in their portfolio. The PESTLE analysis was applied as an orientation, in order to get an overall picture of the external environment of the automotive sector and driving forces. It helps to classify the environment and to understand long-term trends. Moreover, automotive OEMs modify their business model elements in order to cope with the challenges of the electrification of the drive train. Technological innovation triggers the development of new business models and changes the way companies create and capture value.

Part III.

Empirical Research

6. Research Design

Following chapter contains the detailed research design of the master thesis. First, the overall research process, based on the eight-stage procedure model of Eisenhardt (1989), is explained. Afterwards, the case selection and the empirical phase with data collection and data analysis are described. Finally, the quality criteria to ensure the reliability of the research are illustrated.

6.1. Overall Research Process

The reasons for choosing a qualitative single case study were already elaborated in chapter 1. Moreover, Eisenhardt (1989) defined an eight-stage procedure model, which has proven to be useful for developing new theories based on the case study method. Her framework was selected for the overall research process in this thesis. It was found to be most ideal for use in business model research and when there is a need to build theory through the development of a conceptual model. [Eisenhardt, 1989, p. 532ff] Figure 20 illustrates the complete research process including the activities and objectives of each process step.

The first step included a literature screening in order to narrow down the topic and formulate a research question. Moreover, the topics business model, business model change, technological change and alternative drive concepts were introduced. Based on the selection of the case company BMW and the information gathered, theoretical aspects were considered and used to develop the interview guide. The empirical phase involved the collection of data, an evaluation of the collected data and the preparation of the findings. Afterwards, the findings were compared with literature. The eight-step research process aims to conclude with a theoretical saturation as well as the discussion and conclusion of the present thesis.

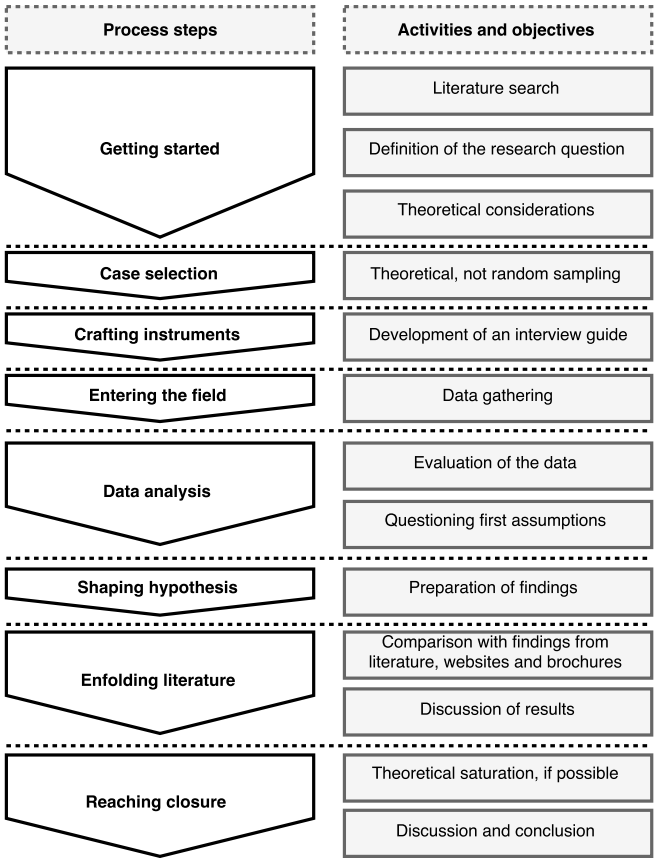

Figure 20.: Research Process [based on Eisenhardt, 1989]

6.2. Case Selection

As outlined above, a qualitative single case holistic design is chosen. According to Yin (2009), the single-case design is eminently justifiable under certain conditions, where the case represents (a) *a critical test of existing theory*, (b) *a rare or unique circumstance*, or (c) *a representative or typical case*, or where the case serves a (d) *revelatory*or (e) *longitudinal purpose*. [Yin, 2009, p. 52]

Theory building from a single case requires a well thought case selection. In this thesis, theoretical sampling is applied. Overall, theoretical sampling means that the case is selected because it is particularly suitable for illuminating and extending relationships and logic among constructs. Representative cases are therefore important in order to generalize. The cases are selected because they are unusually revelatory, extreme exemplars, or opportunities for unusual research access. [Yin, 2009, p. 54]

The case enterprise BMW was chosen as it is one of the worlds leading car producers. With BMW,

MINI and Rolls-Royce, the BMW Group owns three of the most valued brands in the automotive branch. Moreover, they were the first European company with a purpose-designed battery electric vehicle in the premium segment. Starting early with the series production of a fully electric vehicle allowed them to build up expertise in this field. In addition, the BMW case is an extreme and unique one as they launched the first electric car on the European mass market based on an highly innovative vehicle concept.

For the interviews, staff engaged at the company BMW and aware of the topics electric mobility and business model innovation were chosen. In addition, pragmatic reasons such as the accessibility of interview partners were taken into consideration.

6.3. Data Collection and Data Analysis

According to Myers (2009), a qualitative research serves the most appropriate option if a researcher wants to study a specific subject in-depth. It works best in exploratory studies when the topic is new and previously published research on the topic can be limited to a minimum. Overall, qualitative research methods study real situations, not artificial ones. To conduct this research type, the researcher is expected to actively engage with people in real organizations. [Meyers, 2009] The quality of the data is expected to be good and includes a set of data forms such as observations or interviews. According to Gioia et al. (2012), semi-structured interviews are a common method to gather data and can be used when the interview partner has complex knowledge on a particular topic. They allow not only for assessing the opinions and statements of the participant but also allow eliciting narratives about the personal experiences. [Nohl, 2009] A special form of the semi-structured interview is the expert interview. If expert interviews are considered, mainly employees of a company with a specific function and a specific experience are the target groups. Furthermore, Bogner and Menz (2009) discuss that experts are people of technical process oriented and interpretive knowledge regarding their specific professional sphere of activity. [Bogner et al., 2009, p. 19]

In order to gather good quality data for the qualitative case study, experts were chosen by making following preliminary considerations [Müller, 2014]:

- Who has the required information?
- Who suits best and is willing to provide the information needed?
- Who of the selected persons is available?

Following the three considerations, semi-structured expert interviews with four people linked to the company BMW and aware of the topics electric mobility and business model innovation could have been arranged. The interview partners were contacted exclusively by e-mail. As illustrated in

table 8, the interviews were conducted face-to-face between December 7th, 2017 and December 18th, 2017 and ranged from 00:25:31 to 01:07:04. At their request all interview partners were treated anonymously.

Table 8.: Interview Partners

Interview Partner	**Date**	**Duration**
1	7th of December	00:55:43
2	14th of December	01:07:04
3	18th of December	00:25:31
4	18th of December	00:26:12

Afterwards, all four interviews were transcribed in full. As the focus of the interviews lies in the content and in the form of what the expert explains, nonverbal expressions like sighing, coughing or breaks between two words were not considered in the transcription. The data analysis was conducted using the MAXQDA 2018 software tool.

For the qualitative data analysis, the step-by-step model of Mayring (2014) was used. As illustrated in figure 21, the deductive category application is based on prior formulated and theoretical derived aspects of analysis, which are brought in connection with the text. Moreover, an inductive category development was applied. [Mayring, 2014, p. 550]

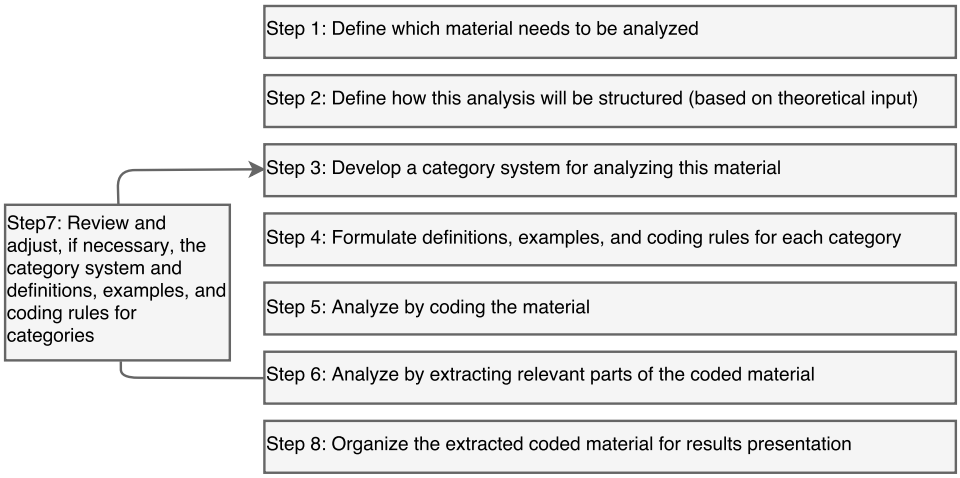

Figure 21.: Step-by-step Model for the Research Process [according to Mayring, 2014, p. 550]

Coding large amount of different files can cause that the coder fails to be able to be consistent in his or her coding and interpretation (intra-coder agreement). Moreover, when conducting content analysis in a team, coders need to be "synchronized" in terms of interpretation of the codes and coding procedure (inter-coder agreement). To tackle the intra-coder agreement issue, after the four

coded interviews, the coder checked the first interview again if the coding remains the same (see figure 21). To tackle the inter-coder agreement issue, the supervisor of this thesis checked and compared the results. In a second step, the results were discussed and it was decided which coding is adequate and which is not. [Mayring, 2014, p. 550f]

6.4. Quality Criteria

As a research design is supposed to represent a logical set of statements, the researcher should judge the quality of any given design according to certain logical tests. Therefore, following four tests are used to establish the quality of a case study [Yin, 2009, p. 40ff]:

- *Construct validity*
  The construct validity is the identification of correct operational measures for the concepts being studied. In the present thesis, data was primary collected using semi-structured expert interviews. In a second step, the data was checked for its plausibility. The appendix provides the paraphrased and coded data to improve the construct validity.

- *Internal validity*
  According to Yin (2009), internal validity refers to *"seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships"*. Overall, it defines the validity of causal relationships in findings and their reliability. The more plausible alternative findings are, the weaker the internal validity gets. For this purpose, the thesis includes tables and figures to provide evidence.

- *External validity*
  The external validity defines the domain to which the findings of a study can be generalizable. This quality criterion is seen as a major barrier in doing case studies as critics typically state that single case studies offer a poor basis for generalization. [Yin, 2009, p. 43] However, external validity relates also to the issue of case selection [Seawright and Gerring, 2008]. This thesis aims to increase the generalizability of the single case study through thoughtful case selection.

- *Reliability*
  The objective of the reliability test is to ensure that another researcher will obtain the same results if he or she follows the same research process. The overall goal of reliability is to minimize errors and biases in a study. [Yin, 2009, p. 45] In this thesis, traceability was ensured by precisely documenting the steps in the research process. Moreover, data was recorded and the paraphrased and coded data was checked by the author's supervisor.

7. Case Study

This chapter aims to reveal the collected information derived from statistics, brochures and semi-structured interviews related to the investigated case. The single case study focuses on the company BMW in Austria. Paraphrased evidence from the interviews should support the presented results. Table 9 illustrates the coding scheme with the applied deductive and inductive categories.

Table 9.: Coding Scheme [own illustration]

(Deductive) Superordinate Category	Inductive Category	Definition of the Category
Macro Dimensions	**– Politics** **– Economy**	*Driving factors towards electric mobility and business model innovation can be placed on either macro–level or micro–level dimensions. The macro–level perspective includes external drivers of change.*
Micro Dimensions	**– Customer Needs** **– Competition** **– Service Innovation** **– Company Philosophy**	*The micro–level perspective is defined by the direct periphery of the company.*
Challenges of Business Model Change	**– Challenges and Barriers** **– Approaches to Handle the Challenges**	*In order to innovate the business model, companies have to overcome a set of barriers and challenges. Challenges and barriers for incumbent firms include for example the overcoming of existing corporate structures, cognitive barriers and the ambidexterity of parallel business models. Approaches to handle the business model innovation process are for example to strive for flexibility converging to that of a start-up.*

Value Proposition	**– Driving Forces of the Value Proposition** **– Customer Segment** **– New Services** **– New Products**	*The value proposition reflects the value of a product or service, created for the customers and their needs.*
Value Creation	**– Driving Forces of the Value Creation** **– Core Competencies** **– Development Strategy of Battery Electric Vehicles**	*The value creation includes core competencies as well as activities to create value in a company.*
Value Capture	**– Driving Forces of the Value Capture** **– Pricing** **– Sales Process**	*The value capture element defines how a company captures value from its product and service offers in order to sustain the business. It includes the sub-elements pricing and sales process.*
Future Outlook for Electric Mobility	**– High Share of Electric Vehicles** **– Low Share of Electric Vehicles**	*The future outlook for electric mobility includes perspectives on the global share of electric vehicles and where the automotive industry is headed.*

Initially, a brief description of BMW and the Project i is given. Afterwards, factors directing the automotive industry towards more sustainable solutions are pointed out. Finally, changes in the components value proposition, value capture and value creation are analyzed in order to answer the research question outlined in section 1.1.

7.1. The Company BMW

The BMW Group is one of the most successful producers of cars worldwide and among the largest industrial companies in Germany. With BMW, MINI and Rolls-Royce, the BMW Group owns three of the strongest premium brands in the automotive industry. The vehicles they manufacture set high standards in terms of technology and quality. Moreover, the BMW Group provides the full spectrum of individual mobility, ranging from premium segment, small vehicles through to ultra-luxurious and powerful vehicles. [BMW, 2017a]

One of the first steps of BMW towards electric mobility was the implementation of field trials to investigate electric vehicles. In 2009, they tested more than 600 MINI E models on pilot customers

in Europe, USA and Asia in order to gather feedback. Two years later, more than 1000 BMW ActiveE models were launched for reasons of research on electric vehicle related technology and services. Based on a 1 Series Coupe, the ActiveE can be also viewed as the first iteration loop towards the way to the BMW i3. [BMW, 2017a]

In 2007, BMW started the Project i with a team of top managers and top engineers. The Leipzig plant plays an important role in the production and assembly of BMW i models. It is the place where the series production of the first all-electric car of BMW started. In September 2013, the BMW i3 was launched to the market. Stringent high standards for both material selection and production processes have been achieved in the areas of lightweight construction, sustainability and the careful use of resources. The BMW i3 is based on an innovative vehicle concept, which is tailor-made for electric mobility and includes a passenger compartment made of CFRP (Controlled Free Radical Polymerization). The i3 itself is powered by a lithium-ion battery developed and produced by the BMW Group and integrated in the underbody to save space. Driver assistance systems and mobility services from BMW ConnectedDrive as well as the services of 360 ELECTRIC have been exclusively developed for the i Series. [BMW, 2017b]

The i3 was carried over unchanged till 2016. In 2016, BMW introduced a new, optional, larger-capacity battery, extending the i3's range by 200 kilometers. As of January, 2018 customers can choose between the six options, outlined in table 10.

Table 10.: History of the i3 Series [according to the interviews and the website BMW, 2017b]

	BMW i3 60 Ah	**BMW i3 60 Ah with REX**	**BMW i3 94 Ah**	**BMW i3 94 Ah with REX**	**BMW i3s 94 Ah**	**BMW i3s 94 Ah with REX**
Year	2013	2013	2016	2016	2018	2018
Electric range in km (NEDC)	190	170	312/300	240	280	220
Customer-orientated total range in km	130-160	240-300	200	300-330	200	300-330
Electric motor: Output in kW	125	125	125	125	135	135
Top speed fully electric in km/h	150	150	150	150	160	160

7.2. Driving Factors of Business Model Change

A set of driving factors towards electric mobility and business model innovation of BMW were identified that can be placed on either macro–level or micro–level dimensions. The macro–level perspective includes external drivers of change while the micro–level perspective is defined by the direct periphery of the company. For better comprehension, the business model change drivers are further sub–divided into different categories. Overall, this section aims to outline external and internal factors influencing BMW's business model.

7.2.1. Macro-level Dimension

The automotive industry is seen as one of the most complex and technologically advanced industries. During the past few years, a shift to environmental friendly transport modes has taken place. Companies in the car industry have started to include alternative power train systems in their portfolios such as the battery electric vehicle. However, there are two distinct driving factors on the macro level that have pushed BMW towards this direction: political authorities and economy.

The analysis of the interviews has indicated that all interview partners have similar views on the influence of political authorities. Politicians are dedicated to promote the shift towards electric mobility. BMW Group and generally companies in the automotive industry are subject to regulations and restrictions. The European Commission's current limit on CO_2 from vehicles is 95 g/km that has to be reached by 2021. For 2030, the EU has determined a further reduction of 30 % of the average CO_2 emissions from car manufacturer's fleets. [European Commission, 2018] As the individual manufacturers have specific targets backed by financial penalties, BMW Group is forced to adapt their business model accordingly. Finally, funding policy and environmental policy are determining political factors on the expansion of electric mobility. Following the view of interview partner 2, an important instrument in the context of electric mobility is the allocation of public funding. Table 11 provides evidence on the reported political influences.

