Master Dissertation:

An explorative Analysis of how Autonomous Driving Technology impacts the Business Model of the Automotive Premium Segment:

A Case Study of the BMW Group

by

Alexander Kahlert

An explorative Analysis of how Autonomous Driving Technology impacts the Business Model of the Automotive Premium Segment:

A Case Study of the BMW Group

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I certify that the dissertation entitled:

An explorative Analysis of how Autonomous Driving Technology impacts the Business Model of the Automotive Premium Segment: A Case Study of the BMW Group

submitted for the degree of MSc in Programme International Business Management is the result of my own work and that where reference is made to the work of others, due acknowledgment is given.

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Abstract

An explorative Analysis of how Autonomous Driving Technology impacts the Business Model of the Automotive Premium Segment:

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The subject matter of this thesis is strategic innovation management. In particular, it analyses how business model innovation can help an incumbent firm to achieve long-term viability in times of disruptive technologies. The research was focused on one specific case: The BMW Group. With 133,778 employees and an overall revenue of approximately 104 billion euros it is one of the key companies of the German economy. Within the Group, the eponymous BMW brand of cars dominates the annual sales volume at 86%. This case study focuses on one disruptive technology development scenario: the achievement of high-end autonomous driving.

The overall objective of this research was to outline the business model innovation implications of autonomous driving for BMW today and in the future. In order to achieve this objective and to structure the research the following lead questions were proposed:

(A) Does the BMW Group face the typical Innovator's Dilemma in regard of autonomous driving technology?

(B) How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?

(C) Which organisational conditions need to be established today to enable this kind of Business Model Innovation and the development of the autonomous driving technology?

This explorative case study was based on semi structured interviews with a relevant expert panel of ten experts with heterogeneous backgrounds. Expert input was analysed through both deductive and inductive thematic analysis.

This research contributes to existing innovation management literature by proposing new conceptual models in one framework. Firstly, a disruptive innovation needs to be sensed and evaluated. Secondly, the new arising opportunity is seized by analysing the business model innovation implications of it. Lastly, organisational conditions to enhance this exploration of business model innovation have to be established. The research strongly suggests that BMW will face the typical Innovator's Dilemma since the internal structure of it is not aligned with the significant technology push and market pull triggered by autonomous driving. Only a significant shift of its business model towards a digital enhanced premium mobility service can ensure long-term viability for BMW. A far-reaching programme of business model innovation should be launched today, beginning with organisational exploration. The case study suggests enabling conditions of organisational exploration in three interrelated dimensions.

Keywords: Strategic Innovation Management; Disruptive Innovation; Business Model Innovation; Ambidexterity; Automotive Industry

1 Introduction

1.1 Overview

German car manufacturers like BMW were and still are the quality leaders in the global car manufacturing industry. BMW and other German producers were able to develop the car as a product further and used incremental technology development steps to continuously increase the value of the single car. According to Christensen, these technologies are called *sustaining technologies* (2015). Sustaining technologies improve products and enhance the profitability of existing companies (Christensen, 2015). In the automotive industry, innovations that make cars faster, safer, or more luxurious are typically considered as sustaining (Iyer and Alton, 2019). Such product developments mainly respond to customer preferences. BMW and other manufacturers improve the hardware (e.g. exterior design, engine performance or chassis tuning) in a way that it directly raises the perceived customer value per car and of the brand. This product development strategy led to significant business growth of BMW from 2014 to 2018. BMW reached a new company record of automobile delivery of 2,490,664 (incl. the brands BMW, Rolls Royce and Mini Cooper) and an EBIT margin of 7.2% in 2018 (BMW, 2019a).

In contrast to the described sustaining technologies, so-called disruptive technologies can cause great firms to fail since these technologies disrupt existing business systems of incumbent firms. In the car manufacturing industry, the technology of autonomous driving is seen as a potentially disruptive technology for incumbent firms (Eliot, 2017). In this technological scenario, the car itself, based on machine learning and neuronal networks, decides how driving situations need to be resolved. The user of an autonomous car no longer makes traffic-related decisions and can, therefore, concentrate on other interactions like entertainment, socializing or working while driving (Eliot, 2017). This technological possibility holds enormous disruptive forces for premium manufacturers, since the original value proposition, such as BMW's “the ultimate driving machine”, requires a transformative reinterpretation (BMW, 2019b).

The overall objective of this research is to provide a strategic innovation management approach in response to disruption by new technologies like autonomous driving for BMW. Therefore, the research of this dissertation ultimately aims to explore the disruptive potential of the autonomous driving vehicle for the BMW brand and how it has to amend its business model in this new technological landscape to achieve long-term viability.

The complexity of the dissertation’s research approach stems from the uncertain technological progress in this area. Hence, this study needs to be explorative to find answers in an uncertain and ambiguous research setting. It analyses the potentially disruptive impact on BMW’s business

model. Based on that, it explores possible business model innovation requirements for BMW to align the future business model. Finally, conditions that are required to enable organisational exploration of business model innovations and the development of the autonomous driving technology at BMW are identified based on the literature and the primary research. The locus of the research is the automotive industry with a focus on premium brands. Premium brands are the ones that can combine a high perceived customer value through branding with high production volumes (Reichhuber, 2010). The form of research is a case study based on one of the world's leading automotive manufacturers in this premium segment, the BMW Group. Hence, BMW is the object of this case study research. The external variable that affects the case object BMW is the thriving technology of autonomous driving, which can be defined as the approach to replicate the cognitive and mechanical processes of a today's human driver by software and high-end technology solutions in the areas of recognition and processing of external variables (Eliot, 2017).

The analysis of autonomous driving and the derivation of an appropriate business model helps automotive companies to find the right path towards a self-driving future. In times of high pacing technology, business model innovation and technology understanding are key sources of competitive advantage (Johnson *et al.*, 2008).

1.2 Justification for the research

A thriving high technology sector is challenging the current business systems of incumbent car manufacturers like BMW. These, in the case of BMW, are the artificial intelligence-based self-driving car and the political and social discussions about what future mobility could look like (The Economist, 2016; Heineke *et al.*, 2017). In times of traffic-intensive cities, the overall impression is that mobility will shift towards Mobility-as-a-Service (MaaS) (The Economist, 2016). This means, that more and more customers, especially city dwellers, do not want to own a car but to have access to mobility on demand. A survey by the consulting firm McKinsey shows that premium car buyers, the client base of BMW, are more willing to use car-sharing services than the mass market customers (Köstring *et al.*, 2019). Although the majority of surveyed customers still prefer a mix of owning a car and MaaS, it shows that the premium segment needs to consider new mobility solutions (Köstring *et al.*, 2019).

In addition to that new mobility demand of customers, a worldwide survey of the consulting firm Capgemini found out that 25% of the people today would prefer a self-driving car to a regular car. After ten years of technology development, even 64% would prefer the self-driving one (Winkler *et al.*, 2019). This is mainly caused by a higher mobility convenience and cost reduction (Winkler *et al.*, 2019). The combination of a Mobility-as-a-Service structure and the autonomous driving technology promises a significant cost decrease per kilometre from 0,9€ to 0,3€ for the

customer (Roland Berger, 2018). More than 70% of the interviewed experts of a McKinsey survey agree on the fact that high levels of automation will be highly demanded by customers of the premium segment (Köstring *et al.*, 2019). In this context, customers also value more and more connectivity services of the vehicle (access to entertainment platforms like Spotify or Netflix) and the user-centric interior design which will get more relevance than the exterior (Köstring *et al.*, 2019). These combined mobility trends of growing customer preference towards self-driving cars and new individual mobility solutions as well as the completely new differentiation potentials of a self-driving car increase the complexity and uncertainty of BMW's business environment significantly.

Therefore, the long-term viability of BMW's business model may be at risk. This risk is the key trigger of the proposed research objective. The discussion of how strategic innovation can help to achieve long-term viability is deeply embedded in the strategic management literature. In the world of self-driving cars, premium manufacturers like BMW potentially get into a so-called "Innovator's Dilemma" (Christensen, 2015, p.3) in which old capabilities, structures and assets inhibit incumbent firms to take the required transformation steps.

The findings of this dissertation are highly relevant especially for decision-makers of the global car industry, but it can also give insights to all decision-makers in organizations since managing externally disruptive innovation and internally strategic innovation is an overall management challenge in an ambiguous and uncertain environment.

1.3 The research question and objectives

The understanding of future environmental changes like technological progress and shifts in customer behaviour and deriving a proper business model are key organizational capabilities for long-term viability. Two main research fields correlate with the long-term viability of a company. Firstly, the disruptive impact of specific technologies on incumbent firms and how these affected firms could manage the coming disruption with the help of innovation. The areas of innovation and strategic management are interlinked since continuous innovation is more and more integrated into modern company strategies. BMW's case study, supported by qualitative research with a predefined panel group, provides a theory-based strategic innovation management approach applied practically.

Therefore, the leading research questions of this dissertation are:

Does the BMW Group face the typical Innovator's Dilemma in regard of autonomous driving technology?

How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?

Which organisational conditions need to be established today to enable this kind of Business Model Innovation and the development of the autonomous driving technology?

To answer this leading research questions, the following sub-questions need to be analysed:

Lead Questions		
A	**B**	**C**
Does the BMW Group face the typical Innovator's Dilemma in regard of autonomous driving technology?	**How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?**	**Which organisational conditions need to be established today to enable this kind of Business Model Innovation and the development of the autonomous driving technology??**
What are the current generic business systems and market conditions of an incumbent automotive producer?	What is an appropriate business model framework based on relevant innovation literature?	How does BMW manage its innovation processes today?
How disruptive is the impact of autonomous driving on the business model of BMW?	Which other business model trends are relevant for the case of BMW?	What are organisational conditions that enable business model innovation in an incumbent firm?
/	How could a future BMW business model look like?	Which conditions are already established at BMW?

Table 1- Relationship between lead and sub-questions.

These guiding research questions are answered through achieving the following three research objectives:

O1. Assess whether BMW faces the Innovator's Dilemma in times of autonomous driving vehicles

a) Describe the theory of the Innovator's Dilemma
b) Define the generic business systems and market conditions of an incumbent automotive producer
c) Analyse the disruptive impact of the autonomous driving technology on the business model of BMW

O2. Develop a technology fitting business model for BMW to solve the Innovator's Dilemma

a) Develop a theoretical-based business model framework for further research
b) Discuss and apply modern business model trends affecting the automotive industry and especially BMW
c) Derive relevant implications for each business model dimension for the BMW group in times of autonomous driving

O3. Derive organisational conditions required to enable the successful development of autonomous driving vehicles and the related business model

a) Discuss literature-based organisational conditions that enable business model innovation and the management of disruptive technologies in incumbent companies
b) Understand BMW's approach to managing innovation in today's organisation
c) Derive organisational conditions of successful organisational exploration for BMW to enable the development of autonomous driving vehicles and the related future business model

1.4 The study structure

The research design needs to be aligned with the explorative targets. Therefore, a case study of BMW supported by qualitative research is applied. According to Yin, a case study is an in-depth analysis of a topic or phenomenon in its real-life setting (2017). The author follows this definition for the research design. The case study of BMW is used to analyse and understand disruptive technologies and its business model implications for an incumbent firm. Since business models can vary from brand to brand, the research is focused on the brand BMW of the BMW group (Mini Cooper and Rolls Royce are excluded from the research since the key brand of the group is BMW). BMW's case is used to understand the dynamics between the case object BMW and the specific context of a disruptive environment through technology like autonomous driving vehicles (Eisenhardt, 1989). Only a case study can deliver the possibility to derive business model innovation implications in order to manage a potentially disruptive technology. To give relevance to the proposed case study, qualitative research is conducted. The qualitative research panel should reflect a virtual group of experts and interest groups that together find an answer to a complex problem (Okoli and Pawlowski, 2004). The author builds up a heterogeneous stakeholder panel (e.g. Industry competitors, Consultants, BMW employees, Customers, Suppliers) to derive the required knowledge regarding the lead questions (Saunders *et al.*, 2015).

The research firstly presents a critical literature review where relevant references for the above-described research questions are discussed and knowledge gaps are identified. The Innovator's

Dilemma theory is discussed and the case object, BMW and the structure of its industry, and the case variable, the technology of autonomous driving, are described and discussed whether autonomous driving is a potentially disruptive technology for BMW. The literature in the strategic innovation area is used to construct a theoretical business model that is able to frame the explorative research of the lead question B. Finally, multiple sources of managing the development of disruptive technologies in incumbent firms are analysed and key organisational conditions of how these technologies and related business model implications can be explored and developed today are derived to structure the research process regarding lead question C.

The literature review is summarized by a consistent conceptual framework. It is principally based on three layers: Research questions, research process and research outcomes. Finding answers to the described lead questions is the guiding objective of the overall research. This is done in two ways: Besides the exhaustive review of relevant literature regarding the lead questions, the research process is expanded by primary qualitative research based on semi-structured interviews. These two streams combined result in the research outcomes focusing on the lead questions. It is answered whether autonomous driving is potentially disruptive for BMW, how innovation could help in the future to align the business model with the new technological landscape and which organisational conditions enable BMW to explore the new technology and the related business model.

Based on this conceptual framework, the author describes the research design and strategy that is applied to gain the required insights from semi-structured interviews. Finally, the theory from the literature review and the results from the described research method are merged in the findings and discussion chapter. The theoretical frameworks are filled with practical insights from multiple experts. The chapter discusses the findings and their implications for BMW's future business model.

Finally, all the insights are summarized in a concluding chapter where limitations and further research potential in the area of strategic innovation are derived and discussed.

2 Critical Literature Review on the Research Field

Today's business environment is worldwide characterized by four dimensions: Volatility, uncertainty, complexity and ambiguity (*VUCA*) (Millar *et al.*, 2018). In this world, innovation is one of the most required business disciplines to protect the relevance of the incumbent firm and is a key source of organic growth (Tidd and Bessant, 2009). Innovation is defined as "a process of turning opportunity into new ideas and of putting these into widely used practice" (Tidd and Bessant, 2009, p.16). Innovation always combines new inventions (coming up with new ideas) and trends in the environment of an innovating organisation with potential market opportunities (Bessant and Tidd, 2015). However, innovation is a broadly used term and it can be achieved at different stages. Besides the incremental innovation, which describes small improvements to existing products, processes or services, some innovations potentially change business systems and how current products are perceived by customers. These are called radical innovations (Bessant and Tidd, 2015). Radical innovation represents "significantly different changes to products, services or processes" (Bessant and Tidd, 2015, p.39). A subcategory of radical innovation is the so-called discontinuous innovation. It describes innovations that "change the rules of the game and open up a new game in which new players are often at an advantage" (Bessant and Tidd, 2015, p.39). Christensen labels these innovations as disruptive innovations (2015). Disruptive innovation means that the environment is changing in a way that the existing players are challenged to redesign their holistic business model and company DNA, otherwise new players could disrupt the incumbent firms (Tidd and Bessant, 2014). Especially fast technology progress is challenging the current business systems of incumbent companies like BMW (Tidd and Bessant, 2014). In the context of VUCA, Schoemaker et al. established a three-step framework that describes how organisations can manage the thriving VUCA environment with a focus on high-pace technology:

(1) Sensing external change

(2) Seizing new opportunities

(3) *Transforming the current organisation* (Schoemaker *et al.*, 2018).

The following literature review follows this framework. The first subchapter describes the possible Innovator's Dilemma of BMW in times of autonomous driving. It is described how today's automotive industry is structured and how the typical value chain of an automotive company like BMW is composed. The next step is to understand the fundamentals of the new technology of autonomous driving. The five levels of autonomous driving are described and the generic system behind the technology is mapped. Finally, taking the two perspectives together,

the potentially disruptive effect on BMW is analysed and discussed. Hence, this first section correlates with sensing external change.

Based on this understanding, chapter 2.2 is used to discuss the current literature of business model innovation. Firstly, the modern business model innovation theories are presented. The models are discussed to derive one framework that can be used for further research. The second step is to take the business model influencing effects in the automotive industry into account. Topics like shared and connected mobility are discussed. Influencing trends are outlined and integrated into the used business model framework. The chapter of developing a business model framework influenced by modern mobility trends fit the second step of Schoemaker's process: Seizing new opportunities. The models are used to frame the data derived from primary research.

Finally, chapter 2.2.3 discusses the last step of the above-described framework: Transforming the current organisation. After the business model framework is derived and, therefore, new opportunities can be seized, the next question is how organisations can enable the development of these new opportunities. Hence, the last literature chapter discusses current state articles and books about organisational conditions that enable business model innovation. A final model summarizes the key organisational conditions that need to be implemented to enable the organisational exploration of new opportunities.

The structure of the review is mainly based on the three lead questions since they include the Innovator's Dilemma of BMW, business model innovation for BMW in times of autonomous driving and organisational conditions for BMW to enable the development of autonomous driving and the related business model implications. Based on this literature review approach, the conceptual framework of the research is presented and discussed. The literature review in this structure is a key contributor to execute the conceptual framework and to find answers to the defined lead questions. A conclusion chapter summarizes all gained insights and outlines how the literature review is connected to the further chapters of the dissertation.

2.1 The Innovator's Dilemma of BMW

In the history of economies and markets, many successful companies lost their relevance although they had a leading position in profitable markets. The main reasons for that are disruptive technologies (Christensen, 2015). Disruptive technology "initially underperforms the dominant one along the dimensions mainstream customers in major markets have" (Tellis, 2006, p.34). This means, disruptive technologies firstly deliver a worse business case for the management in comparison to the development of sustaining technologies, which have an initial impact on the perceived mainstream customer value (Christensen, 2015). This trade-off in the product and business model development is the so-called "Innovator's Dilemma". Although management was able to continuously raise the customer value of their product portfolio, disruption can occur if the disruptive potential of technology was not sufficiently mapped and no willingness to cannibalize existing structures and assets is shown. Chandy and Tellis also call this the "incumbent curse" (2000, p.1). This curse is mainly based on management's preferences of avoiding sunk costs and focusing on short-term expectations of investors (Henderson, 2006; Christensen and Raynor, 2013). Sunk costs mean that cannibalization of specialized assets and structures is avoided since significant investments into the existing business model are executed and planned (Machaj, 2013). Chandy and Tellis identify the ability to cannibalize existing structures as a key ability to manage disruptive environments (1998). The willingness to cannibalize internally is influenced by four main dimensions:

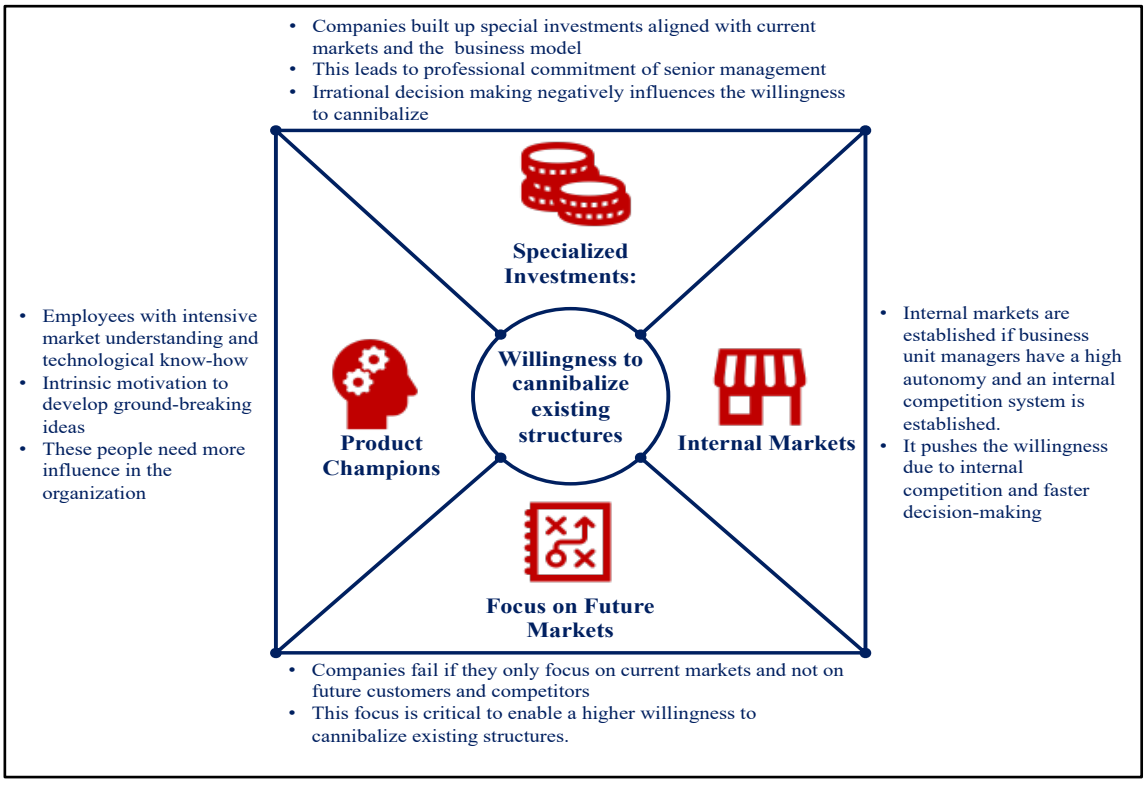

Figure 1 - Influencing dimensions of the willingness to cannibalize structures (based on Chandy and Tellis, 1998).

Furthermore, the dilemma is pushed by the growth expectations of investors. Share-based companies like BMW need to deliver continuous growth to their investors. However, to achieve this required growth, companies need to take more and more unpredictable risks which are simultaneously not accepted by the investors (Christensen and Raynor, 2013). Only one of ten companies can achieve this kind of required growth over several business periods (Christensen and Raynor, 2013).

The most relevant decision field in terms of new growth opportunities is the management of research and development (R&D) (Preuss *et al.*, 2018). According to Johnson et al., three main dimensions influence this management:

(1) *Follow technological pace:* Companies need to decide on which extent they want to follow the potentially disruptive technology by investing financial and human resources in it (Johnson *et al.*, 2017).

(2) *The investment volume for product innovation:* Companies, in times of disruptive technologies, face the decision whether to invest in short-term sustaining technologies or to invest in long-term disruptive technologies (Johnson *et al.*, 2017).

(3) *Openness towards outside innovative ideas:* Companies need to decide whether they want to rely on internal innovation capabilities or to cooperate with innovative partners from their business ecosystem (Johnson *et al.*, 2017).

In most of the disruption cases, these decision dimensions were focused on how the current needs of existing customers are fulfilled with a maximized perceived value (Bower and Christensen, 1995). However, a disruptive technology achieves only a high threat for incumbent firms, if a business model is established which aligns the technology with business methods (Johnson *et al.*, 2008). Together, these two factors lead to disruptive innovation which changes fundamentally customer preferences and how business is done (Worlock, 2007). This diffusion of disruptive technology can be described in the so-called “S-curve”-model:

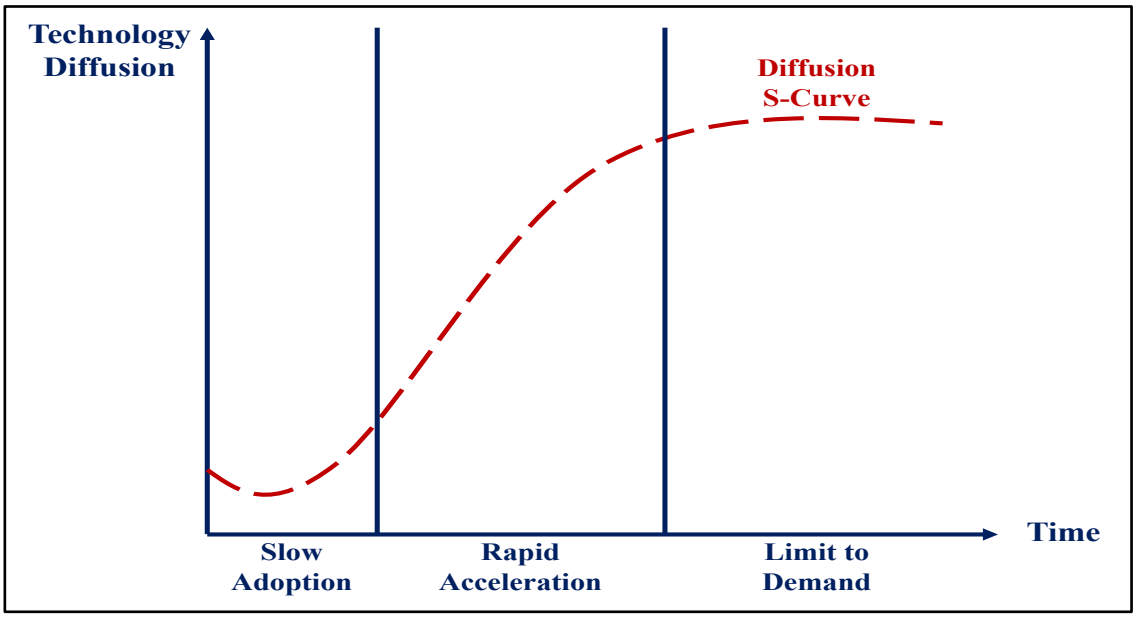

Figure 2 – The technology diffusion S-curve
(based on Johnson *et al.*, 2017).

Disruptive innovations start in a small use and business case, but with the fast market diffusion and further technological progress, they gain customer acceptance in a broader sense and disrupt former successful business models (Christensen *et al.*, 2015; Bohnsack and Pinkse, 2017). Henderson proposes a similar development of disruptive technologies: Disruptive technologies start in a niche market and follow from there the development of the S-Curve towards the mainstream market and consequently disrupt the incumbent technology standard (see Appendix C) (Henderson, 2006). Although Tellis argues that the shape of the S-curve is too simplistic and that disruptive technologies develop in irregular and difficult to predict development jumps, he confirms that disruption occurs in a combination of sustaining improvement focused management and a thriving potentially disruptive technology (2006).

Therefore, the first step of analysing whether BMW faces the Innovator's Dilemma is to understand the key characteristics of BMW's industry environment and business model in this industry. Furthermore, the new technology of autonomous driving vehicles is explained and discussed to understand the key elements of the new technology. The derived insights are used to give a literature-based evaluation of the disruptive impact of autonomous driving on premium manufacturers like BMW.

2.1.1 Key characteristics of the German automotive industry with focus on BMW

The worldwide and German automotive industry is a complex and broad network of different companies and tasks. It can be described as a vertically integrated production network which is orchestrated by large assembling corporations. Most of the component manufacturing is outsourced to different supplier networks (tier one suppliers) (Pavlínek and Ženka, 2016). Based on this complex industry network, the research requires a tighter definition of the automotive industry. Automobile manufacturers are, in this dissertation, defined as economic units that combine components, systems and modules produced internally or externally and receive a vehicle as a final product. This vehicle is offered on the market to end-users (Wolters, 1995). The focus lies on the passenger cars segment of the automotive industry. The producers of passenger cars can be further clustered by taking the dimensions sales volume and brand positioning into account (Reichhuber, 2010).

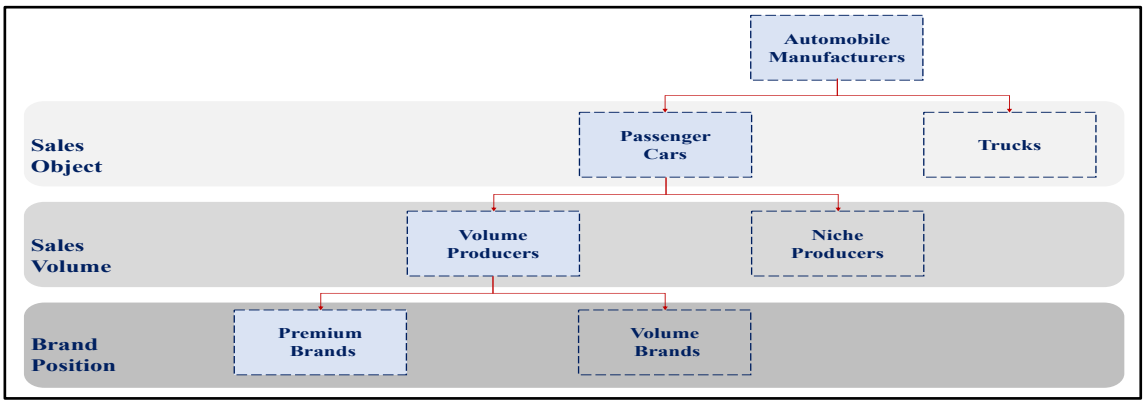

Figure 3 – Classification of automotive producers
(based on Wolters, 1995; Reichhuber, 2010).

The volume producers' business system can be described by the value chain framework by Porter. It is used to describe and analyse how industries and companies create and capture value (Porter, 1985). The following figure shows an automotive generic value chain of incumbent firms in today's industry landscape:

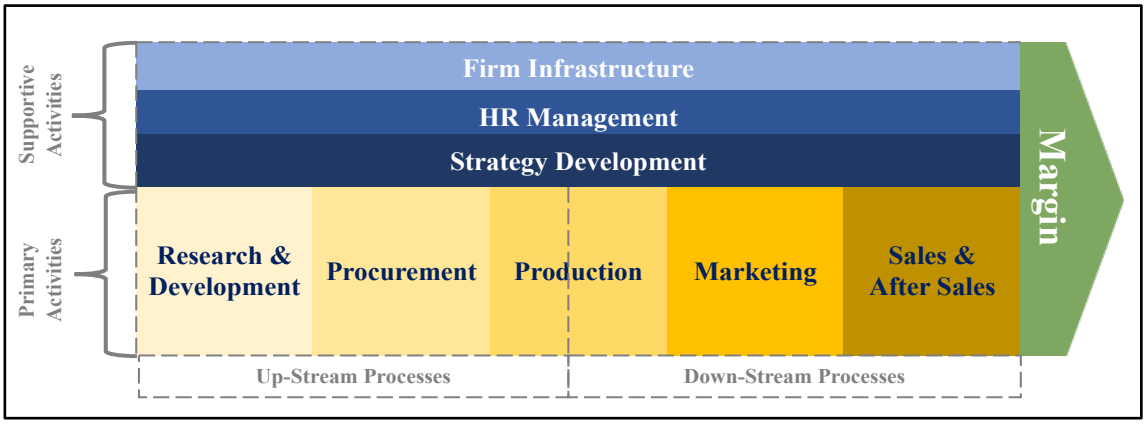

Figure 4 – The automotive value chain
(based on Porter, 1985; Reichhuber, 2010).

The description focuses on the primary activities since these are the key value drivers of the automotive industry (Reichhuber, 2010). The primary activities are divided into upstream and downstream activities (Diez, 2006).

(1) *Up-Stream Processes:* The first step is research & development. It screens the market and technology landscape for new growth and innovation opportunities. It contains early-stage research and market-ready developments which makes R&D a broad task field (Reichhuber, 2010). Secondly, procurement is the step that enables the production part to produce valuable products. They organise the required production factors like components and raw materials. Up-Stream processes are characterized by a symbiotic collaboration approach with tier one suppliers (e.g. BMW and Bosch). The innovation ability of car manufacturers highly depends on the ability of their key suppliers (Reichhuber, 2010).
(2) *Production:* The production step is the key step to produce value for the customers of the car manufacturer (Reichhuber, 2010). It mainly focuses on assembling components from direct suppliers efficiently and flexibly (e.g. flexible production capacities) (Dudenhöffer, 2016).
(3) *Down-stream Processes:* After a car is produced, the value of the car needs to be perceived by the target groups. Marketing is used to identify and attract relevant customers (Reichhuber, 2010). Sales and After Sales are based on a decentralized approach. Third-party car dealer, own branches and more and more online sales channels are the key channels of car producers' sales portfolio (Reichhuber, 2010; Winkelhake, 2017).

German car producers like BMW were able to design the above-described value chain in a way that they outpaced the global competition in the last decade. According to Dudenhöffer, customers' buying decision is mainly characterized by irrational factors like status and sense of beauty (2016). German car producers were able to produce on scale trustful and aesthetic cars and sell them worldwide. This shows the export share of 69.9% from the 493.71 billion € revenue of the German car industry (Statista, 2019a; Statista, 2019b). The main markets of German producers are the regions Europe, USA and China (Statista, 2018).

Automotive industries, especially the German one, show different strategic orientations of different car brands. As Dudenhöffer describes, brand positioning and alignment with the needs and tastes of the target groups are important (2016). Therefore, strategic groups need to be defined to segment the German automotive industry. "A strategic group consists of those rival firms with similar competitive approaches and positions in the market" (Channon, 2006, p.321). It can be used to identify holistic approaches of different companies. According to Reichhuber, the two dimensions of *Perceived Value* and *Production Volume* can be used to cluster the German automotive industry (2010):

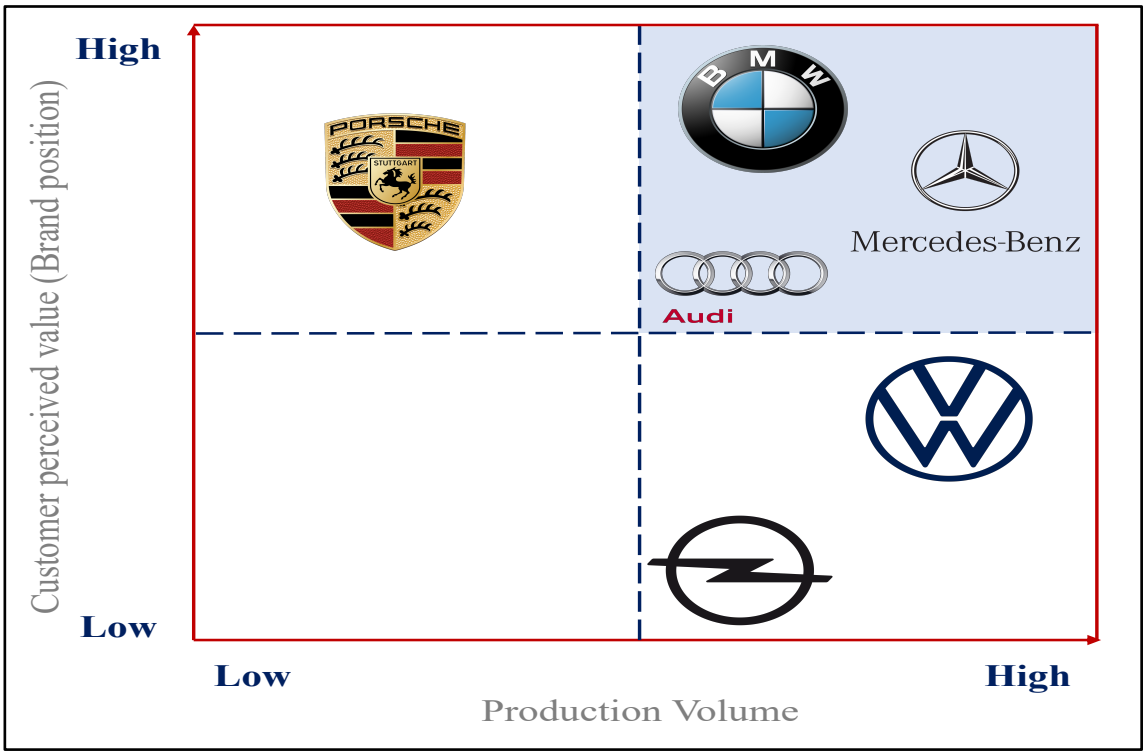

Figure 5 – The strategic groups of the key German car producers
(based on Channon, 2006; Reichhuber, 2010; Dudenhöffer, 2016)

The strategic grouping of the German car producers suggests that BMW's key competitors are Audi and Daimler since all three are premium brands (Reichhuber, 2010). However, reality shows a more complex competitive environment. All of the three brands in the upper right dimension have product categories which also compete with Porsche (e.g. BMW 8-series) or with Volkswagen (e.g. BMW 1-series). As described above, the German car manufacturers highly depend on export business which implies that competitive peer groups can vary in regions as well. However, the three brands BMW, Audi and Mercedes-Benz are considered as key competitors, since they all have a similar product portfolio and homogenous target markets (Reichhuber, 2010).

The key question, related to the research objectives, is: *How is BMW able to differentiate itself in this strategic group and the global competition with other brands?*

The focus area of BMW lies in the automotive division. In 2018, the automotive division delivered 88% of the total revenue of 97.5 billion € (BMW, 2019a). This emphasizes the significance of this business segment for the overall group. The major brand in this segment is, without any doubt, the brand BMW itself. It is the key driver of worldwide sales volume of the group (BMW, 2019a). BMW as a brand has a long history and experience with the production and sales of premium cars. Over the years, BMW introduced sustainable improving car models. A broad product portfolio from entry-level cars like 1-series to high-end cars like 7-series is committed delivering the propositions of enjoyment, comfort and security to the customers (BMW, 2020). Each new product has a regular life-cycle of five years (Reiter and Ohnsman, 2011). This development cycle

requires continuous innovation and improvement (BMW, 2020). Therefore, BMW commits itself to customer-centric innovation (BMW, 2019a). However, a study of the Centre of Automotive Management showed that BMW lost its leading position in terms of innovation to Mercedes and Audi (Bratzel, 2019). Simultaneously, new players like Tesla are improving their innovative capabilities (Bratzel, 2019).

However, BMW's focus on the premium segment shows the strategic risk of dependency. This segment is characterized by a higher demand elasticity and, therefore, leads to the dependency on economic growth in target markets like China, Europe and USA (Reichhuber, 2010). BMW was able to balance this risk through a strong brand in these target markets and an efficient production approach of a common platform (BMW, 2019a). A common platform means that a different series of BMW can be produced by using the same common ground components (Wedeniwski, 2015; BMW, 2020). This production approach leads to synergies between different products (Wedeniwski, 2015).

It can be summarized, that BMW's commitment to the premium market is currently working well. BMW was able to achieve an EBIT margin of 7.2% which is on a similar level of Mercedes Benz (7.75%) and significantly better than Audi (5,96%) (Audi AG, 2019; Daimler AG, 2019; BMW, 2019a). On the one hand, this success is mainly based on a thriving world economy in recent years, but also on BMW's highly customer valued propositions of security, enjoyment and comfort which are aligned with the design and production of BMW's cars. On the other hand, BMW can produce efficiently on a scale with flexible production utilization and common production platforms for different car categories. Today, these aspects are relevant market barriers for new entries which currently protect BMW's business success.

However, the German automotive industry faces new complexities in the market environment. New customer preferences like digital connectivity, flexible mobility services (using not owning) and less focus on status symbols are new challenges for the brand BMW (Winkelhake, 2017). Additionally, new technological developments like autonomous driving or electrification of the car engines have the potential to disrupt old value propositions and business systems (Wedeniwski, 2015). These new technologies enable new market entries like Waymo, Uber or Tesla to compete with incumbent firms like BMW (Wedeniwski, 2015). The following chapter discusses these developments with a focus on autonomous driving and its potentially disruptive impact on BMW.

2.1.2 The new technology of autonomous driving vehicles

According to McKinsey, autonomous driving vehicles are one of the four most important automotive trends in the future (Heineke *et al.*, 2019). These four trends are summarized under *ACES* (Autonomous, Connected, Electrified and Shared cars) (Heineke *et al.*, 2019). The development of autonomous driving vehicles is simultaneously the most challenging one of these four. It can be compared to a moonshot project (Eliot, 2017). According to Eliot, autonomous driving vehicles try to replicate the cognitive and mechanical processes of today's human driver (2017). Özgüner et al. define autonomy of a car as "the car making driving decisions without the intervention of a human" (Özgüner *et al.*, 2007, p.397). It promises to reduce road fatalities, improve the time spent in the car and transforms mobility into a commodity that is available everywhere and every time (Schwarting *et al.*, 2018). However, the current development of autonomous vehicles is incremental with small steps of progress. It is mainly based on a continuous learning approach (Eliot, 2017). Therefore, the Society of Automotive Engineers International defined five degrees of replication of human decision making and physical acting in terms of car driving (SAE, 2020):

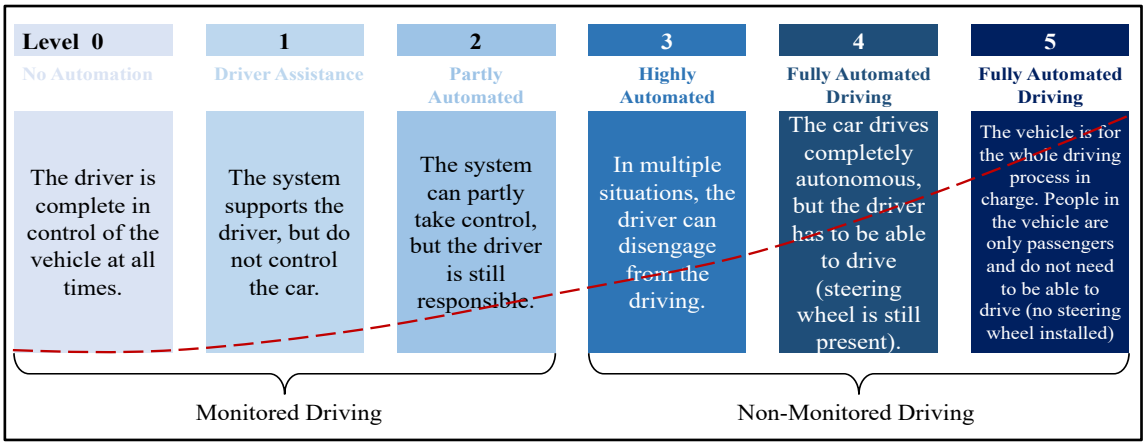

Figure 6 - Five levels of vehicle autonomy
(based on Heineke et al., 2017; SAE, 2020).

The current levels of automation, that are achieved, are three and partly four. Many BMW products like the 3-series have sophisticated automated driving abilities, for instance steering the car on the highway (BMW, 2016). Other new ventures like Waymo, a subsidiary of Alphabet, already offer self-driving "Robo-taxis" in selected US cities (Iyer and Alton, 2019). Waymo is gaining and curating traffic-related data since 2011 when the project started (Guizzo, 2011). All these moves by market participants indicate that the potentially disruptive technology is on the forerun.

However, according to Eliot, the real disruption and consumer gain are achieved at level five where every single aspect of driving a car is managed by the car's intelligence (2018). The so-called Eliot framework can be used to describe how the holistic system of a self-driving car works.

At this stage, the dissertation focuses on the holistic view since the detailed technological functionalities are out of the dissertation's scope. The following figure illustrates the Eliot framework of Level 5 autonomous driving components:

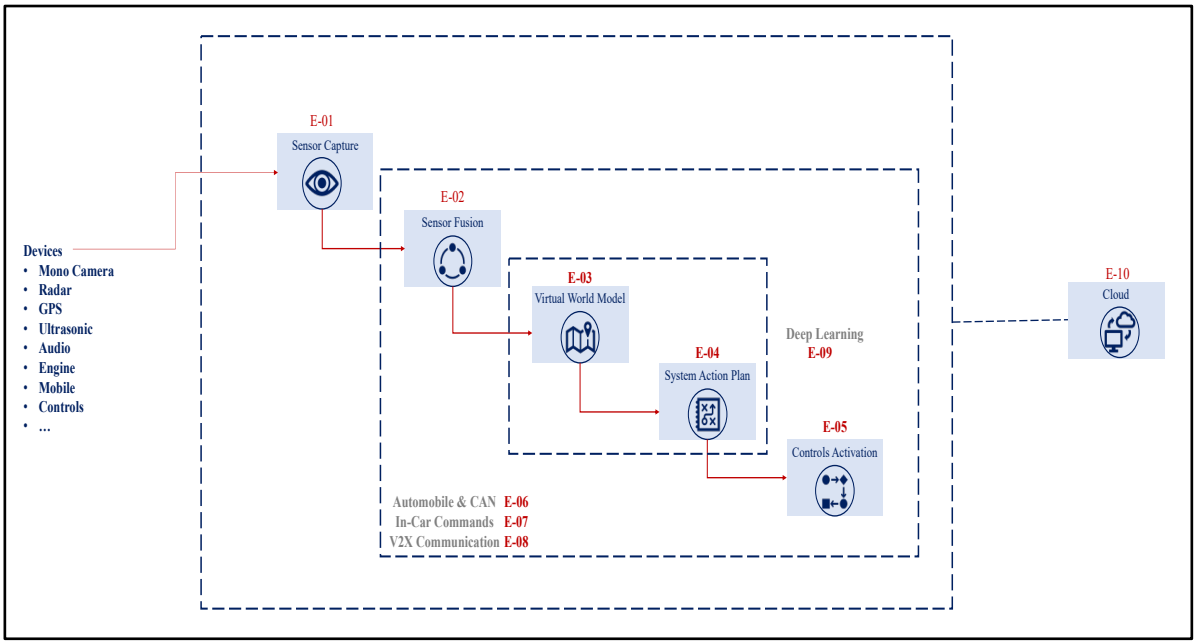

Figure 7 – AI autonomous vehicles framework
(based on Eliot, 2017; Liu et al., 2018).

(1) *Sensor Capture:* The sensor capturing can be compared to the senses of the human (e.g. ears and eyes). Through accurate sensor technology, the algorithms obtain the status of the car and its environment (incl. other cars, weather, cyclists, etc.). The main sources of data are the GPS (localize the car), LiDAR (mapping, localization and obstacle avoidance by bouncing a beam off surfaces and measuring the reflection time to measure distances), cameras (object tracking and recognition in 360 degrees of the car) and finally radar and sonar (last line of defence in avoiding coalitions with obstacles) (Liu *et al.*, 2018). Most of the devices capture raw data of the environment continuously, which needs to be transformed to interpretable data for the algorithms.

(2) *Sensor Fusion:* The gained data is now used for three main tasks of perception: Localization, object detection and tracking (Liu *et al.*, 2018). All impressions from the sensor sources need to be aligned by one algorithm that develops a holistic picture from the multiple impressions (Eliot, 2017) (see Appendix – D for pictures of the perception of autonomous vehicles).

(3) *Virtual World Model:* The artificial intelligence (*AI*) of the car needs to have access to a model containing common traffic rules and behaviours to plan and predict actions (Eliot, 2017; Liu *et al.*, 2018; Schwarting *et al.*, 2018). It can be compared to the driving experience of a human driver (Eliot, 2017). Based on that virtual model, the AI can predict the actions of other traffic participants and can plan paths.

(4) *System Action Plan:* Based on the virtual world model, the AI needs to determine further steps to take. This action is mainly based on searching all possible paths towards the required outcome. The decision is then taken based on a minimization function of costs (e.g. time or risk involved) (Liu *et al.*, 2018). These paths need to be realizable by the physics of the vehicle. An AI needs to consider for instance physical braking distances (Eliot, 2017). This decision is primarily based on LiDAR point clouds, GPS information and navigation information of the user's destination (Schwarting *et al.*, 2018).

(5) *Controls Activation:* This action plan is now executed by precise communication to the control units of the vehicle. Like human moves the arms or head, the AI needs to send a signal to accelerator control to increase speed or to the steering control to move the wheel by 45 degrees (Eliot, 2017). These core steps of an autonomous vehicle are conducted simultaneously and, hence, increases the complexity of the orchestration by an AI significantly (Eliot, 2017).

(6) *Automobile & CAN, In-Car Commands and V2X Communication:* These three dimensions are external requirements for the core process (1-5). Controller Area Networks (*CAN*) and Electronic Control Units (*ECU's*) manage subsystems of the controls of a car (brakes or doors). Therefore, an AI-based car needs to consider these systems for the core process (Eliot, 2017). Furthermore, an AI needs to be flexible in the re-planning of paths since users of the vehicle can decide to change their plans and might want to change the route. Therefore, the AI needs to be continuously aware of new commands and has to be flexible to change routes in a short period of processing time. Natural language processing (*NLP*) by an AI can recognize new enquiries, process new requests and derive implications for the virtual world model incl. path planning (Li, 2018).

Finally, the car needs to consider sharing information with other vehicles or infrastructure like streets. This is called Vehicle to X communication (*V2X*). It helps to ensure a sufficient level of information combined with shared computing power (Eliot, 2017).

(7) *Deep Learning:* Deep learning is the overall decision-making technology. It is based on replicating the human brain through artificial neurons that together built a network. This network can learn from huge datasets and derive common decision patterns. Although Sünderhauf et al. describe that deep learning applications face significant higher complexities in robotics use cases like self-driving cars, it is still the most used computational decision-making framework in the development of autonomous driving (Eliot, 2017; Sünderhauf *et al.*, 2018).

(8) *Cloud Computing:* The process steps 1-7 require a sufficient level of storage and computing performance. Therefore, every autonomous vehicle needs to be connected to a centralized cloud computing architecture that ensures the performance of the computing infrastructure (Liu *et al.*, 2018).

As the framework shows, the system of autonomous driving is complex and requires excellence in different disciplines of engineering and programming. This is the reason why Fridman et al. explain in their research that still many technological foresteps need to be taken for a marketable technology (2019). The high variance of the car's dynamic environment (weather, road debris and darkness) and the significantly low tolerance of mistakes is a key challenge for artificial intelligence. The deep learning application is still slower and less able to manage new and complex traffic situations compared to the human driver (Schwarting *et al.*, 2018). Furthermore, the new technology development is strongly limited by a misaligned legal framework and open ethical issues: Who is liable for damage caused by the autonomous vehicle? Should the user of the vehicle always be protected while the death of other is accepted? (Bonnefon *et al.*, 2016). The political players need to define clear ethical and legal governance to deliver a clear framework for further technological developments (Bonnefon *et al.*, 2016).

Nevertheless, the report of Fridman et al. also lines out that humans are poor drivers based on our irrational behaviour and unpredictability (2019). Childress et al. agree on that point. Their research proposes that autonomous driving can solve two key issues of regional mobility: Reducing greenhouse gases and manage the urbanization trend (Childress et al., 2015). Their scenarios imply that the mobility capacities of urban regions can be increased by 21%-50% in the first step of autonomous driving. A second generation can even achieve 80-100% more traffic capacities in the investigated regions (Childress et al., 2015). This higher traffic capacity will lead to fewer hours of delay per vehicle (100,000-150,000 hours less of delay). The research also assumes that this reduction of stress and the increase of convenience for citizens lead to strong demand for self-driving services in urban regions (Childress et al., 2015).

McKinsey expects that level 5 autonomous driving vehicles are achieved between 2030 – 2040 and will change the way how we perceive mobility (Heineke *et al.*, 2017). In 2040, 66% of passenger kilometres will be travelled by autonomous vehicles (Heineke *et al.*, 2017). Although Eliot says that concrete time schedules cannot be determined based on the incremental nature of the progress, he agrees that the fast technological progress in sensor technology, deep learning and cloud computing can accelerate the development of autonomous vehicles (Eliot, 2017).

The level five framework reinforces the impression that future car producers need to establish different company characteristics than nowadays. The whole business system behind the new car infrastructure needs to be redesigned. Data collection, interpretation and software development are new key capabilities and processes that need to be embedded. Furthermore, autonomous driving is not a single new technology, it is a composition of different new technologies like cloud computing, sensor integration and deep learning (Liu *et al.*, 2018)

2.1.3 The disruptive potential of autonomous driving vehicles for BMW

By comparing the two previous chapters, it needs to be said that the further development of autonomous driving can have a disruptive effect on BMW and other incumbent firms since it requires complete new capabilities, resources and potentially changes the way how individual mobility is perceived by the customer (Schwarting *et al.*, 2018). The value chain of a car industry participant will be changed in times of market-ready autonomous driving. Christensen and Raynor describe that disruptive technologies have the potential to commoditize former premium goods through easier access to technology (2013). Winkelhake confirms this threat for incumbent automotive original equipment manufacturers (*OEMs*) like BMW. He argues that autonomous driving will commoditize the premium factors comfort and security which leads to complete new competitors and business models with the notion of Mobility-as-a-Service (*MaaS*) in the core (2017). The legal and infrastructure issues like liability and the performance of the communication infrastructure for V2X connectivity will be solved around 2030 (Winkelhake, 2017). The analysed research articles in the autonomous driving technology show that the technological progress is significant and that a realistic launch of marketable products and services are realistic in the upcoming 10-15 years (Lee et al., 2015). BMW faces a technology push towards innovation since the embedded technologies in autonomous driving and related infrastructure are rapidly developing.

Simultaneously, customers show more and more acceptance in terms of the new technology. According to a Capgemini survey, 50% of surveyed customers (n= 5538) worldwide show readiness for autonomous driving cars (Winkler *et al.*, 2019). 56% of the asked customers would pay a premium of 1% to 20% for Level five autonomous driving abilities (Winkler *et al.*, 2019). This shows that a leading position in this technology can help to raise margins per product for an innovating company. It is important for the successful launch of innovation that early adopters, people that are curious about new technologies and innovations, are convinced and use the new product or service to diffuse the innovation into the mass market (Rogers, 2003). Only then, disruption is occurring in markets (Bohnsack and Pinkse, 2017). According to Capgemini, the typical early adopter of autonomous driving vehicles are mainly male with a higher-than-average income and primarily urban citizens (Winkler *et al.*, 2019). This persona fits the customer target of BMW and represents a good chance for BMW to be a premium brand with outperforming business success in the future (BMW, 2019a). However, BMW is, in the new rising market of autonomous driving, not considered as the technological leader. Tesla is perceived as the current leader in autonomous driving (DHBW Ravensburg, 2019). This observation is based only on consumer opinions and does not reflect the real technology level of the companies in terms of autonomous driving, but it gives an impression about the fact that a significant shift in the automobile sector is coming. The commoditization of premium mobility and the significant

market potential of two trillion US-Dollars of Robo taxis in 2030 attracts new entrants like Uber, Lyft or Waymo which are mainly focused on serving mobility, not cars (Unsted, 2019; Iyer and Alton, 2019). All these signs lead to the impression that innovation in the car industry is not only triggered by a strong technology push but also by a market pull.

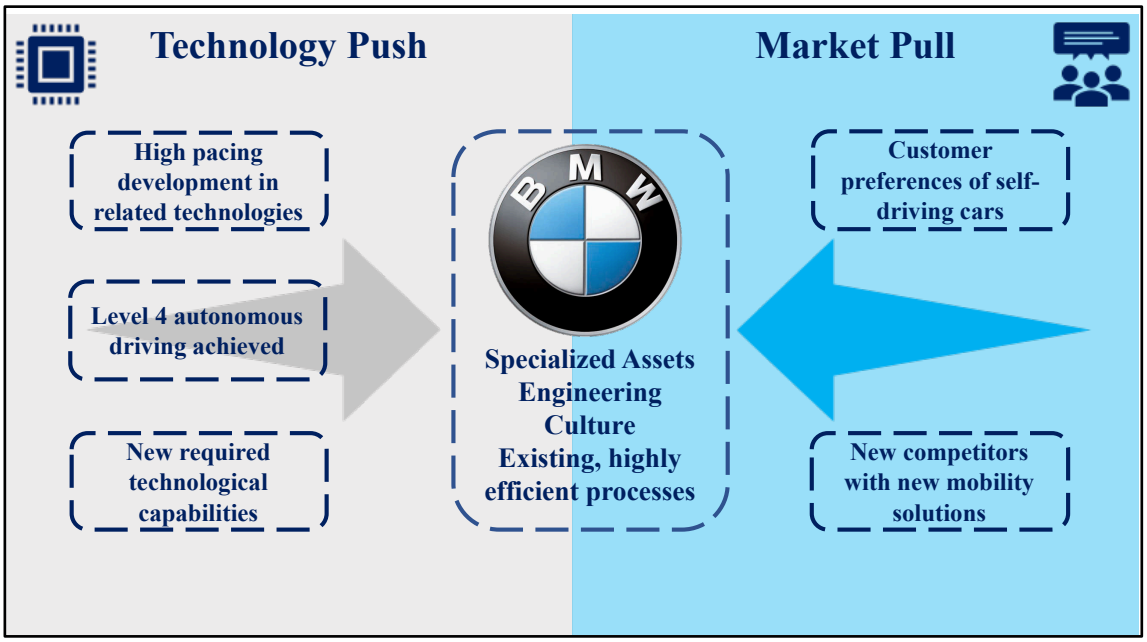

Figure 8 – The Innovator's Dilemma of BMW.

Christensen and Raynor describe that the commoditization of a value chain part is linked with a reciprocal de-commoditization in other value chain dimensions (2013). Incumbent companies need to identify de-commoditizing potentials within a new technological architecture. These potentials can lead to the requirement of designing a new business model around a re-interpreted value proposition (Bohnsack and Pinkse, 2017). Bock and George argue that business model innovation is a key source of growth in times of fast-developing technologies and the only opportunity to achieve long-term viability (2018). Therefore, BMW needs to consider how the business model needs to be aligned with the new technology to cannibalize old structures and assets and, finally, to solve the Innovator's Dilemma (Chandy and Tellis, 1998). BMW identified the key trends in an autonomous driving investor report from 2016: New mobility concepts, autonomous driving and monetization of free time (2016). Although the strategic importance of each dimension is emphasized, the report lacks in developing a clear future business model that is capable of solving the Innovator's Dilemma of BMW in the coming 10-15 years.

Based on the described characteristics of disruptive technologies and autonomous driving technology, it has the potential to commoditize individual mobility and is, therefore, a threat for a premium brand like BMW since significant differentiation aspects of the brand are reluctant. BMW is in a dilemma between a clear asset and resource commitment for autonomous driving exploration and short-term success expectations of stakeholders and involvement in existing

structures and assets (Christensen, 2015). The only way to solve this dilemma is to consider new ways of serving mobility by exploring new ways of doing business (Christensen, 2015; Millar *et al.*, 2018).

2.2 Business model innovation for BMW

Autonomous driving vehicles are one of the four main technological changes in the automotive industry (ACES). It has a significant impact on how mobility is distributed, served and created by automotive companies like BMW.

Two aspects of a company need to be aligned with the environment: The business model and the organizational system (De Wit, 2017). This can only be achieved through strategic innovation. In this dissertation, strategic innovation is defined as "renewing the firm's business model to create or sustain a competitive advantage" (De Wit, 2017, p.449). The ultimate goal of strategic innovation is to achieve a long-term corporate life through the adaptation of the business model and organisational system to environmental developments (Johnson *et al.*, 2017).

It can be said that BMW potentially faces the dilemma between exploiting the current business model success and how the business model can be realigned with the technological landscape in the future and how the organisation can enable initiatives of strategic innovation. Even today, Waymo, a self-driving car ride-hailing company of Google, has a higher market capitalization than BMW (Gottfredson, 2019). The financial market has the opinion that autonomous ride-hailing business models face a brighter future than incumbent automotive producers. This can be interpreted as a signal of disruption on the horizon. BMW needs to solve the dilemma and has to rethink its current business model through innovation. This fits the fact that technologies are only disruptive when they are combined with a homogeneous business model and organisational conditions that enable these kinds of disruptive innovations (Christensen, 2015; Bock and George, 2018). Finally, this disruptive innovation ability leads to competitive advantage (Johnson, 2006). In addition to that, Arend argues that "the business model concept has a potential for strategic use in these more entrepreneurial and challenging environments" (2013, p.391).

Therefore, the following chapters discuss current theories and frameworks of business model innovation and modern business model developments in the automotive segment. Additionally, the success of a new business model relies on organisational conditions that enable this kind of strategic innovation. Hence, the author discusses conditions that enable the exploration of strategic innovation in incumbent firms like BMW.

2.2.1 Theory of business model innovation and modern design frameworks

The term business model is a widely discussed topic in practice and academic literature. According to Teece, a business model is a holistic, not financial, model of how a company produces, delivers and captures value (2010). Frishhammar and Parida similarly define business models: "A business model represents a cognitive schema that explains how a company creates, delivers, and captures value by exploiting business opportunities" (2019, p.8). This fits Zott et al.'s business model definition of "activity system-based value creation mechanisms and sources of competitive advantage" (2011, p.1038). Therefore, it is a holistic dimension of strategic management that needs to be continuously analysed and helps to understand the holistic processes of a company's value creation (Chesbrough and Rosenbloom, 2002; Zott *et al.*, 2011). Geissdörfer et al. define a business model as "a simplified representation of the elements of an organisation and the interaction between these elements for its systemic analysis, planning, and communication in face of organisational complexity" (2017, p.263). Gabriel confirms the narrative importance of a business model. It explains stories of how enterprises work and helps to understand organizational behaviour (Gabriel, 2000).

George and Bock argue that the definition of a business model needs a more practical and opportunity-focused perspective (2011). They say a "business model is the design of organizational structures to enact a commercial opportunity" (George and Bock, 2011, p.99). Additionally, for Chesbrough and Rosenbloom "the business model is conceived as a focusing device that mediates technology development and economic value creation" (2002, p.532). This dissertation follows these two definitions since the business model framework is used to enable the commercial opportunities of autonomous driving for BMW and to solve the potential Innovator's Dilemma of BMW through mediating between technology and economic value creation.

Multiple researchers propose different ways of how business model innovation can be implemented. According to Bock and George, business model innovation is "the development of novel configurations of resources and transactions to create new markets or serve markets in new ways" (2018, p.206). An organization can use three paths towards business model innovation. Its main target is to align the business model with external influencing factors (De Wit, 2017).

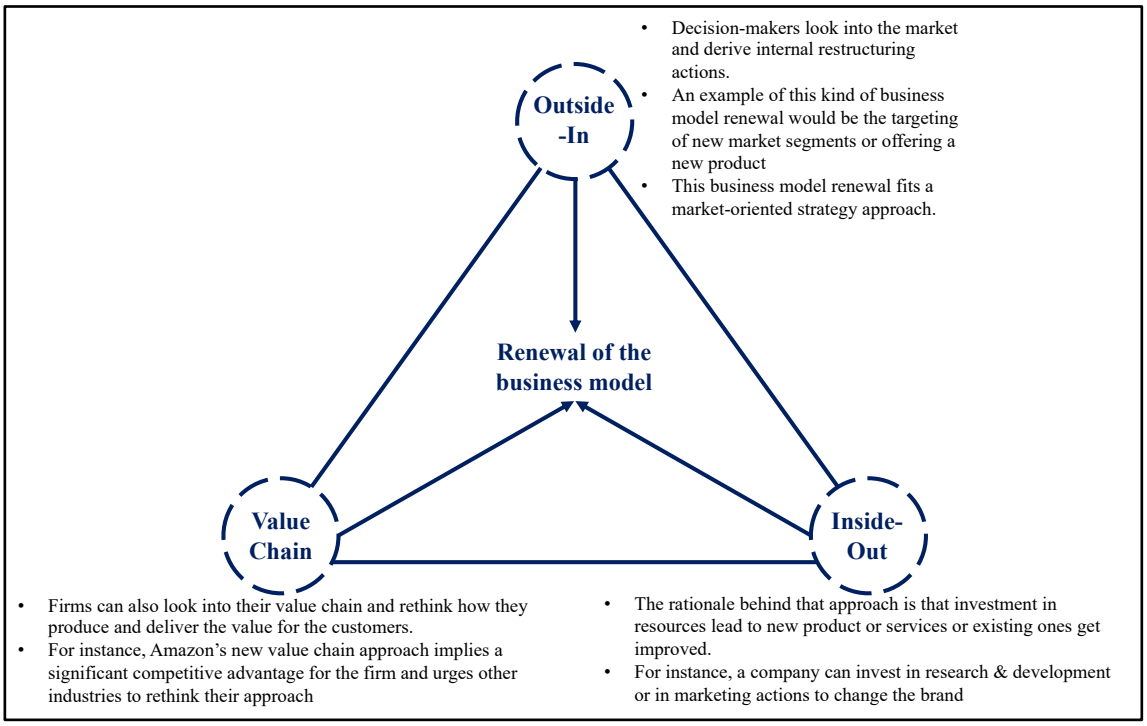

Figure 9 - Sources of business model renewal (based on De Wit, 2017).

Amit and Zott argue that business model innovation can be achieved by either adding new activities in the production or in delivering new value (content), by linking activities in a new way (structure) or by changing the parties that execute parts of the activities (governance) (Amit and Zott, 2012). Frishammar and Parida summarize it by saying that innovation of the business model is required when multiple dimensions of the elements need to be redesigned to be aligned with environmental developments (2019).

To innovate in the field of business models, it is required to understand which dimensions a business model contains. The key dimensions of a business model defined by selected authors are:

(1) *Business model purpose*
(2) *Value proposition towards predetermined target customers*
(3) Resources for the value creation
(4) Internal and external processes and transactions (Johnson et al., 2008; Zott et al., 2011; De Wit, 2017).

All authors agree on the fact that a business model is all about producing value in an efficient way that customers want and bringing that value to customers. Additionally, all researchers argue that the value proposition is the centre of a business model and the other dimensions need to be aligned with this proposition towards target customers. The authors use different abstraction levels. Johnson et al. name concrete parts while Zott et al. and De Wit summarize multiple subdimensions

under one topic like revenue and cost structure or value chain (Johnson *et al.*, 2008; Zott *et al.*, 2011; De Wit, 2017). Bock and George add a new dimension that is not considered by other authors: They argue that a business model needs to be aligned through a shared narrative that tells the purpose and story of the business model (2011).

A sufficient framework to design a new business model should contain these four essential parts of a business model to some extent. Simultaneously, they are the key triggers of innovation within a business system. The literature review continues with the value proposition design as the core of a business model. All discussed authors mention value and its proposition towards target customers as the key starting point for every business model framework (Johnson *et al.*, 2008; Zott *et al.*, 2011; De Wit, 2017). Bohnsack and Pinkse confirm that a well-defined value proposition helps to overcome disruptive technology inferiority (2017). The ultimate goal of a value proposition is to activate and trigger the willingness of customers to pay (Biloshapka and Osiyevskyy, 2018). The value proposition communicates to customers that their needs and desires are met by the value creation process of the company (Biloshapka and Osiyevskyy, 2018). Therefore, a value proposition "describes the benefits customers can expect from your products and services" (Osterwalder *et al.*, 2014, p.4). Since the value proposition design is one of the most important tasks to align customer wants with the system of corporate value creation, Osterwalder et al. have developed a framework that enables business modellers to design a customer fitting value proposition (2014). It is called the "*Value Proposition Canvas*" (Osterwalder *et al.*, 2014, p.3). It is mainly built on two perspectives on the value proposition of a company: The customer perspective ("*customer profile*") and the creation of value ("*value map*") (Osterwalder *et al.*, 2014).