Table 11.: External Influence Factors

Interview partner	Inductive category	Paraphrase
1	**Politics**	*For political reasons, car manufacturers have to fulfill a quota. The German government specified a target of 1 million electrical cars by 2020.*

1	**Economy**	*The cost of batteries is one of the biggest hurdles for commercializing battery electric cars. However, prices have drastically decreased over the past few years. Falling prices will pave the way for a broader use of electric vehicles.*
2	**Politics**	*In how far electric mobility is established in a city depends on the size and on driving bans. A strong incentive is for instance to forbid drivers of conventional cars to drive through the downtown area. Financial incentives are important too. In Austria, the government offers about 4000 € furtherance for battery electric vehicles and 1500 € for hybrids. Finally also taxes have a significant influence.*
2	**Politics**	*Legislation clearly determines a reduction for car manufacturer's CO_2 fleet consumption to 95 g/km by 2021.*
2	**Politics**	*Generally, the quota of electric cars is dependent on where you live. In China for example the determining factor for politicians to raise the quota is the bad air quality. The number of people suffering from cardiovascular diseases has drastically increased during the past years. The pressure for offering alternative solutions for vehicles is therefore high. In Austria, the determining factor to turn to electrical vehicles is the topic of global warming.*
3	**Politics**	*Politicians play a major role on the expansion of electric mobility. Looking at current legislatures someone can clearly see that automotive manufacturers won't be able to reach the predetermined values if they don't increase their share of electric vehicles in their fleet by 2020, 2025 and 2030. It is quite clear that political authorities force us to include electric cars in our portfolio.*
4	**Politics**	*The growth of electric mobility is mainly triggered by political institutions.*

Interview partner 1 identified the costs for batteries as determining factor for the shift towards electric mobility. Falling prices are a crucial reason for people to switch to alternative drive concepts. Based on his opinion, technological development of lithium-ion batteries continues to improve while its prices decrease. Shrinking expenses for batteries make the cars more affordable for customers while increasing the profitability for automotive OEMs.

7.2.2. Micro-level Dimension

In the previous section, two external factors that drive the change towards electric mobility and business model innovation, were indicated. Nevertheless, business models do not merely change due to external inputs. They are further subject to influences on the micro-dimension. As outlined in table 12, the main internal drivers indicated by the 4 interview partner were changing customer needs, competition, service innovation and company philosophy.

Table 12.: Internal Influence Factors

Interview partner	Inductive category	Paraphrase
1	**Competition**	*Automotive OEMs, operating in the field of electric mobility, face increased competition from a set of new player. New competitors are grid providers, electricity suppliers and companies that provide the infrastructure for the electric cars.*
2	**Customer Needs**	*Today's customers want to drive environmental friendly vehicles.*
3	**Competition**	*Tesla is a main competitor and accelerating factor for the company BMW.*
3	**Customer Needs**	*Nowadays, customer want configure their car on the internet and expect it to be ready within one day.*
3	**Customer Needs**	*Over the past few years, people have started to buy a big share of their products online.*
3	**Service Innovation**	*We have perceived a strong tendency towards connectivity in the automotive industry. It is a topic that is shaping our society and our business model. Taken my own car as an example, I have a vehicle that is fully connected with its surroundings. The topic of connectivity has a huge potential in the car industry.*
3	**Company Philosophy**	*Our company wants to be market leader in the field of innovative technology.*
4	**Company Philosophy**	*BMW's company philosophy is to be market leader.*
4	**Customer Needs**	*Services are getting more and more important our the customers request them. Moreover, our customers are used to have apps and make use of them in their daily life.*

Three of the four experts pointed out that changing customer preferences support the shift towards electric mobility and encourage automotive companies to innovate their business models. Interview partner 3 and 4 emphasize customer's reliance on the internet and the tendency to purchase products online. Moreover, interview partner 3 links changes in BMW's business model to new expectations of customers relating to the delivery time of the vehicle. Prior, the average delivery time of a new car model was several weeks. Nowadays, customers expect their car to be ready to be picked up within a few days. Interview partner 4 considers consumer's environmental awareness as an important change driver for innovation. Rising consciousness of the environmental impacts of conventional vehicles results in the need for developing sustainable mobility solutions. The growing environmental awareness has also led to various forms of shared mobility usage.

For BMW, competition is a major internal change driver towards electric mobility and business model innovation. Interview partner 1 emphasizes new players entering the market of electric mobility. In the new supply network, grid operators, energy providers, electricity suppliers and infrastructure companies play a significant role and foster changes on current automotive business models. Moreover, interview partner 2 highlights the company Tesla as acceleration factor for BMW. Tesla has already established charging stations in key regions across the globe and BMW is following by announcing that they are planning to do the same.

Service innovation was stated as significant change driver by interview partner 4. According to him, the automotive industry has perceived a strong tendency towards connectivity over the past four years. Connectivity is a topic that is shaping the society and the business model of BMW. It is further seen as having a huge potential in the car industry.

The company philosophy is important for firms as the whole business and business model is built around it. Although a company's philosophy won't guarantee success, it is a principle that a business strives to work toward. In the case of BMW, experts 3 and 4 clearly stated that the vision of BMW is to be market leader in the topic of electric mobility and innovative technology. Moreover, interview partner 3 has complemented that it is the innovative thinking in total that makes BMW to reflect early on future business models.

7.3. Business Model Change at BMW

According to the definition in section 2.1.2, a business model is defined as a representation of how a company creates and delivers value to the customers. The process of new and further development of a component or the whole business model is referred to the term business model innovation. Business model innovation helps companies to meet the continually changing customer requirements while staying ahead of the competition. However, innovating the business model can be challenging. This section outlines the business model challenges BMW had to face and the way they handled them when adding the BMW i3 model to their portfolio.

7.3.1. Challenges of Business Model Change

The analysis of the interviews revealed that BMW had to face several barriers and challenges during their business model innovation process (see table 13). A challenge that is generally common for incumbent firms is to overcome existing corporate structures. Interview partner 3 mentioned that it is hard to innovate if the structure of a company is large. Large-scale organizational change, such as adding to the portfolio of product offerings, is more difficult in big companies like BMW. Expert 4 referred to the cognitive barriers of people that lead to an inability of managers and employees to remain receptive for changes on established business models. Interview partners 2 generalized that radical changes are always associated with a risk and therefore constitute a major barrier to business model change. Furthermore, the ambidexterity of BMW's parallel business models, the established one and the new one, constituted a main challenge. Interview partner 1 referred to the missing dynamics of big organizations:

> *The main challenge of big companies such as BMW is to early detect changes and to have the flexibility and dynamics needed to respond to them. However, the automotive industry is not known for its great dynamics. The bigger the structure of an organization, the greater its inertia. It correlates with a certain slowness. I am inclined to doubt whether the traditional automotive manufacturers such as BMW, Volkswagen and Daimler will handle future changes in the automotive branch quickly enough to keep up with the smaller, more dynamic companies.*

Overall, business model innovation can result in more than just a product change. The change can affect the heart of an organization. As a consequence, it constitutes a challenge to the purpose and culture of an organization. Returning to entrepreneurial skills and negotiating new positions requires increased collaboration. Therefore, it is crucial to have the ability to break away from current managerial paradigms and overcome path dependencies in order to innovate business models in established firms. However, interview partner 1 clearly pointed out that he doubts whether incumbent automotive OEMs such as BMW are able to handle this. He further states that established companies might not have the flexibility and dynamics to respond to the changes in the automotive branch quickly enough.

Table 13.: Challenges of Business Model Change

Interview partner	Inductive category	Paraphrase
1	**Challenges and Barriers**	*The bigger the structure of an organization, the greater its inertia. It correlates with a certain slowness. I am inclined to doubt whether the traditional automotive manufacturers such as BMW, Volkswagen and Daimler will handle future changes in the automotive branch quickly enough to keep up with the smaller, more dynamic companies.*
2	**Challenges and Barriers**	*Changes in the business model are always related to resistance within the company. Of course, they are also associated with risk.*
3	**Challenges and Barriers**	*For big companies like BMW it is hard to change something because the structure is too big.*
4	**Challenges and Barriers**	*The willingness to radically change the business model will always face headwinds from employees within the company. However, if it makes sense, BMW does it anyway.*

7.3.2. Approaches to Business Model Innovation

In the previous section BMW's challenges of business model innovation were outlined including the overcoming of corporate structures and cognitive barriers. To reconfigure the business model accordingly to the i3 model, BMW needed to strive for flexibility converging to that of a start-up. They demonstrated entrepreneurial courage by setting up a parallel development team. The project i team worked outside the normal corporate structures and away from the long-time employees. On that way, they managed to maintain the current business model while developing the battery electric vehicle together with new services. This decision was taken because they needed a completely new mindset, as interview partner 4 stated. Expert 3 mentioned, that an important success factor for business model innovation in general is to deal intensively with future trends. From his perspective it was obvious that BMW needed to respond to the need for electric mobility. Moreover, BMW's management is very decisive in their decision making and if needed, they enforce the change. Table 14 provides evidence on the reported approaches.

Table 14.: Approaches to Business Model Change

Interview partner	Inductive category	Paraphrase
1	**Approaches to Handle the Challenges**	*By building up a parallel structure for the project i, BMW has successfully managed the uncoupling from existing structures. However, they achieved to do this only one time as the project i team does no longer exist.*
3	**Approaches to Handle the Challenges**	*We greatly facilitate innovation and try to bring new innovations as fast as possible in series production. We always work on the latest topics in research and development and thereby try to screen out topics with significant future potential. All in all, it is the innovative thinking in total that moves BMW forward. Our focus is not on classical value concepts but rather on future business models we want to create.*
3	**Approaches to Handle the Challenges**	*If the managers of BMW want to change something, it will happen anyway. The need enforces the change.*
4	**Approaches to Handle the Challenges**	*The project i team was a parallel organization. The team was built up away from the long-time employees.*
4	**Approaches to Handle the Challenges**	*BMW invested heavily in the i3. We used highly innovative technology, starting with the technology up to the propulsion. BMW simply wanted to press on even though there was no clear vision of the future. BMW has made it abundantly clear that they wanted to be market leader in this field. That's why we now have the i3 and the i8.*

7.4. Changes to the Core Elements

As illustrated in section 2.2, this thesis uses a business model framework that consists of three core components: the value proposition, the value creation and the value capture. The value proposition includes product offers, service offers and the customer segments. The value creation reflects how the battery electric cars are developed and which competencies are therefore needed. The value capture indicates the sales process and which payment models the company BMW uses.

7.4.1. Value Proposition Change

In broad terms, the value proposition reflects the value of a product or service, created for the customers and their needs. It can be seen as the key to a successful business model and is further the determining factor for a customer to turn to a company. In this thesis, the value proposition includes the three sub-elements service content, product content and customer segment. This section aims to outline forces that effectuate a change on the value proposition element of BMW. Moreover, changes on the three sub-components in the value proposition are discussed.

7.4.1.1. Driving Forces of Value Proposition Change

Two driving forces that foster the change of BMW's value proposition could be examined: technology usage patterns and health impact.

It is crucial to a company to have a decided opinion about what their customers want, as it is every firm's goal to win more consumers and not to lose any of them to their competitors. Therefore, following actual market trends and usage patterns are highly important for BMW to fulfill customer requirements and stay ahead of the competition.

Interview partner 1 referred to the sharing economy. It is an upcoming trend that allows automotive manufacturers to make money from their hardware without selling it. The internet, the ease of mobile payments and pervasive computing are a decisive enabler for it. BMW addressed this trend by offering DriveNow, a carsharing service. By offering the hardware and the corresponding app, the company creates a new revenue opportunity. Interview partner 3 further stated that nowadays people are accustomed to have apps and are also aware of their usage.

The second driving force, mentioned by interview partner 2, is the health impact that fosters companies like BMW to think of new products and services. However, he added that countries like China have a much higher pressure on changing their offerings as the cardiovascular diseases in China have increased enormously. In Austria, the main issue is climate change. Interview partner 4 mentioned that BMW addressed a new customer base with the i3 model. This group buys the car to promote environmental thinking. In the end, the reason of addressing a customer base that wants to set a statement with driving a battery electric car might have also been decisive for applying the purpose design for the i3.

Table 15 summarizes the overall findings on driving forces that cause a change to the value proposition element. Value proposition change further induces changes on the value creation and the value capture element.

Table 15.: Driving Forces of Value Proposition Change [own illustration]

Interview partner	Driving force	Value proposition change	Additional BM elements change
1, 2, 3	Trends and technology usage patterns	DriveNow	It creates a new sales opportunity.
2, 4	Health impact	New products and services	It impacts the value creation element.

7.4.1.2. Product-Content

The analysis of the interviews revealed that two products in correlation with the battery electric vehicle were emphasized: the range extender and the BMW i Wallbox. Adding hardware to the electric vehicle to overcome the fear of insufficient range and to react on the infrastructure issue is a tactic BMW uses to promote the battery electric vehicle and to address customer requirements.

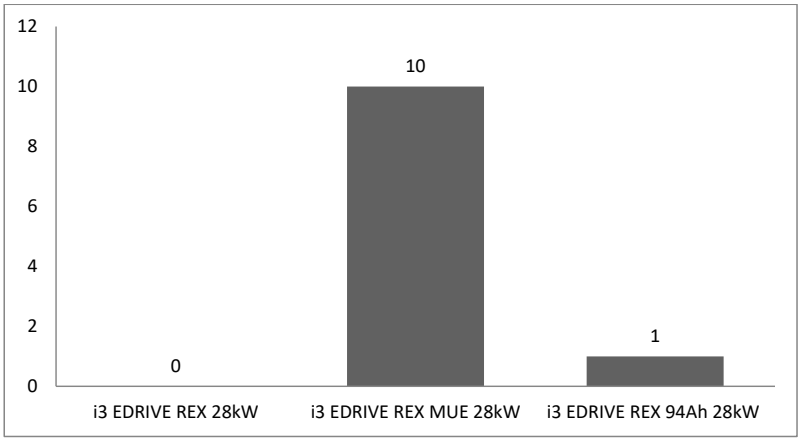

Figure 22.: Range Extender Sales Figures [Helwig Schmitt GmbH, 2017]

The range extender is a feature BMW optionally provides to address concerns relating to the range of the battery electric vehicle by almost doubling the driving range. However, the sales numbers in figure 22 illustrate, that the number of sold range extenders in Austria for the i3 is marginal. While the i3 REX 94 Ah 28 kW was only sold once in the period of January till November 2017, the i3 REX 28 kW wasn't sold at all. Only the updated version of the i3 REX 28 kW had achieved better sales figures amounting in 10 pieces sold within the eleven months.

In Austria, range extenders only attract a small share of people. Although this could be an indication that the provided range of the BMW i3 is sufficient for the customers, interview partner 2 presumes other reasons behind it:

> *We offer our customers three versions of range extenders. Overall, the sales figures of all three range extenders taken together made up 1.2 % in the period of January till November 2017, hence, they are not relevant at all. From my point of view, reasons for this evidence might be financial incentives. The furtherance for a fully electric car in Austria is around 4000 €, for hybrids it amounts to 1500 €. A customer loses 3500 € of the furtherance, while the range extender additionally costs 5000 €. Moreover, the costs for private use of company vehicles in Austria, depending on the emission limit, makes up 740 € to 950 €. As battery electric vehicles are seen as emission free, these costs are invalid and therefore result in a benefit for me as a private user. Additionally to the 950 €, a customer would have to pay income tax which currently make up 35 %, resulting in around 300 € per month. Again, for a battery electric vehicle, these costs are void. Finally, fully electric vehicles are entitled to deduct input tax, hence, you get back the value added tax which results in 20 % savings.*

Viewed in total, interview partner 2 points out that several factors argue against a purchase of a range extender as a corporate client:

- 3500 € loss of incentives
- 20 % value added tax
- 720 €–960 € for private use of company vehicles (depending on the emission limit) [1]
- 35 % income tax

In addition to the range extender, BMW provides a complete range of BMW accessories, especially made for the i series. For a convenient charging of the battery, BMW Group offers a home charging solution, the BMW i Wallbox. If a customer has a private parking space, he can fully charge his car within approximately six hours. Moreover, customers can optionally buy an AC fast charging cable which achieves up to three times the charging speed compared to the standard charging cable supplied with the car. Also accessories like all-weather floor mats, a transport net and a storage bag, especially designed for the i3, are offered. [BMW, 2017a]

[1] In 2016, the Austrian parliament adopted a new tax reform. The monthly taxable income from the private use of company vehicles increased from 1.5 % to 2 % of the total acquisition costs for automobiles with a certain CO_2 emission limit. For vehicles beneath that threshold, the monthly taxable income stays at the current 1.5 %. The highest taxable income increased to 960 € for the private use of company cars. According to the new tax reform, private use of battery electric cars is tax free. Moreover, the reform results in significant savings for employers and employees. The current ceiling rate of 50 % applies to annual taxable income of more than 90.000 €. If for instance a BMW i3 is used as company car, the employee saves 3.000 € per year at a margin tax rate of 50 %. The employer can save currently 600 € incidental wage costs. [WKO, 2017]

7.4.1.3. Service-Content

Services that directly enhance the ease of use, maximize the value over the vehicle's lifetime and address customer requirements will be the key to commercialize the battery electric vehicle on the mass market. Car-sharing services, connected applications as well as location-aware applications will play a significant role helping the customer to make the most of their battery electric vehicle while enhancing the ownership experience. As outlined in table 16, all interview partners agree on the importance of services in correlation with the battery electric vehicle.

Table 16.: Importance of Services

Interview partner	Inductive category	Paraphrase
1	**New Services**	*Only those, who follow the trend of the sharing economy and offer car-sharing services, will be competitive in the future.*
2	**New Services**	*Today, automotive manufacturers mainly look for staff in the field of information technology as the focus on services is increasing, especially in the case of the battery electric vehicle.*
3	**New Services**	*We focus on services to make the battery electric vehicle more attractive to our customers.*
4	**New Services**	*I think services will be the most important competence of BMW in the future.*

A topic especially highlighted by interview partner 4 is connectivity. The BMW i3 has an integrated SIM card as standard and is thereby fully connected with the environment. It allows the customers to make use of BMW i ConnectedDrive services. BMW i ConnectedDrive supports the car owner during their journey and when charging the vehicle. To address the fear of insufficient range, the services include a range assistance that provides the customers reliable information on the location of charging points along the route and further suggests efficient driving styles. As part of the holistic approach of 360 ELECTRIC, a customized repair and maintenance package is offered to customers of the BMW i3. [BMW, 2017b]

According to interview partner 1, BMW early identified the need to address the trend of sharing economy in order to diversify their services while finding new revenue streams and adaptions to their business model. Together with Sixt SE (Societas Europaea), they started offering their cars for rental in European cities. The customers can locate the available cars via the DriveNow app and can afterwards leave the car wherever they want. Because carsharing is both environmentally friendly and affordable, the BMW Group hopes to broaden their customer base by attracting younger and

environmental-aware people. Moreover, the sharing economy trend affects the degree of utilization of the BMW i3 as 20 % of the vehicles offered for rent are BMW i3 models. An ordinary car is parked 95 % on average and usually used by one person or at best by a whole family while shared cars are used by a few thousand people over their life cycle.

7.4.1.4. Customer Archetypes

In December 2017, BMW Group announced that, within a year, they have delivered more than 100.000 BMW i3 models worldwide [BMW, 2017b]. The rise in popularity of the BMW i3 can also be observed by looking at the Austrian share of the i3, as illustrated in figure 23. According to Statistik Austria (2017), sales figures continue to grow, having registered 752 units in 2016, representing a 329,8 % surge over the year 2015. In November 2017, 752 new registered BMW i3 models were counted. Therefore the question arises in how far the introduction of the battery electric vehicle has changed the customer segment of the BMW.

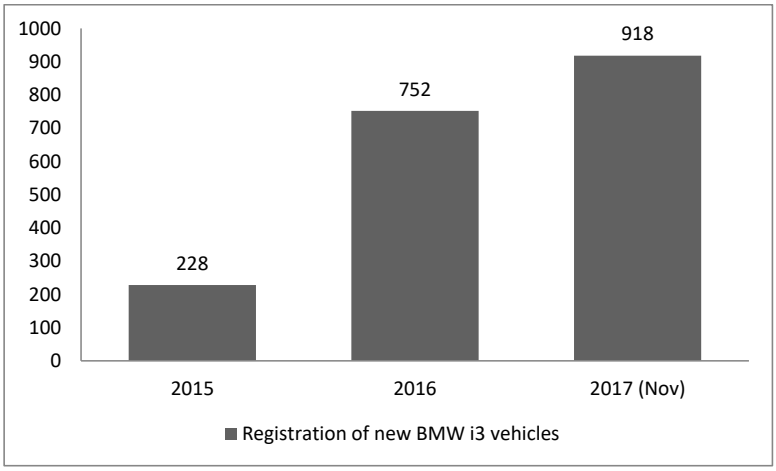

Figure 23.: Registration of New BMW i3 in Austria [according to Statistik Austria, 2017]

Interviewing a sales partner of the BMW Group, situated in Upper Austria, helped to gain insights into the current customer base of BMW. The interview revealed that BMW's battery electric vehicle is primary purchased by corporate clients. Following reasons were stated by the interview partner:

> *The current customers of the BMW i3 have already been in our portfolio before the release of the i3. Overall, these are solely corporate clients. I wouldn't dare to suppose in how far fully electric vehicles are purchased by private customers. Reasons why the i3 is mainly adopted by corporate clients are the incentives. A private customer has to pay 50.000 € minus 4.000–5.000 € promotion for battery electric vehicles. For corporate clients it is much cheaper as they don't have to pay value added tax. Moreover, the*

cost for private use of company vehicles is depending on the emission limit. As battery electric vehicles are seen as emission free, these costs are also invalid. In the end, our clients are owners of big companies, who want to extend their vehicle fleet and therefore add two or three battery electric vehicles.

However, the interview partner also pointed out that, in general, there are three customer archetypes that purchase an i3. While the first group was said to already exist in the customer portfolio, groups 2 and 3 form a new segment each.

1. Business Customers: The business customers make up the largest customer segment of the BMW i3 model, which was also confirmed by interview partner 4. According to interview partner 2, reasons therefore primary constitute cost benefits and tax advantages.

2. Early Adopters: The early adopters make up a small group of technically oriented people who want to have the new technology before the others. Interview partner 2 pointed out that the decisive aspect for this customer group is to show that they drive an electric car, even if it means that they have to pay more. According to a study from McKinsey (2017), early adopters make up a sizable customer segment of battery electric vehicles. They describe them as high-income, well-educated consumers, who are willing to pay more although they are aware of the downsides of electric vehicles.

3. Environmentalists: The third group that can be reached with the i3 model are the environmentalists. They form a new client base that couldn't have been reached with conventional vehicles.

7.4.2. Value Creation Change

In general, the value creation includes core competencies as well as activities to create value in a company. To point out the changes on the value creation element of BMW, driving forces causing the change and the ways BMW reacts to them are outlined. Moreover, refinements and adaptions on core competencies are discussed. The section concludes with the conducted and planned activities of BMW in order to achieve scaling effects and flexibility in the production of the battery electric vehicle.

7.4.2.1. Driving Forces of Value Creation Change

The analysis of the interviews revealed, that the value creation of BMW is influenced by four driving forces: battery technology, infrastructure, connectivity and the need for providing mass suitable vehicles.

Although, battery technology is constantly improving all interview partners agreed that the fear, the car has insufficient range to reach the destination, discourages customers' acceptance and also retrains its social benefits. As BMW follows a customer-centric approach, addressing the needs of customers who travel long distances constitutes a big challenge for them. Therefore, they decided to rely on in-house developments for the high-voltage battery system of their electric vehicles to do their best to meet the customer's requirements and also address the customer segment of long-distance drivers.

A point, which was also mentioned by all four interview partners, was the infrastructure. According to interview partner 3, the infrastructure issue constitutes the greatest obstacle for establishing BMW's battery electric vehicles on the mass market. He further stated, that the BMW Group has recognized the infrastructure issue long time ago but, like other automotive manufacturers too, they waited till someone else might tackle this issue. Moreover, interview partner 2 pointed out that investing a high amount of money in the vehicle development of battery electric vehicles, which might not be sold because of the missing charging stations, is not expedient. Therefore, BMW decided to invest into charging stations to have a realistic opportunity to retail their electric cars. Together with Volkswagen Group with Porsche and Audi, Daimler AG and Ford Motor Company, BMW announced the joint venture IONITY. They aim to build up 400 High-Power Charging stations by 2020 across Europe, to make long distance travels easier. [IONITY GmbH, 2018] Moreover, it also marks a significant step for electric vehicles and an increase in sales of BMW's battery electric cars. Additionally, it opens up new possibilities for the value capture element of their business model.

Interview partner 1 named connectivity as a force, driving the way how BMW creates value. They early recognized the importance of connecting car and driver with their surroundings. Thereby, the focus is on the improvement of the customer's comfort and the ensuring of optimal safety for both the driver and the passengers. For the value creation that means, in concrete terms, that BMW already had to hire additional staff in the field of informatics and software engineering, which was confirmed by all interview partners. Moreover, having customer data enables BMW to customize the mobility services.

Providing mass suitable cars was said to be important by 3 of the 4 interviewed partners. Interview partner 4 stated that the i3 model was truly ahead of its time, integrates highly innovative approaches and has a design which might not be appealing to the commercial customer. Additionally, he said that it was never the intention of BMW to produce the i3 in a high volume. According to interview partner 3, the i3 model was developed to gain a foothold in the field of electric mobility and to build up experience. Further reasons are outlined in section 7.4.2.3. In order to make the battery electric suitable for the mass market, BMW starts to build on existing car concepts and new platforms. On that way, they are also able to react quickly on changes in the company's environment.

Table 17 summarizes the overall findings on driving forces fostering the change in the value creation. Value creation change further induces reconfigurations on the value proposition and

the value capture as additional services, new sales opportunities and a new customer base can be reached.

Table 17.: Driving Forces of Value Creation Change [own illustration]

Interview partner	Driving force	Value creation change	Additional BM elements change
1, 2, 3, 4	Battery technology	In-house developments	A broader customer base can be attracted.
1, 2, 3, 4	Infrastructure	IONITY	It creates a new sales opportunity.
1	Connectivity	Customized mobility services; Additional staff	It creates a new sales opportunities and causes changes in the value proposition.
1, 3, 4	Mass suitability	New platforms	A broader customer base can be attracted.

7.4.2.2. Core Competencies

The broadening of the core competencies at BMW took place in the area of battery technology. Interview partner 4 referred to the importance for the BMW Group to offer a reliable battery system for their electric vehicles. Triggered by the announcement that Tesla reveals the world biggest battery, BMW invested 200 million Euros in their new competence center, based in Munich. They aim to make progress in the cell technology in order to achieve a sustainable transportation in the near future. Besides focusing on the cell design and technology, BMW has the goal to create prototypes of future battery cells by focusing on the usage of different materials as well as on the chemical composition. With the production of the prototypes, they are able to analyze and fully understand the whole value creation process of the cells. It further enables BMW to define how their potential suppliers produce the cells according to their specifications. However, interview partner 3 has clearly underlined that existing core competencies of BMW will remain important, such as the design. According to him, the design is a significant distinctive feature among the automotive manufacturers.

The interviews highlighted that, besides of the additional knowledge in battery technology, the company's core competence portfolio has not changed yet. However, all interview partners predict a change in the near future. Summing up the paraphrased answers in table 18, interview partner 1 makes clear that the integration of electric mobility in the company will result in an unusual portfolio of competencies containing areas such as electrical engineering, telematics, mechatronics and software engineering. According to the recent job advertisements of BMW, interview partner 2 related to the need for informatics. Interview partner 3 predicts the service sector as future core

competence while interview partner 4 refers to the importance of the drive technology for BMW's battery electric vehicles. However, regarding the growing focus on the field of informatics and services, interview partner 3 expressed his concern:

> *In search for suitable personnel in the area of information technology we don't compete with classical car manufacturers such as Daimler but rather with large corporations such as Google and Apple. Those firms look for people with similar know-how which makes it hard for us to get the right staff.*

Table 18.: Changes in the Value Creation Element

Interview partner	Inductive category	Paraphrase
1	**Core competencies**	*Competencies needed for electric vehicles obviously involve electrical engineering, telematics, mechatronics and software engineering. A new, unusual portfolio of competencies will arise, which hasn't existed in the automotive industry before.*
2	**Core competencies**	*I personally think that the core competencies of BMW haven't changed yet, though, I belief that they will in the near future. Job advertisements clearly illustrate that BMW is mainly looking for informatics.*
3	**Core competencies**	*Services will be a future core competence.*
4	**Core competencies**	*Drive technology is highly important for the BMW Group. We will not employ standard-electric engines or standard battery technology. Therefore, we are going to technologically empower ourselves in these areas.*

7.4.2.3. Electrification Pathway

The pathway towards electrification started for BMW with the "pioneering-phase". This phase was characterized by three points: project i, technology innovation and building up expertise. The project i team was a small group of people, including only top engineers and highly qualified managers of BMW who worked in parallel to the normal operations of the company. In 2014, the i3 was launched on the Austrian market. The vehicle itself included a highly innovative and expensive technology and further applied a purpose design. Surprisingly, the interview partners stated that the model was rather produced to convey a message than has attempted to be sold in high volumes. The technology included in the i3 is too expensive to produce it for the broad mass.

Interview partner 3 mentioned economic reasons behind the decision of BMW why they have never aimed to produce the vehicle in large quantities. Overall, with the i3, BMW wanted to gain a foothold in the area of electric mobility. Their clear statement is to be market leader even if it means that they launch a car which is too far ahead of its time and might not be suitable for the broader mass. In the end, BMW has benefited from its early start in the development of battery electric vehicles by gaining a lot of expertise in this field.

The second phase of the pathway is characterized by three updates: the upgrade of the i3, the announcement of the MINI BEV and the announcement of the BMW X3 BEV. After a battery system upgrade in 2016, the i3 is bound to get another technology update this year, in 2018. The BMW Group is currently launching the first facelift of the i3, the i3s. The i3s is a sporty version of the previous i3 model aiming to deliver better driving dynamics. Moreover, the BMW Group published to launch the fully-electric MINI and the all-electric BMW X3 in the coming years. In this way, they are starting to electrify their core portfolio.

The third step of BMW is to build new platforms in order to achieve more flexibility and scalability. Interview partner 1 expects a high share of electric vehicles in the upcoming years. However, factors such as incentives, infrastructure and regulations have major effects on the scale of electrification. In order to react appropriately to those factors and their customer's demands, BMW Group started to develop platforms that enable their production facilities to build vehicles with an internal combustion engine, a plug-in hybrid or a fully electric power train at the same time.

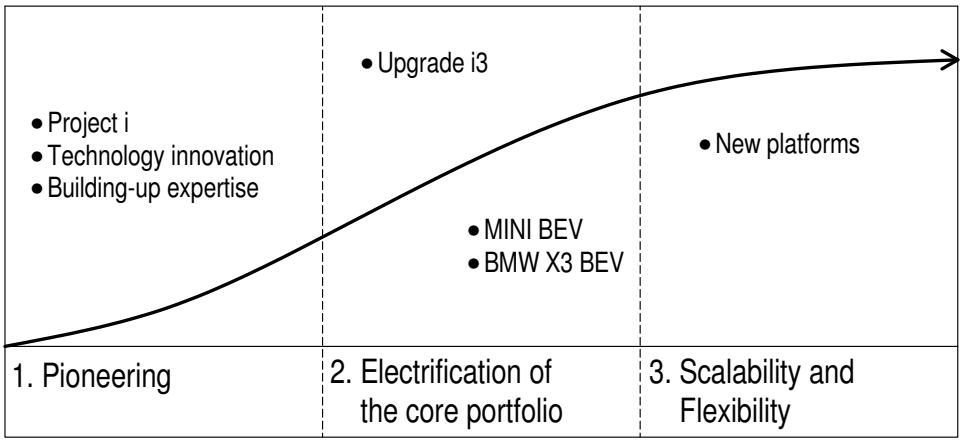

Figure 24.: Electrification Pathway [own illustration]

Figure 24 illustrates the electrification pathway of BMW with the three phases: pioneering, electrification of the core portfolio and flexibility and scalability. Moreover, table 19 gives evidence on BMW's production strategy to reach more scalability and flexibility.

Table 19.: Elelctrification Evolution

Interview partner	Inductive category	Paraphrase
1	**Development Strategy of Battery Electric Vehicles**	*The development of the i3 model has started in 2006, market launch was in 2014. BMW applied the Purpose-Design, integrating a completely new vehicle platform.*
1	**Development Strategy of Battery Electric Vehicles**	*BMW has now started to make conversions with new plug-in models.*
1	**Development Strategy of Battery Electric Vehicles**	*New platforms are very important to BMW. They made their strategy of electrifying their whole model range public. Therefore, they want to use platforms which can be used for all three options, hybrid, conventional and fully electric. In a few years, we will have a significant share of electric vehicles.*
2	**Development Strategy of Battery Electric Vehicles**	*Of course, we want to make the electric vehicle suitable for the mass. Therefore, we use existing platforms to reach a broader range of customers.*
2	**Development Strategy of Battery Electric Vehicles**	*With the i3, BMW was a pioneer. The model is a so-called solitary vehicle, which was rather produced to convey a massage than has attempted to be sold in high volumes.*
2	**Development Strategy of Battery Electric Vehicles**	*Although the i series hasn't been extended so far, BMW is leader in the area of plug-ins. Compared to other car manufacturers, they offer a wide range of plug-in models. Moreover, they started electrifying the MINI and the X3. Also the i3 has been upgraded, now offering a higher range and a new battery technology.*
3	**Development Strategy of Battery Electric Vehicles**	*We massively foster innovation and focus on launching new innovations as fast as possible on the market. With the i3, we wanted to set a statement, though, we never attempted to sell it in high volumes as the technology included in the i3 is too expensive to draw profit out of it. Moreover, we believe that the i3 is not proposed for a broadly use. In the future, we eventually want to extend the i series, but for now, the i3 is titled to be a technology leader.*

4	**Development Strategy of Battery Electric Vehicles**	*We want to be market leader. The core requirement of BMW is to be first on the market with future-oriented technologies. With the i3, we managed that quite well. Additionally, the i3 incorporates highly innovative approaches, which were ahead of its time and might not be mass suitable. The production of the i3 was very expensive, but the keynote was to be technology leader. Other car manufacturers are followers.*

7.4.3. Value Capture Change

The value capture element defines how a company captures value from its product and service offers in order to sustain the business. It includes the sub-elements pricing and sales process. This section discusses possible forces causing changes on the value capture element. Moreover, influences on the sub-elements pricing and sales process are outlined.