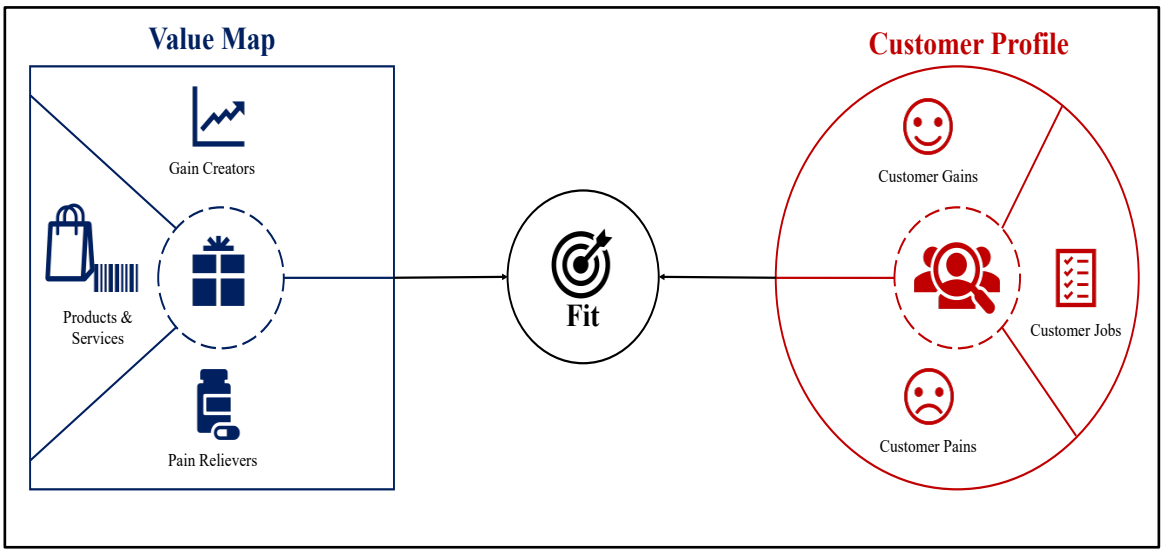

Figure 10 - The value proposition canvas
(based on Osterwalder et al., 2014).

(1) *Customer Profile*: The authors propose that a value proposition design always starts with a deep understanding of the customer (Osterwalder *et al.*, 2014). This seems to be diametric towards the assumption that Innovator's Dilemmas occur since managers focus on the direct needs of the customers (Christensen, 2015). However, Osterwalder et al. use another innovation theory to overcome this fact. The customer profile is mainly based on the so-called *Jobs-to-be-done* theory which says that every product or service is hired for jobs that the customer wants to get done in their life (Christensen, *et al.*, 2016). This theory seeks for causality. The causality of which progress a customer searches for in specific circumstances (Christensen, *et al.*, 2016). Companies with a Jobs-to-be-done approach want to understand the circumstances and the jobs of a product in these circumstances to align the value proposition and creation with it (Christensen, *et al.*, 2016). The deep understanding of the job dimensions is a key success factor of developing a customer valued business model (Costello, 2018). The jobs related information should be gathered from target customers including new, steady and potential customers (Wirtz and Daiser, 2018).
The customer profile is completed by the customer gains and pains (Osterwalder *et al.*, 2014). This holistic understanding of the target customer helps to develop a value map that targets the jobs and wants of the preferred customers.

(2) *Value Map*: The value map shows how the company wants to help the customer to fulfil single jobs in specific circumstances. Firstly, all services and products of the company are listed (Osterwalder *et al.*, 2014). Furthermore, the value map describes how the new business model wants to solve the pains described in the customer profile by deriving concrete pain relievers (Osterwalder *et al.*, 2014). Value propositions should focus on a few pains and alleviate them well. It is a key trigger of being relevant as a company for its customers (Osterwalder *et al.*, 2014). The last dimension of the gain creators describes how the company wants to achieve the desired customer gains (Osterwalder *et al.*, 2014). It is all about making the difference. The company can differentiate itself through the achievement of customer happiness (Osterwalder *et al.*, 2014).

This framework will be used for the key dimension value proposition. It is based on one of the most important innovation theories and delivers sufficient practicability for the case study research design. The next step is to design the rest of the business model framework so that it fits the value proposition framework. The following structures discuss how the proposed value can be created and captured (Biloshapka and Osiyevskyy, 2018). The author focuses on three key concepts.

(1) *RVTN Framework:* Bock and George have developed a framework to gain a holistic understanding of the business model for pre-venture opportunities. It uses a less complex approach than, for instance, the business model canvas framework where the business model

dimensions are concretely discovered (Bock and George, 2018). The RVTN framework focuses on the solution a new venture can deliver and helps to explore a new opportunity (Bock and George, 2018).

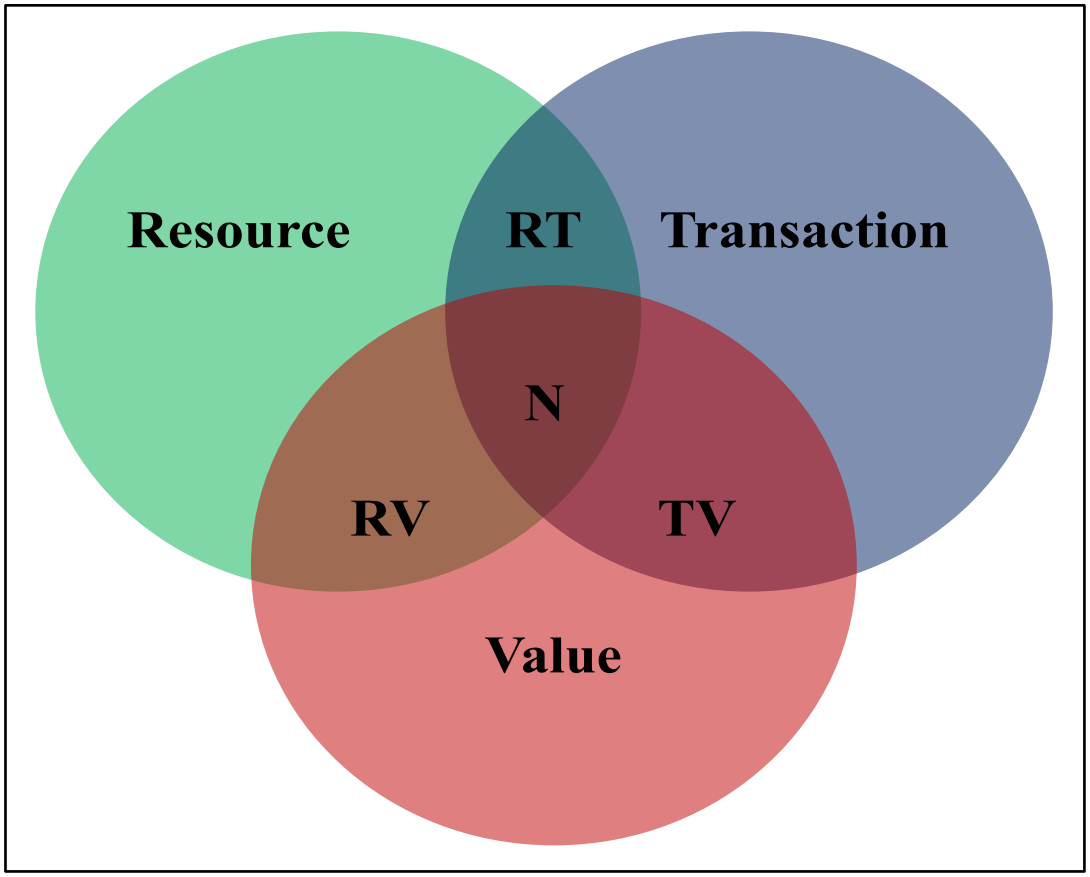

Figure 11- The RVTN business model design
(Bock and George, 2018)

Bock and George define three steps towards an RVTN based business model. Firstly, the venturist should define the key resources (tangible and intangible), the transactions (internal and external) and relevant values for different stakeholders (2018). For Bock and George, these are the key dimensions of a business model. After a venturist defines these, it is required to develop the intersections.

The Resource value (RV) answers the question: "Which resources are directly linked to the value that customers need?" (George and Bock, 2011, p.122). It helps to identify the key resources that generate new value for customers. The next intersection is the resource transaction (RT). It helps to identify the key channels of sales to deliver the proposed value and the required resources (Bock and George, 2018). The last dimension discusses transactional preferences of customers. For instance, customers might have trust issues with new entrants in markets where liability plays a significant role. This fact is evaluated by the intersection transaction value (Bock and George, 2018).

The last step is to assess whether the narrative of the business model is reflected in the single dimensions of the business model. The narrative ensures that the overall purpose of the company is integrated and influences the whole system (Bock and George, 2018).

(2) *The St. Gallen Business Model:* An alternative to the pre-venture framework of Bock and George is the St. Gallen business model. It was developed at the leading European business school of St. Gallen and broadly used for business model innovation (Doleski, 2015). The St. Gallen framework is based on answering the following questions:

- *Who* is your target customer/segment?
  Understand precisely which customers relevant and which ones are addressed with the business model.
- *What* do you offer to the customer?
  It describes the offering of the company and which needs of the target customers are met.
- *How* is the value proposition created?
  This dimension discusses how the proposed value is achieved by using specific resources, capabilities and assets. The value chain is described in this dimension.
- *Why* does the business model generate profit?
  The last question focuses on the overall goal of every company: Making a maximized profit. Cost structures and revenue mechanisms to capture part of the produced value needs to be discussed to ensure economic viability (Gassmann *et al.*, 2014).

The first two questions address external aspects, mainly the customer, and the last ones the internal dimensions. Gassmann et al. argue that business model innovation is achieved when at least two dimensions are modified (2014). This can happen from the inside (How and Why) or the outside (Who and What). Therefore, Gassmann et al. confirm the opinion of De Wit that different renewal approaches are possible (2017). This understanding of a business model can be summarized in the following diagram:

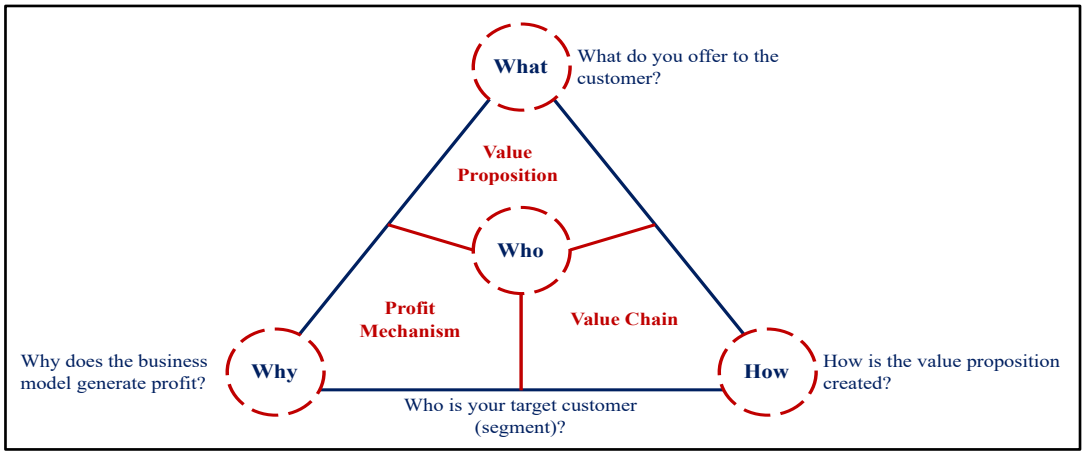

Figure 12 - The St. Gallen business model (Gassmann et al., 2014).

(3) *The effective business model*: The last discussed framework for business model innovation is the effective business model framework by Johnson et al. Similar to Gassmann et al., the authors defined as well four dimensions of a business model.

- *Customer Value Proposition:* The business model helps customers to achieve specific needs or to solve relevant issues in their circumstances. The model performs a specific job. Again, the jobs-to-be-done theory is applied (Johnson *et al.*, 2008; Osterwalder *et al.*, 2014; Christensen, *et al.*, 2016).
- *Profit Formula:* It describes how the company captures value from the generated one through a revenue model, the cost structure and the desired margins per sold value (Johnson *et al.*, 2008).
- *Key Resources:* The company needs to define and use inputs like people, technology, products, equipment and brands to deliver the predefined value proposition (Johnson *et al.*, 2008).
- *Key Processes:* Processes like training, manufacturing or customer service are used to leverage the key resources of a company. It is comparable to Porter's framework of the value chain (Porter, 1985; Johnson *et al.*, 2008).

The following figure summarizes the authors' definitions and shows the interrelations of them:

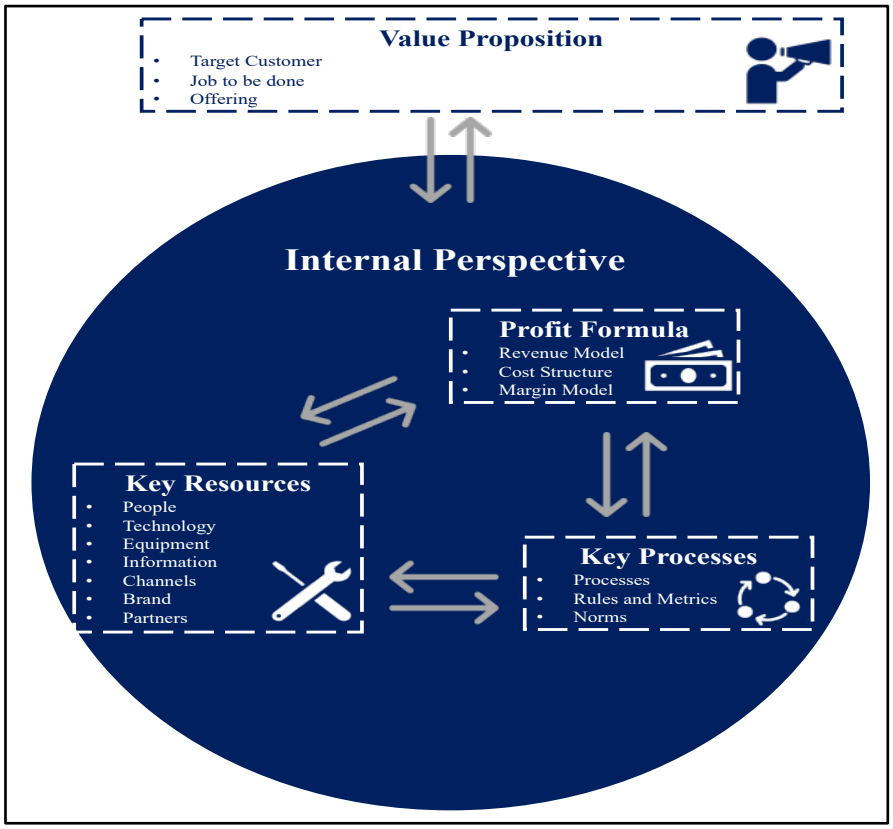

Figure 13- The effective business model
(Johnson et al., 2008).

The authors argue that business model innovation is triggered by new technologies that enable new or better job fulfilment for existing and new customers or by addressing needs or a larger customer group who find existing solutions too expensive or complicated (Johnson *et al.*, 2008). Again, the value proposition needs to be the core of business model innovation. In contrast to Gassmann et al., the authors say that business model innovation is required when every dimension needs to be realigned with external factors (Johnson *et al.*, 2008). This is based on the observation that truly disruptive innovation is achieved when a new explored technology is combined with a powerful business model (Johnson *et al.*, 2008).

All selected and presented models show that a sophisticated business model requires a well-designed value proposition that takes characteristics of the target customer segment into account. Therefore, the dissertation uses the value proposition canvas to emphasize the importance of the value proposition by reacting to the disruptive technology of autonomous driving. The rest of the dimensions are very similar in all models: It is all about transactions and resources and how a company can capture value from the model. The author decides to use the St. Gallen framework but, simultaneously, taking the specialities of the other two models into account. Especially, Bock and George argue that a business model needs a narrative which guides the single dimensions of a business model. It represents the purpose of a business model (Bock and George, 2018). This leads to the following business model framework of the dissertation:

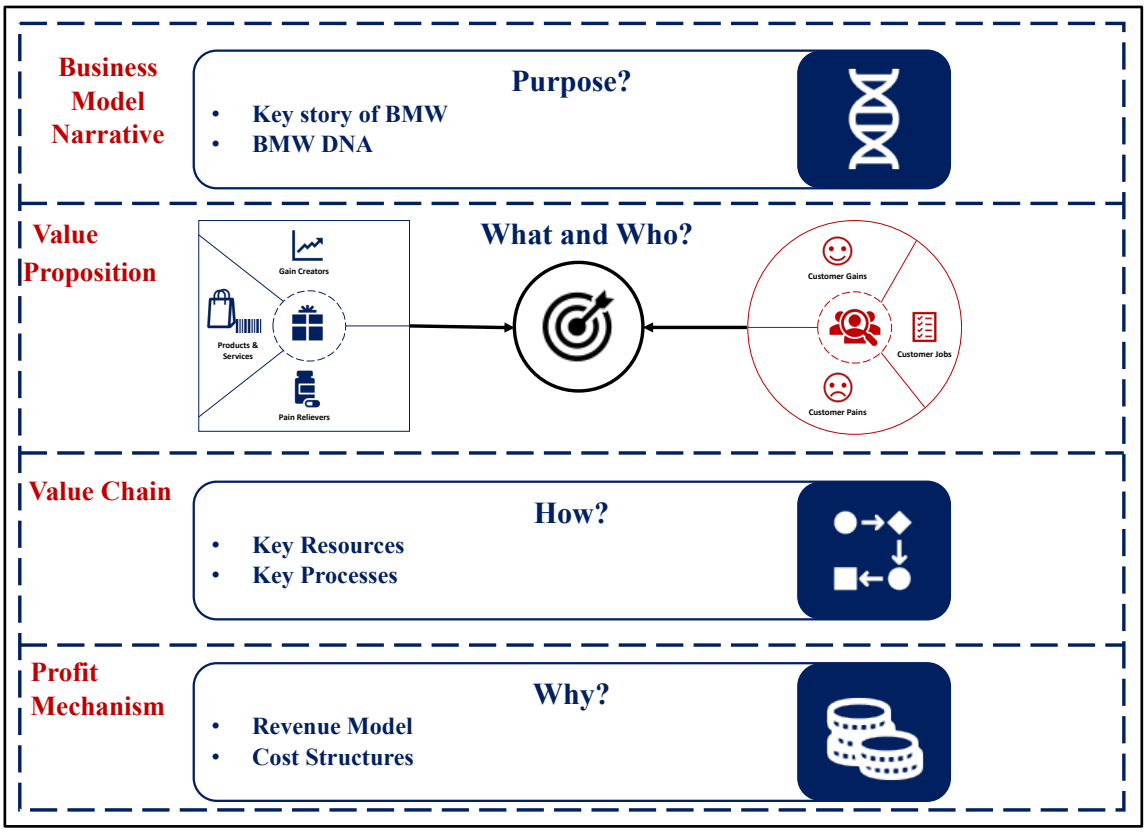

Figure 14 – The business model framework of the dissertation
(based on Johnson et al., 2008; Osterwalder et al., 2014; Gassmann et al., 2014; Bock and George, 2018).

Based on this framework, the author identifies whether BMW needs a real business model innovation, by changing the content of multiple business model dimensions, and, based on the heterogenous expert opinions, how a new business model could look like in an autonomous driving future. The derived framework represents Geissdörfer et al.'s second step of business model innovation: Concept Design (Geissdoerfer et al., 2017). The expert interviews are used to fulfil the third step of Virtual Prototyping (Geissdoerfer et al., 2017). Now further open theoretical questions are which current business model trends like car sharing influence the automotive segment and which organisational conditions reinforce the exploration of business model innovation. These insights strongly influence the conceptual framework of the dissertation's research.

2.2.2 Modern business model innovation developments in the automotive segment

BMW and the automotive industry mainly face ACES as key trends which influence the business model design of the future significantly. The research focuses at this point on the trends autonomous, connected and shared since they are all interrelated and together they have a significant impact on the future of car manufacturers (Eliot, 2019). Autonomous driving is a key enabler of the other two trends of car-sharing and connected cars since mobility can be more easily distributed in a network and the passenger of the vehicle has more free time in the car and wants to use that time in multiple ways. The focus in this chapter is on the business model implications and the underlying holistic concepts of these trends.

Car-sharing and additional mobility services like street parking services show a different view on how mobility should work in the future: Mobility-as-a-Service (BMW, 2016; Heineke *et al.*, 2017). A survey shows that premium car buyers are more willing to use car-sharing services (38% of asked customers prefer to be driven; 26% in the mass market). Although more asked customers still prefer a mix of both (MaaS and own car) or owning a car, it shows that the premium segment needs to consider new mobility solutions (Heineke *et al.*, 2017). Car sharing mainly changes how the ownership of the car is structured. Customers do not buy the car. They just pay for the time or route for which the car was used (Cohen and Kietzmann, 2014). However, explicitly two different carsharing business models have been developed over the years:

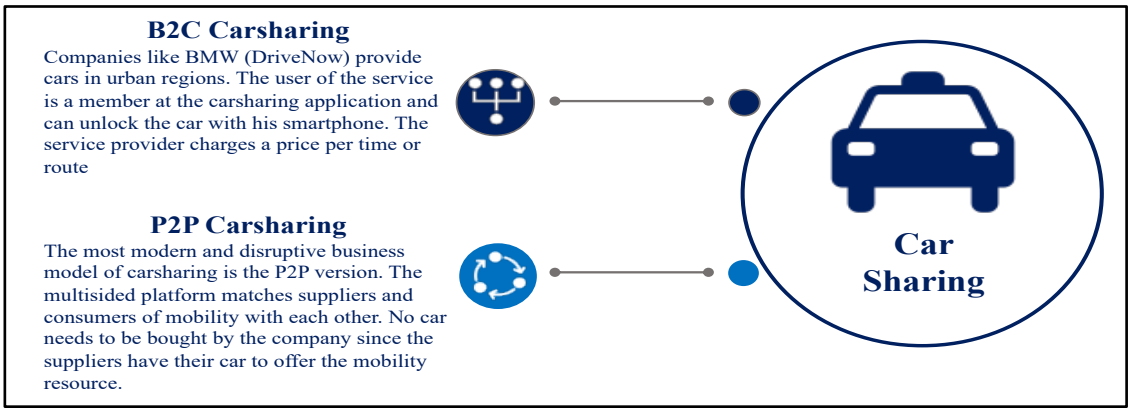

Figure 15 - Types of carsharing
(based on Cohen and Kietzmann, 2014).

As described above, BMW focused its efforts on carsharing on the B2C version. BMW launched in multiple cities worldwide the service where different cars of the BMW Group could be hired. 27 million people currently use car-sharing services worldwide (Stolle et al., 2019). However, the providers struggle with convincing the customers to use the service regularly in their daily life. Furthermore, carsharing still struggles to achieve a sufficient return on investment since the model of providers like BMW is capital intensive (Stolle et al., 2019). The technology of autonomous driving promises to push the business model of carsharing towards a profitable future since the allocation and movement of the vehicles can be automated (Heineke et al., 2017). The sharing economy services "use cloud-based technology to match customers with providers of services such as short-term apartment rentals, car rides and household tasks" (Apte and Davis, 2019, p.104). The matchmaker companies like Uber or Lyft mainly focus on facilitating the interaction between providers and consumers of the resource (Apte and Davis, 2019). This business model structure promises significant growth in the coming years. Munoz and Cohen estimate that the worldwide revenue from sharing economies will reach $335 billion in 2025 (sectors: travel, carsharing, finance, staffing and entertainment streaming) (Muñoz and Cohen, 2018).

The second additional trend related to autonomous driving and its execution through a business model is the connectivity of the car. A connected car is "a vehicle capable of accessing to the Internet, of communicating with smart devices as well as other cars and road infrastructures, and of collecting real-time data from multiple sources" (Coppola and Morisio, 2016, p.1). As described in chapter 2.1.2, vehicle to X communication is a key part of achieving self-driving cars. Furthermore, it is also a new source of differentiation for premium manufacturers like BMW. A survey of the consulting firm McKinsey shows that future differentiation factors will be the connectivity and customer-centric interior design instead of speed and joy of driving (Köstring et al., 2019). Connectivity from the perspective of the passenger mainly means the usage of internet-related services and programs. For instance, streaming music per Spotify, watching movies per Netflix or working per Google Suite applications (Coppola and Morisio, 2016). This is called "in-

vehicle connectivity" (Kilian *et al.*, 2017, p.1). In Level 4 or 5 autonomous driving vehicles, the passenger is not obliged to control and to steer the car in the traffic. The passenger has free time in the third living room (Winkelhake, 2017). Herbert Diess, the CEO of Volkswagen, consequently argues that the car will be the most important mobile device soon and, hence, requires a completely new interpretation of what a car needs to deliver (Handelsblatt, 2020). This requirement includes car-related infotainment applications like real-time navigation systems or safety monitoring and daily-/work-life related applications (see Appendix E) (Coppola and Morisio, 2016). In 2017, the Boston Consulting Group estimated that the market of connected cars will achieve 120 billion dollars in the next years (Kilian *et al.*, 2017). It shows the significant economic potential of developing a business model that considers connectivity. New entrants like Tesla focuses on this point: A Tesla car is completely connected and open for third-party applications (Winkelhake, 2017).

In addition to that, technology-enabled developments, the demand and regulatory pressure on car manufacturers like BMW are rising. People, especially urban citizens, realize that the individual mobility of today faces multiple limitations (The Economist, 2016). Kavadias et al. have developed a framework where influencing factors are used to derive modern business model implications (2019). He argues that market needs and technology trends result in new business model approaches. Based on the above-described trends of BMW, the framework summarizes this in the following factors:

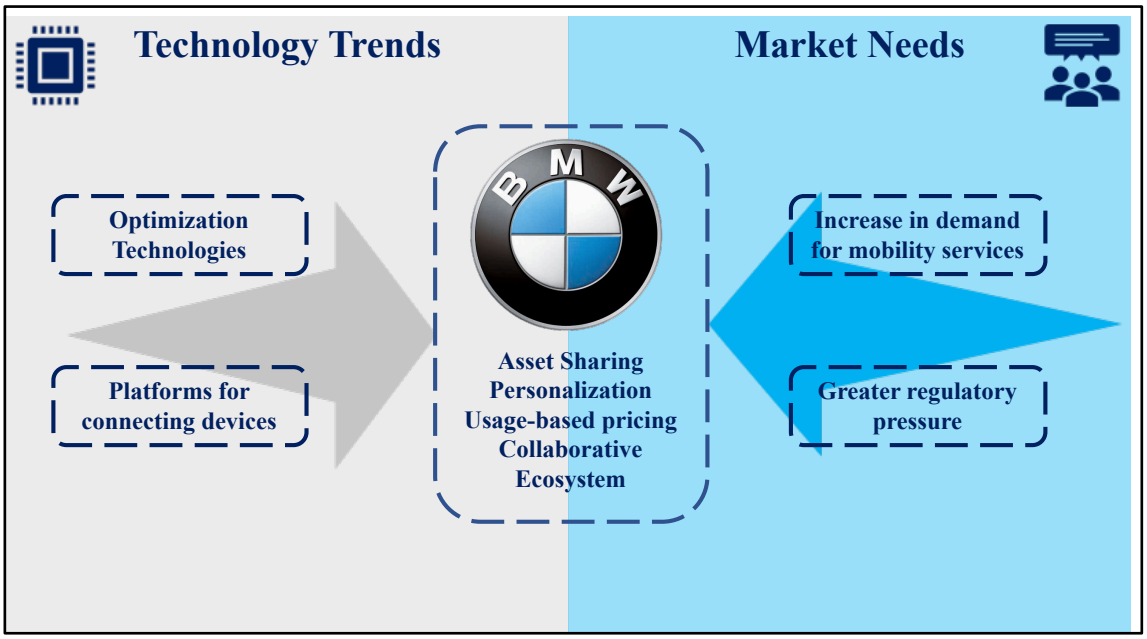

Figure 16- Linking technology and markets
(based on Kavadias *et al.*, 2019).

Optimization technologies like autonomous driving vehicles and new platforms that connect vehicles are new technology trends. Additionally, the increasing demand for new mobility

solutions and the greater political pressure towards sustainable mobility represent new market needs. Together, they urge BMW to consider business model transformations in terms of asset sharing (e.g. car sharing), personalization (connectivity and interface design in the car), usage-based pricing (based on a monthly subscription or pay-per-use model) and a collaborative ecosystem where suppliers and alliances are needed to achieve an alignment between external developments and the business model (Kavadias *et al.*, 2019).

All these implications are connected through one main business model trend in recent years: The platform economy. The new worldwide leading companies use technologies like smartphones or machine learning to enhance their new business model. Firms like Google, Amazon or Uber are platforms that serve two sides of a market: Consumer and producer (Choudary, 2015). Many of the recent disruptive technologies were combined with a platform-based business model which resulted in a wave of disruption in classic markets (see Spotify, Netflix, Smartphones and related app stores) (Montero and Finger, 2017). A platform business model is always useful if scarce resources need to be efficiently allocated (Choudary, 2015). This efficient allocation saves transaction costs for the network of the platform (Montero and Finger, 2017). The platform is the facilitator of interactions between two parties (see Uber: Coordination of drivers and passengers towards economic exchange). In this modern business structure, technology like artificial intelligence helps to allocate the matching of supply and demand in the network. By doing that, no intensive asset capacity is required and marginal costs per interaction are near zero for the platform (Sorri et al., 2019).

Parker et al. provide a holistic model of the key elements of a platform on which many popular business models are based:

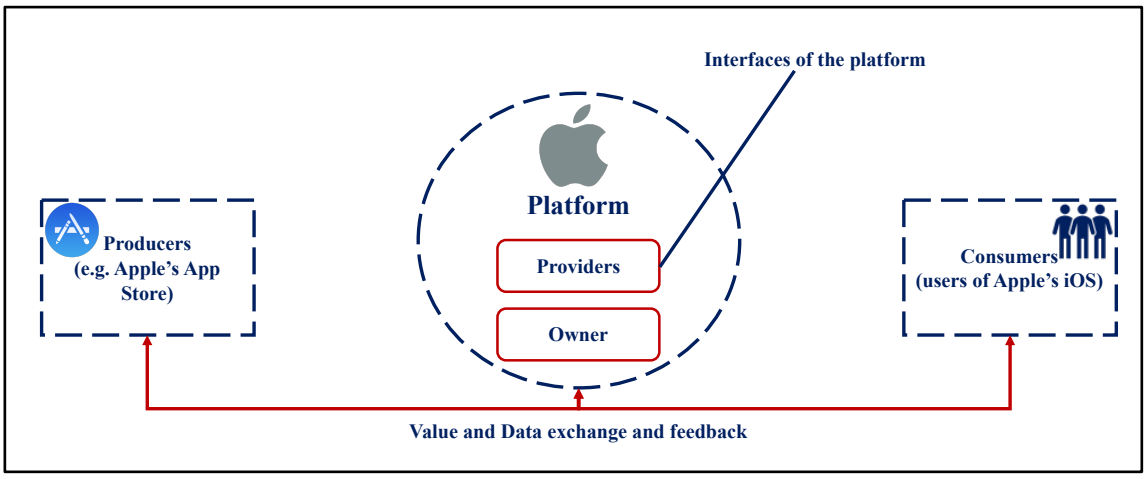

Figure 17- Key dimensions of a platform business model based on Apple's App Store (based on Parker et al., 2017).

The case study shows that the interaction between the app developers and the users of Apple's iOS system produces value for both sides as well as Apple and, additionally, data for the platform

owner (Parker et al., 2017). Through an open platform structure, Apple is not urged to develop all applications which can be executed with an Apple device (Van Alstyne et al., 2019). The app store can be compared to a city mall where the mall owner has the task to facilitate and curate interactions between stores and visitors (Evans and Schmalensee, 2016). The currency, in this case, is relevance. Relevant users have to be matched with relevant stores (Evans and Schmalensee, 2016). This open structure enables open innovation approaches. Apple can participate through owning the platform in innovations by other companies. For instance, Spotify uses the iOS and App Store platform of Apple to reach a critical mass of users. Apple does not have to establish a streaming service to deliver that service to its users. Hence, Apple does not have to innovate out of their core competencies but still can deliver innovations in heterogeneous use cases for a heterogeneous user base. Additionally, a new source of revenue is established by charging transaction fees from the producer's revenue on Apple's platform (Parker *et al.*, 2017). Furthermore, Apple can learn from every new trend in its App store and, therefore, can implement it quickly in its products. This was the case with Apple's music streaming service, which is now the key competitor of Spotify worldwide.

Evans and Schmalensee, Parker et al. and Sorri et al. agree that the facilitation of the interaction between the two parties is the key task of a platform/sharing economy business model. A key target for every platform strategy is to achieve a critical mass of users on both sides since the achievement means that positive network effects will let the platform grow on its own (Van Alstyne et al., 2019).

The platform structure contains all four business model trends for BMW: Asset sharing (sharing economy through platform facilitation), personalization (through data capturing and analytics), use-based pricing or subscription models (see Spotify's or Apple TV+'s subscription model) and a collaborative ecosystem (open innovation through multiple producers on a platform). In an autonomous vehicle future, classic manufacturers have five possible value drivers, which need to be considered by BMW in terms of the platform economy and the autonomous driving future:

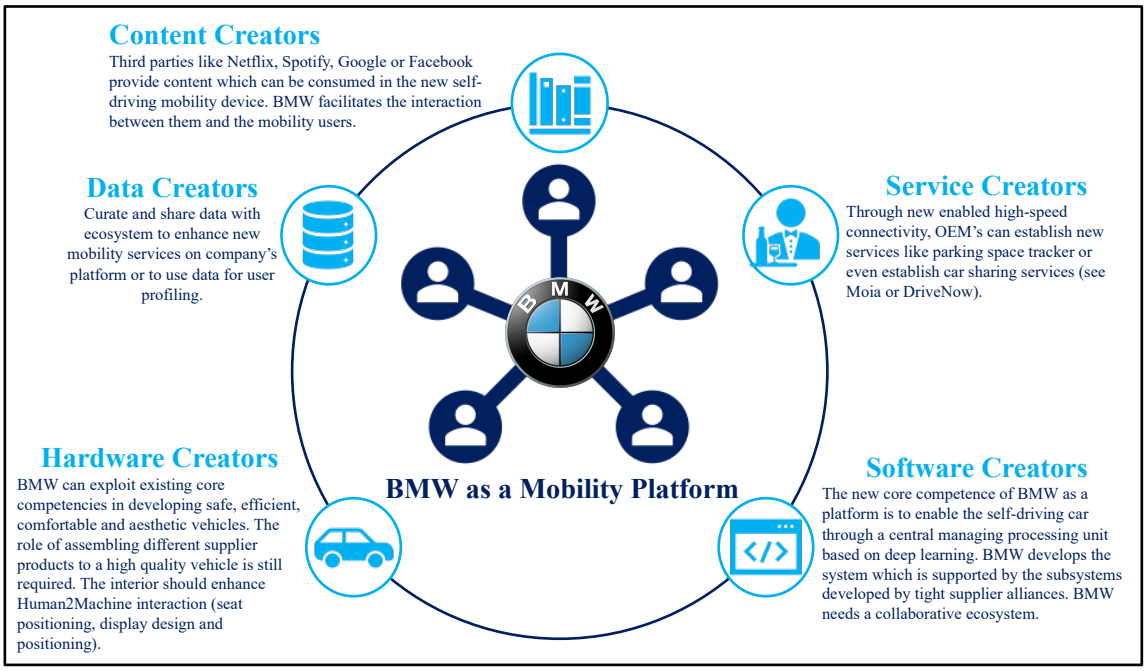

Figure 18- The future value drivers in the automotive industry (based on Herrmann et al., 2018).