7.4.3.1. Driving Forces of Value Capture Change

The analysis of the interviews revealed, that four driving forces cause a change to the value capture of electric vehicles: new market entries, taxes, customer's buying behavior and rapidly developing technologies.

A paradigm shift to a sharing economy along with new entrants inevitably forces automotive manufacturers to compete on multiple fronts. New players in the field of electric mobility such as energy providers increase the complexity of the competitive landscape and put traditional car manufacturers and retailers under enormous pressure to reduce costs. Evidence on this provides the comparison of two sales offers of the BMW i3, illustrated in table 20. First one is derived from the website of Energie AG Upper Austria and the second one from the BMW car retailer Hans Geyrhofer&Sohn GmbH, also situated in Upper Austria.

Table 20.: Sales Offer [according to Hans Geyrhofer & Sohn, 2018, Energie AG, 2018]

	Offer
Energie AG Upper Austria	*– 669 €/month leasing rate* *– 15.000 kW/year credit for charging current* *– BMW i Wallbox and a fast charging cable* *– Winter and summer tires including montage and storage* *– Comprehensive insurance* *– Service package and safety check*
BMW Retailer Hans Geyrhofer&Sohn GmbH	*– 610 €/month leasing rate* *– Seat heating* *– BMW i Wallbox and a fast charging cable* *– Winter tires with rims* *– Comprehensive insurance* *– Navigation system*

Energy providers such as the Energie AG have discovered the field of electric mobility as a new market opportunity and sell the BMW i3 along with their electricity. Car retailers are in the pressure to follow and have to establish better offers in order to gain an edge over their competitors. Compared to Energie AG, the BMW retailer offers to lease the car for 70 € less together with the opportunity to configure it freely. In the end, interview partner 2 clearly pointed out that retailers have to offer cheaper and more attractive contracts to retain their customer base and to win new ones.

Although sales figures show an increase, the market share of battery electric vehicles in Austria is still low. The analysis of the interviews has revealed that one barrier contributing to the relatively low competitiveness is relating to cost perception. In order to overcome this barrier, countries like Austria have introduced policies for promoting the use of electric vehicles. These apply different categories of incentives such as a grant of 5.000€, an exempted parking fee and tax benefits. However, the primary target group are still corporate customers as they are the only ones enjoying tax benefits. According to interview partner 2, the average customer buys a car for 20.000€–25.000€, and not for 50.000€ as in the case of the BMW i3. In order to compensate the absent tax exemption for private customers, companies like BMW have to review their price setting to reach a broader customer base.

Table 21 summarizes the findings on driving forces that influence the price setting and in a broader sense also additional business elements like the customer segment. Alterations caused due to changes in customer's buying behavior and rapidly improving technologies will be discussed more accurately in the next two sections.

Table 21.: Driving Forces of Value Capture Change [own illustration]

Interview partner	Driving force	Change in the price setting	Additional BM elements change
1, 2, 4	New market entries	Lower leasing rates	It aims to retain and attract customers.
1, 2	Taxes	Considering a decrease in the initial price	A broader customer base can be reached.

7.4.3.2. Pricing–Model

Overall, the technology of the BMW i3 has come a long way in the past four years. The ranges have extended, battery technology has improved, charge times have gone down and performance has increased. Two years after the market launch of the BMW i3 in Austria, the vehicle got an upgrade. The larger-capacity battery extended the i3's range by 200 kilometers. In 2018, BMW has again revealed a new variant on its i3 battery electric vehicle. Considering these high development leaps in BMW's battery technology, the question of leasing or buying in the case of the battery electric vehicle needs to be rethought. Interview partner 2 offered a thought-provoking impulse on the leasing or buying decision of fully electric vehicles:

> *Until now we have no experience values on the price development of battery electric vehicles. The new version of the i3 has a higher range, offering a better battery technology. With this improvement, the predecessor models got abruptly irrelevant. We believe that new development leaps will be following soon, hence, the drop in price of current models will further increase. Currently, the fully equipped i3 is sold for 60.000€, but how will the price for the used car be? Will anyone buy a used BMW i3 model?*

Due to fast developments in the battery technology, vehicles depreciate in their value rather quickly. To lower the residual value risk, leasing might serve the better option. It avoids missing out on the latest developments in electric vehicle's technology and makes the vehicle more affordable. Moreover, it shifts uncertainties about the reliability of the new technology from the customer to the company, while decreasing the vehicle's residual value risk. For the car retailers, leasing serves the advantage of keeping in contact with their customers.

Another option for BMW to reduce the uncertainty according the battery would be to offer battery leasing, like Renault does it for a monthly fee of 79€. However, interview partner 3 has a clear statement on that:

> *Our evidently claim is that the battery has to work over its defined lifetime. If a car manufacturer offers to lease the battery, he admits concurrently that he lacks in*

controlling its technology. Obviously, Renault is afraid of giving their customers the promise that the battery has a long durability and therefore suspects that they will be dissatisfied after a few years. Our battery has to fulfill the customer's requirements and has to last over the entire lifetime.

All taken together, the battery electric vehicle influences the pricing of the value capture element. The interviews revealed clear statements why leasing might be the better option when considering to purchase a fully electric vehicle. Moreover, with battery leasing a company admits that they lack in controlling the battery technology.

7.4.3.3. Sales Process

BMW has set up an innovative multiple-channel model [1] for the BMW i products and services that focuses on selected markets. As illustrated in figure 25, it comprises 46 selected BMW i agents in the area of Austria who deliver the battery electric vehicles to the customers [BMW, 2017b].

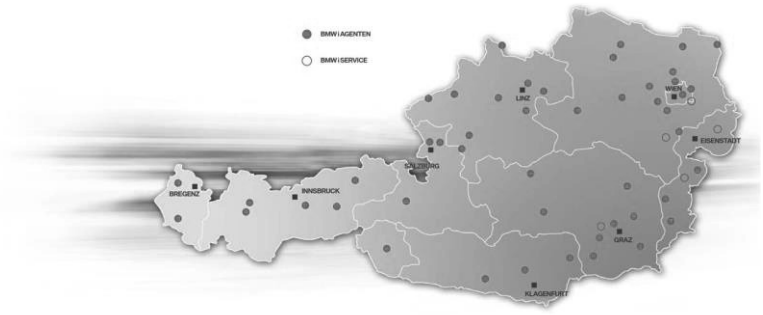

Figure 25.: BMW i Agents Austria [according to BMW, 2017b]

The determining factor to set up this model was to reach a new customer base. Creating an online channel for the younger, technically-oriented customers seemed to be the next logical step for BMW to address changes in consumer's buying behavior. For automotive manufacturers as well as retailers, this trend poses both significant opportunities and challenges. By selling the car online, BMW is no longer limited to local retailers during business hours as today's customers are shopping anywhere and anytime. For retailers, the shift to the multi-channel model served also significant advantages, as interview partner 2 expressed:

At the moment, the customer is buying the car directly from BMW, not at our dealership.

[1] The so-called "Agenturmodell" allows a selected number of BMW retail partners to hand over the BMW i3 model. Customers purchase the vehicle online, directly at BMW.

> *Practically, we are only the middleman and get a fixed commission if a car is sold at our store. As the contract is between BMW and the buyer, we are not allowed to give any discount on the vehicle. For us as dealers, the Agenturmodell is actually quite advantageous as we get our fixed provision and can save a lot of extra work. [...] Howsoever, the multi-channel model was abolished as it wasn't accepted very well by the customers. Uncertainties in new technologies raise issues and build up prejudices. Therefore, traditional retail stores are highly relevant when it comes to the battery electric vehicle. We can address questions and needs of the customers on site; hence, the retails stores for fully electric vehicles are even more important than for conventional cars.*

Usually, car manufacturers use dealers as their retail outlets and don't directly sell their products to the customers. However, with the multi-channel model exclusively set up for the BMW i sub–brand, the contract conclusion is made between the customer and BMW itself, car dealers function only as middlemen and hand over the car to the customer (see figure 26). The car dealerships lose the possibility to give discounts but get a fixed commission for every sold BMW i3 and, at the same time, it reduces their inventory level. Attempting to reach a broader customer base for a new technology through a new sales channel might not have been the best approach. Novel technologies pose uncertainties and therefore strengthen the traditional, stationary trade.

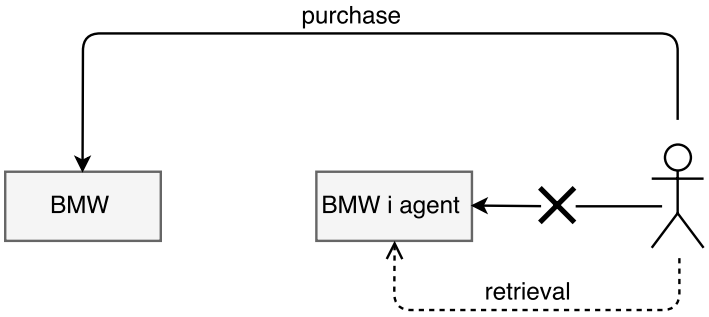

Figure 26.: BMW i3 Distribution Model [own illustration]

However, BMW has announced that they are going to abolish their multi-channel model this year. On the first of October 2018, the distribution program is turning back to the regular sales channel worldwide [BMW, 2017b]. According to interview partner 3, multiple distribution channels increase the complexity and are therefore too difficult to manage. As a result, all sales partners will be allowed to sell BMW's electric vehicles.

7.5. Future Outlook for the Automotive Industry

The interviews revealed that several factors on the macro and micro level dimension have led to a shift in the automotive industry towards alternative drive concepts. To react on the influencing

factors in the company's environment, BMW has started with the parallel production of two power trains– the internal combustion engine and the electric engine. However, changes in the automotive industry happen quickly. Thus, the 4 interview partners were asked to make a personal statement on the future outlook of the the automotive industry (see table 22).

Table 22.: Future Outlook for Electric Mobility

Interview partner	Inductive category	Paraphrase
1	**High share of electric vehicles**	*A topic that will definitely shape the automotive branch in the upcoming years is automatic charging. From my point of view, this will be the standard in the next 5 years. Another topic that is already coming is dynamic load balancing. Dynamic load balancing will allow people to charge multiple vehicles at the same time while using the full capacity of the grid connection. [...] All in all, the share of electric cars will rise significantly. Tough, I personally think that there will still be cars with internal combustion engine and hybrid applications. I also think hydrogen powered vehicles have a high potential for driving long distances while fully electric vehicles will be used for short-distance journeys. [...] Autonomous driving will be an important enabler for electric mobility.*
2	**Low share of electric vehicles**	*I think the automotive industry will increasingly deal with three topics: infrastructure, charging solutions and battery. There will be inductive charging and maybe conductive too. Charging times will further decrease and battery technology will continue to improve. However, I don't expect a high share of electric vehicles in Austria. The main future trend is autonomous driving.*
3	**Low share of electric vehicles**	*Electric mobility will definitely shape the automotive industry, though I don't expect a high share of electric cars in Austria. Vehicles with internal combustion engine will still be existent in the future but the major issue we are currently facing at BMW is autonomous driving. With this new, exciting topic we will be facing bigger challenges than ever before.*

4	**Low share of electric vehicles**	*I think the world is very inhomogeneous when it comes to the topic of electric mobility. In China, for instance, will be a significant share of electric vehicles while other parts of the world, like Austria, might not have a high share. Very exciting topics are and will be digitization and connectivity.*

Expert 1 clearly pointed out that he expects an increasing share in electric vehicles, enabled by autonomous driving vehicles. He referred to new charging solutions and dynamic load balancing. Nevertheless, he thinks that conventional cars won't be pushed aside by electric vehicles. Expert 2 expects only a particular share of electric vehicles and sees the future trend in autonomous driving. Interview partner 3 and 4 share the view that the automotive branch is aiming for an autonomous industry. Though, expert 4 also added two further trends–connectivity and digitalization.

Part IV.

Concluding Remarks

8. Discussion of Results

As stated in the introduction, the research was carried out in order to analyze the process of business model evolution and technological innovation on the basis of electric mobility. Before anticipating the results, the method and process for the analysis of the empirical data was described. In the previous chapter, the collected information related to the investigated case was presented. The research followed a qualitative single case study design. The results are more of descriptive nature, explaining how the business model of an established automotive OEM has changed over a defined time due to the integration of battery electric vehicles in its portfolio. The research was not intended to describe a prescriptive concept of a business model innovation; hence, the findings of the empirical study might not be transferable to other automotive companies.

This chapter synthesizes the empirical data in order to answer the research question. Moreover, it aims to compare the findings with the existing literature and derives recommendations for academia and industry.

8.1. Research Question – Business Model Innovation in the Automotive Industry

This thesis aims to contribute towards the understanding of business model innovation in relation to technology innovation and electric mobility. The goal of the research question was to describe, how a business model framework can be prepared to identify business model changes of a particular manufacturer in the automotive industry. Additionally, it aimed to reveal how the business model elements of automotive companies have changed over a defined time due to the integration of battery electric vehicles in their portfolio. The comprehensive empirical results of section 7 are used to show how the three core elements have been reconfigured against the background of electric mobility. Following sections subsequently answer the research question presented in chapter 1:

> How has the battery electric vehicle transformed the value preposition, value creation and value capture of the automotive business models in the period from 2013 until 2017?

Therefore, a three step approach is applied. First, factors driving the business model change are

outlined. Afterwards, the changes in the indicated core elements are pointed out. In a final step, the degree of business model change is discussed.

8.1.1. The Business Model Change Drivers

A main goal of the thesis was to combine the topics of electric mobility, technological innovation, and business model innovation. To address this issue, driving forces towards electric mobility and business model change were determined. According to Wirtz and Daiser (2017), they can be placed on either macro-level or micro-level dimensions (see section 2.3.2). In addition, factors that trigger changes within the business model and on the single elements were identified. The three indicated components are connected and interact with each other; hence, changing one element constitutes alterations on the others.

Bucherer et al. (2012) identified a set of four different origins of business model innovation. The innovation can be either triggered by an external opportunity, internal opportunity, external threat or internal threat. External opportunities include changes in key technologies while external threats comprise competitive threats, market shifts and legal changes. [Bucherer et al., 2012] Wirtz and Daiser (2017) subdivide external forces into the elements technology, globalization, economic issues and market shifts. However, the case study revealed that the external change drivers of BMW include political, economic and ecological aspects. The BMW Group and generally companies in the automotive industry are subject to regulations and restrictions. Individual manufacturers are forced to reach specific targets on CO_2 ceilings which are backed by financial penalties. The economical aspect incorporates the falling prices for battery technology. Shrinking expenses for batteries make the cars more affordable for customers while increasing the profitability for automotive OEMs. Finally, concerns about the environmental impact of current road transport systems foster the interest in alternative drive train systems. Nevertheless, business models do not merely change due to external inputs. They are further subject to influences on the micro-dimension. According to Wirtz and Daiser (2017), micro-level dimensions include changes in customer needs, product and service innovation, competition and firm dynamics. The results share a number of similarities with their findings, as the main internal drivers detected are changing customer needs, competition, service innovation and company philosophy.

Several factors effectuate changes on the elements within the business model. The analysis of the interviews indicates, that the value proposition is primary influenced by technology usage patterns and health impact. According to literature [e.g. Bozem et al., 2013, p. 66f], conventional vehicles with internal combustion engine are a major pollution contributor, producing significant amounts of nitrogen oxides and carbon monoxide and thereby affect people's health. Driving forces of value proposition change further induce changes on the value creation and the value capture element. This finding is in agreement with Johnson (2008), seeing this element as starting point for business model innovation. Battery technology, infrastructure, connectivity and the need for providing mass

suitable mobility solutions drive the change on the value creation. Referring to the interviews, the topic of connecting car and driver with their surroundings is very important for BMW. The focus is thereby on the improvement of the customer's comfort and the ensuring of optimal safety for both the driver and the passengers. The value creation change further induces reconfigurations on the value proposition and the value capture, as additional services, new sales opportunities and a new customer base can be reached. The value capture element is effectuated by new market entries, taxes, customer's buying behavior and rapidly developing technologies. Interestingly, it was found that the value capture element also influences additional business elements, whereas Osterwalder (2004) explained that changes in this element are an outcome of configurations in the value proposition and value creation.

As shown in figure 27, electric mobility and technology are focal points of this thesis. This concurs well with previous findings. [e.g. Chesbrough and Rosenbloom, 2002, Shin, 2014, Schallmo, 2013] Chesbrough and Rosenbloom (2002) explained that business models and technology are interdependent. New technologies are the source of business model innovation while business models unlock the value potential embedded in new technologies. [Chesbrough and Rosenbloom, 2002] Schallmo (2013) highlighted the role of technology as enabler for a business model, stating that business models are not viable without the respective technology. The analysis of the case study correlates fairly well with literature and further supports the idea that technology is the result of the influencing factors at all levels of the company's environment. It functions as enabler for changes on the business model elements.

As put forward by Bohnsack and Pinkse (2017), the results revealed that business model elements have to be reconfigured to improve the appeal of electric mobility to mainstream customers. While business model innovation, technology and electric mobility co-evolve and interact with each other, there is a certain turning point where the business model affects technology and electric mobility. As outlined in section 7.4.1.3, interview partner 1 states that offering a carsharing service affects the degree of utilization of the electric vehicle and enforces the technology to improve.

The results indicate that the application of electric mobility as well as the technology for electric vehicles are the outcome of driving forces at all levels of the company's environment. Technology further acts as enabler for the changes on the business model elements while electric mobility rather induces the transformation of the core components.

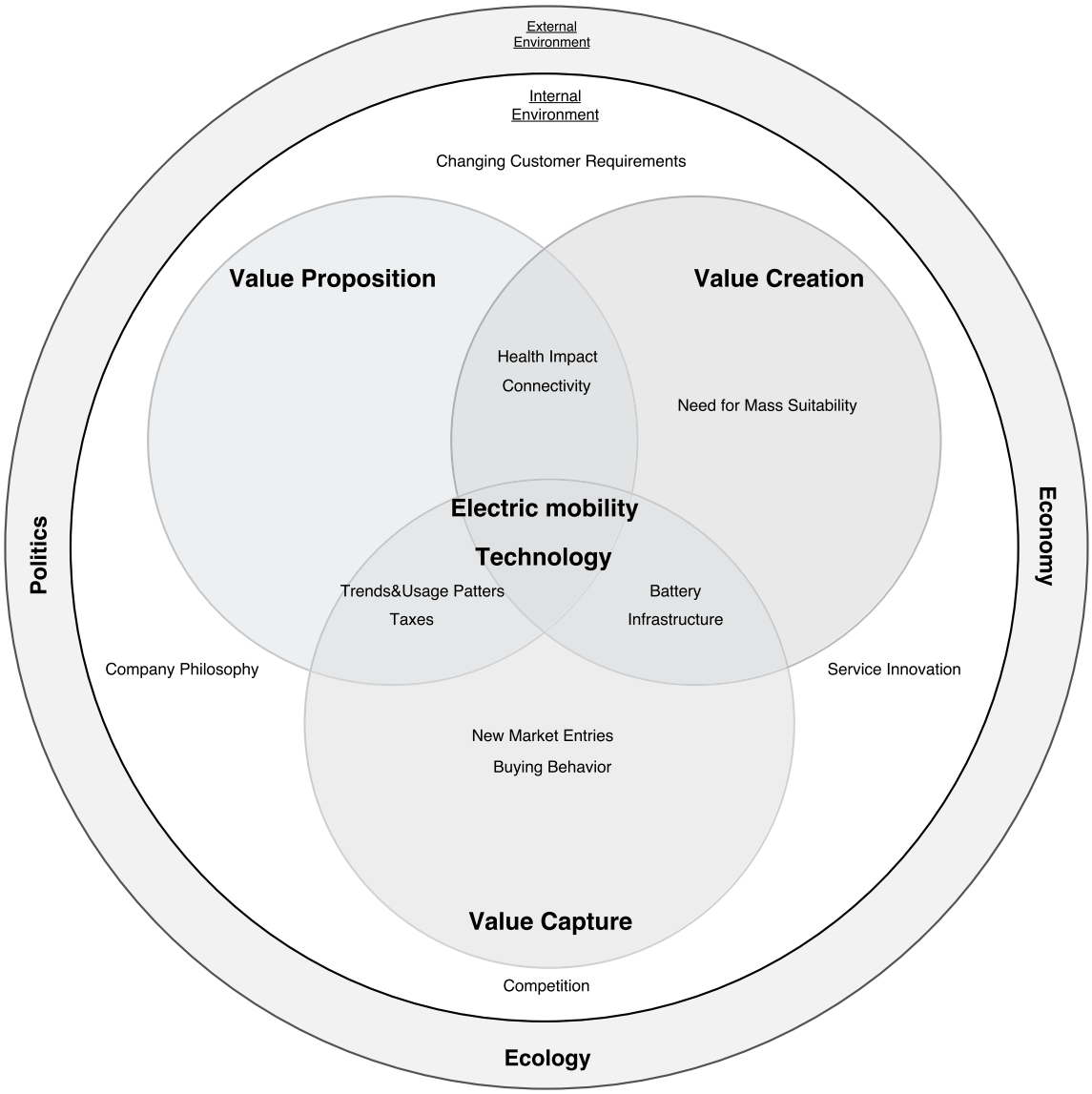

Figure 27.: Framework of Influences on and the Intersections between Electric Mobility, Technological Innovation, and Business Model Innovation [own illustration]

8.1.2. The Value Proposition Change

The value proposition is seen as the promise of a company to provide value to their customers, either in form of a product or a service. It includes the three sub-components product content, service content and customer segment. A modification in the value proposition is usually accomplished by changes in the product and service sector. Two optional products the BMW Group offers together with their battery electric vehicles are the BMW i Wallbox and the range extender. However, the interviews and statistics outlined in section 7.4.1 revealed that it is mainly the service content that automotive manufacturers might have to focus on to offer added value for the customers of battery electric vehicles. The reasons can be explained as follows:

- Although the range extender is a hardware component that can be optionally added to overcome the fear of insufficient range, sales figures illustrate that the number of sold range extenders in Austria is marginal. The low sales numbers could be interpreted as being a result of omitted incentives in the amount of 3500€. Another reason is that only fully electric vehicles are exempted from any private usage taxation.

- The Wallbox, a home charging solution offered by BMW, reacts to the infrastructure issue. However, it is only feasible for customers with a private parking area. This fact constitutes a major limitation for customers living in urban areas as they might not be able set up the Wallbox in the same garage or space as their electricity meter and therefore have no possibility to charge at home.

Broadly speaking, products provided for battery electric vehicles either offer a surplus value for only a particular customer group or have a significant impact on both the fixed and the running costs of the vehicle. In contrast, services like BMW i ConnectedDrive address range and infrastructure issues of the whole customer segment by providing reliable information on the location of charging points and suggesting efficient driving styles. By offering car-sharing services, BMW reacts on the growing environmental awareness and changing usage patterns of the customers. Unlike the product content, services like DriveNow broaden the customer base as also younger and environmental-aware people can be attracted.

It is critical to note that business customers make up the largest customer segment of the battery electric vehicle. Reasons therefore primarily constitute cost benefits and tax advantages. This proves just how important taxation in the context of electric mobility is. The other two customer groups that can be reached with battery electric cars are early adopters and environmentalists. Early adopters purchase the cars out of the urge to have the new technology before others, even if it means that they have to pay more. Environmentalists form a completely new customer base in the portfolio of car manufacturers. These are clients that couldn't have been reached with conventional vehicles.

In short, when companies are facing external and internal pressures, innovation in services can help remedy the situation. Without losing sight of the bigger picture, the luxury vehicle maker BMW is altering its traditional value proposition to become a provider of sustainable transport services and products to reach a broader customer base. Figure 28 illustrates the value proposition trends, including the customer segments.

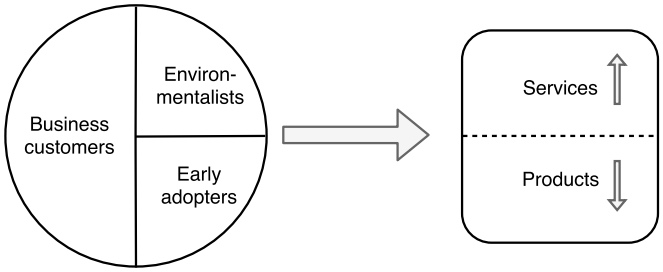

Figure 28.: Value Proposition Trends [own illustration]

8.1.3. The Value Creation Change

The past decade has seen a renewed importance in alternative drive concepts. While the automotive industry was earlier shaped by the complexity of the internal combustion engine, the integration of battery electric vehicles in the portfolios of OEMs causes significant changes. Electric vehicles have distinctive characteristics and therefore require a whole set of new competencies and activities within a company. In general terms, core competencies are defined by several key requirements (see section 2.2.2) including the generation of customer benefits and the alignment of competitive dynamics to market dynamics. The interviews revealed that integrating the battery electric vehicle in BMW's portfolio only adapted, but has not changed the company's core competencies yet. The adaption took place in the area of battery technology. The battery system is a critical point when it comes to electric vehicles as they constitute a great obstacle for the commercialization. Making progress in the cell technology and offering reliable battery systems is therefore highly important to achieve sustainable drive systems in the near future. In-sourcing the battery production serves the advantage to understand the whole value creation process and further enables the company to define how the potential suppliers have to produce the cells according to their specifications. Existing core competencies like the design will remain important as it is a significant distinctive feature among the automotive manufacturers. These findings are in contradiction with previous results reported in the literature. Proff (2015) noted that automotive companies tend to use specialist suppliers instead of developing the novel technologies in–house. Moreover, he claimed that technological changes reduce the existing competence base of car manufacturers. However, this has to be qualified by the fact that the technology of the BMW i3 is new to the company.

Further examinations showed that BMW has a clear vision on how to establish battery electric vehicles on the mass market. Their way towards integrating battery electric vehicles in their

portfolio started with the launch of the i3. Producing a car based on a highly innovative and expensive technology enabled them to set a statement and gain expertise in the field of electric mobility. However, products have to become simpler and should be produced on a more modular basis with decreasing complexity and higher standardization. This is decisive in order to to react quickly to environmental changes. Developing platforms that enable the production facilities to build vehicles with an internal combustion engine, a plug-in hybrid or a fully electric power train at the same time allows for more flexibility. It is also aimed to take advantage of the economies of scale resulting from a greater number of common units per platform, such as savings on the purchase of components.

8.1.4. The Value Capture Change

The value capture element defines how a company captures value from its product and service offers in order to sustain the business. It includes the sub-elements pricing and sales process. In general, there are two possibilities to choose between when considering purchasing a new car, either buying or leasing. The decision to buy or lease depends on several factors such as the customer's personality, preferences and finances. In the case of the battery electric vehicle, more aspects have to be considered when deciding on which way to purchase the vehicle:

- Due to fast developments in the battery technology, vehicles depreciate in their value rather quickly. Leasing serves a good option to lower the residual value risk.
- Leasing avoids missing out on the latest developments in electric vehicle's technology and makes the vehicles more affordable.
- Leasing shifts uncertainties about the reliability of the new technology from the customer to the company.

According to Proff (2015), the electrification of the drive train is negatively affecting the automotive aftermarket as battery electric vehicles have around 90 % less moving parts compared to conventional vehicles. For the car retailers, leasing serves the advantage of staying in constant contact with their customers. Another option to keep in touch with the customers would be battery leasing. However, in accordance to the statements of the interview partners outlined in section 7.4.3.2, battery leasing is related to an indication of the company to lack in controlling the battery technology. BMW promises the customer to provide a battery that fulfills the customer's requirements and works over its defined lifetime.

Sales channels are of great importance for capturing value. They join together the three reference groups of production, car dealers and final customers. In the automotive industry, it is mainly indirect sales which comes about via authorized dealers. Although literature [e.g. Wedeniwski,

2015] refers to direct sales only in the case of special customers like authorities and employees, car manufacturers have started using the internet as direct distribution channel. BMW has introduced the "Agenturmodell", exclusively for the BMW i sub–brand. The contract conclusion is made between the customer and BMW itself, car dealers function only as middlemen and hand over the car to the customer. The car dealerships lose the possibility to give discounts but get a fixed commission for every sold BMW i3 and, at the same time, it reduces their inventory level. However, attempting to reach a broader customer base for a new technology through a new sales channel might not be the best approach for novel technologies. BMW has announced that they are going to abolish their multi-channel model this year. They are turning back to their regular, indirect sales channel. Considering the planned broadening of the product portfolio of battery electric vehicles, this step seems to be reasonable as boundaries between conventional and electric cars are blurring. Moreover, multiple distribution channels increase the complexity and are therefore difficult to manage.

8.1.5. The Degree of Business Model Change

There are different types of business model innovation relating to the degree of change and the degree of novelty. According to the degree of change, a business model can either be characterized by an evolution, transformation or reshaping. [Wedeniwski, 2015, p. 265] The evolution is described by a minimal extent of change and concentrates on the development of the product portfolio while the transformation is defined by making a step towards a new business model. The creation or reshaping is the highest degree of innovation and is usually shaped by the establishment of a new company. It replaces the underlying business logic.

Figure 29 illustrates the transformation of BMW's business model. The analysis revealed that the case enterprise BMW investigates and tests a new business model on a step by step approach. As shown in figure 29, they started with the integration of the battery electric vehicle BMW i3 in order to build up expertise and gain a foothold in the field of electric mobility. Since 2013, their business model has transformed. Technology innovation inside and outside the company brought about changes on their business model elements. To offer an added value for battery electric vehicles, the service content had to increase. Additional services such as carsharing have led to an enlargement of their existing customer base. Another adaption took place in their portfolio of core competencies. BMW has built up a new competence center in order to make progress in the battery cell technology. However, the extension of their sales channels turned out to be too complex to handle. New technologies pose uncertainties and therefore strengthen the traditional, stationary trade. Consequently, adapting all three business model components at the same time is highly risky for battery electric vehicles. The third block of figure 29 illustrates the present status of BMW's business model. They are currently working on modular platforms that enable the production facilities to build vehicles with an internal combustion engine, a plug-in hybrid or a fully electric power train at the same time. The platforms which fit all power

train derivatives allow them for more flexibility. Moreover, it is aimed to take advantage of the economies of scale resulting from a greater number of common units per platform. Nevertheless, the company is limited by the goals of their existing business model. They still focus on improving the internal combustion engine as it is hard to turn electric vehicles profitable for the company. The continuing focus on conventional vehicles might also be the result of a so called "lock-in" of existing technologies [Amalie Bjornavold and Van Passel, 2017, p. 2]. In contrast to battery electric vehicles, conventional vehicles are well understood by the manufacturers and have the advantage of a long history of efficiency improvements. Moreover, brand identity is an important factor for BMW. Reshaping the business model replaces the underlying business logic and may thus result in irreversible irritation among their existing customer base. However, BMW has proven that they managed the integration of the battery electric vehicle in their portfolio quite well.

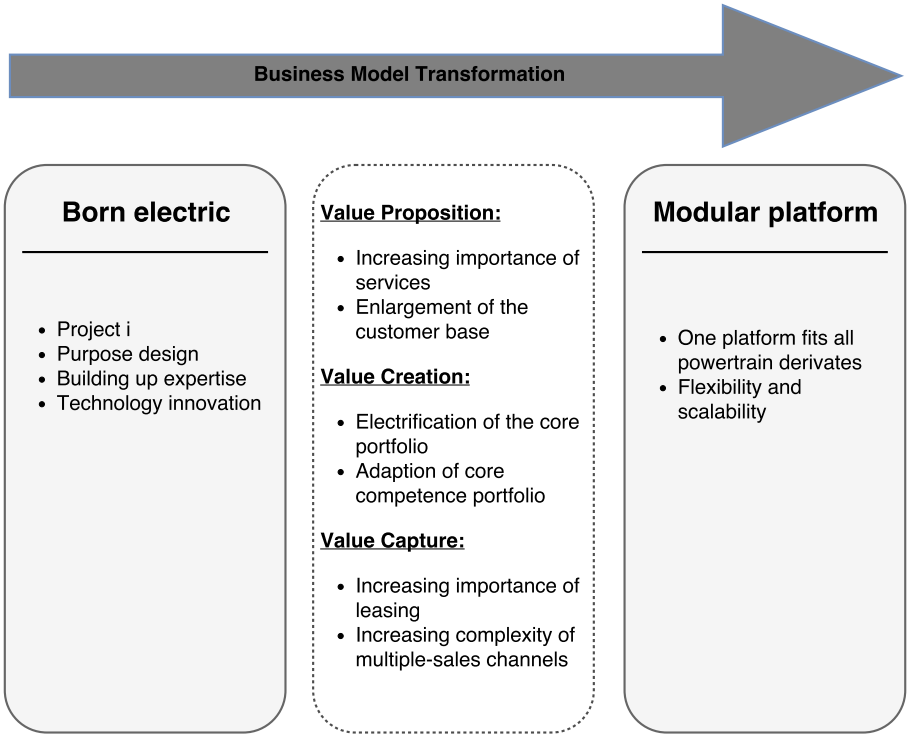

Figure 29.: Business Model Transformation [own illustration]

9. Conclusion

This chapter aims to recapitulate the outcome of the thesis. Sections 9.1 and 9.2 summarize the findings of the theoretical considerations and present the main results of the empirical study. Afterwards, section 9.3 points out the limitations and directions for further research.