The future business model potentials of BMW could depend on the ability to transform BMW towards a platform business where BMW focuses its resources on exploiting core competencies like hardware production or development of mobility services as well as on designing a BMW platform approach where data is curated shared and monetized and interactions between content creators and users are managed to enhance interactions (Herrmann *et al.*, 2018).

The literature review in the field of modern business model systems and mobility trends shows that the model of platforms needs to be integrated into the theoretical business model framework of this research. Based on the key trends autonomous driving, connectivity and sharing, BMW vehicles need to be understood as mobile devices empowered by platform structures on multiple levels. The preference of mobility on demand pushes BMW towards new structures like subscription models where the customer of BMW is seen as a member and pays monthly fees to get access to mobility as a service (Tzuo and Weisert, 2018). For instance, Volvo established the service "Care by Volvo" where the customer is a member of Volvo and get access to multiple car versions which he can change on a monthly base (2020). Alternatively, BMW could consider the Uber model where the user pays per use. He/she would pay per minute or kilometre which he/she used the autonomous vehicle (Evans and Schmalensee, 2016). BMW might be a service creator supported by the core competence of hardware building. As the chapter shows, BMW also needs to explore new competencies like software creation or platform design in terms of data creator and content creator.

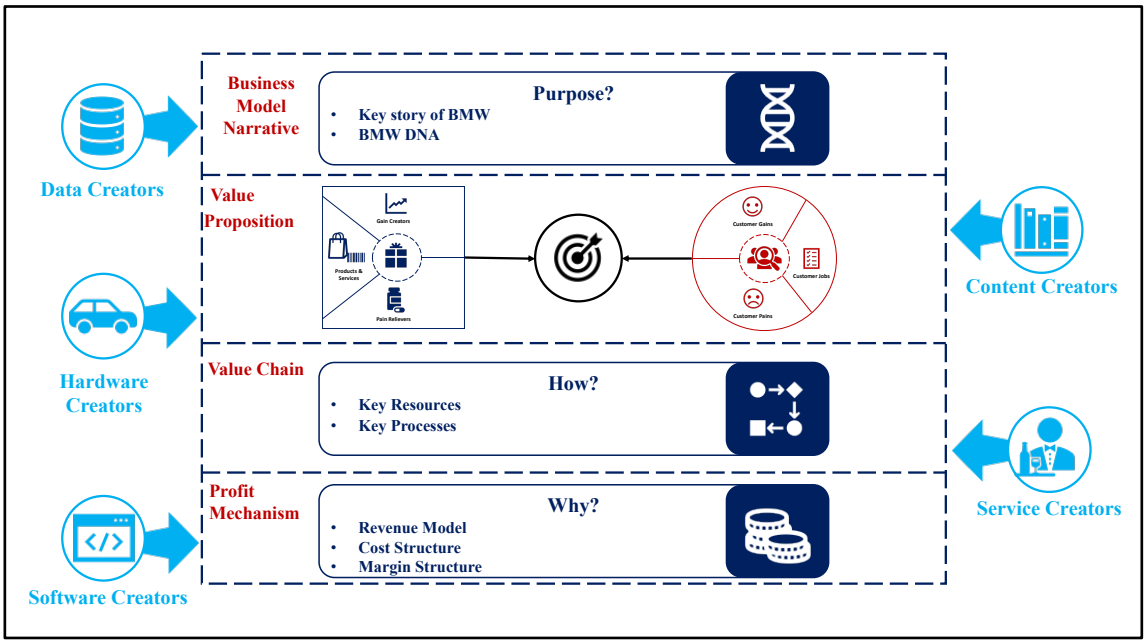

Figure 19- Updated business model framework of the dissertation
(based on Johnson et al., 2008; Osterwalder et al., 2014; Gassmann et al., 2014; Bock and George, 2018; Herrmann et al., 2018).

The qualitative research needs to consider these theoretical assumptions. The experts will be asked in which extent BMW needs to understand the autonomous vehicle as a platform. The interview insights should be used to understand how BMW can fulfil new roles through their newly established business model. This could include that BMW needs to develop itself towards a hardware company enhanced by platform structures like Apple.

2.2.3 Business model innovation through organisational exploration

Significant changes in the environment of a company lead to the need for strategic change. De Wit describes that the firm needs to realign itself to changes in the environment (De Wit, 2017). Rising technologies and new competitors are parts of the environment in which only adaptive companies can survive. Therefore, organisations need to conduct strategic renewals over the time of existence (De Wit, 2017).

A firm comprises two aspects: The business model and the related organisational system which needs to be aligned with the new environment (De Wit, 2017). Without this alignment, incumbent companies like BMW are not able to survive in the long run. To achieve continuous alignment, companies need to develop so-called dynamic capabilities (O'Reilly and Tushman, 2008). Dynamic capabilities are defined as "the ability to integrate, build and reconfigure internal and external competences" (Teece et al., 1997, p.510). The dimensions of the development of dynamic capabilities are organizational structure, processes, culture and members of the organization (De Wit, 2017). In contrast, Leonard-Barton argues that a capability is defined by four different dimensions: Skills and knowledgebase, managerial systems, technical systems and values and norms of an organization (Leonard-Barton, 1992). Competitive advantage is, therefore, achieved

by developing distinctive resources within the organization and dynamic capabilities are the key source of it (Wernerfelt, 1984; Leonard-Barton, 1992). However, dynamic, distinctive capabilities also show a downside: Old capabilities can lead to a product development that does not fit the challenges in the environment (Leonard-Barton, 1992).

Therefore, the main issue of managing the development of a new business model is to develop proper capabilities and to minimize the interferences of core rigidities. O'Reilly and Tushman argue that successful, responsive companies developed an organizational system that can balance the exploration of new opportunities and exploitation of existing markets. This management theory is called *ambidexterity* (O'Reilly and Tushman, 2008).

This dynamic capability is the main source of competitive advantage in times of fast-moving technology development and global competition. O'Reilly and Tushman agree with Christensen that great firms failed because of their inability to manage rising disruptive technologies (1996). Managers and the organization need to constantly improve on the fit of strategy, structure and culture. However, technologies have the potential to disrupt this current alignment. They urge organizations to build up a new organization and a business model that is suited for the next technology period (Tushman and O'Reilly, 1996). This paradox needs to be managed by many incumbent firms today. For instance, BMW needs to follow its strategy based on cars driven by persons in the short run but, simultaneously, needs to manage the rising disruptive technology of autonomous driving in the longer run. Different authors propose different answers to how an organization can establish conditions that enable ambidexterity.

One of these approaches is the concept of open innovation. This concept helps to operationalize the exploration part of ambidexterity. It is all about creating innovation that is adopted by customers (Curley and Salmelin, 2017). Open innovation can be defined as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organisation's business model" (Chesbrough and Bogers, 2014, p.17). Open innovation authors argue that companies are only able to manage a changing environment with the help of a talented company ecosystem (Curley and Salmelin, 2017). A business ecosystem refers to "intentional communities of economic actors whose individual business activities share in some large measure the fate of the whole community" (Moore, 2006, p.33). The initial idea of open innovation was established by Chesbrough and he argues that companies should not only look within the company but also outside the company for innovative ideas that can help to realign the organisation's business model with environmental challenges (Chesbrough, 2006). This collaboration helps to explore new markets and, simultaneously, improve the value delivered to existing markets (Chesbrough,

2006). It expires the knowledge pool of each company collaborating in the ecosystem and enhances the creation of new opportunities (Chesbrough, 2006).

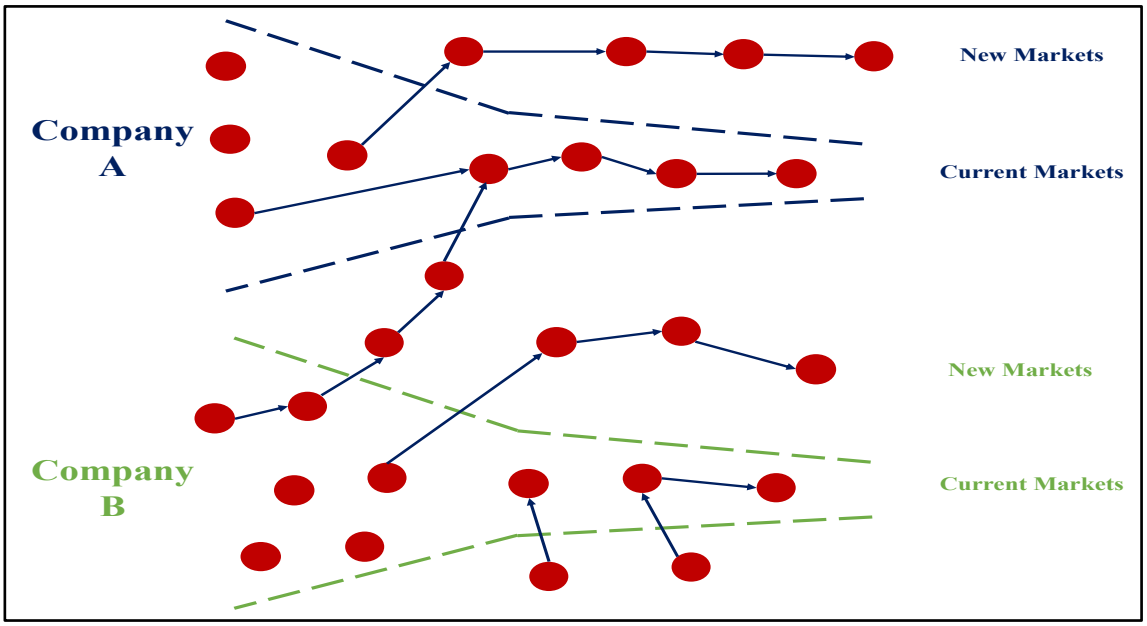

Figure 20 - The open innovation concept
(based on Chesbrough, 2006).

The figure shows a simplified process of innovation: Generate broad ideas, develop promising ideas further and finally diffuse the collaboratively developed concepts into markets and the target customers. This three-step framework is called the innovation value chain (Hansen and Birkinshaw, 2007). In this context, the traditional open innovation approach recommends tight collaboration between ecosystem players in the first two process steps. The openness of a company's innovation approach depends on two interrelated factors: The technology development approach and intellectual property strategy (Bogers *et al.*, 2019). For instance, Tesla develops many Research & Development programs internally but does not acquire patents to protect its ideas (Bogers *et al.*, 2019). They use an open patent system to trigger the diffusion of electric vehicles (Bogers *et al.*, 2019). The question is now: How does open innovation enhance the dynamic capability of ambidexterity?

Bogers et al. argue that open innovation can help to enhance the three main dynamic capabilities of a company: Sensing, Seizing and Transforming (2019). Outside-in innovation is used in sensing new opportunities from the ecosystem of the company. These opportunities are then evaluated and promising ones are internally developed (Bogers *et al.*, 2019). Finally, existing business models or new business models are developed and launched through collaboration with ecosystem companies in the phase of transforming. Open innovation helps to leverage and enhance internal capabilities to exploit existing markets or to explore new ones (Bogers *et al.*,

2019). Hence, it can be summarized that the theories of ambidexterity and open innovation are directly interlinked.

However, the concept of open innovation was updated in the last years. Today's researchers discuss the notion of open innovation 2.0. It mainly says that the environment got more and more complex in recent years. This growing complexity requires a more sophisticated business ecosystem of an innovating company (Curley and Salmelin, 2013). The concept says that open innovation needs to consider more stakeholders of the company. The most important ones are the government, the industry partners, academia and customers of the company (Curley and Salmelin, 2017). This four-dimensional concept is called the quadruple helix system (see Appendix F) (Curley and Salmelin, 2017). The authors argue that many disruptive innovations of today require multiple adoptions of different stakeholders. For instance, the launch of autonomous driving vehicles highly depends on the infrastructure delivered by the government, the development of relevant components from suppliers, the development of sufficient deep learning applications by academia and the customer acceptance of potential customers. An exploring unit of an ambidextrous organisation needs to consider the quadruple helix system to create a completely new value through a new business model. A study by Galvao et al. outlines the importance of governmental support. In the helix system, it is one of the most important parts to enable shared value-creating innovations (2017).

This multidimensional innovation approach requires a structure of the exploring unit that can cope with this level of complexity. Curley and Salmelin propose that the unit should be understood as a platform that orchestrates and aligns the interaction between the different stakeholders with the vision of the exploring innovation projects (2017). Open-source applications like wikis should be established to ensure a sufficient flow of information between the cross-organisational teams (Curley and Salmelin, 2017). Hill and Birkinshaw argue that corporate venture units, which are allowed to invest in start-ups from the ecosystem are a vehicle to gain ambidextrous structures within an existing organization (2014). To success in ambidextrous approaches, the corporate venture unit manager needs a direct and regular interaction with senior executives, other business units and members of the venture capital community (Hill and Birkinshaw, 2014). In contrast, Christensen proposes that a company facing a disruptive technology needs to pursue this technology in a completely separated unit in which the parent company cannot interfere (Christensen, 2015). The new business unit needs a sufficient level of autonomy. However, the exploring unit should still be integrated into the overall organization to ensure alignment and information flow (O'Reilly and Tushman, 2008). Kauppila summarizes the theory of ambidexterity and open innovation in one organisational model. He argues that a company needs an ecosystem consisting of exploring and exploiting related partners (Kauppila, 2010). He advises to build up strong strategic ties to non-profit exploring organisations like public research

organisations (Kauppila, 2010). These partners are more capable of radically explore new technologies like autonomous driving. The company builds up a research unit that is completely committed to developing innovation for the overall company and is the direct partner of the external exploring organisation (Kauppila, 2010). To bring exploring and exploiting together, he recommends building up a cross-divisional matrix organisation that works together on innovation projects (e.g. R&D and marketing employees together) (Kauppila, 2010). A strong customer-oriented culture in all divisions is critical for the successful execution (Kauppila, 2010).

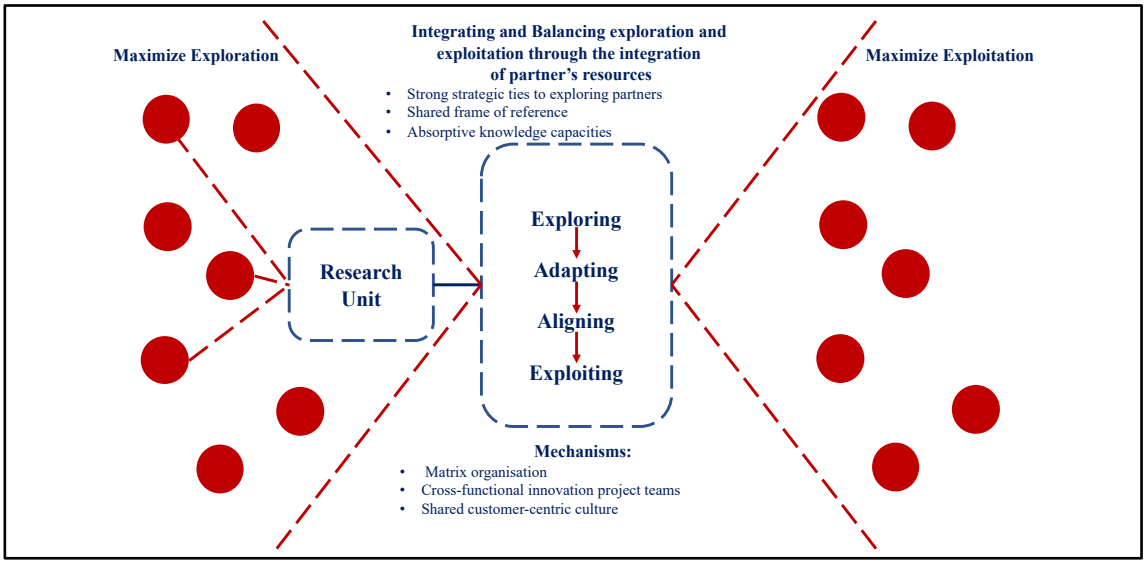

Figure 21- Ambidexterity through inter-organizational partnerships (based on Kauppila, 2010).

The studies of Dutta show: Companies that achieve situational ambidexterity have an improved ability to strategically renew the organisation to be aligned with the changing environmental factors (Dutta, 2013). A revolutionary shift in a business model requires structures that enable explorative thinking and doing (O'Reilly and Tushman, 2008). The review of the literature shows that business model innovation as a strategic change requires three key organisational parameters: Business Units focused on exploring new opportunities, corporate commitment and autonomy of the exploring unit and open innovation approaches through the quadruple helix system.

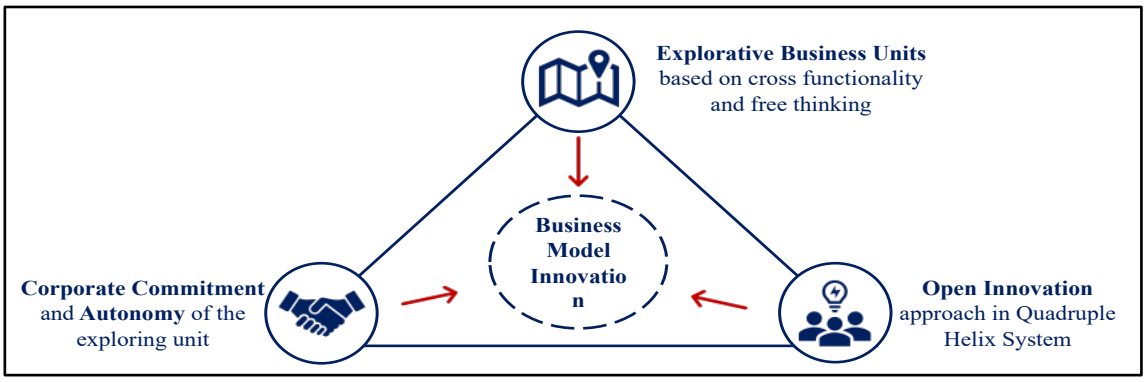

Figure 22 - Organisational conditions enhancing business model innovation (based on Kauppila, 2010; Hill and Birkinshaw, 2014; Christensen, 2015; Curley and Salmelin, 2017).

These three dimensions are used to explore organisational opportunities of how BMW could enable the above-described business model innovation. Figure 23 is the second part of the conceptual framework. These dimensions are reflected in the interview questions and, therefore, discussed with the experts. The outcome should be specific organisational settings that can help BMW to develop the new business model. The question of how BMW should start the development of the autonomous driving-based business model is directly interlinked with the question, which organisational conditions need to be established to enable the organisational exploration. Every innovating company needs to build up an organizational system that supports the desired future state of the business model (De Wit, 2017).

2.3 The conceptual framework

The review of relevant literature shows that the topic of business model innovation in times of disruptive technologies is highly relevant and affects many incumbent firms. As the literature review outlines, three main research fields are relevant for the dissertation: The Innovator's Dilemma of BMW in times of autonomous driving; business model innovation theories and frameworks and, finally, organisational conditions that enable the development of a new business model with autonomous driving as the core technology.

The review of BMW's potential Innovator's Dilemma leads to the impression that BMW faces a strategic problem in the future. On the one hand, BMW could be influenced by a strong technology push through a fast development progress of related technologies. On the other hand, consumers could be broadly ready for autonomous driving in the next ten years and new competitors like Waymo have the potential to threaten the business success of incumbent automotive producers like BMW. This future pressure of a market pull and technology push is not aligned with the current value chain and business model structures of BMW. They have specialized investments in hardware-oriented productions, have an engineering culture and have specialized processes, which are focused on exploiting the efficiency of today's business model to maximize the short-term profit. Hence, the literature indicates that BMW will face the Innovator's Dilemma in the coming years.

The next dimension of the review is the business model innovation part. Many different authors state that business model innovation is highly relevant in a challenging and uncertain environment. A holistic perspective of the overall business of a company is required. If a company needs to redesign multiple dimensions of the business model, then business model innovation is achieved. The final model for the research is based on the value proposition, containing a value map and customer profile of the target group. The narrative (purpose), value chain (how) and profit mechanism (why) are the additional dimensions that need to be aligned with the value

proposition for autonomous driving vehicles. Additionally, five key value drivers of the future automotive industry were identified: Data, Service, Software, Hardware and Content Creator. All these new roles are mainly based on the overall trends of connected cars and sharing mobility which are derivates of the global business model trend of the platform economy. The facilitation of interactions between producers and consumers of values. This overall trend needs to be reflected in a future business model.

Finally, the last question for the literature review is: Which organisational conditions reinforce successful exploration in the field of autonomous driving? Mainly influenced by the strategic management theories of ambidexterity and dynamic capabilities, the author identifies three key dimensions to enable the development. Firstly, explorative business units need to be implemented with cross-functional teams and space for freethinking with a clear guiding vision. Additionally, incumbent firms need to explore their ecosystems through an open innovation approach. The modern quadruple helix system requires the integration of broad interest groups like the public sector or telecommunication companies. Finally, the corporate commitment of the senior management and, simultaneously, sufficient autonomy of the exploring unit are further key enablers of exploring disruptive technologies like autonomous driving and new business models for this new technological landscape.

However, the landscape of management literature lacks in terms of combining business model innovation and managing disruptive technology, although many different sources are available in each dimension. Especially the impact of autonomous driving on business models of incumbent automotive companies is not a broadly discussed topic since it is subject to great uncertainty and complexity. Therefore, the combination of the conducted literature review and the derived research design leads to the overall conceptual framework of the dissertation:

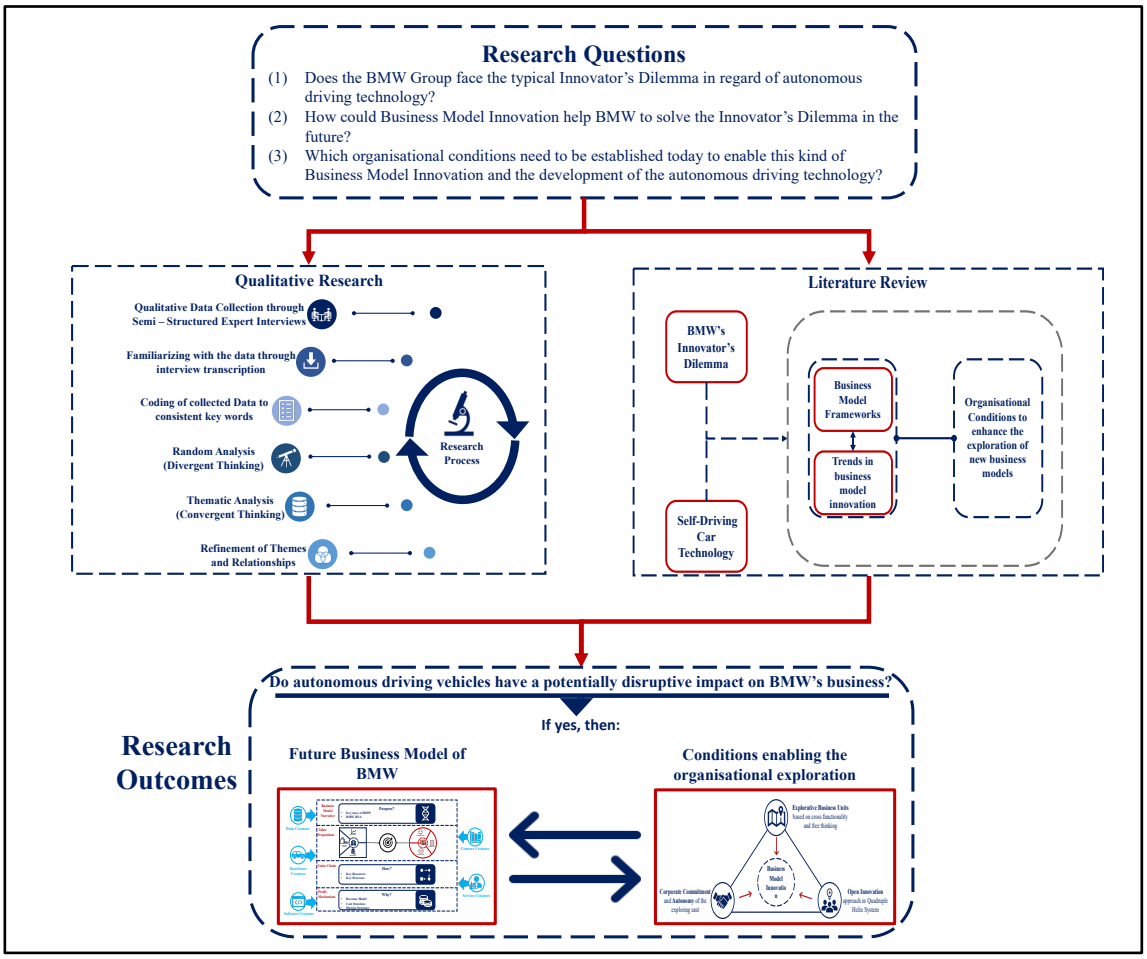

Figure 23– The conceptual framework of the dissertation.

The conceptual framework shown in figure 23 is based on three consecutive layers. The first layer (the box on top) sets the scope of the overall research. The research processes and outcomes need to be designed in a way that these three questions can be sufficiently answered. The questions themselves are also interrelated since question A refers to sensing the potentially disruptive change through self-driving cars. Question B represents the seizing of the new opportunity for BMW and discusses how the theory of business model innovation and its practical models can help BMW to compose a technology-fitting business model for the future. Lastly, question C discusses how organisational exploration enables the development of the autonomous driving vehicle technology and the associated business model. Hence, these three questions represent the dynamic capability set of Schoemaker et. al. which is required to manage a VUCA environment.

Finding answers to the above-mentioned lead questions require explorative research, which is based on two input factors: Primary qualitative research and literature review. These two input factors are used for two different purposes. The literature review helps to frame the data collection and analysis of the research. The understanding of BMW's potential dilemma in an autonomous driving future helps to ask the right questions to the right experts. The review in this field showed that the autonomous driving in level 4 or 5 has a potentially disruptive character for BMW and,

hence, it is worth to ask experts about their opinion. The second literature field deals with the business model innovation part. Common business model frameworks are used to frame the exploration of future business model implications for BMW. It can be seen as the scaffold of the target to develop a future aligned business model. Lastly, the related organisational conditions that enable organisational exploration are discussed based on relevant management literature. The three predefined key conditions are tested in primary research. Additionally, they are again used as a scaffold for further exploration of any other organisational conditions that need to be established. As a result, the literature review serves as a framework for the second input factor of primary research. The process of primary research is based on two analyses: Inductive and deductive thematic analysis of qualitative data. Firstly, the data is collected and transcribed. Relevant text passages are coded into keywords and, therefore, analysed. All defined themes and relationships are refined and, finally, lead to the output of the research. This research part is the content of the scaffold. It helps to verify derived content and to fill frameworks. These two input factors together help to compose the final models and verification of literature-based options. The third and last layer of the conceptual framework represents the output of the research: Verified models that help BMW to manage the upcoming disruption of autonomous driving vehicles.

This conceptual framework requires a practical and explorative research strategy. This research mainly bases on a research object, here BMW, facing a significant change in the environment, here the technology of autonomous driving. The result describes how the object should act today to be aligned with the new environment and, hence, be ready to survive a potential wave of disruption. This research setting of the conceptual framework indicates that a case study strategy is the most suitable one to achieve the defined research targets. Since a case study research analyses a case object in a specific circumstance and develop implications for the object, it fits the structure of this research (Yin, 2017). The research method is extensively described in chapter 3.

2.4 Conclusion

The literature review was conducted by searching for keywords from the innovation and strategic management research field in common and peer-reviewed journal sources like EBSCO and SAGE Journals to ensure a sufficient level of academia. Additionally, relevant books were identified and reviewed by analysing the current literature landscape concerning the objectives of this research.

The review shows that business model innovation in times of thriving technology is one of the key terms in the research field of innovation and strategic management. These two fields are more and more interlinked since the long-term viability of a company strongly relies on its ability to develop new business models, which enable the customer to adopt new convenient technologies. This is directly interlinked with the ability of a company to explore new opportunities and to reallocate resources, knowledge and competences. However, as the review of the innovator's dilemma theory showed incumbent firms like BMW struggle with these two disciplines based on their short-term shareholder expectancy, the commitment to existing assets and the specialized knowledge and capabilities of a company. BMW is a global market leader in the current automotive industry system since it was able to establish a highly efficient car manufacturer value chain with a highly valued brand and a high-quality product. However, the thriving technology of autonomous driving requires new assets, structures and capabilities of BMW. Based on the literature, this situation can be defined as a dilemma of BMW and it can only be solved by establishing explorative structures in the company, which enable a rethinking of the current state's business model. The concrete implications for the future business model of BMW and how explorative structures should be designed are explored by the qualitative research of the dissertation. As a first step, the following chapter describes the overall research design and approach of the dissertation.

3 Research Design and Methodology

3.1 Overview

The following chapters discuss how the proposed research questions and the related objectives can be achieved through a sufficient research design. To describe the proposed design of the research, the so-called 'research onion' of Saunders et al. is used:

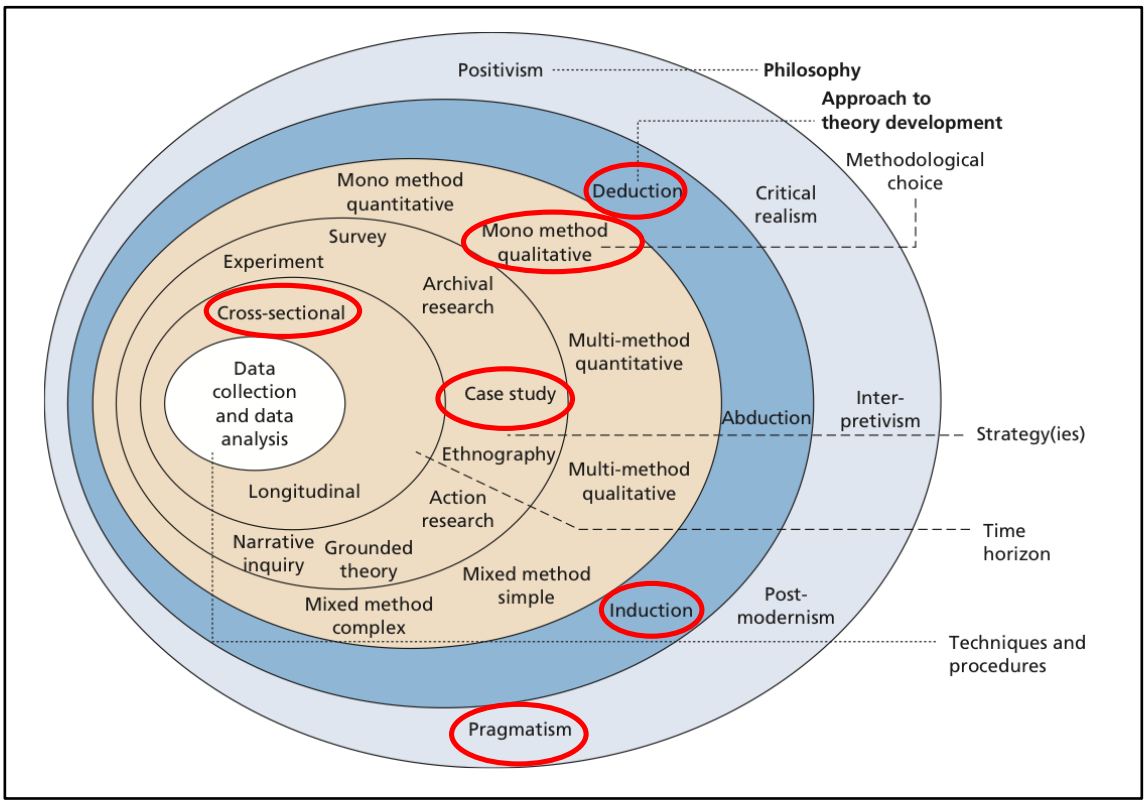

Figure 24- The research onion
(Saunders et al., 2015, Highlights added by the author afterwards).

The description of the research design of the dissertation follows the layers of the model from the outer to the inner dimensions. The highlighted points of the model refer to the used dimensions for the research and are discussed in the following chapters.