9.1. Summary

This thesis starts in chapter 1 with a description of the initial situation and the presentation of the research problem. To answer the research question outlined in section 1.1, the theoretical background of business model change, technological innovation and alternative drive concept was considered.

The business model concept has developed over an extended period of time and is characterized by different streams of research. Several approaches were attempted for defining and understanding business models. Chapter 2 includes a reformed and simplified business model framework used to identify changes on business model elements in the automotive industry. The framework has also formed a basis for the interview guide. As the automotive branch is strongly influenced by its environment, a literature review on drivers and types of business model changes was conducted. According to section 2.3.2, change drivers can be placed at different levels and thus might lead to an evolution, transformation or creation of a new business model. Chapter 3 presents theoretical considerations on technological changes in conjunction with business model evolution. It was found that technological innovation and business model innovation are interdependent. Both are crucial to a company in order to gain competitive advantage. The literature review in chapter 4 functioned as a general knowledge base for the topic electric mobility. The focus was thereby set on the battery electric vehicle as it is the topic of research. Chapter 5 highlights changes in the automotive industry. Different factors force companies in this branch to include electric vehicles in their portfolio. Technological innovation triggers the development of new business models and changes the way companies create and capture value.

The business model change of automotive OEMs is still ongoing and technology is constantly improving. Therefore, the research landscape presents itself as being diverse, but provides a good basis for the phenomenon of business model innovation in correlation with technology and

electric mobility. To study the research question, a qualitative single case study approach was applied analyzing the company BMW as case enterprise (see chapter 6). BMW was chosen as it is one of the worlds leading car producers in the premium segment and deals with the challenge of changing their business model in order to maintain their market position. Semi–structured interviews with staff, engaged at the company BMW and aware of the topics electric mobility and business model innovation, were arranged. All interviews were transcribed and analyzed by applying the step-by-step model of Mayring.

The goal of the research question was to describe, how the business model of a particular manufacturer has changed over a defined time due to the integration of battery electric vehicles in their portfolio. Chapter 7 revealed the collected information derived from statistics, brochures and semi–structured interviews related to the investigated case while chapter 8 synthesized the empirical data. The collected data and discussion was used to answer the research question.

9.2. Main Results

This thesis has identified changes in the value proposition, value creation and value capture aspects of the investigated business model as well as the respective change drivers. The analysis indicated that the case enterprise BMW tests a new business model on a step by step approach. They started with the integration of the fully electric BMW i3 model in their portfolio in order to build up expertise and gain a foothold in the field of electric mobility. Over the four year period from 2013 to 2017, their business model transformed. External and internal pressures brought about changes on the company's business model elements. To offer an added value for battery electric vehicles, the service content had to increase. Additional services such as carsharing have led to an expansion of their existing customer base. Another adaption took place in the value creation element. Their portfolio of core competencies increased as the case enterprise BMW has built up a new competence center for battery cell technology. Moreover, several benefits of leasing in conjunction with battery electric vehicles were revealed. Remarkably, this correlation is related to the fast developments in the battery technology that initiated a fast depreciation in the value of the vehicles. However, new technologies pose uncertainties. Therefore, attempting to reach a broader customer base for a novel technology through an online sales channel might not be the best approach. Consequently, adapting all three business model components at the same time is risky for new technologies. Battery electric vehicles rather strengthen the traditional sales channel and need personal advice. Nevertheless, the company is limited by the goals of their existing business model. They still focus on improving their vehicles with internal combustion engines.

In short, the three business model elements are influenced by alternative drive systems. Without losing sight of the bigger picture, the luxury vehicle maker BMW has transformed its business model to become a provider of sustainable transport services and products. Moreover, the results have demonstrated that electric mobility and technology are the outcome of driving forces at all

levels of the automotive OEM's environment. Technology further acts as enabler for the changes on the business model elements while electric mobility rather induces the transformation of the core components.

9.3. Limitations and Outlook

Research Design
To enhance the quality of the empirical study, multiple sources were used in the research process of this thesis. Figures and tables were applied to present evidence and increase the reliability of the case. However, the sources were limited to four interviews, two statistics and information on the manufacturer's website. Unfortunately, it was not possible to conduct more interviews as the interview partners were selected according to their expertise in the field of research. Employees aware of the topics business model innovation and electric mobility hold a higher position in the company's hierarchy and are therefore difficult to reach. Moreover, more documents and statistics would have been needed to check the qualitative data for its plausibility. According to Eisenhardt (1989), the eight-step research process illustrated in section 6.1 aims to conclude with a theoretical saturation. However, a theoretical saturation was not achieved in the present thesis. Another significant downside regarding the single case study methodology is the issue of generalisability. In contrast, multiple cases allow for wider exploration of research questions and evolution of theory [Eisenhardt, 1989]. Again, due to resource and time constraints it was not possible to conduct a multiple case study.

Case Selection
According to Seawright and Gerring (2008), the generalisability of a single case study can be increased by a strategic case selection. Theoretical sampling of the case makes the study more dependable [Eisenhardt and Graebner, 2007]. Extreme cases often expose richer information as they activate more mechanisms in the situation studied [Flyvbjerg, 2006]. However, the case enterprise taken for the single case study is related to a company that operates in a technology-driven environment and has experienced many years of successful business model innovation. The applicability of this thesis' finding to other companies can be soon as limited.

Future Research
The author of this thesis suggest further data collection to determine how electric mobility affects automotive business models on a more general basis. Additionally, tracking developments in business models is worth follow-up investigation since change processes are still ongoing. Future researchers could try to use samples from companies outside the region of Austria and outside from Europe. This will broaden the understanding of business model innovation and might be also interesting due to different environmental settings.

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Part V.

Appendix

A. Interview Guide

Allgemeine, einleitende Fragen

1. Welche Funktion nehmen Sie in Ihrem Unternehmen wahr?
   Welche Aufgaben sind damit verbunden?

2. Wie würden Sie das Wertversprechen Ihres Unternehmens an Ihre Kunden beschreiben?
   Wie gelingt es Ihnen einen bedeutenden Kundennutzen zu erstellen und diesen zu monetisieren?

Business Model Change

3. Welche Differenzierungsmerkmale gegenüber anderen Automobilherstellern zeichnet Ihr bestehendes Geschäftsmodell aus?
   Wie findet aus Ihrer Sicht eine Absicherung Ihres Geschäftsmodells gegenüber Nachahmern statt?

4. Welche Bedeutung hat bzw. hatte Ihrer Meinung nach die Entwicklung eines neuen Geschäftsmodells für die Etablierung der i Serie?

5. Welche Herausforderungen und Barrieren sehen Sie darin, bestehende Geschäftsmodelle zu verändern?
   Wie werden diese Herausforderungen innerhalb von BMW bewältigt?

Value Proposition

6. Welche Faktoren gaben aus Ihrer Sicht BMW den Anstoß mit dem BMW i3 2013 in Serienproduktion zu gehen?

7. Welche Rolle spielen Ihre Kunden bei der Entscheidung das Portfolio 2019 erneut zu erweitern?

8. Inwiefern unterstützen zusätzliche Produkte die Nachfrage am BMW i3?

9. Wie hat sich aus Ihrer Sicht das Serviceangebot durch die Etablierung des Elektroautos innerhalb Ihrer Firma verändert?

Value Creation

10. Wo sehen Sie die Tätigkeitsschwerpunkte von BMW in Bezug auf die Elektromobilität?
    Welche Ressourcen und Fähigkeiten sind für die neuen Tätigkeitsschwerpunkte notwendig?
    Wurden zusätzliche Fachkräfte benötigt?

11. Was waren aus Ihrer Sicht die maßgebenden Gründe für den Beschluss der Unternehmensgründung von IONITY?

Figure 30.: Interview Guide 1/2

12. Welchen Einfluss hatte aus Ihrer Sicht die Etablierung der Elektromobilität auf die Anzahl Ihrer Geschäftspartner?

Value Capture

13. Mittels welcher Kommunikations- und Vertriebskanäle werden Ihrer Einschätzung nach Kunden beim Kauf von batterieelektrischen Autos am besten erreicht?
    Hatte die Etablierung des Elektroautos innerhalb von BMW generell Auswirkungen auf die Vertriebskanäle?

14. Konnte ein Trend in Bezug auf Kauf oder Leasing im Zusammenhang mit dem reinen Elektroauto festgestellt werden?

15. In Anbetracht der längeren Serviceintervalle und der limitierte Anzahl an Komponenten des Elektroautos, wie wirkt sich das auf den After-Sales Service aus?
    Welche Schritte erachten Sie als sinnvoll um trotzdem den Kundenkontakt zu sichern?

Abschlussfragen

16. Welche technologischen Entwicklungen, welche die Elektromobilität mit sich bringt, werden Ihrer Meinung nach die Automobilindustrie in den kommenden 5 Jahren prägen?

17. Wie hoch schätzen Sie die Möglichkeit der Substitution des batterieelektrischen Autos durch einen anderen Antrieb ein?

18. Haben Sie bezüglich des besprochenen Themas noch Anmerkungen bzw. haben Sie wichtige Punkte vermisst?

Figure 31.: Interview Guide 2/2

B. Codings

Überkategorie: Makro- und Mikro-Dimensionen		
Kategorie	**Definition**	**Paraphrase**
K1: Kunden-anforderungen	Neue Ansprüche des Kunden, dh. Ansprüche die neu sind und Ansprüche die Veränderungen beim Hersteller erzwingen	B2: Es gibt Leute, die sich aus reinem Umweltgedanken ein Elektroauto kaufen. B3: Leute heutzutage ticken anders. Heutzutage sind die Leute eher so, dass sie das Auto im Internet konfigurieren und erwarte, dass das Auto am nächsten Tag am Hof steht. B3: Ich brauche das nur bei mir selbst anschauen. Man kauft viel mehr Online und man schaut sich viel mehr im Internet an. B4: Diese Services werden in Zukunft wichtiger werden weil sich die Gesellschaft in diese Richtung sehr stark entwickelt. Unsere Kunden sind es mittlerweile gewohnt, dass sie eine App haben und das nutzen können.
K2: Wettbewerb	Wettbewerber die Veränderungen erzwingen, dazu gehören neue Wettbewerber sowie bestehende Wettbewerber	B1: Das heißt in diesem Versorgungsnetzwerk speilen völlig neue Player eine zentrale Rolle, das sind Netzbetreiber, das sind Stromerzeuger, Energieversorger, das sind Infrastrukturunternehmen die jetzt Ladeparkplätze zur Verfügung stellen, diese Chargepoint-operators, und es entsteht eine völlig neue Struktur die es in dieser Form noch nie gab. B1: Dann gibt es noch andere Leute, die in den Vertrieb drängen. B3: Ein großer Treiber und Beschleunigungsfaktor ist sicher auch das Unternehmen Tesla im Elektromobilitätsbereich.
K3: Service Innovation	Innovation im Servicebereich des Unternehmens	B3: Was man in der Automobilindustrie wahrnimmt ist eine Tendenz in Richtung Connectivity. Das Thema Konnektivität prägt die Gesellschaft generell. Ich habe das gerade am Beispiel meines Autos erlebt. Mein Auto hat alles was man sich vorstellen kann, alles ist vernetzt. Zu diesem Thema tut sich viel.
K4: Unternehmens-philosophie	Klare Aussprache der Vision der Organisation	B3: Beim Thema innovative Technik wollen wir Marktführer sein. B4: Wir wollen ganz klar Merketleader sein.
K4: Politik	Das politische Umfeld umfasst hierbei auch die Bereiche Umweltpolitik und Förderpolitik	B1: Das heißt Automobilhersteller wissen, und das sind politische Vorgaben, dass sie eine Quote für Elektroautos erfüllen müssen. In Deutschland gibt es die 1 Million- Vorgabe für das Jahr 2020. B2: Es hängt auch davon ab ob wir in Wien sind oder London. Weiteres hängt es von Fahrverboten ab oder ob ich in einer Kleinstadt wie Graz lebe. B2: Generell in China gibt es einen ganz anderen Beweggrund für die hohe Elektroautoquote. Hier geht es um die Luftqualität, darum dass die Leute einfach nicht mehr atmen können und die Herz-Kreislauf-Erkrankungen stark zunehmen. Da hat man einen viel größeren Druck dahinter, dass man etwas verbessert. Bei uns hat sich die Luftqualität über die letzten 20 Jahre verbessert hat. Bei uns geht es mehr um das Thema Erderwärmung. B2: Ein Anreiz ist es zu sagen, man darf mit Verbrennungskraftmotoren nicht mehr in eine Stadt fahren. B2: Es gibt die CO2 Gesetzgebung, bei denen man als Hersteller schauen muss, dass der Flottenverbrauch der verkauften Fahrzeuge bis 2021 auf 95 Gramm sinkt. B2: Es ist vor allem regional ganz unterschiedlich weil die Ausgangssituation ganz anders ist. Anreize, wie etwa die Besteuerung, haben einen entscheidenden Einfluss. Ein weiterer Punkt ist, dass nur reine Elektroautos vollkommen vorsteuerabzugsberechtigt sind. Das heißt man kann sich die Mehrwertsteuer zurückholen und damit wir er wieder 20% günstiger. Was wir davon ableiten können ist, dass der Preis eine ganz wesentliche Rolle spielt. Erst durch den Anreiz der steuerlichen Begünstigung wird es angenommen. B2: Dies hat auch mit den finanziellen Anreizen zu tun. Es ist so, dass es eine E-Förderung von etwa 4000€ für reine Elektrofahrzeuge gibt, für Hybrid sind es weniger als 1500€. B3: Auch Politik spielt eine wichtige Rolle, wenn man sich die aktuellen Gesetzgebungen Richtung CO2 anschauen. Diese Gesetzgebungen gehen ganz klar in die Richtung, dass wir ohne einen gewissen Elektromobilitätsanteil in 2020, 2025, 2030 die CO2 Werte nicht erfüllen werden können und somit erzwingt die Politik das.
K5: Wirtschaft	Nennung wirtschaftlicher Faktoren, die eine Veränderung erwirken	B1: Aktuell sind die Batterieroadmaps so gestaltet dass sie in den Kosten sinken. Die kWh wird immer günstiger, wird sich aber auch gegen einen bestimmten konstanten Wert asymptotisch annähern.

Figure 32.: Macro and Micro Dimensions

Überkategorie: Challenges of Business Model Change		
Kategorie	**Definition**	**Paraphrasen**
K1: Herausforderungen und Barrieren	Herausforderungen und Barrieren die sich bei der Geschäftsmodellinnovation ergeben und	B1: Ich glaube die große Herausforderung für große Unternehmen ist es Veränderungen frühzeitig zu erkennen und das man als Unternehmen die Flexibilität und Dynamik hat, auf diese Veränderungen auch einzugehen. Ich denke, dass sich da gerade in der Automobilindustrie sehr große Herausforderungen ergeben werden zumal die Automobilindustrie nicht für ihre große Dynamik bekannt ist. Je größer eine Organisationen sind, das korreliert auch mit einer gewissen Trägheit, desto Schwerfälliger sind sie. Ich wage es zu bezweifeln, dass jetzt die klassischen großen Automobilkonzerne, wie man sie kennt, die großen deutschen zum Beispiel wie der Volkswagen Konzern, BMW, Daimler aber ganz generell etablierte große Unternehmen, die notwendige Dynamik schaffen auf diese sich schnell verändernden Rahmenbedingungen auch entsprechend einzugehen und diese mit zu entwickeln. B2: Veränderung stößt immer auf Widerstand. Es ist natürlich mit einem Risiko verbunden B3: Es ist natürlich schwierig in einem großen Konzern wie BMW etwas zu verändern, weil einfach die Struktur sehr groß ist. B4: Die Bereitschaft alles radikal zu verändern wird immer gewisse Widerstände haben. Aber wenn etwas sinnvoll ist, wird es bei BMW durchgezogen. Hierfür gibt es viele Beispiele, finde ich.
K2: Handhabung von Herausforderungen	Art, wie das Unternehmen Herausforderungen im Zuge der Geschäftsmodellinnovation handhabt	B1: Aber es ist auf jeden Fall zu beobachten, dass BMW es sehr erfolgreich und konsequent geschafft hat, sich von bestehenden Strukturen loszulösen und etwas parallel aufzubauen. Sie haben jedoch auch gezeigt, dass es bei dem einen Mal mehr oder weniger blieb und sich das Team danach bis zu einem gewissen Grad zerschlagen hat. B3: Einerseits dadurch, dass wir Innovationen massiv fördern und versuchen neue Innovationen so schnell wie möglich in Serienumsetzung bringen und andererseits dadurch, dass wir gerade in der Vorentwicklung und Forschung die neueste Themen bearbeiten und auch versuchen, die Zukunftsweisen dabei herauszufiltern. Ich würde auch sagen, dass es ein innovatives Denken bei BMW in Summe ist. Wir denken nicht an klassische Werte die BMW repräsentiert, sondern auch an zukünftige Geschäftsmodelle, die man entwickeln kann. B3: Aber ich denke, dass gerade, wie es bei BMW ist, durch die Notwendigkeit die Veränderung erzwungen wird und damit wird es einfach geschehen. B4: Das Projekt i3 ist eine Parallelorganisation gewesen. Hier wurde ein paralleles Team zusätzlich zu alteingesessenen Entwicklungsabteilungen gegründet. B4: Als Beispiel nehmen wir den i3 her, wenn wir schon mal beim Elektroauto Thema sind. Hierbei hat BMW sehr, sehr viel Geld in die Hand genommen, sehr innovative Technik vom Fahrzeug bis zum Antrieb hergenommen und hat gesagt, das ziehen wir durch obwohl hier noch kein Land in Sicht war, dass andere hier miteinsteigen. BMW hat gesagt wir wollen hier dabei sein und Führer sein bei diesem Thema. Deshalb haben sie wir i3 und den i8.

Figure 33.: Challenges of Business Model Change

Überkategorie: Value Proposition		
Kategorie	**Definition**	**Paraphrasen**
K1: Einflussfaktoren auf das Wertversprechen des Unternehmens	Faktoren die eine Veränderung im Wertversprechen (dh. Service-, Produkt- oder Kundenbereich) hervorrufen beziehungsweise erzwingen	B1: Mit dem Smartphone als Türöffner kam auch die Möglichkeit der Sharing Economy auf. B2: Es gibt zum Beispiel bei BMW eine Kooperation mit Sixt, wo man 2 bis 3 Wochen im Jahr Auto ein Auto mit konventionellem Motor mieten kann und welches sehr gut angenommen wird. B2: In China geht es um die Luftqualität, darum dass die Leute einfach nicht mehr atmen können und die Herz-Kreislauf-Erkrankungen stark zunehmen. Da hat man einen viel größeren Druck dahinter, dass man etwas verbessert. B3: Menschen sind es mittlerweile gewohnt, dass sie eine App haben und das nutzen können. B4: Es gibt Leute, die sich aus reinem Umweltgedanken ein Elektroauto kaufen.
K2: Kundensegment	Käufer batterieelektrischer Autos, dh. neue Kundengruppen sowie bestehende Kundengruppen	B2: Eine kleine Gruppe kauft Elektroautos aus Prestige oder soziales Ansehen. B2: Es gibt Leute die ein Elektroauto kaufen wollen, wie etwa einen Tesla, um ein Statement in Richtung Umweltschutz zu setzen. Sie wollen zeigen, dass sie ein Elektroauto fahren. B2: Es gibt die Early adopters, die zeigen wollen, dass sie ein Elektroauto fahren und dabei sein wollen. B2: Natürlich gibt es die Umweltschützer. Diese Gruppe ist jedoch sehr klein, da es sehr selten geschieht, dass man sich aus reinem Umweltgedanken ein Elektroauto kauft. B2: Bei reinen Elektrofahrzeugen traue ich mich nicht zu sagen wie stark das angenommen wird, weil wir zum Beispiel sehen, dass die i3 Modelle nur an Firmenkunden verkauft werden. Wir haben keinen einzigen an eine Privatkunden verkauft. Der Privatkunde muss die 50.000€ abzüglich den 4000-5000€ E-Förderung zahlen. Für den Firmenkunden ist es viel, viel günstiger weil er keine Mehrwertsteuer und keinen Sachbezug zahlt. Letztendlich sind das größere Firmen die sowieso einen größeren Fuhrpark haben und 2 bis 3 Elektroautos zusätzlich haben wollen. B2: Die i3 Kunden bei uns waren vorher schon BMW Kunden. Das sind Firmenkunden. B4: Elektroautos werden hauptsächlich als Geschäftsautos genutzt, das hat uns ein Kollege bestätigt. Das ist dadurch zu begründen, dass nur diese auch die entsprechenden Förderungen bekommen.
K3: Neue Serviceleistungen	Konkrete Nennung neuer Services in Zusammenhang mit dem batterieelektrischen Autos und Betonung der Wichtigkeit neuer Serviceleistungen	B1: Im Mobilitätsbereich, und bewusst nicht Fahrzeughersteller beschränkt, glaube ich dass völlig andere Modelle sehr erfolgreich werden und das sind jene die mit Mobilität als Service funktionieren. B1: BMW hat auch bei dem Thema Laden in der Elektromobilität einige Steckenpferde platziert und das war im ersten Schritt DriveNow, sprich Carsharing und Mobility as a Service. B1: Wichtig ist auch das Thema DriveNow, welches sich mit dem Mietwagenunternehmen Sixt entwickelt hat. B1: Automobilhersteller verkaufen im Allgemeinen Fahrzeuge, die 95% der Zeit stehen. Mit dem Thema Connectivity, kamen die Möglichkeit der Sharing Economy auf. Mit der Sharing Economy steigt der Fahrzeugnutzungsgrad. Das heißt, ein Fahrzeug wird von einigen 1000 Leuten über den Lebenszyklus verwendet. Für BMW jetzt konkret würde das bedeuten, dass die Verkaufszahl sinkt, und das Anforderungsprofil an die eigenen Produkte sich verändert. Aus meiner Sicht ist das eine sehr sinnvolle strategische Entscheidung zu sagen, dass sich neue Geschäftsfelder entwickeln und man selbst als Automobilhersteller ein Kernelement nutzt und die Hardware liefert. B2: Der Fokus im Elektromobilitätsbereich liegt auf neuen Services und nicht auf neuen Produkten. B2: Es gibt zum Beispiel bei BMW eine Kooperation mit Sixt, wo man 2 bis 3 Wochen im Jahr Auto ein Auto mit konventionellem Motor mieten kann. Diese Option wird sehr gut angenommen. B4: Menschen sind es mittlerweile gewohnt, dass sie eine App haben und das nutzen können sodass DriveNow und ParkNow sicherlich in Zukunft wichtiger werden. B4: Ich glaube, dass Dienstleistungen eine zukünftige Kernkompetenz werden wird.
K4: Neue Produkte	Konkrete Nennung neuer Produkte in Zusammenhang mit dem batterieelektrischen Autos	B2: Ein Punkt, den ich noch ansprechen wollte bezüglich neuer Geschäftsmodelle und Produkte ist die Wallbox. B2: In Österreich, im Verlauf von Jänner bis November wurden 918 Fahrzeuge insgesamt verkauft. Es gibt zusätzlich 3 Arten von Range Extender. Die Range Extender stehen für 1,2 %. Sie sind somit überhaupt nicht relevant. Der Grund ist unserer Meinung der, dass finanzielle Anreize für den Range Extender nicht gegeben sind.

Figure 34.: Value Proposition

Überkategorie: Value Creation		
Kategorie	**Definition**	**Paraphrasen**
K1: Einflussfaktoren auf die Wertaktivitäten und Kernkompetenzen des Unternehmens	Faktoren die eine Veränderung in den Aktivitäten und Kernkompetenzen hervorrufen beziehungsweise erzwingen	B2: Man kennt nicht die genaue Lebensdauer von einer Batterie, man kann damit nicht in den Urlaub fahren, es gibt momentan noch wenig Ladeinfrastruktur. B2: Ich glaube bei Elektromobilität geht es ganz klar um die drei Themen: Ladeinfrastruktur, Ladetechnik und Batterie. B3: Unser Anspruch ist ganz klar, dass die Batterien halten und dem Anspruch des Kunden auch genügen müssen. B4: Bei Kunden, die lange Strecken fahren, ist es eine Herausforderung, dass BMW etwas Entsprechendes anbieten kann womit man die Kunden befriedigen kann. Also Reichweite, Batterie und Laden sind ein Thema. B1: Ich sehe den großen Hemmschuh der Elektromobilität tatsächlich in der Ladeinfrastruktur. B1: Durch das Thema Elektromobilität entsteht eine Unabhängigkeit von Mineralölfirmen. Es besteht eine andere Notwendigkeit die Mobilität zu energetisieren und zwar über Strom. B2: Viel Geld in die Fahrzeugentwicklung zu investiere und ein Fahrzeug zu habe, welches nicht verkauft wird, mach keinen Sinn. Somit muss man dann das Geld für die Infrastruktur auch noch draufschlagen dass man eine realistische Chance hat, die Fahrzeuge auch abzusetzen. B3: Was mit der i-Serie und generell mit Elektrofahrzeugen dazukommt ist das Thema Laden, welches es zu lösen gilt. B3: Das Tankstellennetz hat die über die Jahre entwickelt. Man hat erkannt, dass das Thema Ladeinfrastruktur keiner so richtig in die Hand nimmt. Im Prinzip wurde darauf gewartet, dass die Energieversorger herkommen und dieses Thema in die Hand nehmen, nur zeichnet sich das derzeit nicht ab. B4: Ohne Ladestationen kauft niemand ein Elektroauto. B1: Was man in der Automobilindustrie wahrnimmt ist eine Tendenz in Richtung Connectivity. Mit diesen Connectivity Themen, bei denen das Smartphone als Türöffner fungiert hat und die Vernetzung ermöglicht hat, kamen auch die Möglichkeit der Sharing Economy auf. B1: Ich denke, dass ihnen neue Plattformen wichtig sind. B3: Es ist eine Herausforderung das Thema Elektromobilität auch massentauglich in die Breite bringen. B4: Was hierbei noch zu ergänzen ist, ist das gerade die i-Serie vom Fahrzeugkonzept her sehr innovative Ansätze beinhaltet, die seiner Zeit eventuell auch voraus waren und vielleicht jetzt auch nicht die sind, die sich in der Masse durchsetzen werden.
K2: Änderung der Kernkompetenzen	Subjektive Gewissheit, dass sich bestehende Kernkompetenzen zukünftig verändern oder bereits verändert haben, dh. Nennung zukünftiger Fokusschwerpunktbzw. Überzeugung, dass es eine Veränderung geben wird	B1: Die Kompetenzen, die man für Elektroautos braucht gehen logischerweise in Richtung Elektrotechnik, Telematik, Mechatronik, Softwaretechnik. Ein neues, unübliches Kompetenzportfolio, welches bis dato der Automobilindustrie nicht zugeschrieben war, ergibt sich. B2: Ich glaube es gibt noch keine Veränderung der Kernkompetenzen, diese wird aber noch kommen. Schaut man sich die Stellenausschreibungen an, sieht man, dass hauptsächlich Informatiker gesucht werden. B2: Bei Fahrzeugherstellern hört man vor allem, dass Informatiker stark gesucht werden und dass das schwer ist. B2: Es kommt jetzt induktives Laden und vielleicht auch konduktives und Techniken um die Ladedauer zu reduzieren. B3: Bei der Suche nach geeignetem IT Personal konkurrieren wir nicht mehr mit klassischen Automobilherstellern wie Daimler, sondern mit Konzernen wie Google und Apple und irgendwelchen Informationstechnologiefirmen die im Prinzip Leute mit ähnlichem Knowhow brauchen. B3: Dienstleistungen werden auch eine zukünftige Kernkompetenz werden. B3: Gerade das Thema Batterie ist wichtig. Wir haben jetzt ein eigenes

Figure 35.: Value Creation 1/2

		Batterietechnologiezentrum in München gegründet. Da geht es gerade darum, dass man das Knowhow wie man eine Zelle auslegt zu einer wichtigen Kernkompetenz näherer Zukunft macht. B3: Ich glaube jedoch, dass die bestehenden Kernkompetenzen von BMW weiterhin wichtig bleiben, wie zum Beispiel das Thema Design da es ein massives Unterscheidungsmerkmal unter den Automobilherstellern ist. B4: Batterie wird ein zentrales Thema werden. B4: Gerade das Thema Antriebstechnologie ist ein wichtiger Punkt. Wir werden bei BMW keine Standard-Elektromotoren und keine Standardbatterien einsetzen und uns ganz klar in diesem Thema technologisch auch befähigen. B4: Das Thema Schnellladen ist ein Thema, welches wahrscheinlich nur gemeinsam gelöst werden kann. B4: Unser Anspruch ist ganz klar, dass die Batterien halten und dem Anspruch des Kunden auch genügen.
K3: Entwicklungsstrategie des Unternehmens in Bezug auf das batterieelektrische Fahrzeug	Nennung von Gründe das batterieelektrische Auto erstmals in das Portfolio aufzunehmen, weitere Forcierung der Elektromobilität und Nennung zukünftiger Ziele für die Produktion batterieelektrischer Autos innerhalb des Unternehmens	B1: Die Entwicklung des i3 hat schätzungsweise 2006 begonnen. Der i3 kam dann irgendwann 2014 auf dem Markt. Das ist eigentlich eine völlig neue Fahrzeug-Plattform, die jetzt ein Purpose Design ist. B1: BMW hat begonnen Purpose Design Fahrzeuge zu etablieren und zwar in einer ausgegliederten Marke, und zwar dieser i Marke. B2: Man war bei den Vorreitern dabei. B2: Autos wie der i3 werden als solitäre bezeichnet. Das heißt, solche Fahrzeuge entwickelt man um eine Botschaft zu transportieren, aber man erwartet sich keine große Stückzahl. B3: Wir fördern Innovationen massiv und versuchen neue Innovationen wie den i3 so schnell wie möglich in Serienumsetzung bringen. B3: Man hat mit der i-Serie einmal ein Statement gesetzt an dieser Stelle. B3: Also die i3 werden wir womöglich nie in millionenfachen Ausfertigungen verkaufen können und gerade die Technologie, die wir in so einem i3 drin haben, ist eine sehr teure Technologie und somit wird es vom Gewinn her auch sehr schwierig so etwas so breit einzusetzen. B3: Die i-Serie wird eventuell irgendwann noch erweitert werden. Die i-Serie hat ganz klar den Anspruch Technologiesperrspitze zu sein und da geht es nicht darum, dass die Serie hundert verschiedene Autos hat sondern darum, dezidierte Fahrzeuge mit dezidierten Themen am Markt zu platzieren. B4: Wir wollen ganz klar Merketleader sein. B4: Der Kernanspruch von BMW an das Fahrzeug war ganz klar zukunftsweisende Technologie als erster auf den Markt zu bringen und das ist uns glaub ich hier auch recht gut gelungen. Was hierbei noch zu ergänzen ist, ist das gerade die i-Serie vom Fahrzeugkonzept her sehr innovative Ansätze beinhaltet, die seiner Zeit eventuell auch voraus waren und vielleicht jetzt auch nicht die sind, die sich in der Masse durchsetzen werden. Uns war es jedoch wichtig als Technologieträger so etwas frühzeitig auch auf die Straße zu bringen. B4: Beim i3 hat BMW sehr, sehr viel Geld in die Hand genommen, sehr innovative Technik vom Fahrzeug bis zum Antrieb hergenommen und hat gesagt, das ziehen wir durch obwohl hier noch kein Land in Sicht war, dass andere hier miteinsteigen. BMW hat gesagt wir wollen hier dabei sein und Führer sein bei diesem Thema. Deshalb haben sie wir i3 und den i8. Die anderen ziehen eigentlich nur nach. B1: In der BMW Marke selbst, hat man jetzt begonnen diese Conversions zu machen, das heißt Plug-In Fahrzeuge auch zu machen. B2: Die i-Serie hat man zwar nicht ausgebaut aber bei Plug-In Modellen ist BMW trotzdem Spitzenreiter. Im Vergleich zu Audi und Mercedes haben sie vom 3er, 5er, 7er, 2er sowie vom X5 Plug-In Modelle, die wir auch verkaufen und nicht nur irgendwo im Schauraum stehen und verstauben. Solche Modelle werden gut angenommen und verkauft. Von MINI gibt es auch einen Plug-In. Hier hat BMW eine Vorreiterrolle. B2: Beim i3 ist vor kurzem eine aktualisierte Version herausgekommen, mit einer höheren Reichweite und einem neueren Akku und einer neueren Batterietechnologie. B2: Beim X3 ist es so, dass die Plattform schon für alle Antriebe gebaut ist.