3.2 Research philosophy and approach

The research philosophy of an author is primarily influenced by his research paradigm and whether he/she is more subjective or objective (Saunders et al., 2015). The author of this dissertation is subjectively influenced since he believes that social reality is designed and formed by decisions of social actors (for instance: Decision-makers in companies or competitors and customers in a market). In the dissertation, it will be acknowledged that every person perceives reality differently since the individual reality is influenced by individual experiences and

knowledge of a person (Burrell and Morgan, 1979). A subjective researcher believes that social interactions between actors lead to a dynamic and over the time changing state of flux of social phenomena (Saunders et al., 2015). This ideology influences significantly how the research topic is approached. A subjective researcher believes that an objective analysis of the research data is not possible and consequently the researcher's values influence the interpretation of the data (Saunders et al., 2015).

The second dimension that influences the philosophy of a researcher is the research paradigm. According to Burrell and Morgan, researchers can use two different perspectives on planned research: Regulation or Radical Change Perspective (1979).

The research fits the Radical Change Perspective since the author targets to develop a business model that considers new environmental changes and overcomes the current state of BMW's business model. A Radical Change Perspective approaches organisational issues with the perspective to overcome the current state (Burrell and Morgan, 1979). The research looks for the future potential and for conflicts in terms of environmental alignment of the current state of BMW (Saunders et al., 2015).

Since the author is influenced by Subjectivism and the Radical Change Perspective, the research paradigm of the proposed dissertation is a Radical Humanist one (Burrell and Morgan, 1979).

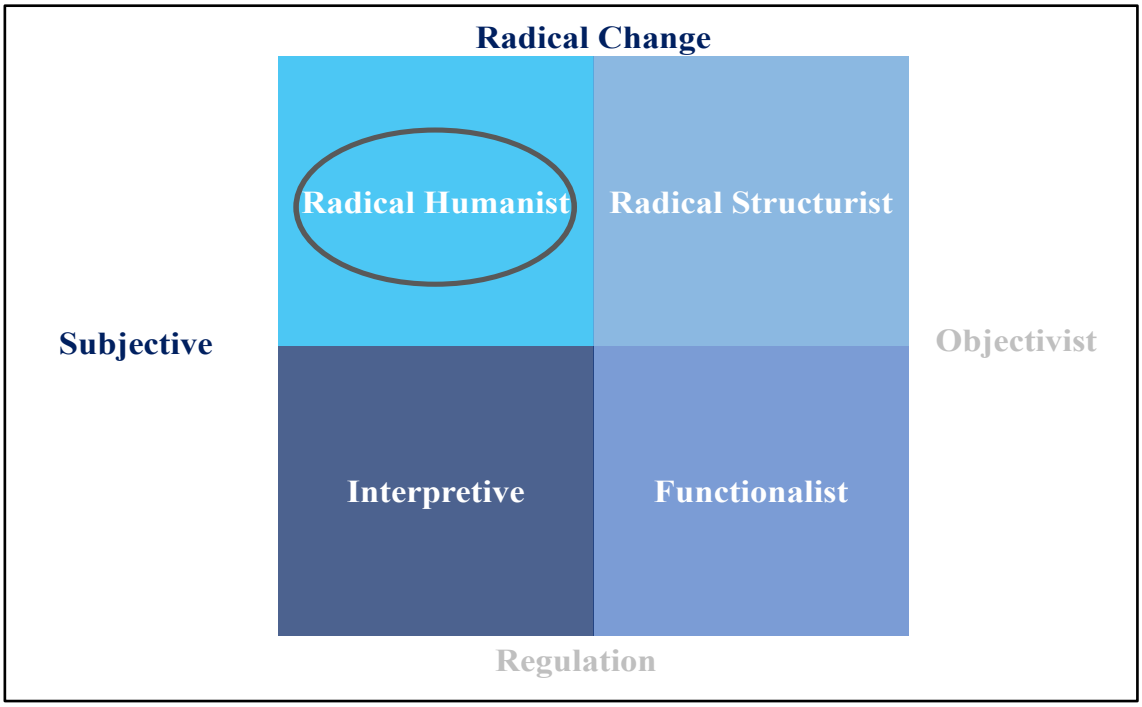

Figure 25- The research paradigm of the dissertation
(based on Burrell and Morgan, 1979).

The paradigm influences the mindset of the researcher. A Radical Humanist wants to change the status quo with the research, and he/she takes the importance of social constructions, processes

and instability of structures (e.g. long-term viability of a company) into consideration. In terms of the dissertation, the key objectives are to examine whether BMW faces an Innovator's Dilemma at the moment, how BMW needs to change the current state business model to be aligned with future environmental developments and organisational conditions that enable this kind of business model transformation through exploration. The author assumes that systems like business models are, in a long-run, unstable and need consequently amendments.

This research paradigm influences the choice of research philosophy. The Research philosophy can be described in three key dimensions:

(1) *Ontology (Assumptions about reality)*: The author sees the reality as complex and believes that reality is built on the consequences of ideas and actions by social actors (Baert, 2004). The reality is a dynamic flux of experiences and practices and needs to be analysed in this way (Saunders et al., 2015). In terms of the research topic, it is to say that BMW faces a dynamic environment with complex interrelations of variables that define a successful future of BMW. Decision-makers of BMW and related stakeholders define the reality for BMW.
(2) *Epistemology (Assumptions about knowledge)*: The author believes that sufficient theories need to enable actions in the reality and knowledge should be used for concrete problem solving or give sound future practices for actors (Baert, 2004). The value of knowledge highly depends on the context in which it is applied (Saunders et al., 2015). The proposed dissertation wants to generate knowledge that concretely solves an issue in a specific circumstance. The key contribution is an informed practice for the BMW brand in times of autonomous driving vehicles.
(3) *Axiology (Role of values and ethics)*: The proposed research is based on the subjective beliefs and values of the author. The author deeply believes in the fact that companies continuously need to innovate and reinvent themselves based on changing environmental actions. The research on the topic of how BMW needs to realign the business model with the new technological environment is based on this belief. The research is value-driven (Saunders et al., 2015).

The described perspectives lead to the research philosophy of Pragmatism. This implies that the pragmatic author considers theories, concepts, ideas and findings only as instruments of thought and action when they help to derive practical consequences (Saunders et al., 2015). The research is motivated by personal doubt that valuable knowledge is existent in terms of technology aligned business models in the premium automobile sector. Therefore, the research question is the key determinant for the choice of research design and correlating strategies (Saunders et al., 2015).

Based on the above-described research philosophy and the influencing paradigm of Radical Humanist, the dissertation has an explorative purpose. The purpose is the second factor that influences the further research design of the dissertation (Saunders et al., 2015).

The research in terms of autonomous driving and BMW wants to discover future implications for the business model of one of the most successful premium automobile producers. The key question is: How can BMW solve the Innovator's Dilemma through a technology fitting future business model and aligning organisational conditions?

The research and understanding of the issue are unsure and complex since the autonomous driving technology is still not ready for the market and no concrete role models are available. The researcher acknowledges that this exploratory research needs to be dynamic in the research period as results from new data can give new insights that might completely change the direction of the outcomes. This dynamic needs to be reflected in the strategy and methods of research (Saunders et al., 2015).

The described exploratory purpose and the pragmatic perspective, that knowledge is only valuable when it helps to explain a practical scenario, clearly indicate that the research needs a practical strategy that can describe a real-life phenomenon. Since the objectives are based on a real-life object (BMW) and a real-life setting (thriving technology of autonomous driving), the philosophy and purpose of the research indicate that the research strategy case study is suitable to achieve the overall goals. The explorative research purpose needs to be reflected in the methodology, which is used to follow the predefined strategy.

3.3 The case study research strategy

The author follows a combination of an inductive and deductive pragmatism for an explorative research purpose. According to Saunders et al., inductive research is commonly conducted with the help of qualitative research (2015). An inductive approach firstly collects the data from sources and then explore it to find themes and issues (Saunders et al., 2015). However, this research firstly uses the literature to frame possible outcomes from the data collection. The described business model framework and the predefined organisational parameters help to give the research an analytical framework (Saunders et al., 2015). The research is, within this literature-based framework, inductive since it does not predefine clear hypotheses, which are then validated by interviews. Therefore, the inductive character of the explorative purpose is framed by a deductive approach. The author follows with this approach the recommendation of Saunders et al. that purely inductive or deductive approaches might not lead to satisfying research outcomes (2015).

The uncertainty and complexity of the chosen dissertation topic and targets require a flexible and dynamic research approach that can react quickly on new insights gained. The author targets to assess the potential Innovator's Dilemma of BMW, develop a conceptual framework in terms of required business model innovation for the brand BMW and derive organisational conditions that enable this kind of business model transformation. This target fits the proposed outcomes of qualitative research: Build a conceptual framework or develop a richer theoretical perspective on a phenomenon (Saunders et al., 2015).

Qualitative research can be conducted in two ways: Mono- or multi-qualitative research (Saunders et al., 2015). The author interviews multiple experts from relevant stakeholders of BMW in a panel group. However, while the research method of semi-structured interviews is used for every expert, the questions can vary based on the background of the expert and his/her predefined stakeholder group. Semi-structured interviews can react to newly gained insights and have, therefore, the required flexibility for an explorative research purpose (Saunders et al., 2015). Hence, the author uses a mono-method qualitative study with a heterogeneous expert group to derive insights from multiple perspectives on a complex and explorative research question.

The next step of the research design is to define how the author wants to answer the research questions mentioned in chapter 1.3. Therefore, a research strategy needs to be defined (Saunders et al., 2015). Multiple strategies like experiments, surveys or the case study exist. The chosen strategy must align the pre-described philosophy with the overall methodology to collect and analyse data (Denzin and Lincoln, 2017). In this research, a strategy needs to link the explorative pragmatism, where concepts and ideas are considered if they have a practical value for specific circumstances, with the mono-qualitative research, where flexible in-depth interviews are used to manage the complexity of the topic. The description of the research issue shows that a phenomenon is analysed in its real-life context (Travers, 2001). This is the first indicator that a case study of BMW in the real-life context of the thriving technology of autonomous driving is a suitable research strategy for this research. A case study strategy is always useful, if:

(1) The overall research questions are mainly based on "why" or "how"
(2) The researcher has no control over behavioural events in the research setting
(3) The research object and setting is a contemporary and dynamic event (Yin, 2017).

This research ultimately wants to answer the questions why the autonomous driving technology leads to a strategic dilemma for BMW and its decision-makers and how business model innovation can help to manage this potential disruption. Additionally, it is discussed how specific organisational parameters help to enable this transformational approach of business model innovation. The overall questions show that all of them are mainly focused on exploring reasons in a specific setting and how an object in this setting could manage the disturbance through

realignment. The described setting cannot be significantly influenced by the researcher. Economic players like BMW are not acting in a static and fixed environment. Hence, the environment is dynamic and, based on that, this setting of the research is contemporary and not fixed. A case study is always useful if a researcher wants to understand a real-world case and acknowledges that this understanding requires the involvement of contextual conditions in the research design (Yin, 2017).

All these facts about the research and its setting lead to the conclusion that the research strategy of a case study is the most suitable one to link the explorative and pragmatic purpose with the qualitative methodology. Concretely, a case study of the BMW brand in the new context of autonomous driving is required. Since defining the setting and boundaries of a case study is critical, the proposed research setting is mainly based on three layers (Flyvberg, 2017):

(1) *Organisation*: BMW Group with a focus on the BMW brand
(2) *Change Process*: Business model innovation and organisational preparation for BMW in a new technological environment
(3) *New technological environment*: Autonomous driving as a new potentially disruptive technology on the landscape of the premium automobile segment.

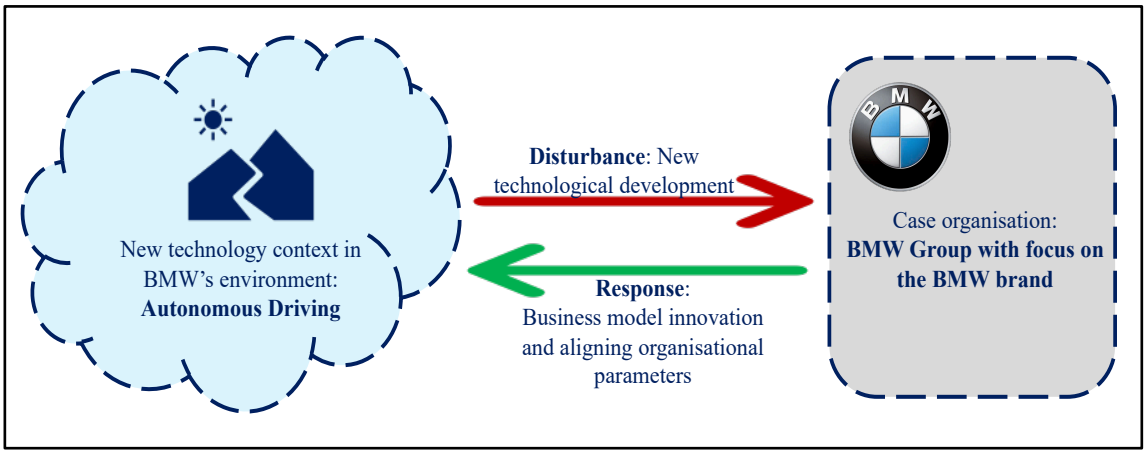

Figure 26- The case setting of the proposed research.

The main goal of this case study is to understand the dynamics of the interactions between the case subject (BMW) and the case setting (autonomous driving as a potentially disruptive technology). The case derives a conceptual framework, which explains how BMW needs to align its business model with the new environment and which organisational conditions enable this exploration of business model innovations (see figure 26: Response). Since the business model is a holistic approach to understand how a company like BMW generates, delivers and captures value, the proposed case study aims to analyse the organisation as a whole. This leads to the fact that the research aims to deliver a focused holistic case study for BMW. This approach to the

research question fits the pragmatic philosophy of the author since the research is influenced by the belief that knowledge is only valuable if it is used in a concrete context.

The time horizon of the case study is cross-sectional since the research methodology of qualitative research aims to gather the expert opinions of multiple stakeholder groups. It is a study in a particular time of 14-15 weeks which leads to a time-constrained research setting (Saunders *et al.*, 2015).

3.4 Collection of the primary data

The following chapters describe how the explorative purpose of the BMW case study can be practically executed by the specific research method of conducting semi-structured interviews. The purpose of the study is fulfilled if the three described lead questions can be answered by the collected and analysed data.

These questions reflect the explorative character of the research. All questions are directed towards the described case study setting of BMW facing a new technology wave of autonomous driving vehicles in the future. Consequently, the mode of data collection needs to be able to manage exploratory characteristics. The reviewed literature in the field of strategic innovation shows that many researchers used a qualitative approach of interviewing multiple related experts in the field of interest. Common theories like Christensen's Innovator's Dilemma or Tushman and O'Reilly's Ambidexterity are validated by case study companies in different industries. Most of their hypotheses were justified by case studies operationalized by expert interviews with interest groups of the case setting. This research follows this schema by conducting qualitative interviews with related experts from BMW's ecosystem. Only interviews offer the required flexibility and responsiveness to explore uncertain implications of the new technology for BMW. The research questions are future oriented and, therefore, requires data sources that have the competence and experience to evaluate the possible implications of autonomous driving on BMW's future and how business model innovation can help to manage the future disturbance. The following chapter 3.4.1 outlines the concrete approaches for data collection while 3.4.2 discusses the possible ethical and access issues deriving from the chosen data collection method.

3.4.1 Data collection approach

The main data collection method of this dissertation is the interview. Interviews mainly base on asking relevant questions and carefully listening to the answers of predefined interview partners (Saunders et al., 2015). It enables direct interaction with participants. Hence, the interviewer can directly adjust questions and response to expert opinions. Unclear questions can be initially clarified (Flick, 2019). The author follows a subjective approach of interviews since he believes that social reality is created by social actors. Therefore, the data collection mode is based on the

subjective theory which says that every participant has a stock of knowledge and that open questions can be used to trigger the expression of this implied knowledge (Flick, 2019). The former experience and ideology of the interviewer and interviewee influence the interview answers and the interpretation of them. This subjective theory is best applied by using semi-structured interviews. A semi-structured interview means that the interviewer prepares multiple questions before the interview is conducted. It gives the data collection process a structure (Flick, 2019). However, the interviewer is still able to ask further questions to extract knowledge from new discussed topics. For explorative research this capability is critical (Saunders et al., 2015). The questions asked are mainly based on the three main research questions and all of them are used to find a sufficient level of saturation to answer all of them appropriately. The main type of questions used are open ("What do you think is the value proposition of BMW and why do customers buy vehicles of this brand?") and scenario typed questions ("Would you agree that BMW must strategically design a new business model, with the autonomous driving at its core, in order to still be relevant tomorrow?) (Flick, 2019). This mixture helps to verify literature-based scenarios and to explore new business model implications. The interview schedule reflects this degree of flexibility, too. It contains the time for additional comments at the end of the interview process. The research objectives require to completely understand the backgrounds of the topic and the opinions of the experts. Furthermore, this kind of interviews can lead to 'thinking aloud' moments where the expert thinks about dimensions he/she never have thought about before (Saunders et al., 2015). Although this method does not clearly outline a method to analyse the collected data and that the definition of a clear saturation level is not easy, semi-structured interviews suit best to the requirements of an explorative case study.

A critical success factor for this kind of data collection method is the alignment between the overall research questions and the predefined interview questions since these are the main sources of knowledge in this case study (Flick, 2019). The author already derived a theoretical-based business model framework and main organisational conditions to enable exploring new business models and technologies. These insights from the literature are also embedded in the question design. Each asked question and the related lead question are shown in the appendix G. Furthermore, an exemplary interview sheet is attached in the appendix H.

The topic of this dissertation refers to the whole business ecosystem of BMW. Therefore, the expert panel structure needs to take this heterogeneity into account. As the literature review has shown, the development of the autonomous driving technology not only depends on BMW on its own but on many other interest groups as well. These stakeholders are mainly derived from the automotive value chain described in chapter 2.1.1. BMW is the key orchestrator of this value chain and is, therefore, the centre of a whole business ecosystem. Hence, the panel structure is mainly based on the key stakeholder groups of BMW's value chain. A stakeholder group is an

interest group that is directly or indirectly affected by BMW's strategic decisions (Kerzner, 2017). They also have a strong influence on the decision-making of BMW (Kerzner, 2017). The following figure illustrates which stakeholder groups are relevant for the research to answer the lead questions properly.

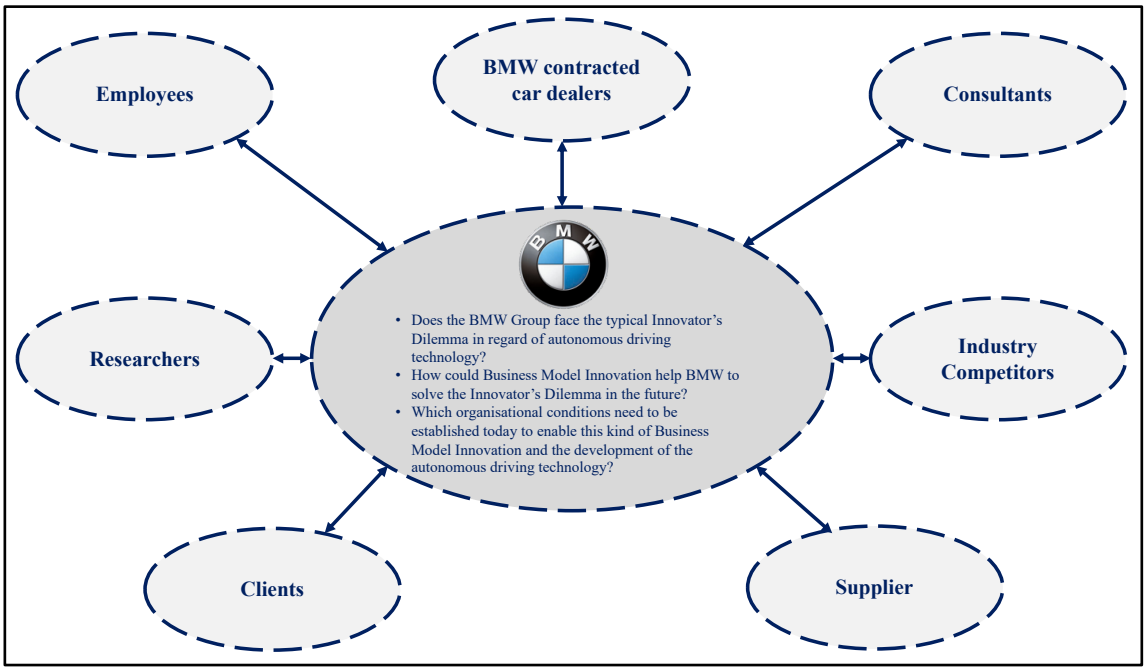

Figure 27 - Expert panel of the research topic.

The author defines seven relevant expert groups. With the help of the snowball sampling method, where already interviewed experts acquire additional experts from their network, it is planned to conduct interviews in every group so that at the end ten interviews are conducted and saturating data is collected (Handcock and Gile, 2011). Although significantly external limitations through the COVID-19 crisis have influenced the data collection process, it was still possible to gather ten qualitative interviews from the most relevant expert groups researchers, employees, consultants, industry competitors, suppliers and clients.

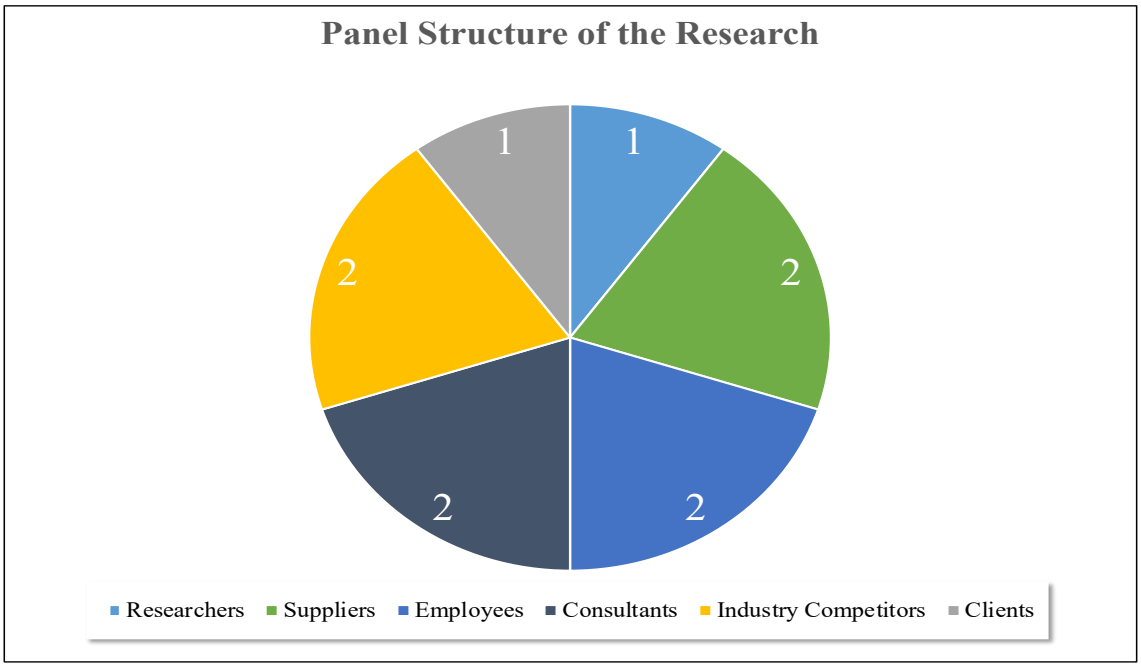

Figure 28 - Distribution of the expert interviews to the different panel groups.

The high quality of the interview partners leads to a high saturation level for the research. The main goal is to conduct every interview face-to-face. However, all interviews are executed and audio-taped by internet-mediated (e.g. Skype or Google Hangout) or telephone interviews. The main reason for that is the limited time of research (14-15 weeks) and the fact that the COVID-19 crisis urges the researcher and the experts to keep a social distance. Since the research is focused on the content of the expert's answers and not on the feelings and gestures of each, this fact is not a constraining factor for the outcomes of the research.

As described above, the experts are hired from heterogeneous stakeholders of the case setting. The following table shows the different backgrounds and stakeholder groups of a single expert. This table is also used to guide the quotation in the findings chapter. In some cases, the experts wanted to be anonymised. Hence, the author labelled them as "Participant X" and anonymised the company background of the expert.

Number	Interviewee	Panel Group	Company	Role	Interview Duration
1	**Mark Kuhn**	**Researcher**	DHBW Stuttgart	Director of Studies Business Administration Industry / Service Management	35:08 min
2	**Participant 2**	**Supplier**	Direct BMW Supplier	Sales & Marketing Director	40:10 min
3	**Participant 3**	**Employee**	BMW AG	Associate Product Management	38:21 min
4	**Participant 4**	**Consultant**	Global Bank from Germany	Director Experteam Automotive & Engineering	40:50 min
5	**Nicolas Kesselmeier**	**Supplier**	HELLA GmbH & Co. KGaA	Senior Consultant Digital Transformation	49:43 min
6	**Participant 6**	**Employee**	BMW AG	Associate	35:52 min
7	**Participant 7**	**Competitor**	Leading German Premium OEM	Manager Marketing - New Projects and Strategy	42:04 min
8	**Participant 8**	**Competitor**	Leading German Premium OEM	Employee Marketing - New Projects and Strategy	51:15 min
9	**Thomas Appel**	**Customer**	Innogy SE	Manager Telecommunication	22:44 min
10	**Dr. Christoph Steiger**	**Consultant**	Roland Berger GmbH	Senior Partner Digital Transformation	48:33 min

Table 2- Detailed structure and backgrounds of the expert panel.

The shown experts are primarily hired by exploiting the existing business network of the researcher. The nonprobability snowball sampling method helped to access difficult expert groups like leading researchers or managers through the network of hired experts from the author's direct network (Handcock and Gile, 2011). Additionally, modern business networks like Xing and LinkedIn are used to verify whether the curriculum vitae of the potential candidate fits the topics of the research. Therefore, only suitable experts are included in the stakeholder panel. This ensures that the answers to each interview question were reliable and interpretable in a way that implications for BMW can be derived. All questions are asked flexibly to each expert. The semi-structured interview character is consequently executed. All predefined questions are asked, and further questions, based on the expert's answers, are added. The researcher allocates for each expert and his/her stakeholder group an interview question sheet from the portfolio of questions shown in appendix G. This process ensures that only relevant questions for the stakeholder group are asked in each interview.

The overall goal is to receive a sufficient level of data quantity and quality through the conducted interviews. The conducted expert interviews are capable of serving a sufficient level of saturation. However, the author decides to include a secondary data source into the data collection process. Secondary data sets are always useable if additional knowledge from another research focus can be integrated into the research to find more saturated answers to the research lead questions (Saunders *et al.*, 2015). The research institute of Capgemini has published an exhaustive study called "The autonomous car. A consumer perspective". It is mainly based on a global customer and executive survey (n consumers= 5,500; n executives = 280). It gives quantitative insights into the topics of consumer readiness in terms of autonomous driving, the consumer's expectations for driverless cars and the assessment of automotive companies' investments (Winkler *et al.*, 2019). It is a published summary of statistically derived insights and can be classified as a document secondary data (Saunders *et al.*, 2015). This published summary helps to include an exhaustive consumer perspective on possible future business models of BMW. Additionally, the customer expectations and the evaluation of automotive companies' investments can help to assess whether the autonomous driving vehicle technology has a disruptive potential on BMW's current business model (lead question A).

As a result, the primary data from the conducted expert interviews combined with the secondary data source from the Capgemini Research Institute result in a case-fitting data set that is capable of delivering the sufficient data potential to achieve the predefined research objectives.

3.4.2 Access and ethical issues

The above-described data collection processes are only possible if the author receives sufficient access to relevant experts and their opinions on the research topic. Therefore, data collection is a critical point in this research approach (Saunders et al., 2015). This research risk could not be eliminated but minimized with the help of sufficient preparation (Saunders et al., 2015).

The following strategies are applied to get the required access to data:

(1) Familiarise with the organisation before making a contact
(2) Using the existing network in the innovation management, digitalisation consulting segment and private contacts to BMW and other premium automobile producers
(3) Prepare a short research briefing containing the purpose of the research and the potential gains from the cooperation for the interviewee and his / her organisation
(4) Using suitable language in the whole research process (Saunders et al., 2015).

In the process of the research, the author identifies one ethical issue that needs to be covered: Confidentiality of data. This ethical question is becoming increasingly important for research, especially in times of digitalisation (Saunders et al., 2015). The author made every effort to ensure data privacy and security in the process steps of data gaining, analysing and reporting. Based on European data protection acts, the author considered the following data security dimensions:

(1) Data is processed fairly and lawfully
(2) Data is only used for the described research purpose
(3) Accurate usage of the data
(4) Data will be deleted after the purpose of the research is fulfilled
(5) Data is processed under the data security acts
(6) Data is securely saved

The recorded interviews will be stored on a password-secured computer in password-secured files and will be deleted after the research purpose is fulfilled. The single transcriptions are anonymised, if the interviewee demands to do so, and are interpreted only concerning the research questions. Before interviews are conducted, the author shares the "Plain Language Statement" as well as the "Informed Consent Form" with the experts to ensure a saturating level of transparency between the interviewer and the interviewees.

3.5 Analysis of the data

The collection of the primary data is based on semi-structured interviews and an additional secondary data source from the Capgemini Research Institute. The next step is to analyse the data in a way that the lead questions of the explorative research approach can be answered. The first step of the analysis is the familiarizing with the data set (Saunders *et al.*, 2015). The familiarization is mainly achieved by the focused transcription of each interview. While transcribing the single sequences of the interview, the author can identify the first opinions of the single expert in the different dimensions of the research. This transcription is also used for first interpretations in forms of first notes and self-memos (Saunders *et al.*, 2015). The notes are focused on the first possible keywords and themes (Saunders *et al.*, 2015). These preparations are the sources of data for further analyses. The next steps of the research target to develop information and finally knowledge from the curated data set. The analyses need to reflect the overall purpose and character of the research design (Flick, 2019). In this case, it is an explorative one. The uncertain topic of the future of BMW in times of autonomous driving requires a qualitative and multi-dimensional data analysis approach. The starting point of the analysis is the coding of each expert interview and the key insights from the secondary research source. It helps to make information out of data by aligning all data points under different subtopics (Saunders *et al.*, 2015). For this approach, standardized keywords are used to ensure consistency throughout the data set (Silverman, 2013).

This information needs to be set in the context of the research questions which leads to the final gained knowledge from the research. The author uses the methodological triangulation for the keyword analysis. Methodological triangulation means that a mix of different analysis approaches is used to combine derived information from one method to identify additional themes that could corroborate or complement the information from the other analysis method (Saunders *et al.*, 2015). It refers to the approach to find a “true” fix on a case by combining different perspectives on it (Silverman, 2013). As a result, two different data analysis lenses are integrated into the overall data analysis process. There are multiple forms of qualitative data analysis methods. However, the choice needs to reflect the explorative and, hence, creative research approach. There are two underlying ways of thinking that need to be reflected to ensure a sufficient level of creativity in the analysis approach: Divergent and convergent thinking.

Divergent thinking refers to open-ended problems with multiple solutions and convergent thinking to problems that have only one correct solution (Jung and Vartanian, 2018). In the design thinking process, divergent thinking is defined as creating choices and convergent thinking as making choices (Liedtka *et al.*, 2013).

Therefore, convergent and divergent thinking, seen with a research lens, fit the combination of inductive (divergent) and deductive (convergent) approaches to this qualitative analysis. These two lenses are used in the thematic analysis of this research. Thematic analysis is defined as "a method for identifying, analysing, and reporting patterns (themes) within data" (Braun and Clarke, 2006, p.6). It is also a tool that is used to interpret multiple aspects of the research topics (Boyatzis, 1998). A thematic analysis of qualitative data is always preferable if the research purpose requires to search actively for particular themes and relations (Saunders *et al.*, 2015). This is the case in this research. Aspects of a potential Innovator's Dilemma of BMW in an autonomous driving future, business model innovation dimensions based on the new technology and organisational conditions to enhance organisational exploration at BMW are leading themes that need to be explored through the analysis approach. Thematic analyses have a high level of flexibility since strict coding rules are not established (Braun and Clarke, 2006). This fits the explorative character of this research. It requires the triangulation of the inductive and deductive research lens on the same data set to ensure a sufficient level of exploration and concreteness. Thematic analysis is capable of combining inductive and deductive perspectives in one data analysis approach (Saunders *et al.*, 2015). Hence, the chosen thematic analysis mode contains the two relevant ways of thinking:

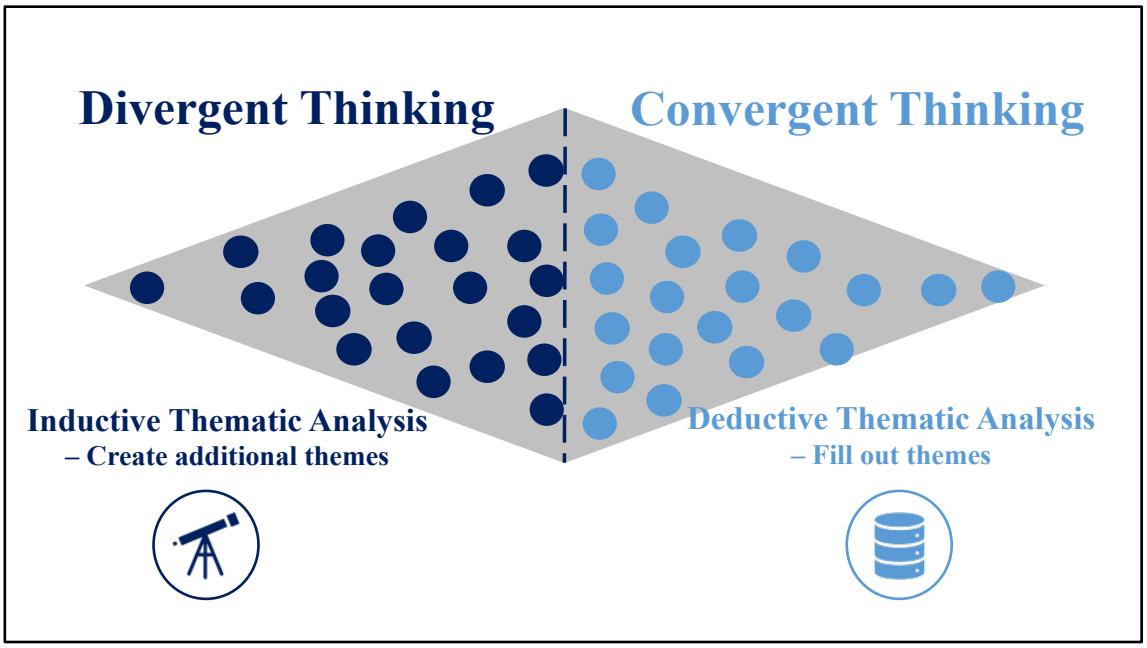

Figure 29 - The overall data analyses methods of the research
(based on Jung and Vartanian, 2018).