Figure 36.: Value Creation 2/2

Überkategorie: Value Capture		
Kategorie	**Definition**	**Paraphrasen**
K1: Einflussfaktoren auf die Ertragsmechanik des Unternehmens	Faktoren die eine Veränderung in der Ertragsmechanik (Preisbildung, Kauf vs. Leasing, Verkaufsprozess) hervorrufen beziehungsweise erzwingen	B1: Dann gibt es noch andere Leute, die in den Vertrieb drängen wie zum Beispiel Stromanbieter. B2: Das heißt in diesem Versorgungsnetzwerk speilen völlig neue Player eine zentrale Rolle, das sind Netzbetreiber, das sind Stromerzeuger, Energieversorger, das sind Infrastrukturunternehmen die jetzt Ladeparkplätze zur Verfügung stellenund es entsteht eine völlig neue Struktur die es in dieser Form noch nie gab. B2: Die Energie AG bietet jetzt ihrem Kunden an, dass sie einen i3 um 660€ monatlich leasen. Sie befinden sich eigentlich in einem ganz anderen Gebiet drängen hier praktisch auch in den Markt. Wir sind mit diesem Angebot von Kunden konfrontiert worden und irgendwann haben wir gesagt „was die Energie AG kann können wir auch". Unser Angebot kostet nur 610€. Es ist genau das gleiche mit Vollkasko, Wallbox und Winterreifen. Der Unterschied ist der, dass man unser Auto frei konfigurieren kann und es ist um 60€ günstiger. Wir können natürlich keinen Strom verkaufen aber für 60€ im Monat auf mehrere Jahre kann man schon einiges an Strom über mehrere Jahre kaufen. B2: Wie gesagt, ganz persönlich glaube ich, dass sie generell die Kunden-Händler Beziehung verändern wird. Ich brauche das nur bei mir selbst anschauen. Man kauft viel mehr Online und man schaut sich viel mehr im Internet an. B2: Beim Elektroauto trägt man ein Restwertrisiko. Man weiß nicht wie viel ein Elektroauto in 10 Jahren wert sein wird. Wahrscheinlich ist der Preisverfall höher, weil die Entwicklungssprünge noch so hoch sind. B2: Der i3 kostet aktuell 55.000€ wenn man ihn entsprechend ausstattet, eventuell sogar 60.000€. Wird sich dann der Gebrauchtwagenpreis bei 30.000€ ansiedeln oder etwa bei 25.000€? Kauft überhaupt jemand gebrauchte Autos? Ein weiterer Punkt ist, dass nur reine Elektroautos vollkommen vorsteuerabzugsberechtigt sind. Das heißt man kann sich die Mehrwertsteuer zurückholen und damit wir er wieder 20% günstiger. Was wir davon ableiten können ist, dass der Preis eine ganz wesentliche Rolle spielt. Erst durch den Anreiz der steuerlichen Begünstigung wird es angenommen. B3: Es ist so, dass es eine E-Förderung von etwa 4000€ für reine Elektrofahrzeuge gibt, für Hybrid sind es weniger als 1500€. B4: Heutzutage sind die Leute eher so, dass sie das Auto im Internet konfigurieren und erwarte, dass das Auto am nächsten Tag am Hof steht. B4: Wie gesagt, ganz persönlich glaube ich, dass sie generell die Kunden-Händler Beziehung verändern wird. Ich brauche das nur bei mir selbst anschauen. Man kauft viel mehr Online und man schaut sich viel mehr im Internet an.
K2: Änderungen der Ertragsmechanik	Veränderung der Ertragsmechanik, dh. man erkennt eine klare Tendenzen beim Beziehen von Elektroautos Richtung Leasing oder Kauf	B2: Innerhalb unseres Unternehmens verkaufen wir Elektroautos rein über Leasing. B2: Wir denken beim Kauf der Elektroautos bereits daran dass der Kunde das Auto auch wieder verkaufen muss und können dahingehend auch beraten. B2: Wir bieten über BMW Financial Services ein Leasing an und versuchen das als zusätzliche Ertragsquelle zu nutzen. Man hat dadurch auch mehr Information. Wenn der Kunde bei uns ein Fahrzeug least wissen wir, wie lang die Leasingdauer ist. Wenn wir sehen dass das Leasing bald ausläuft, kontaktieren wir den Kunden rechtzeitig und beraten ihn diesbezüglich. Bei einer anderen Bank habe ich diese Information nicht. Das ist für uns wichtig und bei Elektroauto nochmal wichtiger, weil die Kundenfrequenz bzw. der Kontakt weniger wird. B2: Die Kunden denken nicht an die Möglichkeit des Leasings ohne Restwertrisiko. Sie würden das Auto einfach kaufen. Das macht kein Problem, jedoch in 4 Jahren sind sie verärgert da sie kein Geld mehr dafür bekommen. B3: Ich glaube nicht, dass ein Trend in Bezug auf Kauf oder Leasing im Zusammenhang mit dem reinen Elektroauto festgestellt werden kann. B4: Elektroautos werden hauptsächlich als Geschäftsautos genutzt, das hat uns ein Kollege bestätigt. Das ist dadurch zu begründen, dass nur diese auch die entsprechenden Förderungen bekommen. Das werden somit eher Leasingautos sein.

Figure 37.: Value Capture 1/2

K3: Einflusses von batterieelektrischen Fahrzeugen auf Vertriebskanäle	Diskussion des Einflusses von batterieelektrischen Fahrzeugen auf Vertriebskanäle	B2: Der stationäre Handel wird durch Elektroauto eher noch mehr verstärkt da es eine neue Technologie ist, wo die Leute mehr Fragen haben, wo es Vorurteile gibt usw. Auf diese Fragen muss man eingehen und darum ist eben bei neuen Technologien der klassische Verstriebkanal noch wichtiger wie bei konventionellen Autos. B2: BMW hat für i-Modelle ein anderes Vertriebssystem für Hersteller-Händler Beziehung. Bei konventionellen Autos ist es so, dass der Hersteller an uns verkauft und wir es dann dem Kunden weiterverkaufen. Kunde schließt Kaufvertrag mit uns als Händler ab. Bei den i Modellen hat BMW ein sogenanntes Agentur-Modell eingeführt bei dem Händler nur als Mittler auftreten. Das heißt der Kunde kauft das Auto direkt bei BMW und nicht bei uns als Händler. Wir sind praktisch nur der Mittler bei dem Kauf und bekommen Provision aber der Kaufvertrag wird zwischen Kunde und Hersteller geschlossen und es gibt zum Beispiel für den i3 keinen Nachlass. Wir als Mittler können nicht im Namen von BMW einen Rabatt geben. Das Agenturmodell wird jedoch wieder umgestellt, da BMW die Komplexität mehrerer Vertriebskanäle nicht stämmen kann. Die i Modelle werden wieder klassische vertrieben und verkauft. B3: Ganz persönlich glaube ich, dass sie generell die Kunden-Händler Beziehung verändern wird. Ich brauche das nur bei mir selbst anschauen. Man kauft viel mehr Online, man schaut sich viel mehr im Internet an. Der stationäre Handel verändert sich generell und damit wird sich das auch im Autokauf verändern und somit denke ich, dass da generell ein gewisser Wandel entstehen wird. B3: BMW hat schon ein neues Modell für den Vertrieb vom i3 eingeführt. B4: Meiner persönlichen Meinung nach verändert die Elektromobilität nicht die Vertriebswege.

Figure 38.: Value Capture 2/2

Überkategorie: Zukunft der Elektromobilität		
Kategorie	**Definition**	**Paraphrase**
K1: Hoher Anteil an Elektroautos	Anteil der Elektroautos wird in den kommenden 5 Jahren zunehmen	B1: Das Thema automatisiert Laden. Diese Technologie ist in 5 Jahren Standard und liegt draußen auf allen Parkplätzen. Dann das Thema Connectivity im Sinne von Lademanagement bzw. Lastmanagement. Jedes Elektrofahrzeug hat einen Speicher und wenn man diese addiert, dann hat man einen gigantischen dezentralen Speicher der an diesen Chargepoints hängt und der auch für gewisse Sachen wie Speicherung und Lastmanagement verwendet werden kann. Das besteht aktuell noch nicht, weil Anzahl an Elektroautos noch marginal ist. In einigen Jahren wird das jedoch ein signifikanter Anteil sein. Es würde technisch und ökonomisch großen Sinn machen, diesen Speicher auch zu verwenden. […] Es wird nicht den einen Antrieb geben, es wird ein Konglomerat sein. Es wird sicher noch lange den Verbrennungsmotor geben in Hybridanwendungen. Batterieelektrische Fahrzeuge sind aus meiner Sicht nicht für Langstrecke gemacht. […] Aus meiner Sicht sind die Anforderungen, dass es in kurzer Zeit betankbar sein muss, was für irgendeinen chemischen Energieträger spricht und genauso in einer entsprechenden Energiedichte gespeichert werden können muss und es muss möglich sein ein entsprechendes Netzwerk aufzubauen. Aus meiner Sicht spricht das sehr stark für Wasserstoff. Ich denke, und das ist mein Statement, die Technologie für die Langstrecke wird Wasserstoff sein und die Technologie für die Stadt und für Zweitautos wird die Batterie sein.
K2: Eher geringer Anteil an Elektroautos	Anteil der Elektroautos wird in den kommenden 5 Jahren nicht stark ansteigen; Nennung andere Trends	B2: Ich glaube bei Elektromobilität geht es ganz klar um die drei Themen: Ladeinfrastruktur, Ladetechnik und Batterie. Es kommt jetzt induktives Laden und vielleicht auch konduktives und Techniken um die Ladedauer zu reduzieren. Das geschieht über höhere Leistungen. Bei der Batterie wird es große Sprünge geben. Autonomes Fahren ist davon komplett unabhängig. Es ist natürlich ein Enabler, denn die Fahrzeuge können wenn sie vollgeladen sind autonom die Fläche freigeben. […] Ich denke es ist nicht so sicher, dass sich Elektroautos durchsetzen werden. Es ist vor allem regional ganz unterschiedlich weil die Ausgangssituation ganz anders ist. Auch Anreize und Besteuerungen sind ganz unterschiedlich. B3: Aus meiner Sicht ist jedoch das Thema autonomes Fahren ein viel spannenderes in der Zukunft und auch die Herausforderungen, die damit vor der Tür stehen. […] Meine persönliche Einschätzung ist eher, dass wir einen gewissen E-Mobilitätanteil sehen werden. Dieser Anteil wird nicht so hoch sein wie vorausgesagt. Der Anstieg wird langsam gehen. Daneben wird es noch einen hohen Anteil mit klassischen Verbrennungskraftmotoren geben. Ich persönlich sehe jedoch hier noch keine dritte Technologie. B4: Die USA hat Thema autonomes Fahren und nicht Elektromobilität. Autonomes Fahren ist das wichtigste. […] Es wird sicher etwas anderes auch noch geben wie z.B. das Thema Wasserstoff, wobei dieses Thema noch extremer wird als das Thema Elektromobilität in Bezug auf Ladeinfrastruktur. Dieses Thema wird mit Wasserstoff noch krasseres werden, aber da tut sich auch etwas. […] Aber das Thema Digitalisierung wird spannend und uns weltweit beschäftigen. Es ist im Zeitgeist und die Kunden fordern das halt.

Figure 39.: Future Share of Electric Vehicles

C. Battery Electric Vehicle Models

Table 23.: Battery Electric Vehicles on the European Market (as of September 2017) [according to BYD, 2017, Chevrolet, 2017, Citroen, 2017, Ford, 2017, Hyundai, 2017, Kia, 2017, Mercedes, 2017, Mitsubishi, 2017, Opel, 2017, Nissan, 2017, Peugeot, 2017, Renault, 2017, Smart, 2017, Tesla, 2017a, Volkswagen, 2017, BMW, 2017a]

Manufacturer	Model name	Market release date
BYD	e6	2010
Chevrolet	Volt	2010
Citroen	C-Zero	2010
Nissan	Leaf	2010
Peugeot	iOn	2010
Renault	Fluence	2010
Mitsubishi	i-MiEV	2011
Opel	Ampera	2011
Smart	ForTwo Electric Drive	2011
Ford	Focus Electric	2012
Mercedes	Vito E-Cell	2012
Mercedes	A E-CELL	2012
Renault	Kangoo	2012
Renault	Twizy	2012
Tesla	Model S	2012
BMW	i3	2013
Chevrolet	Spark EV	2013
Fiat	500e	2013
Renault	Zoe	2013
Kia	Soul EV	2014
Mercedes	SLS electric drive	2014
Mercedes	B-Klasse Electric Drive	2014
VW	e-Up!	2014
VW	e-Golf	2014
Tesla	Model X	2015
Citroen	e-Mehari	2016
Mercedes	B250e	2016
Nissan	e-NV200 EVALIA	2016
Nissan	e-NV200	2016
Chevrolet	Bolt EV	2017
Citroen	Berlingo	2017
Honda	Clarity Electric	2017
Hyundai	Ioniq	2017
Peugeot	Partner	2017
Peugeot	ZOE R400	2017
Smart	ForFour Electric Drive	2017
Smart	ForTwo Cabrio Electric Drive	2017
Tesla	Model 3	2017

Table 24.: Battery Electric Vehicle Ranges [according to BYD, 2017, Chevrolet, 2017, Citroen, 2017, Ford, 2017, Hyundai, 2017, Kia, 2017, Mercedes, 2017, Mitsubishi, 2017, Opel, 2017, Nissan, 2017, Peugeot, 2017, Renault, 2017, Smart, 2017, Tesla, 2017a, Volkswagen, 2017, BMW, 2017a, Autorevue, 2016, Goingelectric, 2017, Greengear, 2017]

Manufacturer	**Model name**	**Range**				
		Car Manufacturer	Grünesauto	Autorevue	Greangear	GoingElectric
BMW	i3	200	190	190	190	
BYD	e6	400	300		400	
Chevrolet	Volt EV		383	83 + 420***		
Citroen	Berlingo	170	130		170	170
Citroen	C-Zero	150	150	150	150	150
Citroen	e-Mehari	100			100	100
Ford	Focus Electric	225	162	162	162	162
Hyundai	Ioniq	280	280		280	280
Kia	Soul EV	250	212	212	212	212
Mercedes	Vito E-Cell	130				
Mercedes	SLS electric drive	250				
Mercedes	B-Klasse Electric Drive	200	200		200	200
Mercedes	B250e	200		200		
Mitsubishi	i-MiEV	150	160	150		160
Nissan	Leaf (24 kWh)	250	199	199	199	199
Nissan	e-NV200 EVALIA	170	167		170	167
Nissan	e-NV200	170	167	170		163
Opel	Ampera	250				
Peugeot	Partner	170	170		170	
Peugeot	iOn	170	150	150	150	150
Renault	ZOE	400**	210	210	240	250
Renault	ZOE R400	400	400			
Renault	Kangoo	270**	170	170	170	170
Renault	Twizy	100	50-120	120	90-100	100
Smart	ForTwo Electric Drive	160			160	160
Smart	ForTwo Cabrio Electric Drive	155				
Smart	Forfour Electric Drive	155				
Tesla	Model S 75	450	470	455	400	480
Tesla	Model X	565	417	450	417	417
Tesla	Model 3	540				
VW	e-Up!	160	160	160	160	160
VW	e-Golf	300**	190	190	300	300

** NEDC, *** Range Extender

Table 25.: Battery Electric Vehicle Prices on the German Market [according to BYD, 2017, Chevrolet, 2017, Citroen, 2017, Ford, 2017, Hyundai, 2017, Kia, 2017, Mercedes, 2017, Mitsubishi, 2017, Opel, 2017, Nissan, 2017, Peugeot, 2017, Renault, 2017, Smart, 2017, Tesla, 2017a, Volkswagen, 2017, BMW, 2017a, Autorevue, 2016, Goingelectric, 2017, Greengear, 2017]

Manufacturer	**Model name**	**Price in €**			
		Car Manufacturer (base price)	Grünesauto	Greangear	GoingElectric
BMW	i3	on request	34.950	34.950	
BYD	e6	on request			59.500
Chevrolet	Volt EV	$34.995			
Citroen	Berlingo	27.750		24.978	24.978
Citroen	C-Zero	21.800	19.800	19.800	19.390
Citroen	e-Mehari	24.790*		24.790*	
Ford	Focus Electric	34.900	34.900	34.900	34.900
Hyundai	Ioniq	31.190	33.300	33.300	33.300
Kia	Soul EV	25.690	28.890	28.890	28.890
Mercedes	Vito E-Cell	on request			
Mercedes	SLS electric drive	on request			
Mercedes	B-Klasse Electric Drive	on request	39.151	39.151	39.151
Mercedes	B250e	on request			
Mitsubishi	i-MiEV	29.990	23.790		23.790
Nissan	Leaf (24 kWh)	22.892	23.365*	29.265*	23.365*
Nissan	e-NV200 EVALIA	32.500	31.289*	31.706*	31.289*
Nissan	e-NV200	25.290	24.218*		24.219*
Opel	Ampera	39.330			39.330
Peugeot	Partner	21.290	18.671	25.335	
Peugeot	iOn	13.550	19.800	19.800	21.800
Renault	ZOE	22.100*	22.100*	22.100*	21.500*
Renault	ZOE R400	24.900	24.900		
Renault	Kangoo	23.800	20.300	24.157	23.800
Renault	Twizy	6.950*	6.950*	6.950*	6.950*
Smart	ForTwo Electric Drive	21.940		21.940	21.940
Smart	ForTwo Cabrio Electric Drive	25.200			
Smart	Forfour Electric Drive	22.600			
Tesla	Model S 75	80.000	88.200	81.419	68.970
Tesla	Model X	106.000	98.800	106.800	96.750
Tesla	Model 3	$35.000			
VW	e-Up!	26.900	26.900	26.900	26.900
VW	e-Golf	35.900	34.900	35.900	35.900

* without battery