The detailed process of each analysis step, as well as the practical execution and experience, are described in the following paragraphs:

(1) *Coding of collected data to consistent key phrases*

The coding process is applied to categorise data from the transcribed interviews with similar meanings. In this research, a code is a short phrase that summarizes homogeneous statements of interviewed experts (Saunders et al., 2015). The coding is used for the data reduction and display of the analysis (Miles *et al.*, 2013). It helps to make the collected data interpretable in the concrete analyses steps by reducing the exhaustive data set to a portfolio of standardised codes (Thomas, 2006; Silverman, 2013). The drawing of conclusions and relations is, therefore, possible (Miles *et al.*, 2013). It is important to use the same codes for the same content to ensure consistency of the whole data set (Saunders et al., 2015). Based on the exploratory character of the research, the author conducts a general inductive coding approach, which means that the codes are derived from the data itself (Thomas, 2006). However, a purely inductive approach would violate the efficiency and precision of the further analyses (Saunders et al., 2015). Therefore, the author uses the three lead questions of this dissertation to guide the coding (Thomas, 2006). Every derived code is labelled with the lead question. Hence, an overall categorization of all codes is conducted straight from the start. The tools of the coding are the basic Microsoft Office applications Excel and Word. These tools are sufficient since the coding only aims to structure and make the information from the transcribed interviews more accessible for the researcher (Osborg Ose, 2016). The transcripts of each interview are stored as a Word file, which makes it accessible to further readings and notes. The first step of the coding is to initially read the interviews and mark them with labels (Thomas, 2006). A blue mark for the lead question A, a yellow one for B and a green mark for C (see appendix I). This initial process helps to identify and structure relevant quotes and paragraphs aligned with the overall objectives of the research (Creswell, 2018). The single interview is now structured and curated. Based on the first segmentation, first codes are derived. The initial coding round is conducted “in vivo”, that means that the text passages are coded based on the data itself (Saunders et al., 2015). Hence, initial text passages are labelled (Creswell, 2018). These labelling codes are documented in a coding excel file to ensure consistency in the coding of all interviews (see appendix J). The coding template contains four dimensions that are aligned with the structure of Saunders et al.: *Code; Code Definition; Citations and Lead Question* (2015).

The first interview delivers the initial codes which are added, specified or changed with every new interview that is coded. As a second step, the “in vivo”-codes are reviewed and centred based on the underlying theories of the research. That means that codes are clustered and amended regarding the dimensions of the Innovator’s Dilemma, of the derived business model framework and the identified organisational conditions for the successful organisational exploration of a new business unit. Hence, “a priori”-codes are additionally developed (Saunders et al., 2015). This process results in a code portfolio that contains “a priori”-codes (codes based on the read literature

and the derived theoretical frameworks) and “in vivo”-codes (codes based on the data set). This process is conducted for all ten interviews and the secondary research source and leads to a portfolio of 100 codes. This shows that the triangulation of inductive and deductive research perspectives is integrated into the research process of coding. The last step of the coding process targets to reduce overlaps and redundancies among the codes (Creswell, 2018). Therefore, a refinement process of the excel file is conducted. Overlapping and redundant codes are deleted, merged and renamed so that the final portfolio contains 66 codes distributed among the three lead questions.

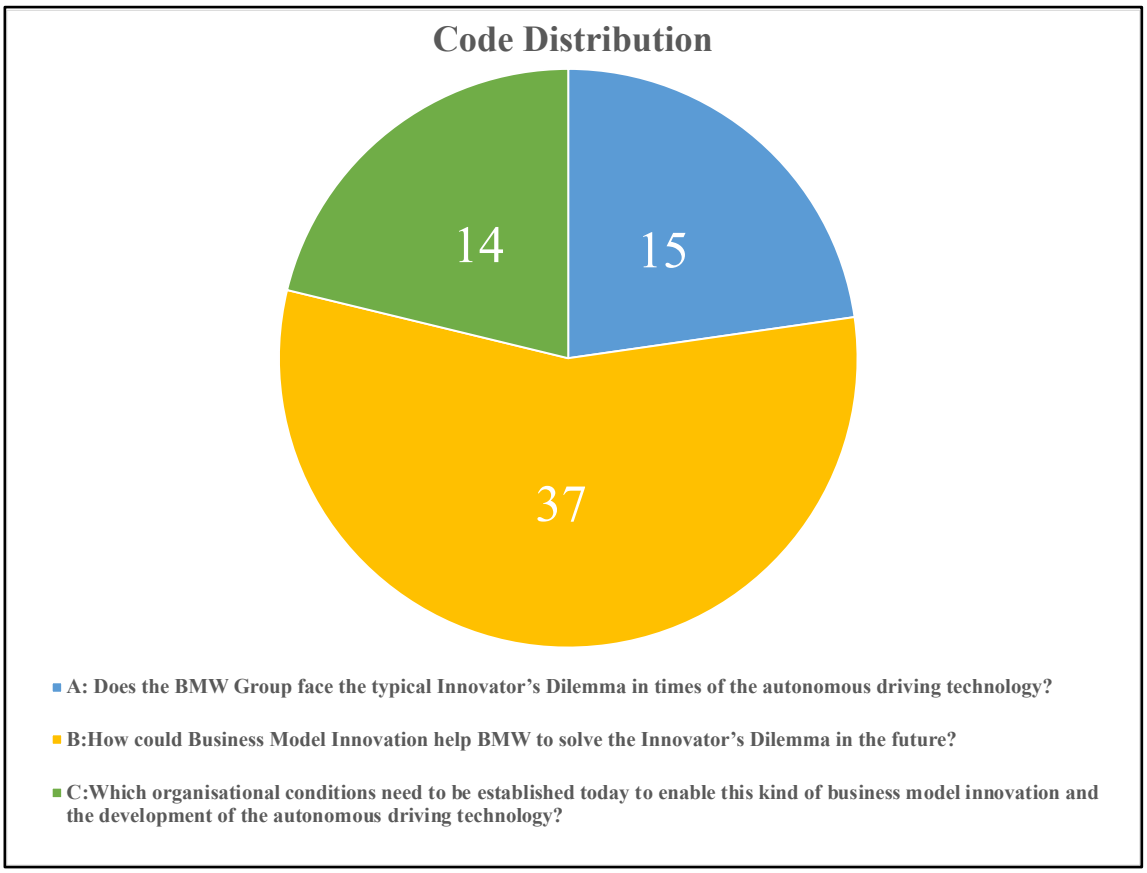

Figure 30- Code distribution of the research.

These codes are then used to derive themes, relations and patterns in the two-step analysis framework. The detailed process of the inductive and deductive thematic analysis is described in the following steps.

(2) *Inductive and deductive thematic analysis*

At this stage of the thematic analysis, all data have been coded and mapped in a coding template (see appendix J). The initial 66 codes are used to categorize them into broader sub-themes and topics (Braun and Clarke, 2006). A theme is defined as “a broad category incorporating several codes that appear to be related and which indicates an idea that is important to your research question” (Saunders *et al.*, 2015, p.584). It is the analysis of whether some combined codes are

capable of describing an overall theme related to the lead questions of the research (Braun and Clarke, 2006). The literature recommends to build up an initial visualization of the codes and firstly derived themes (Braun and Clarke, 2006; Saunders *et al.*, 2015). Therefore, the author establishes an initial ideation board on a digital whiteboard. The codes are mapped on digital post-its and clustered in different rows which indicate that the mapped codes in a single row stay in a relation. This initial code mapping is conducted with an inductive research lens. This means that no literature-based themes are integrated into the first step. This ensures that the author can identify additional themes and relations "bottom-up". Additional themes are identified from the data itself. An exemplary ideation board is shown in the appendix K. These initial themes and coded groups are then reviewed and amended so that they are ready for further analyses. Secondly, the convergent lens, represented by a deductive perspective on the theme rows, is executed. The author compares the inductively established themes with the literature-based ones and merges them to both perspectives containing a thematic map. The next step is to establish more sophisticated maps for each lead question so that a sufficient answer can be given. Braun and Clarke suppose that typical methods of mapping like mind maps should be used for sophisticated maps (2006). The author follows this recommendation and defines individual frameworks for each lead question section. For instance, the lead question A regarding BMW's Innovator's Dilemma in times of autonomous driving is answered by mapping the identified themes and codes in an Ishikawa-diagram, which describes the causes of an effect. Especially in the area of lead question B, many concepts from the literature review are useable as models. For instance, the value proposition canvas is used to map the theme value proposition and related codes.

(3) Final refinement of themes and relationships

This more sophisticated mapping is an iterative process, which enables the author to execute a refinement process of the relations and codes of each theme area. The literature proposes a dual criterion to evaluate whether the thematic maps have a high-level of sophistication: Internal homogeneity and external heterogeneity (Patton, 2014). This concept is similar to the management framework *MECE* (Mutually Exclusive and Collectively Exhaustive) (Minto, 2020). This means that the themes and related codes need to be homogeneous within themselves and, simultaneously, they should be distinguishable from the other theme blocks. These two criteria are the main focus of the final refinement of the themes and relationships of different codes and sub-themes. Redundant codes and sub-themes are identified and, hence, deleted or merged with related sub-themes or codes. This process is conducted iteratively for all derived models and frameworks. The results are MECE models that do not show any redundancies within the themes and sub-themes. In some cases of this iterative refinement, additional categories are identified and embedded in the overall model.

3.6 Conclusion

The design of this research is based on the author's pragmatic approach and the explorative purpose of the research. This implies that concepts, ideas and theories were only used if they help to derive practical consequences for the case study of BMW in the case setting of an autonomous driving future. The three related lead questions are answered in an explorative way. The case study is influenced by high uncertainty and, hence, requires a more flexible research design. The explorative purpose of this research is framed by two perspectives on theory development. The research combines inductive and deductive research lenses in one research design to achieve a combination of exploration of new insights from the data set and the exploitation of literature-based frameworks (e.g. theory-based business model framework). The dynamic and uncertain research setting leads the research towards a mono method qualitative research, which is based on a heterogeneous expert panel group. Semi-structured interviews with the experts are conducted which enable the required flexibility of the research. These interviews are the core source of data in the research strategy of a BMW case study. The object BMW gets set in a future case setting which reflects a future where cars achieve high levels of automation and the experts are used to find answers to the overall question of how BMW should react to the potentially disruptive future. The research wants to understand an object in a future scenario. This target leads to the impression that a case study is the most suitable strategy for this research purpose since the interaction between a phenomenon and its context can be best understood by a case study (Saunders et al., 2015). The case study has a cross-sectional time horizon since it wants to identify the opinions and ideas of multiple experts in a research time of 14-15 weeks.

To achieve sophisticated answers to the lead questions a panel group containing the most relevant stakeholders of BMW is established. It consists of consultants, employees, clients, suppliers, industry competitors and researchers. In sum, ten interviews from all these stakeholders are conducted and analysed by an inductive and deductive thematic analysis. The author familiarizes himself with the data by transcribing the interviews and making first notes about relevant content. The transcribed interviews are then coded in Excel by establishing a coding template. Codes are defined, relevant expert opinions are cited and, finally, the codes are mapped accordingly to the three lead questions. These codes are mapped in an inductive ideation board per lead question and first themes and sub-themes are identified. Typical analysis frameworks like Ishikawa diagrams or the value chain are used to map the codes and sub-themes in a logical and structured way. This helps to identify conflicts and relations between different codes and themes. These models containing the information from the interviews are iteratively refined, which lead to qualitative models according to the dual criterion framework of Patton. These validated models with the newly gained information are now used to describe and discuss possible answers to the lead questions in the coming chapter.

4 Presentation and Discussion of the Findings

4.1 Overview

Chapter three describes the author's path and believes of this research towards finding sophisticating answers to the three established lead questions. The thematic analysis framework helps to derive information from the raw data set sourced from semi-structured interviews. The following chapter develops knowledge from the information contained both in codes and frameworks. The derived knowledge reflects the experts' voices presented in chapter 3.4. The analysis uses direct quotations from the expert interviews to ensure that the voice of the expert panel is adequately reflected. In this context, the background of the expert needs to be considered as well. Table 2 is, hence, used to structure the citation and to guide the contextual summary of the single voices. Since all interviews have been executed in German, all direct quotations are translated to English without any changes by the author.

The following chapters outline three main outcomes:

(A) Does the BMW Group face the typical Innovator's Dilemma in regard of autonomous driving technology?

(B) How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?

(C) Which organisational conditions need to be established today to enable this kind of Business Model Innovation and the development of the autonomous driving technology?

These desired outcomes are directly reflected in the chapter structure of the findings chapters. Chapter 4.2 starts the discussion by finding an answer to the question of whether autonomous driving is such a disruptive technology that it could drive BMW into the typical Innovator's Dilemma. Chapter 4.3 describes the dimension to which extent autonomous driving requires business model innovation from BMW and outlines to which extent the new rising technology urges BMW to innovate on the business model level. The last chapter deals with the question which organisational conditions are critical to initialize successful business model innovation initiatives for BMW today to enable the long-term viability also in times of level 5 autonomous driving. It will be outlined what innovation processes and initiatives BMW has today and how appropriate they are compared to the opinions of the experts. Additionally, other conditions in multiple levels of a company system, derived from the experts' voice, are discussed.

This three-step discussion framework helps to finally assess the impact of autonomous driving on BMW and its long-term viability.

4.2 The Innovator's Dilemma of BMW in the future

The reviewed literature divides the Innovator's Dilemma into three interrelated areas to assess the external change by technology: Technology Push, Market Pull and the internal focus of an incumbent organisation on the current customers and value chain. The literature indicates that the current market and technology signals validate the urgency of assessing whether BMW faces the Innovator's Dilemma. This is exactly what the following paragraphs outline. The qualitative research in this first field wants to identify causes which might lead to the effect of BMW facing disruption in the long run. Hence, the Innovator's Dilemma of BMW is seen as a symptom in the future which is based on underlying causes triggering the dilemma. These causes are discussed based on the voice of the interviewed experts so that a final answer to the above-described lead question A can be given. To structure the findings logically, the typical cause & effect framework of the Ishikawa-Diagram is applied for this discussion. It is one of the most practical frameworks to identify the causes of an observed problem (Kerzner, 2017).

4.2.1 The technology push by high-end autonomous driving

The first discussion section of this lead question deals with the paradigm of a possible technology push by autonomous driving. The literature identifies that the technological progress of related technologies like V2X connectivity and sensor or Lidar components are developing at a rapid pace (Winkelhake, 2017). This fast progress of components of the holistic autonomous driving system could indicate a strong technology push that could commoditize former premium aspects of a car: Driving dynamics, comfort and security (Winkelhake, 2017).

(1) High technological complexity and incremental development of autonomous driving

Some experts do not see a clear disruption from a technological perspective. Firstly, a sales & marketing director of a sensor supplier of BMW argues that the autonomous driving will definitely follow an incremental development and that BMW follows this path successfully by researching on a Level 4 vehicle[1]. A product management employee of BMW agrees with this assumption. The disruptive pace of the technology is low since the infrastructure preparation will take time: "These regions also have the infrastructure for this and are equipped accordingly, but I dare to doubt that this will achieve a high disruptive speed globally" (Participant 3, 06.03.20, p.3, line 23-26). He also says that the urban regions might be faster with a roll-out but an area-wide launch with a massive disruptive impact on BMW will not be observable. This is the first argument that disagrees with the literature-based technology push towards an Innovator's Dilemma of BMW. Other expert voices support this argument. They argue that level 5

[1] "This is an incremental development that automakers like BMW will clearly survive. BMW is currently working on a vehicle that can drive at level 4", Participant 2, 26.02.20, p.2, line 9-11.

autonomous driving is a very complex, highly expensive and time-consuming technology. One consultant from a global German bank argues that the complexity of autonomous driving was underestimated a few years ago[2]. Many firms are now disillusioned and argue that the feasibility of Level 4 or 5 vehicles is highly questionable (Mark Kuhn, 25.02.20, p.2, line 7-9). An employee of BMW even argues that it is completely uncertain if door to door autonomous driving can be achieved in the future. All competitors of BMW and the company itself is far away from a technological solution to the complexity of the system (Participant 6, 13.03.20, p.2, line 11-17). He further describes that many officially presented prototype cars are more a marketing tool than a real working autopilot (Participant 6, 13.03.20, p.2, line 11-17). However, Dr. Christoph Steiger, senior partner at the management consulting firm Roland Berger for digital transformation projects, acknowledges the complexity of the development and the currently non-existent infrastructure. In contrast to the other experts, he sees autonomous driving as an absolute revolution for incumbent OEMs like BMW. Hence, he categorizes the high-level automation of vehicles as disruptive and game-changing for BMW[3]. This statement leads the discussion to the voices of the experts who argue that autonomous driving will trigger a significant technology push affecting BMW.

(2) Autonomous driving as a disruptive technology

Based on the argument that the development is complex, further experts like Participant 7 argues that it is not the question of whether the level 5 autonomous driving will be reached, but when it is reached[4]. Participant 7 is a marketing manager of another leading German OEM partly located in BMW's peer group of premium OEMs. He is responsible for new projects & strategies of the OEM. Hence, he is urged to take a long-run perspective on the automotive industry. One of his colleagues agrees with him on the assumption that it will affect BMW and his company[5]. Again, Christoph Steiger summarizes it as: "(…) it will come" (09.04.20, p.1, line 16). He agrees with the fact that for sure high-end autonomous driving, door to door, will be achieved in the future.

Concretely, many voices of experts agree with the fact that Level 5 stage, indeed, will trigger a technological disruption push. "In absolute terms, autonomous driving has great potential. It is, of course, a huge lever in the transformation of the automobile" (Nicolas Kesselmeier, 12.03.20, p.2, line 17-18). Nicolas Kesselmeier, as a representative of the supplier Hella, sees the autonomous driving as a key element of the automotive industry since the technology has

[2] "The complexity of the topic was overly optimistically assessed a few years ago", Participant 4, 12.03.2020, p.5, line 25-26.
[3] "I believe it is an absolute revolution and the reason why it is not progressing so fast and we do not yet have hundreds of thousands or millions of self-driving vehicles on the roads is simply due to the complexity of the technology and infrastructure needed", Christoph Steiger, 09.04.20, p.1, line 11-15.
[4] "AK: So, it's rather a matter of time. That means it is rather a question of when it comes and not if it comes. T7: Exactly", Participant 7, 26.03.20, p.3, line 9-11.
[5] "Nonetheless, it will affect them, too. I am quite sure of that" (Participant 8, 01.04.20, p.4, line 1-2)

enormous potential for all aspects of today's mobility issues like sustainability or security of driving. Even experts like Prof. Dr. Mark Kuhn, who has outlined the technological complexity, confirm that the technology changes the game of today's mobility[6]. A BMW employee agrees with this point. He bases the argument of a technological push on the fact that new use cases for customers will be enabled. Concretely, the V2X communication, especially the one towards content and service suppliers like Amazon, Spotify or Netflix, is a technological aspect that will establish the perception of a future car as a mobile device[7]. Other experts argue that the technological push will reinforce new mobility concepts like car-sharing and the loss of a car as a property. Participant 8, an employee from a leading German OEM in the new projects & strategy department, defines it in the following way: "One is, in my estimation disruptive, the area of sharing in which Google Waymo is also on the move. And of course, highly automated driving or autonomous driving creates the new business potential that the topic of sharing today, this kind of ride-hailing, cannot yet serve" (01.04.20, p.1, line 11-16). His manager sees this shift in mobility through the technology push as a real revolution since it enables completely new competitors with other technological capabilities to enter the individual mobility market[8]. The experts from the competitor panel group agree with the fact that the technology itself will trigger disruption for BMW and other premium OEMs: "In any case, I consider the technology to be disruptive. You can also see this in new players entering the market" (Participant 8, 01.04.20, p.2, line 1-3). Participant 7 even argues that autonomous driving and not the other big topic of electrified mobility will have a disruptive effect on the whole industry[9]. Also, the consultant panel group sees this trend. Dr. Christoph Steiger sees a shift in the perception of a car and the correlating technological developments. Cars will be differently used[10]. Participant 4, who outlines that autonomous driving can today be seen as a hype, agrees that if level 5 is achieved then disruptive shifts will take place in the automotive industry[11]. As a conclusion, Participant 7

[6] "Autonomous Driving, should it be ready for the market, certainly has a disruptive character, because it simply makes the most diverse business models possible, see also the activities that Uber has been promoting for a long time with the clear objective of leading drivers ad absurdum", Mark Kuhn, 25.02.20, p.1-2, line 22 p.1 - line 3 p.2.

[7] "(...), it is, of course, a tremendous impact, because firstly: What is the customer doing in the time when he doesn't have to steer the car at all? Of course, in the form of how do I entertain the customer while he is sitting in the car? That's why Amazon and Google are of course keen on the interface to the car, because if I now say I'm going from here to Hamburg with my car, then I have 8 hours to consume Netflix, buy things and be sprinkled by Amazon" (Participant 6, 13.03.20, p.2-3, line 21 p.2 - line 3 p.3).

[8] "This is quite a revolution, where new players have good chances to enter the market", Participant 7, 26.03.20, p.1, line 21-23.

[9] "But the real disruption or revolution will only come through autonomous driving. (...)", Participant 7, 26.03.20, p.1, line 17-18.

[10] "And when you talk about the disruptive potential, I think it's extremely large. It will completely change the automobile industry and the way we use cars will change completely", Christoph Steiger, 09.04.20, p.1-2, line 22 p.1 - line 2 p.2.

[11] "So, if level 5 is given, then I will have certain disruptive movements in mobility and to that extent it may well imply disruptive changes in the OEM's business model" (Participant 4, 12.03.2020, p.3, line 6-9).

confirms that the technology push by autonomous driving should definitively be on today's strategic agenda of OEMs like BMW[12].

In summary, the degree of the technology push by autonomous driving has the potential to trigger disruption for BMW. As the literature describes, the new technology will change the perception of cars. Former premium aspects will be commoditized and, additionally, new perceptions of individual mobility will arise. Shared concepts without the notion of a car as the property will grow. Premium aspects like security and comfort might be commoditized through autonomous driving. However, the disruptive shift from the technology perspective is lowered by the fact that the technology requires enormous efforts in terms of time and investment. This fact makes it uncertain when real automation levels of vehicles will be achieved. Hence, the analysis shows that Level 5 will represent a disruptive technology push for BMW. The only open question is when this level will be reached. As the experts outline, the answer to this question relies on the progress of the infrastructure and relevant components of the holistic autonomous driving system (see the AI Autonomous Vehicles Framework in figure 7). The following figure summarizes the arguments of the experts in terms of a technology push affecting BMW:

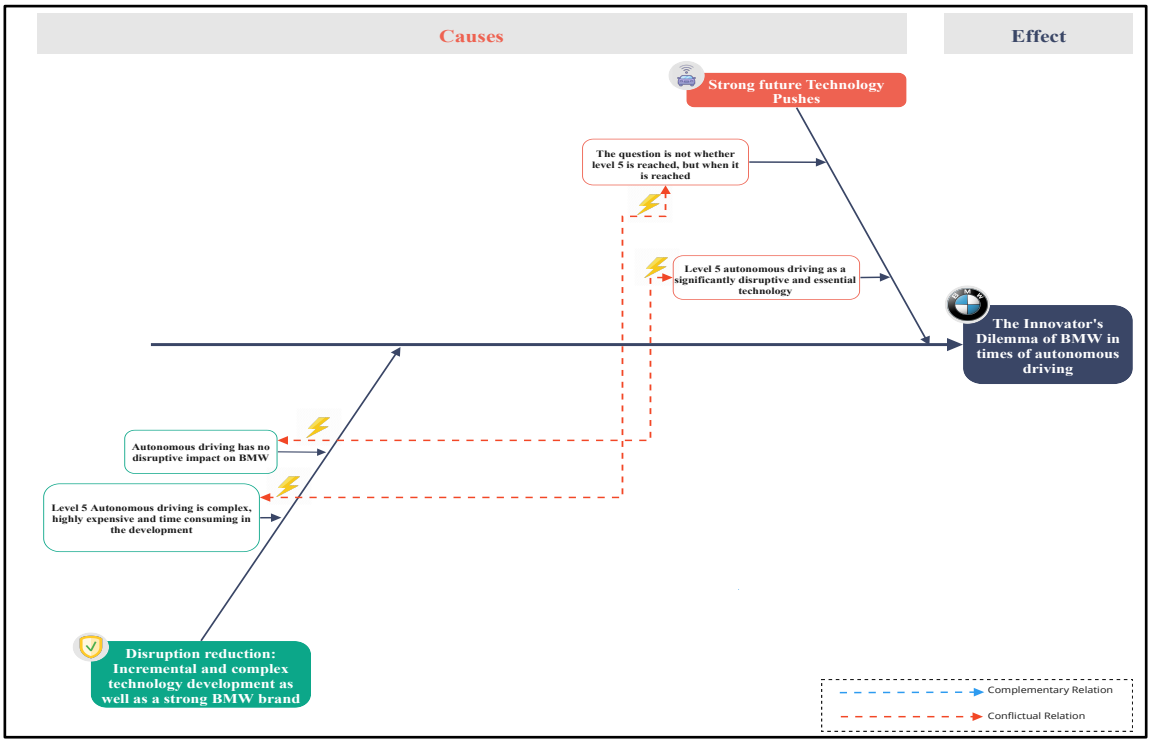

Figure 31 - The technology push by autonomous driving.

Many experts already outline that the technology push is directly interlinked with a shift in the market structure of the automotive industry. Exemplary for many other experts, Participant 7

[12] "AK: Yes... so it should definitely be a big item on today's strategic agenda, if I understood you correctly. T7: In my opinion, yes!" (Participant 7, 26.03.20, p.2, line 6-8).

summarizes it as: “This is already a revolution, where new players have good chances to enter the market” (Participant 7, 26.03.20, p.1, line 21-23). The introduced aspect market pull by new competitors of Christensen’s Innovator’s Dilemma in the context of autonomous driving will be discussed in the following section.

4.2.2 Market pull affecting BMW’s leading market position

The second dimension of the Innovator’s Dilemma is the market pull. It gets analysed to what extent the market structures change. The literature proposes that mainly customers and competitors are the source of market pulls (Kavadias *et al.*, 2019). In the context of autonomous driving’s impact on BMW, two key market pull sources are identified: Rising customer preference of self-driving cars and new competitors which challenge today’s structure of individual mobility (Winkler *et al.*, 2019; Unsted, 2019; Iyer and Alton, 2019). The following analysis of the expert’s voices targets to verify these dimensions and to identify further aspects of a possible market pull enabled by high levels of autonomous driving.

(1) New competitors in the automotive landscape

The first aspect that many experts confirm is that completely new competitors will have a chance to enter a formerly well-protected industry. Many experts argue that Tech-companies like Facebook, Google or Apple have competencies in more relevant fields than BMW. Especially the competence to collect, analyse and monetize data is a competitive advantage of these firms in the future[13]. In comparison, Participant 7 describes that this data management capability is not established in German premium OEMs: “An example, which may be a little shocking for you. We don't know today how the customer really uses his car. Tesla tracks this every time they use their car, collecting data every day and knowing how customers use their cars. We only know this from primary market research” (26.03.20, p.11, line 13-17).

Another aspect of these firms is their existing platform structures with a significant number of users worldwide. Especially Apple and Google are mentioned as potential platform providers for an interior of a car: “This is of course for Google and Apple interesting to offer another business model in cars like this. These are the operating systems on which the apps could run in the future” (Participant 3, 06.03.20, p.6, line 21-23). These firms will focus on the software, service and content area of a self-driving value chain. Participant 8 argues that new companies like Google Waymo will focus its value creation on software and autonomous driving hardware[14]. However,

[13] “The external players like Google, Facebook, like an Amazon have collected a lot of data and have profiles of us. They have completely different possibilities”, Participant 4, 12.03.20, p.6, line 19-22.
[14] “(...) when you see what Waymo is doing today, it's not to develop their own car, I've read several interviews about this and I don't think they will do that in the foreseeable future, but they rather build software and the appropriate technology, the AD hardware like Lidar, and integrate it”, Participant 8, 01.04.20, p.8, line 12-19.

Participant 7 says that these dimensions will be the new value drivers in the automotive market: “And if you give the software out of your hands and let others do it, like Google with Waymo, I believe that you won't stand a chance with anything but hardware” (26.03.20, p.5, line 7-10).

Another new challenger of BMW, even today, is Tesla. Participant 4 describes Tesla as a “leading” company in the new future relevant fields of software, service and data[15]. Dr. Christoph Steiger confirms the better future aligned competencies of Tesla: “They are incredibly good at orchestrating an ecosystem and building a vehicle architecture that is data-driven because they have a very good software architecture and they are leading in this respect. So now in terms of software, data and services. And this is the competence of the future” (Christoph Steiger, 09.04.20, p.14, line 6-12). The quote shows that Tesla is in a technology-leading position in relevant dimensions: Service, software and data. This perception is also confirmed by the interviewed target customer. He describes that Tesla has such a convenient software architecture that it drives value for the customer: “The best thing about Tesla is that many functions can simply be purchased via upgrades, which are then installed over the air, and this gives Tesla a unique selling point (...)” (Thomas Appel, 03.04.20, p.1, line 11-13).

It can be summarized that different aspects of the future value drivers (see chapter 2.2.2) software, service, content and data will be attacked by new competitors from the tech-sector and players like Tesla. The market pull from this site is confirmed by the experts.

However, Dr. Christoph Steiger describes another new source of competition: Today highly relevant suppliers like Bosch or Continental are developing competencies in the field of software and data, which are the key enablers for all other value parts[16]. Dr. Christoph Steiger describes that a strategic alliance of different suppliers even achieved the ability to build the hardware on their own. “The critical thing about it is that the hardware component is now suddenly no longer with the OEM. It is now with the suppliers and perhaps BMW is driven by the suppliers, who have become stronger and stronger” (Christoph Steiger, 09.04.20, p.13, line 10-13). This hypothesis is directly linked to loss of relevance by the hardware creation (described in the following paragraphs). Furthermore, he argues that few suppliers got bigger and more relevant for OEMs. Today, suppliers like Bosch are not component but total system suppliers. This implies that these suppliers have competencies in all relevant aspects of a future self-driving car[17].

[15] “It must be said quite clearly that a Tesla is much further along than the German OEMs. That means offering services that are constantly updated”, Participant 4, 12.03.20, p.9, line 23-26.
[16] “And if you give the software out of your hands and let others do it, like Google with Waymo, I believe that you won't stand a chance with anything but hardware", Participant 7, 26.03.20, p.5, line 7-10.
[17] “They have become real system suppliers and have naturally built up more turnover, more size and more added value in the chain and are now ready to deliver the hardware. Perhaps the answer to question 1 or 2, which we had in the front, does not come from BMW but is answered by the suppliers”, Christoph Steiger, 09.04.20, p.13, line 15-20.

Additionally, Prof. Dr. Mark Kuhn describes that Bosch is strongly building up artificial intelligence-related competencies and organisational structures[18].

Although only Dr. Christoph Steiger mentions this source of competitive market pull, it fits the above-described shift by tech-firms: A more aligned set of competencies in new relevant fields of an autonomous driving vehicle change the rules of the market. New players are capable of producing cars on their own or to occupy decisive customer interfaces as Apple or Google would do with their platform. A strong market pull from new competitors can, hence, be expected by BMW.

(2) The decreasing demand for premium vehicles

The next identified dimension of market pull for BMW is the expected decrease in demand for premium vehicles. In sum, 30% of the panel sees this trend arising on the autonomous driving horizon. Dr. Christoph Steiger expects that "the premium segment will become smaller (…) due to autonomous driving" (Christoph Steiger, 09.04.20, p.7, line 15-17). He argues that only a small group of people can afford to have a completely self-driving car in a garage. Prof. Dr. Mark Kuhn gives the first hint towards chapter 4.3: "At the same time, they are of course strategically trying to find new concepts, which makes sense if motorized individual traffic decreases" (Mark Kuhn, 25.02.20, p.7, line 19-21). The market pull of decreasing demand by future individual mobility customers will urge OEMs to rethink their business model. The opinion of the experts fit the research of Winkler et al. The study finds out that 50% of today's customers have a preference of self-driving mobility solutions (Winkler *et al.*, 2019).

This assumption combined with the new competition of companies with more aligned competencies leads the analysis to the next aspect of market pulls. It is about the possible loss of BMW's relevance in the future. The first paradigm is the fact that BMW is partly perceived today as a technology follower. Starting again with the outside-in perspective of Prof. Dr. Mark Kuhn and Participant 4, it becomes clear that BMW is not the innovative company anymore compared to former days (Mark Kuhn, 25.02.20, p.1, line 20-22; Participant 4, 12.03.20, p.15, line 11-12). The interviewed target customer Thomas Appel explains his decision against BMW and for Tesla with the fact that Tesla is for him more innovative than BMW, especially in terms of software convenience and electric mobility[19]. This, again, emphasizes the market signal that new competitors will challenge today's leading position of BMW. Even the product manager of BMW, Participant 3, doubts that BMW can defend its position in the future: "There will always be a

[18] "Added to this is the AI or artificial intelligence. The CEO of Bosch has just announced in a huge offensive that this is exactly what is about to happen at Bosch", Mark Kuhn, 26.02.20, p.8, line 25-27.
[19] "AK: For you, was Tesla more innovative as a brand compared to German brands like BMW? TA: Yes exactly", Thomas Appel, 06.04.20, p.1, line 19-21.

justification for car manufacturers, but I believe that BMW has to make a great effort to remain relevant" (Participant 3, 06.03.20, p.15, line 5-8).

Another aspect of BMW's loss of relevance is the above shortly mentioned fact that the value of hardware creation will significantly decrease. Participant 7 argues that the car itself is becoming more and more commoditized: "The car around it, that may be a minor matter. The technology is really in the foreground (…)" (26.03.20, p.2, line 2-3). His colleague, participant 8, concretely confirms this commoditization process of exterior and driving behaviour[20]. Hence, the risk of commoditization of former highly valuable product aspects by disruptive innovation is confirmed by the panel (Christensen and Raynor, 2013). Dr. Christoph Steiger gives a concrete example: Perfect gap dimensions are today a part of BMW's differentiation source. From his perspective, this will not be the case in an autonomous driving future[21].

In summary, the former key differentiation factor of BMW, the perfectly designed and powerful hardware, will significantly lose relevance and might be commoditized by Level 5 self-driving cars. Participant 7 adds another dimension to this hardware loss. He argues that BMW's highly appreciated brand will also forfeit relevance since the brand and the hardware creation is directly interlinked from the customer perspective[22]. If one compares the claim of BMW "the ultimate driving machine" (BMW, 2019) with that then it seems obvious that the premium brand BMW might lose relevance if the driving engine itself gets commoditized in an autonomous driving future.

However, this point is seen as controversial since other experts see the brand value of BMW as a protection against the disruption. Participant 8 argues that this high brand value of BMW protects them against this market pull related commoditization of hardware. He argues that the buying decision of customers will stay irrational and that brands like BMW are in advantage compared to volume producers like Opel: "It's the same now, if I have a 1-series BMW and compare it with an Opel Astra now on sale, then the Opel would probably be more affected after all. A premium brand has an advantage and simply the reasons for buying, which are not purely rational with premium brands, they are not rational with volume brands either, but they are less rational in proportion" (Participant 8, 01.04.20, p.3, line 16-21). This positive customer perception of BMW

[20] "(…), then it is less the hardware, at least topics such as exterior and driving behaviour, these are more likely to be unified, that is, they will be much more homogeneous in the offer. One could almost say that it becomes a commodity", Participant 8, 01.04.20, p.8-9, line 26 p.8 - line 4 p.9.
[21] Whether the sheet metal, the vehicle, has a gap dimension, what is over-precise and fits the millimetre, I don't think anyone will be interested in the future", Christoph Steiger, 09.04.20, p.8-9, line 26 p.8 - line 1 p.9.
[22] "I think it is totally important because I a) think that if this technology works, and not in limited spaces, but that it is possible to drive autonomously all over the country, even if it is only level 4 good on the highway, then I think that brand loyalty is not given in the long run (…)", Participant 7, 26.03.20, p.2, line 17-23.

is confirmed by the second limitating argument: German premium brands like BMW, Audi or Porsche are more trusted in terms of security and reliability. Thomas Appel emphasizes that, for him, these brands and Tesla have an advance of customer confidence[23]. This brand factor might also protect BMW against new car producers established by suppliers or firms like Google. The research of the Capgemini Research Institute confirms this impression[24].

Based on this research, it can be said that BMW will face a strong market pull triggered by Level 5 autonomous driving. The decreasing demand for premium cars and, simultaneously, new competitors entering different aspects of the future value chain of BMW (software, service, content, data, hardware) are emphasized by many experts. Additionally, BMW is even today partly perceived as a technology follower by the interviewed experts. The autonomous driving changes how valuable the hardware creation, the core differentiation source of BMW, is in the future. Hardware will still be a part of the value chain, but it is not the most valued part of the car anymore. The last aspect of BMW's loss of brand relevance is indecisively discussed by the panel. Participant 7 argues that brand loyalty will decrease while Participant 8 outlines that the premium brand position might protect BMW. This position is underpinned by the statement of Thomas Appel that he would trust premium brands like BMW or Tesla more than any other companies. The research of Winkler et al. confirms that. Finally, it can be said that the change of customer preferences and new competitors trigger a strong market pull, but BMW might have the advantage that its brand is highly valued in the market and, therefore, the market pull of disruption is lower for BMW than for other volume producer brands. BMW's brand is well established over the years with the attributes of quality, security, and sportiness. Hence, customers trust brands like BMW more than other car manufacturers or new players. The following figure summarizes the additionally gained insights in terms of market pull and technology push:

[23] "I would put more trust in German brands and Tesla" (Thomas Appel, 06.04.20, p.4, line 3-6).
[24] "Consumers trust automotive OEMs over new start-ups when it comes to these vehicles (...)", Winkler et al., 2019, p.3.

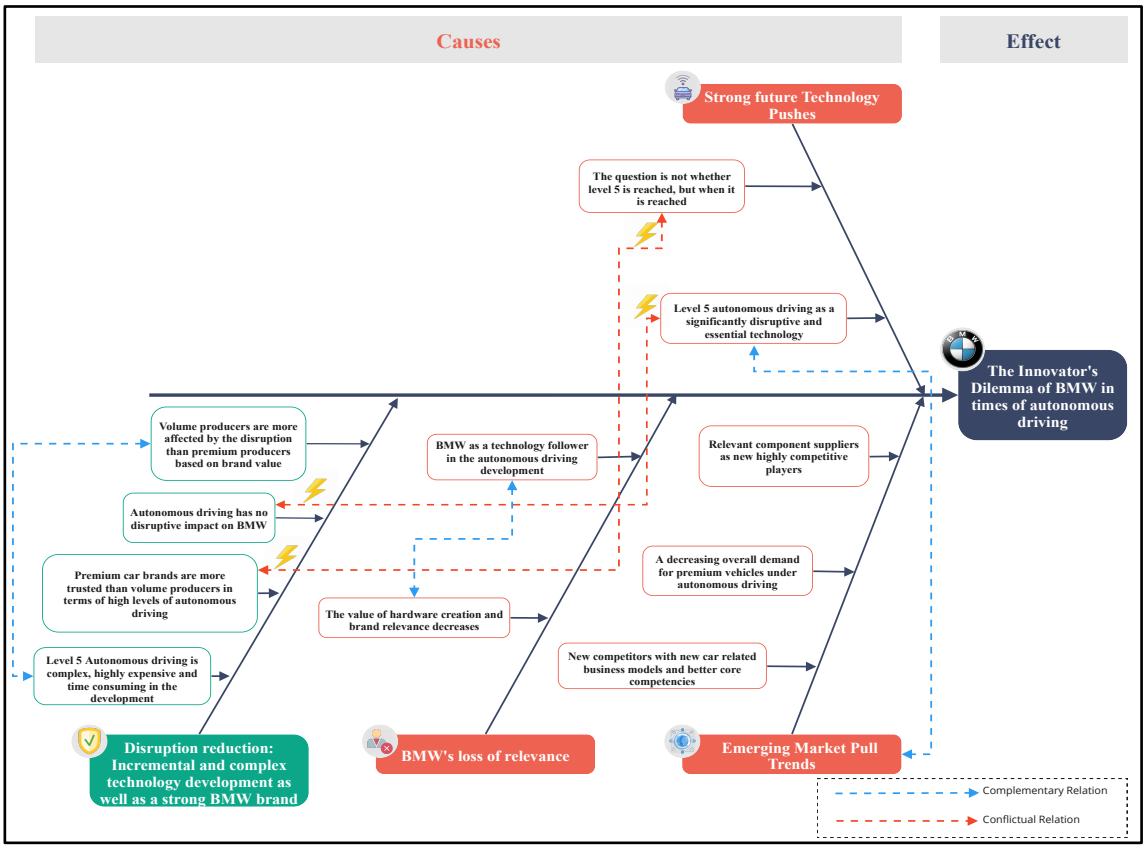

Figure 32 - The technology push and market pull by autonomous driving.

4.2.3 Internal causes of BMW's future Innovator's Dilemma

The last key dimension of Christensen's Innovator's Dilemma is the internal structure and management of a company. As the following paragraphs will show, BMW has internal aspects that might even strengthen the technology push and market pull towards a future disruption by autonomous driving.

Based on the interviewed experts it can be said that the literature-based assumption that internal misaligned structures and beliefs are also a significant reason for great firms facing disruption caused by new technology. Two main categories are identified: Misaligned management beliefs and misaligned organisational capabilities.

(1) BMW's misaligned management beliefs

Experts from the panel groups researchers, suppliers and competitors confirm Christensen's assumption that short-term oriented result expectations enhance the risk of facing disruption in a new technology landscape[25]. Participant 2, with a long experience in the automotive industry, states that this focus on short-term results has developed itself within the last ten years. Furthermore, the positioning of BMW in the media became a focus topic of the new generations

[25] "AK: Short-term profit expectations can be diametrically opposed to long-term developments. MK: Exactly", Mark Kuhn, 25.02.20, p.16-17, line 26 p.16 - line 1 p.17.

of senior management[26]. This focus on public positioning is also identified by Nicolas Kesselmeier, a digital transformation consultant at Hella. He argues that many new mobility concepts from BMW or other OEMs are more advertising and public relation tools and not a committed vision that car producers follow (Nicolas Kesselmeier, 12.03.20, p.16-17, line 21 p.16 - line 1 p.17). He outlines that the short-term interests are currently the focus of the senior management which directly lead to an organisational focus on exploiting the current business model for high margins in the short run. Participant 7 confirms this statement: All OEMs present concept cars, but at the end, every OEM senior management wants to produce and sell big-sized cars with a high contribution margin to fulfil their short-term, share price related contracts[27]. This shows that Christensen's cause of focusing on short-term earnings is confirmed for BMW's case. No expert has the impression that the senior management wants to explore future markets and, on the contrary, focus on exploiting BMW's contribution margins to fulfil the short-term earnings expectations of investors. This observation enhances the potential disruption by autonomous driving since it requires a long-term plan by the senior management. This short-term focus is directly interlinked with the expert's impression that BMW is today only a technology follower and not an automotive pioneer. The short-term focus results in less commitment to long-term technology developments that might lead to a competitive advantage in the long run. This effect is today observable in the electric mobility and will be, according to the experts, even worse in a future of self-driving cars. As Participant 7 claims: "But the real disruption or revolution will only come through autonomous driving. (...)" (26.03.20, p.1, line 17-18).

The second argument, which is directly related to the first one, is the observation by the experts that BMW shows a significant lack of willingness to build up the new valuable competencies. They also do not consider any new business model innovation in the future. Prof. Dr. Mark Kuhn emphasizes this dimension with an example from today's world. BMW is not willing to build up competencies in the battery development for electric vehicles although it might be a significant driver of value in future engine design[28]. Participant 3 states: "We focus on our core business and that is building cars. And that's why initiatives like DriveNow and ShareNow have all been reduced a bit. That's why I also believe that additional business models are being explored by a few departments, but they are not a focus topic in the next few years" (Participant 3, 06.03.20,

[26] "That is much more the case today than it was in the past. In the former days, nobody attached much importance to the share price. Today, however, it is all about short-term profit distributions and being well positioned in the market and the media is 10 times more important today than it was 10 years ago", Participant 2, 26.02.20, p.18, line 20-25.

[27] "You put a few concept cars out there and dream of some great world. But de facto everybody wants to sell SUVs as big as possible with many cylinders and a high contribution margin within the next month, but nobody thinks really far into the day after tomorrow. They can't do that at all, because the board members have limited contracts and have to look at the share price", Participant 7, 26.03.20, p.13, line 4-9.

[28] "In this respect, it can of course be argued that OEMs need to build up competencies in other areas. However, the example of the battery shows that nobody really wants to do that", Mark Kuhn, 25.02.20, p.11, line 6-9.

p.11, line 1-6). The statement shows the lack of willingness to rethink current competencies and business models. BMW wants to focus on the development of excellent hardware and sell them for premium prices. This internal impression is confirmed by experts from a competitor. Both experts argue that many managers and employees do not see the urgency to rethink current beliefs and competencies of an OEM[29]. Participant 8 sees the necessity to transform business model structures and redefine which core competencies a future OEM should have. However, he sees difficulties in the execution of the transformation. The mainstream still sees the traditional business model as the one that is capable of managing long-term changes (Participant 8, 01.04.20, p.11, line 25-26).

The explanation of the experts, why this lack of willingness exists, fits the first argument of focusing on short-term success. "The entire global premium segment has developed better and better and is generating attractive returns" (Participant 4, 12.03.2020, p.1, line 15-16). Hence, BMW is today one of the most successful OEMs worldwide and can earn high margins per car. This short-term success negatively affects the willingness to rethink the general role of BMW in the future. The decision-makers cannot see why the cannibalization of existing structures and competencies is required since the short-term success of exactly this set-up is enormous[30]. However, Participant 8 outlines the necessity to build up new business models and competencies: "This, of course, is a completely different corporate spirit and orientation, and what I learn again and again from the internal votes when it comes to such topics is that many of us shrink back a little bit" (01.04.20, p.15-16, line 28 p.15 - line 4 p.16). The experts from the industry show that not only BMW lacks the willingness to redesign and rebuild competencies and the business model but also other German OEMs. As the analysis shows in chapter 4.2.1 high-end autonomous driving changes the perception of individual mobility and the role of OEMs in the value creation process. A gap between BMW's orientation today and the perception of the expert panel is observable.

(2) BMW's misaligned organisational capabilities

The next dimension of internal causes for BMW's Innovator's Dilemma are misaligned organisational capabilities. The first dimension in this category deals with Chandy and Tellis' argument that specialized competencies and investments negatively impact the willingness to cannibalize the current state. The experts argue that BMW's specialized competencies, assets and structures today are not aligned with a technological landscape of autonomous driving. Dr.

[29] "I think the mainstream in my company is far from ready. There are forces working in that direction, but the mainstream is still in the traditional business: we build cars and we sell them. Next year we will build a few more cars, hopefully", Participant 7, 26.03.20, p.10, line 8-12.
[30] "As things stand today and with the exception of the Corona crisis, we are a very successful company and people are asking themselves: Why should we act so disruptively?", Participant 8, 01.04.20, p.16, line 4-7.

Christoph Steiger and Participant 3 identify two core competencies of BMW, which today help them to be perceived as one of the most successful car producers worldwide: A highly efficient production network and the perfectionist hardware construction (Christoph Steiger, 09.04.20, p.9, line 6-8; Participant 3, 06.03.20, p.7, line 15-16). However, Dr. Steiger argues that these core competencies will not be the key differentiation factors in an autonomous driving future[31]. Furthermore, he outlines that BMW needs to build up competencies in the area of software development concerning autonomous driving (e.g. development of deep learning applications for autonomous decision making or the sensor data processing)[32].

Participant 3 adds that BMW has such specialized and hierarchical structures which are not ready for significant changes in the technological environment (06.03.20, p.14, line 20-22). He links this to the formerly discussed lack of willingness to change competencies. Many managers do not see the urgency to cannibalize currently successful structures and competencies. However, Participant 8 even argues that this shift in competencies is a significant challenge for all German OEMs[33]. Prof. Dr. Mark Kuhn confirms this issue of specialized employee skills (25.02.20, p.9, line 19-21). This shows that the issue of focused assets, structures and competencies is observable. Even today, OEMs have problems with their software development and this problem will increase when fully automated driving is achieved by competitors. Today's car production requires excellent engineering know-how. However, this competence is less required in a time where the software will steer the car and the car is increasingly perceived as a driving mobile device. This conflict between the two worlds of engineering and software development is also embedded in the last argument regarding BMW's misaligned organisational capabilities.

"When you see how vehicles were developed, it was very linear. It took a very long time. It took 5 years to develop a vehicle. That was reduced to 30-36 months in the early 2000s. But still very linear. In the future, you have to be able to develop further in the vehicle" (Christoph Steiger, 09.04.20, p.10, line 17-20). He describes the engineering culture of BMW. A car needs to be 120% ready when it is launched on the market. This requires a detailed and lasting development process. Participant 4 outlines the discrepancy between this linear development process and modern approaches from today's leading companies like Apple with an example: "The answer was honest: We had a meeting with Apple and 1 1⁄2 weeks later they came up with the first

[31] "So, bending sheet metal was presented as an absolute core competence and differentiating feature. And this is still held in such high esteem in many parts of the company today. I personally believe that this will no longer be the case in the future", Christoph Steiger, 09.04.20, p.9, line 6-8.
[32] "In reality, I think it's going to be difficult. And in the software field, there is a lack of competence. It will also be difficult in the area of data. Who owns the data? Who owns driver and vehicle data? Who owns journey data? Nowadays, the OEM claims that it is virtually his data sovereignty. But this will change in the future", Christoph Steiger, 09.04.20, p.4-5, line 26 p.4 - line 3 p.5.
[33] "With today's employee structure, with its core competencies and current collaboration model, this is a very big challenge", Participant 8, 01.04.20, p.17, line 16-18.

solutions. At that point we hadn't even written the visit note, we hadn't even notified our next hierarchy level. Apple was already able to provide ideas for problem solutions" (Participant 4, 12.03.20, p.14, line 20-25). These tech firms can develop a well-functioning solution in a fraction of the time required by BMW. Participant 2 describes this as a key risk: "If you are too slow, then you have completely missed the market and are far too late with the renewal. So, you have to be fast" (Participant 2, 26.02.20, line 11-13). These long and linear innovation processes are also interrelated with the argument that BMW is even today perceived as a technology follower. Companies like Tesla are faster and more agile in terms of updating the car. The car of Tesla is always further developed by Over The Air (OTA) updates. With today's innovation and development pace of BMW, the Innovator's Dilemma of BMW will be even stronger in the future when the technology of autonomous driving is further diffusing into the landscape of the automotive industry. Especially today's leading companies show how fast go to market times should be (Participant 8, 01.04.20, p.17, line 11-16).

The analysis discussed the expert's voices in terms of possible organisational conditions that reinforce the disruption which will intervene on BMW from the described technology push and market pull. The result is that the misaligned management beliefs and organisational capabilities will reinforce the Innovator's Dilemma of BMW in times of autonomous driving. As the framework of level 5 autonomous driving in figure seven shows, autonomous driving cars require a completely new set of competencies with software development in the core. The analysis shows that these competencies are not present at BMW and that short-term earnings expectations hesitate the senior management to think about new competencies and business models. BMW's success story today is also an obstacle that prevents BMW from rethinking internal structures, processes and competencies. The historical German engineering culture, expressed in a perfectionistic innovation process, is not aligned with today's pace of development by leading tech-firms like Google or Apple. Therefore, the internal perspective reinforces the impression that BMW will face Christensen's Innovator's Dilemma in times of high-end autonomous driving.

4.2.4 Final evaluation of the disruptive impact of autonomous driving on BMW

The analysis of BMW's strategic situation in times of autonomous driving vehicles shows that Christensen's theory can be applied to the case of BMW. Although a minority of experts argue that this technology is not disruptive for BMW, the majority of the panel sees the technology push as incisive. This technology requires completely new competencies and changes how the architecture of a car is designed. Many experts confirm that the market launch of highly automated vehicles is only a matter of time. A limiting factor of the technology push is the complexity and the high development costs in terms of investment budget and time. Furthermore, as Eliot outlines, the successful launch is highly dependent on infrastructural progress and the further development of component technology like Lidar, sensor technology and an almost error-free artificial intelligence application (2017).

The fact that most of the experts perceive the technology as disruptive for BMW is also based on market pull trends. New competitors with future aligned competencies will position themselves at different parts of the new value drivers software, hardware, content, service and data creation. Especially tech-companies like Google with Waymo or Apple with focus on content and service or Tesla with an approach that targets all value drivers are mentioned by the experts. They all have in common that they can interpret individual mobility completely new without biased management. Additionally, many experts have the opinion that the overall demand for premium cars will decrease. The segment of premium cars will more and more be a niche market for very rich customers. However, today's customer relevance in buying a premium car will significantly decrease. This fact is also linked to the second argument of BMW's loss of relevance. Since the value of hardware creation and decreasing brand loyalty will happen in a time of high-end automated driving, BMW might lose relevance for future customers. Even today, BMW is partly perceived as a technology follower by some experts. In some parts of the future relevant elements of a car, Tesla is perceived as more innovative than BMW. However, the interviewed target customer and the research of Winkler et al. show that premium OEMs have a trust advantage compared to other competitors. Customers will trust a self-driving premium car more than the ones from volume producers.

The fact that BMW is even today perceived as a technology follower is based on the internal causes of the future Innovator's Dilemma of BMW. Misaligned management beliefs like short-term earnings focus or the lack of willingness to build up new required competencies, assets and structures are reasons for this perception of the experts. In comparison to future competitors, the experts also see misaligned capabilities of BMW. Long and linear innovation processes do not fit to the fast-changing customer requirements and technology opportunities. Additionally, today's highly valuable core competencies of BMW in the field of hardware creation will not have the same relevance in the time of self-driving cars. Hardware will be commoditized, according to the

experts. The following Fishbone-diagram summarizes the identified causes. A bigger version of the diagram is attached in the appendix L. The red-coloured boxes are the key causes of BMW's future Innovator's Dilemma which are proved by the sub-arguments (red-framed boxes). The green-coloured box summarizes the disruption reducing aspects mentioned by the experts.

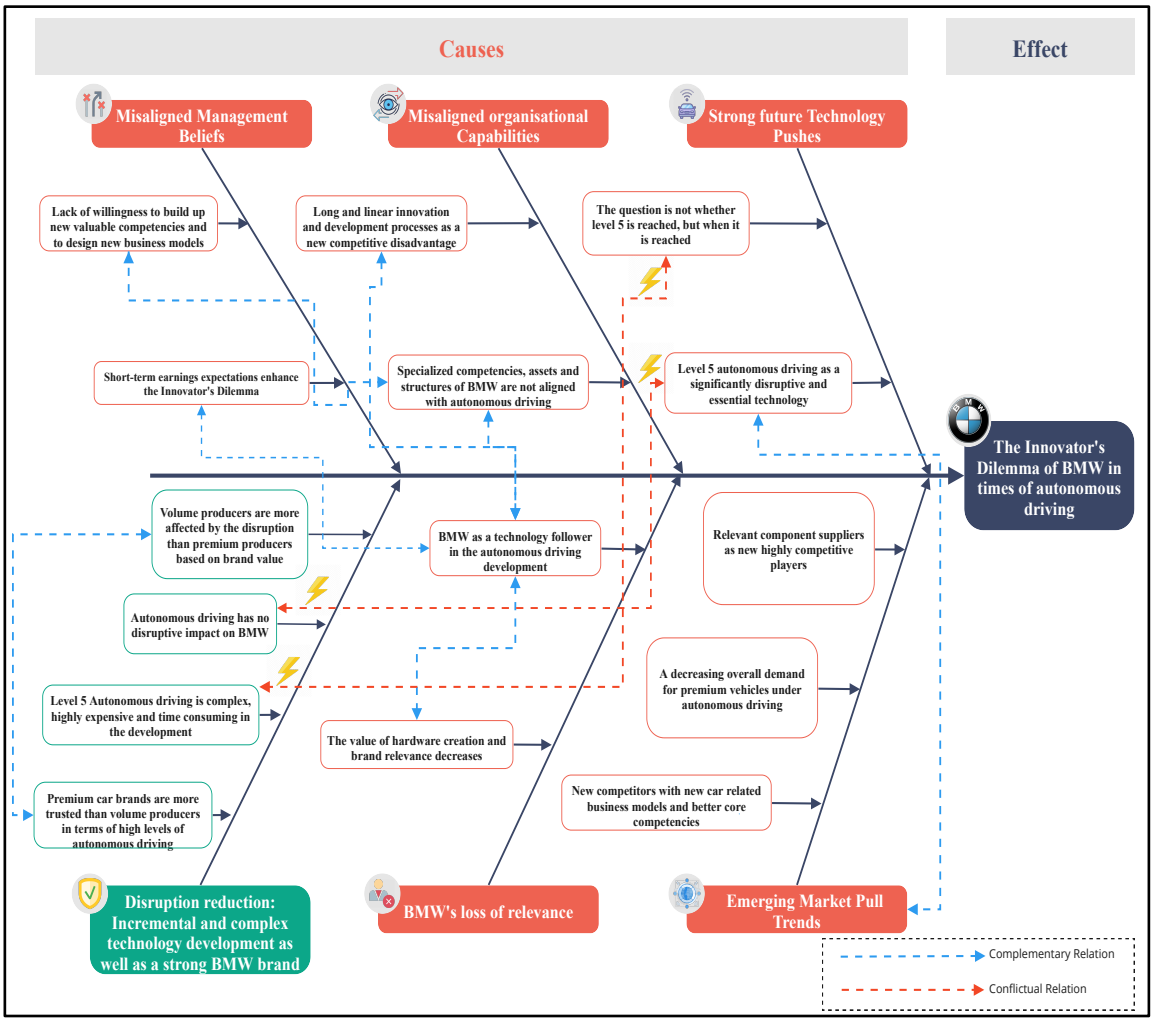

Figure 33 - Fishbone-Diagram of the findings for Lead Question A.

Based on the given data set, it can be said that BMW will face the Innovator's Dilemma in the future of autonomous driving based on a strong technology push, market pull and misaligned internal structures, beliefs and competencies. Self-driving cars will significantly change how individual mobility is demanded and interpreted by new competitors. As Dr. Christoph Steiger summarizes: "It is totally disruptive" (Christoph Steiger, 09.04.20, p.2, line 15). In the framework of Schoemaker et al. it can be said that a significant change in the future is sensed. This raises the question how BMW could use this technology triggered disruption to achieve long-term viability. Based on the literature, business model innovation is a method that might help to manage such significant changes.

4.3 Business model innovation for BMW as a response to the disruption

Chapter 4.2 has shown that BMW will face a disruptive change which will lead them into the well-known Innovator's Dilemma. However, autonomous driving is still a technology of the future and real disruption requires a business model that makes the ground-breaking technology accessible (Johnson et al., 2008). Hence, BMW still has the chance to use the future disruption as an opportunity to achieve long-term viability (De Wit, 2017). The following chapters are focusing on the second step of Schoemaker et al.'s framework: Seizing the opportunity (Schoemaker *et al.*, 2018). They want to assess to what extent the business model of BMW has to change in the future so that BMW can overcome the Innovator's Dilemma. To do so, the author has proposed a literature-based business model framework in chapter 2.2.1 (figure 14).

Chapter 4.3 follows the established framework. Firstly, the overall business model narrative of BMW in the future which represents the base for all other dimensions is discussed. Secondly, the core of the business model, the value proposition, is constructed in a way that it is aligned with autonomous driving-related requirements. The next chapter assesses how the value chain should look like so that the new proposition can be delivered to the target customers. Finally, chapter 4.3.4 discusses how BMW should capture parts of the value through a profit mechanism. All insights are summarized in one holistic future business model and it will be assessed whether business model innovation helps BMW to achieve long-term viability.

4.3.1 The future BMW business model narrative

The initial starting point of the business model for BMW is the business model narrative. According to Bock and George, the business model narrative ensures that the overall business model is aligned with the purpose of the existing company (2018). Based on the data, three interrelated layers of the narrative are identified: BMW's DNA; Strategic implications of the DNA and, finally, the implications for BMW's brand differentiation expressed in an autonomous driving future.

(1) BMW's corporate DNA

BMW defines itself as a company for inventors and pioneers (BMW, 2020c). The interviewed experts confirm this DNA. The historic purpose of BMW is to design and manufacture technology leading vehicles which are capable of combining comfort and sportiness[34]. Prof. Dr. Mark Kuhn confirms the opinion that innovation is a key part of BMW's DNA[35]. The product manager of BMW, Participant 3, adds that BMW's DNA is mainly reflected in their claim: "The ultimate

[34] "Innovation has always been one of the core characteristics of BMW", Participant 4, 12.03.2020, p.1, line 8-10.
[35] "BMW has a value proposition in terms of innovation. As an OEM you are relatively quick to implement new technologies", Mark Kuhn, 25.02.20, p.1, line 7-9.

driving machine" (06.03.20, p.1, line 7-9). He emphasizes the factors sportiness and dynamic of BMW's whole product portfolio. Nicolas Kesselmeier adds that BMW's product portfolio can combine sportiness with a sufficient level of comfort for the customers (Nicolas Kesselmeier, 12.03.2020, p.1, line 13-14). Finally, BMW's DNA is focused on combining sporty and comfortable elements in one mobility portfolio which has the ambition to be perceived as the most innovative and technology leading individual mobility provider. In history, BMW has always been one of the car manufacturers that are capable of inventing breakthrough technologies in terms of forming today's cars (BMW, 2020c). The described DNA needs to be reflected in the strategy and overall business model (Bock and George, 2018).

(2) Strategic implications of autonomous driving and BMW's DNA

The second layer of the narrative is the holistic strategic implications of BMW's DNA and the new disruptive technology of autonomous driving for a future business model. The starting point for the strategic layer is the autonomous driving strategy of BMW today. According to the interviewed experts, BMW's strategy focuses on the development and production of high-quality hardware and does not imply a far-reaching business model innovation: "The classic strategy of a premium manufacturer is: We will simply continue to offer great products and they will simply drive on their own. (...). They put their money on the fact that I will continue to have a personalized vehicle with high-quality equipment. I personally believe that this view is wrong and that it is much worse for premium segment providers against the background of the scenario described" (Christoph Steiger, 09.04.20, p.3, line 16-19). Participant 3 confirms this strategy from his internal perspective. He says that the new CEO wants to position BMW in the automotive market as a strict hardware producer comparable to the aviation industry where Airbus and Boeing focus on delivering the hardware to airlines like Lufthansa or Emirates (Participant 3, 06.03.20, p.8, line 6-9). Other experts like Participant 7 confirm this view[36]. The hardware focus is, hence, a common strategy of the German OEM landscape. However, this strategy is viewed critically by experts. The above-cited statement of Dr. Christoph Steiger shows that he, as a senior partner consultant, sees this strategy of focusing on hardware creation as wrong. He has the opinion that hardware, outlined in chapter 4.2.2, will lose relevance and other parts of the value creation (e.g. software and service provider) will earn more money than the hardware creators (Christoph Steiger, 09.04.20, p.4, line 7-9). Participant 7 confirms that this strategy might lead to a misalignment between BMW's DNA of being the leading innovator and the autonomous driving strategy (26.03.20, p.6, line 6-10). Even BMW's employees see the current strategy as questionable: "When our new CEO announced that BMW did not want to focus on mobility

[36] "I see quite objectively the trend that car manufacturers are focusing on delivering perfect quality and bending sheet metal well. Someone else makes the software, someone else creates the content and services, and the German car industry designs the shell beautifully, (...)", Participant 7, 26.03.20, p.5, line 18-24.

services, but that we would build the hardware and the others would do the rest, there was a murmur from the employees. Many people said: With the past into the future" (Participant 3, 06.03.20, p.15, line 12-17). It shows that the strategy is highly questionable and that many relevant experts from the panel perceive it as wrong. This strategy is also opposed to the next argument of the experts.

Experts from the supplier, consultant and competitor group argue that strategic business model innovation is highly required to align the company with the new technology of autonomous driving. Participant 8 already sees the trend towards a new mobility behaviour of customers[37]. Nicolas Kesselmeier confirms that a new business model around the new customer needs and technological opportunities need to be designed (12.03.20, p.4-5, line 22 p.4 - line 1 p.2). Concretely, Participant 8 proposes a significant shift from hardware provider towards a service provider structure comparable to IBM's shift towards consulting and cloud service provider (01.04.20, p.16, line 7-13). His manager, Participant 7, sees the same trend but has doubts whether the entire German automotive industry understands it in the same way[38]. Participant 3 does not see the requirement to innovate on a business model level (Participant 3, 06.03.20, p.8, line 1-3). This shows the conflict between BMW's DNA, strategy and the recommendation of the most experts to design a new business model in the future.

This requirement is further emphasized by the third strategic implication for BMW in times of autonomous driving: Experts argue that for BMW it will be a critical success factor to defend its today's customer and data interface. The experts say that this digital interface, for instance, the operating platform of the software in the interior, is attractive for new competitors like Amazon, Google, Facebook or Apple (Participant 6, 13.03.20, p.6-7, line 26 p.6 - line 4 p.7). Participant 6 adds: "This is such an elementary interface... we should not give it up" (13.03.20, p.7, line 6-7). The other dimension is the data interface. Dr. Christoph Steiger sees this interface threatened by completely new platform players which will orchestrate the infrastructure of the autonomous driving system (e.g. sensors in the environment or traffic controls). These players will have data dominance and, hence, will be leading players. BMW will only be in a position where they can connect their cars to this platform but will not be able to gain the required data for valuable services (Christoph Steiger, 09.04.20, p.5, line 7-10). This point is extremely important for him and, therefore, he reinforces the importance with the words: "In my view, however, it is fundamentally important to think about this platform infrastructure, (…). As I have said, quite different players are coming into play here, and they have not even been considered before. They

[37] "(...), but I think the idea is exactly that: to recognize in time that the market is changing. In this case, the mobility behaviour of the customers and the company and the value creation adapts to it", Participant 8, 01.04.20, p.16, line 18-21.
[38] "Personally, I think it is. This is, I would imagine, very controversial within OEMs. In our company it is very controversial" (Participant 7, 26.03.20, p.2, line 15-17).

have their interests, they have their power, which will be built up" (Christoph Steiger, 09.04.20, p.17, line 17-25). This defence will not be achieved with a business model that only focuses on high-quality hardware. A clear conflict between BMW's strategy and this strategic implication is given. This second layer clearly shows that BMW's strategy of today is not aligned with the expert's opinions. From their perspective, business model innovation and the defence of relevant digital interfaces are critical for the future success of BMW.

(3) Brand differentiation implications

The last layer of the narrative is the brand differentiation implications of autonomous driving. The initial question is whether the alignment of BMW's claimed DNA and autonomous driving is possible. Although two experts argue that it is difficult to achieve[39], other experts argue that it is indeed possible through new brand attributes[40]. Participant 8, although he formerly has argued that it might be difficult (01.04.20, p.11, line 13-16), acknowledges that new brand attributes can be used to reinterpret "joy of driving" differently in the future (01.04.20, p.11, line 2-4). Some experts argue that BMW needs to establish itself as a lifestyle brand. Dr. Christoph Steiger even proposes Apple as a role model for BMW since both companies have a high brand value and excellent hardware design competencies (09.04.20, p.8, line 3-7). BMW now needs to redefine which factors can express "joy of driving" in the future. These factors, according to Participant 7, should trigger a shift in brand perception as more than a car producer[41]. For Participant 8, "joy of driving" expresses a lifestyle feeling and this should exactly be reflected in new attributes (01.04.20, p.11, line 17-22). Based on the ongoing commoditization of hardware (Participant 8, 01.04.20, p.8-9, line 26 p.8 - line 4 p.9), the experts see that exterior design will be more homogeneous and is more a basic requirement than a differentiation factor[42]. The other basic requirement, but critical attribute will be the connectivity of the car. Concretely, the experts mention today's services like Netflix or Spotify (Participant 6, 13.03.20, p.8, line 22-23). However, Participant 7 sees this kind of services not as a premium differentiation factor (26.03.20, p.7, line 9-11). The experts identify two key differentiators of the future. The first one is the continuous improvement and new car related functions enabled by OTA updates (Participant 4, 12.03.20, p.9, line 18-22; Participant 6, 13.03.20, p.10, line 4-6). Participant 4 argues that new

[39] "If you focus it on BMW, the question arises what else means "joy of driving". That is no longer pure driving pleasure. This slogan will no longer fit in the true sense of the word", Nicolas Kesselmeier, 12.03.20, p.2, line 17-20.
[40] "Yes, well, the brand essence of BMW and autonomous driving are not mutually exclusive for the moment", Mark Kuhn, 25.02.20, p.5, line 13-14.
[41] "You can, we try to do that, the brand should not just stand for cars and we're really working hard on that, that you just create a brand ownership experience that you can transfer the traditional business into. So that you can also own an autonomous vehicle, but on the other hand, at some point in time the BMW or Porsche brand should stand for something in people's minds", Participant 7, 26.03.20, p.6, line 15-21.
[42] "(...), if it is such a Mobility Service, but for my personality, appearance is not necessarily the decisive argument", Thomas Appel, 06.04.20, p.9, line 7-10.

updates can bring a continuous flow of added value to the user of the self-driving car. This can also be compared to the continuous software updates of Apple's operating platform iOS. These updates deliver every time new functionalities throughout the life cycle of the products. The target customer, Thomas Appel, confirms this value added by this updates: "The best thing about Tesla is that many functions can be easily purchased via upgrades, which are then installed over the air, and this gives Tesla a unique selling point" (Thomas Appel, 06.04.20, p.1, line 11-14). Combining this new differentiator and the strategic relevance of defending the digital interface, BMW should consider establishing an own operating platform to ensure a brand differentiation of BMW. The other differentiation aspect needs to be delivered through an exceptional premium service experience[43]. It can be summarized that a new business model of BMW needs to have much more a character of a service provider enhanced by modern software architecture. As Dr. Steiger proposes, BMW could again use Apple as a role model, which has established a platform where third parties can offer services and applications, but Apple itself also launch core competency related applications and services on the platform (see multiple apps or the new service Apple TV+). These applications might also be new differentiation factors for BMW if it is combined with premium mobility as a service experience.

The analysis shows that the business model narrative has direct implications for the design of the further business model. BMW's DNA is characterised by sportiness and comfort enhanced by a leading innovator position. However, this DNA does not fit the autonomous driving strategy of BMW to focus on high-quality hardware creation. A premium differentiation will not be achieved by hardware only. Yes, especially the interior will play an important role in the future, but this needs to be enhanced by digital and premium mobility services. BMW needs to be seen as a broad provider of services enhanced by OTA updates, platform structures and a brand that is positioned as a lifestyle. Joy of driving in a time of self-driving cars means that the enjoyment comes from high-quality services. The discussion of the expert voices shows that a future business model of BMW will be completely different from the today's communicated strategy of focusing on the car production and selling. The following figure summarizes the derived insights and implications for the business model narrative. The grey fields represent the arguments and opinions of the experts per business model narrative layer.

[43] "So, all the rather luxurious train offers or even the business class offers on flights. There are already examples that I can imagine very well. These would also represent many use cases accordingly", Participant 8, 01.04.20, p.13-16.

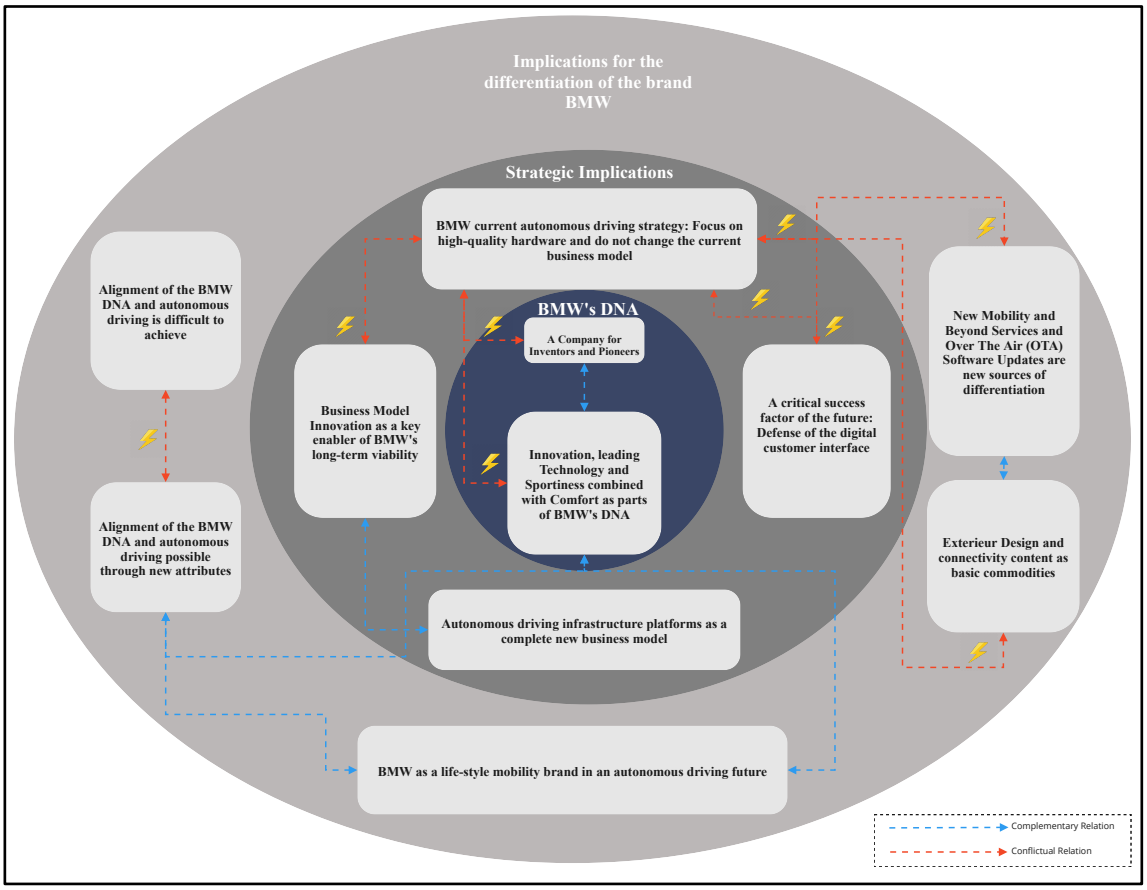

Figure 34 - BMW's business model narrative in times of self-driving cars.

4.3.2 BMW’s future value proposition

After the business model narrative is established, the core of every business model needs to be derived from the experts’ opinions. A well-defined value proposition for future markets is essential to overcome technological disruption (Bohnsack and Pinkse, 2017). Based on this background, the value proposition design canvas of Osterwalder et al. is used to structure the experts’ opinions. The canvas is based on two perspectives: The customer profile and the value map (Osterwalder *et al.*, 2014). The customer profile describes the characteristics of the future target customer of BMW and the value map outlines the offering of BMW to serve the new customer profile (Osterwalder *et al.*, 2014). The analysis starts with the customer understanding of future customers for autonomous driving-based mobility services. The customer profile is mainly structured in the personas and their related jobs of the new service, the new customer gains and pains arising from autonomous driving services (Osterwalder *et al.*, 2014).

(1) The future customer profile

The initial starting point of the customer profile is the persona of an autonomous driving service user of BMW. The experts describe this client as a young (around 35) male or female customer who is highly successful in his or her job. Participant 4 emphasizes that BMW as a brand is a status symbol for many people and the future customers might still appreciate the high brand

value[44]. The product manager of BMW emphasizes that the new customers will be more and more digital affine who appreciate the joy of driving (Participant 3, 06.03.20, p.2, line 4-10). These two aspects emphasize that BMW needs to reinterpret its claim and needs to align digital characteristics with the joy of driving. Nicolas Kesselmeier includes older customer segments which have the same characteristics as the younger ones: Career success, dynamic and sporty (12.03.2020, p.1-2, line 22 p.1 - line 3 p.2). To concretize the profile, the research of Winkler et al. is used to derive more details of the future persona. Based on their customer survey (n=5538), an early adopter of the autonomous driving services is mainly male, has higher-than-average income, live in urban regions and is younger than 36. Hence, the research of Winkler et al. validate the opinions of the experts. Based on this derived profile, the experts dominantly have the opinion that the perception of individual mobility will change. Dr. Christoph Steiger sees the property of a car as redundant if the cars can drive from door to door[45]. Thomas Appel, as a young project manager at Innogy SE, would welcome the development towards mobility without personal property[46]. Nicolas Kesselmeier summarizes that a shift of the customer's job from delivering a product towards the direct offering of mobility solutions is required (12.03.20, p.2, line 18-19). The new job of a car will be the mobility itself and, dominantly, to enable the customer to use the newly gained time within the car as he or she wants. This alignment is also expressed in the fact that 59% of surveyed customers await the market launch of high-level autonomous driving services for typical use cases (Winkler et al., 2019). These use cases are, according to Thomas Appel, urban mobility and long-distance routes[47].

According to the experts, the positive customer assessment is based on the promising customer gains of autonomous driving. The autonomous driving technology can make the whole individual mobility experience more efficient in all relevant dimensions like time, costs, convenience and comfort. The customer gains freedom when cars can drive on their own (Participant 6, 13.03.20, p.3, line 4-6). Participant 8 emphasizes that the customer earns freedom in the notion of time: "On the plus side, I can still see the time saved for the customer. That he no longer has to focus on the road, but can also work, play, sleep or eat. Today's secondary activities are becoming the main

[44] "For me, a BMW driver is a young and sporty user, masculine as well as feminine, who is successful. This is how I would define it. BMW as a brand is still considered a status symbol and the customer segment described also appreciates this", Participant 4, 12.03.20, p.2, line 3-6.
[45]"When we really get to level 4 or 5, it implies for me that I no longer have a personal car. (…). But if we are really fully autonomous, then I won't need a personal car anymore", Christoph Steiger, 09.04.20, p.2, line 19-23.
[46] "No, I think the idea is super good and I hope that it will progress, because I also have certain hopes that we will have less traffic jams, because people will drive more efficiently through perhaps better control of traffic lights and the environment will be protected more. We would then save resources", Thomas Appel, 06.04.20, p.9, line 15-20.
[47] "On the one hand, I drive to work almost every day, so I have urban routes with 30% and the rest is mainly highway and country road", Thomas Appel, 06.04,20, p.2, line 7-9.

activities in the vehicle. (…).” (01.04.20, p.6, line 5-12). Additionally, he is under the impression that the price of individual mobility could decrease by 60-70% (01.04.20, p.5, line 14-22).

As a conclusion, people are empowered to use their time as they want and a car as a property does not commit valuable time of the customer anymore. Mobility is on-demand accessible and transaction costs for the customer are significantly lowered. Additionally, a service and product offering need to serve an infrastructure where the customer can use his or her new gained time as she or he wants.

The second gain dimension is the opinion that autonomous driving will be the key technology towards more secure and sustainable mobility. The interviewed target customer emphasizes that he likes the idea especially because it promises a more sustainable way of mobility (Thomas Appel, 06.04.20, p.6, line 17-18). This argument is validated by the customer survey of Winkler et al. Especially the reduced environmental hazards and carbon footprint and the higher efficiency of the overall individual mobility system are arguments to use the self-driving mobility services (Winkler et al., 2019). Nicolas Kesselmeier confirms this from his supplier perspective, too (12.03.20, p.6, line 13-15). He adds the next gain for customers: Enhanced security[48]. Participant 8 confirms this perspective. Even though, self-driving mobility services may need fuel or electricity to drive, the automated driving reduces the pollution by individual mobility. He sees security and sustainability as improved under highly automated vehicles (Participant 8, 01.04.20, p.6, line 1-16). However, Prof. Dr. Mark Kuhn, who focuses his research currently on future urban mobility, sees the aspect of more sustainable mobility through autonomous driving as questionable[49]. He argues that self-driving cars might trigger more individual mobility than today since the services are accessible for more people and the service might be more convenient than public solutions (Mark Kuhn, 25.02.20, p.4. line 12-16). Participant 8 agrees on that point. He argues that clear traffic control rules need to be established (Participant 8, 01.04.20, p.7, line 17-19).

The last aspect of the customer profile is the possible customer pain in times of autonomous driving. The main pain will, according to Nicolas Kesselmeier, be the loss of control and emotions[50]. This has direct implications for the product and service design. A self-driving vehicle needs to be designed in a way that it expresses trust and emotions. Especially for an emotional

[48] “I could imagine that if the car works perfectly, the machine can make better and faster decisions than humans”, Nicolas Kesselmeier, 12.03.20, p.6, line 9-11.
[49] “It's more of a convenience story to be a little fancier but does not contribute to a sustainable mobility revolution”, Mark Kuhn, 25.02.20, p.4. line 9-11.
[50] “Emotions will be lost for passionate drivers (…) Loss of control is another pain”, Nicolas Kesselmeier, 12.03.20, p.2, line 5-10.

and trusted brand like BMW is this customer pain a critical success factor for the future mobility service.

The following figure summarizes implications for the profile with its three interrelated dimensions of a future customer segment for BMW:

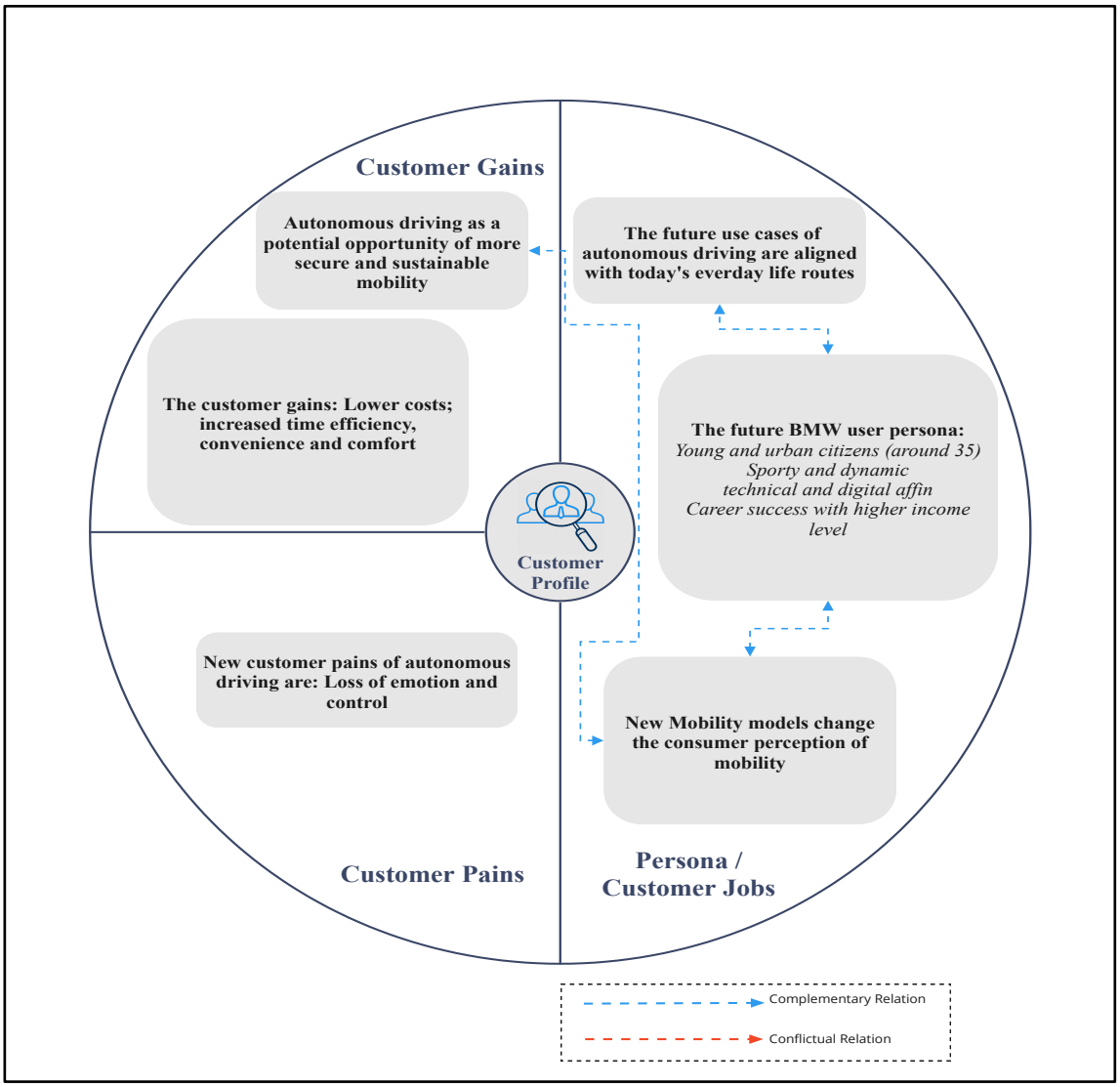

Figure 35 - The customer profile of a future BMW customer (based on Osterwalder et al., 2014).

(2) BMW's future value map

The next step of the value proposition design by Osterwalder et al. is all about constructing a product & service portfolio which can serve the described customer profile (2014). It is structured in three areas: Products & Services; Gain Creators and Pain Relievers (Osterwalder et al., 2014). The starting point is the mapping of the new products and services offered to the described target customer (Osterwalder et al., 2014).

The first aspect of the product & service offering is the use case of autonomous driving. Many experts agree that the initial use cases will be the long-distance routes and especially urban mobility (Participant 2, 26.02.20, p.2, line 21-23). Participant 8 justifies this assumption with the fact that urban regions enable fast scalability of the mobility service while long-distance routes on highways show the lowest degree of complexity (01.04.20, p.5, line 1-4). Participant 6 identifies the complexity of urban mobility as one of the main points that delay the roll-out. He says that this use case is the most complex one (Participant 6, 13.03.20, p.4, line 4-9). However, two experts describe a B2B use case that might combine urban mobility and long-distance routes: "The classic Use Case is: You get into your car in the morning, have to drive to work and tell the BMW assistant that you would like to go to work. Lean back and let him drive you to work. At the same time, you might even have the news read to you. And you are already answering your first e-mails" (Participant 3, 06.03.20, p. 4, line 14-18). Participant 3 can imagine that an urban use case might be launched in this decade (06.03.20, p. 3, line 22-23). These two use cases are aligned with the described job of mobility for the target customers.

The newly designed offering of BMW needs to integrate new valued product & service dimensions. This dimension of the value proposition is directly interlinked with the holistic differentiation factors described in the business model narrative. The overall offering should be a premium mobility experience. This experience should be in the focus of every product and service offering. For instance, this service character implies how comfortable and aesthetic the interior is designed, how accessible the mobility is, and which other services can BMW offer the user (Participant 8, 01.04.20, p.9, line 5-9). According to Participant 2 and 4, these might be mobility services like intelligent navigation (AI enhanced recommendation systems) or beyond services (e.g. food and beverage delivery to the car) (Participant 2, 26.02.20, p.4, line 16-18, Participant 4, 12.03.20, p.9, line 8-12). Additionally, Participant 8 argues that gamification and the alignment of BMW's innovative sportiness and comfort and the design language can help to achieve a premium mobility experience, a joy of driving, within a self-driving BMW vehicle. The importance of interior design is confirmed by the internal view of Participant 6[51]. This shows that BMW is aware of the importance of an innovative and attractive interior design. However, this will be different from the cars of today since today's design is mainly focused on enabling a safe and comfortable active driving for the driver. In an autonomous driving vehicle, the design should be focused on a room where the user can interact easily with others and with the interfaces of the car (Nicolas Kesselmeier, 12.03.20, p.10, line 23-25). Therefore, interior design is not only seating and fittings. A new key differentiation factor arises in this context: Human2Machine Interaction Design. This design field deals with the interaction of people with machines likes

[51] "As far as I am aware and have read in there, the interior is an area that has received much more attention lately", Participant 6, 13.03.20, p.8, line 13-14.

artificial intelligence at predefined interfaces (e.g. voice, touch or gesture) (Guzman and Lewis, 2020). This field is a new dimension of the interior design which, according to Prof. Dr. Mark Kuhn, can be a key differentiation field to enable a premium mobility experience[52]. Concretely, he states: “When you put the iPhone in the car, a 4K HD screen displays a home screen, which I can then interact with through gestures or voice commands. All these can be new competencies of the OEM or supplier” (Mark Kuhn, 25.02.20, p.14, line 3-6). The most important dimensions of this innovation field for OEMs are the factors customer convenience and aesthetic design. Participant 2, with his insights to every German OEM, confirms that the windows of a car will be used as high-end interaction interfaces where multiple applications can be used (26.02.20, p.3, line 24-27). It has to be easy and intuitive to interact with the car and other offerings. The core interaction tool, the steering wheel, will be more and more irrelevant and, therefore, a new intuitive interaction opportunity needs to be developed. Dr. Christoph Steiger argues that these innovative interfaces need to be used to give customers access to services which he or she can use while driving[53]. His comparison to Apple emphasizes again the impression that BMW has to combine innovative Human2Machine interaction ideas with a sufficient level of content. In today’s world, hardware, software and services are not to be considered separately from each other. BMW needs to identify interaction forms that are most convenient for the customer in an autonomous driving car and, simultaneously, has to offer a significant level of services and applications[54]. Participant 6 sees these services as a basic requirement to even consider BMW as a possible provider (13.03.20, p.9, line 14-18). Dr. Christoph Steiger summarizes: “Convenience, brand name, fashion factor and content are included. I have to offer features in my car that are fun, add value and are easy to use” (09.04.20, p.8, line 24-26). He again outlines the importance of services and applications within the car. BMW can use this interface to develop own mobility services applications which can express the new brand identification as a sporty and dynamic lifestyle brand. Urban living-related services might be an additional development field since the urban area is one of the most important use cases of an autonomous driving mobility service. As described in chapter 4.3.1, BMW could use Apple as a role model and offer the car as a platform for other content and service providers to target new customers. Additionally, BMW should offer the above described own services which are aligned with the desired brand identity.

[52] “I could imagine this very well in the field of Human to Machine Interaction”, Mark Kuhn, 25.02.20, p.13, line 12-13.
[53] “Above that then offer additional services. So, what happens in my vehicle when I'm in it. And it must be as much convenience with as much entertainment as possible. I'm going to make the Apple comparison again: The iPhone or iPad is so popular because it's incredibly convenient”, Christoph Steiger, 09.04.20, p.8, line 7-11.
[54] “The second, and even more important, is everything that has to do with digital services. The technology that's on board”, Participant 3, 06.03.30, p.5, line 12-16.

The last offering dimensions are the individualisation and quality of the car. Participant 2 argues that “premium always includes individualization” (26.02.20, p.7, line 21). This means that if the customer entries the autonomous vehicle he or she has to get the impression that he or she sits in his/her car. For instance, his/her BMW profile with related applications is already set up in the car and the seating and colours of the lights are already aligned with his or her preferences. Even the preferred driving mode is already active: “So I can set the style "sporty" and then he takes a curve more sporty so that I can say that I'm sporty even if I'm just sitting in it” (Thomas Appel, 06.04.20, p.8, line 4-6). As a summary, Participant 3 states: “Make it feel like home” (26.02.20, p.5, line 14). The vehicle should reflect the personality of the user and should feel like he is experiencing a time in a room which is highly personalized. This fits the last offering of high-quality. Participant 7 sees this fact as a remaining differentiation factor: “It will make a big difference if you get into a vehicle from a new car manufacturer or if you get into an autonomous vehicle from a very experienced premium OEM” (26.03.20, p.7, line 4-6). This quality promise of German OEMs will remain as a key to achieving a self-driving premium mobility experience for the described customers.

As the analysis shows the new main differentiator is what the vehicle can offer within the car. The next dimension is how the car itself should be structured to enable this kind of new mobility experience. Nicolas Kesselmeier says that “you have to think the car as a whole differently” (12.03.20, p.2, line 23-24). Dr. Christoph Steiger concretely outlines the new architecture of the car: “(…) I exchange functionalities via a defined interface or over the air by applying new software. That still has to expand massively. I have to be able to bring out a vehicle that can be developed even more successively. With hardware, it's a bit more difficult, but the software and service components have to change enormously. I probably also need to be able to upgrade hardware components. Maybe the platform will change too” (09.04.20, p.10-11, line 24 p.10 - line 6 p.11). In summary, the car architecture needs to be much more modular and agile. The software of the overall system and the single applications needs to be easily updated by OTA updates. Even the hardware components need to be modular since technological requirements from the infrastructure can urge BMW to update hardware components like sensors. This fits the above-described differentiation implication that the hardware will be more and more homogeneous. The car needs to be a “(...) a living product, which is not operated in today's life cycles as we see it today” (Christoph Steiger, 09.04.20, p.11, line 13-15).

The product, as Participant 3 already has stated, will be like a living room for the customer: “I sit in the car and let myself be chauffeured. I can write mails, make phone calls, answer questions or prepare for conversations. So simply use time more efficiently in your professional or private life” (Nicolas Kesselmeier, 12.03.20, p.6, line 3-6). According to the experts, the key gain creators are located in the dimensions of productivity, relaxing and entertainment (Participant 7, 26.03.20,

p.10, line 21-24, Participant 2, 26.02.20, p. 3-4, line 27 p.3 - line 1 p.4, Thomas Appel, 06.04.20, p.5, line 9-16). Participant 8 sees the use cases as very heterogeneous and individual[55]. This heterogeneity is an argument that BMW needs third parties which provide multiple applications and services. However, the initial use cases to maximize the gain for customers are located in the productivity, relaxing and entertainment area. This enables the desired customer gains described in the customer profile of having the freedom to use the newly gained time in the way the customer wants.

However, the offering of BMW also needs to relieve the pain of the loss of emotion and control. As Nicolas Kesselmeier outlines: “Security is the absolute key enabler of customer confidence. This must be 100% guaranteed” (Nicolas Kesselmeier, 12.03.20, p.5-6, line 26 p.5 - line 1 p. 6). To enable this trust, BMW needs to display parts of the decision-making process of the artificial intelligence if the customer wants to see it. Tesla is already doing that in today’s cars: “Tesla has that just with the representation of the assistant, e.g. he shows directly the curve of a road. Also, that cars are displayed on adjacent lanes” (Thomas Appel, 06.04.20, p.2, line 22-25).

As a result of the value proposition analysis, it can be said that autonomous driving enables completely new customer gains and, therefore, can serve the customer in a new way. To enable that, BMW needs to focus on delivering a premium mobility service experience enhanced by innovative Human2Machine interaction design, digital services and applications, individualisation combined with high-quality and a sporty and dynamic life-style focused interior design. With these elements, the BMW vehicle will be perceived as an additional living room for the customer where he can spend the additional gained time as he or she wants. The main use cases are entertainment, relaxing and productivity. BMW needs to deliver a living room which can enable these use cases and express individuality for every user of the service. The customer trust advantage of German premium brands might help BMW to solve the customer pain of loss of control. The following figure summarizes the insights derived from the value proposition analysis. A bigger version of the figure is attached in appendix M:

[55] “Very heterogeneous and certainly a field in which the different brands, now that we're back at BMW, can set accents and differentiate themselves. In other words, about the concept of the offer”, Participant 8, 01.04.20, p.14, line 1-4.

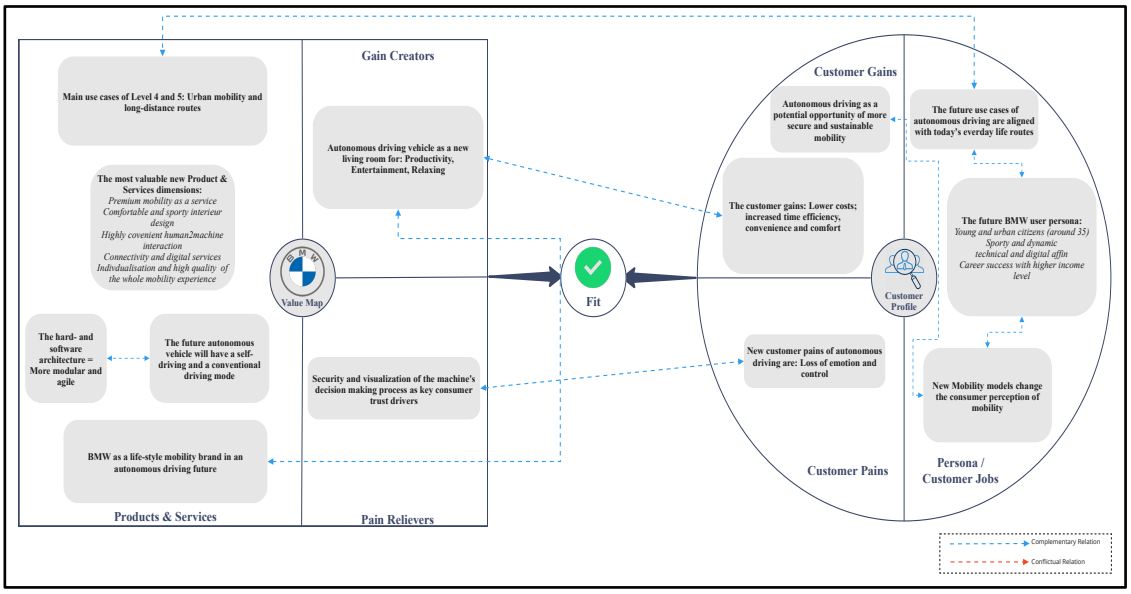

Figure 36 - The value proposition of BMW's future mobility service (based on Osterwalder et al., 2014).

4.3.3 Autonomous driving's value chain implications for BMW

As chapter 4.3.2 has shown, BMW's value proposition will be mainly a digital enhanced premium mobility service experience. This new value proposition needs to be produced by BMW. According to Gassmann et al., the value chain describes how the proposed value is produced with a specific set-up of competencies, structures and resources (2014). This next step of a business model is now discussed.

(1) The key future value drivers and competencies

The first dimension is the fact that the five identified new value drivers in the automotive industry hardware, software, data, content and service creation have to embedded in the new value chain[56]. Dr. Christoph Steiger confirms this view. He adds that BMW should at least be the key orchestrator in value chain parts like content or software (09.04.20, p.4, line 23-25). Participant 7 emphasizes the importance of controlling the software part of the value chain since it is "the key enabler that influences all other business models" (26.03.20, p.5, line 7).

The first part of the value chain is still the hardware creation which will be increasingly homogeneous. The experts like Participant 8 or Dr. Christoph Steiger argue that today's platform approach of BMW will be even more relevant in the future production (Participant 8, 01.04.20, p.8, line 19-20, Christoph Steiger, 09.04.20, p.4, line 19-23). BMW needs to be the orchestrator of an autonomous driving-related hardware ecosystem which can deliver high-end components like Lidar sensors or camera technology. These technologies do not need to be developed but need

[56] "I actually believe that even these five components cannot exist without each other. The sum of them can only create a service of such value that it is also used by the customer. You have to combine all five things to create a competitive service", Participant 8, 01.04.20, p.8, line 1-6.

to be orchestrated by BMW. BMW will be the key designer of the holistic hardware systems and needs the competence to assemble the components in a modular way (Participant 2, 26.02.20, p.15, line 10-13). A new competence of hardware will be the Human2Machine Interaction design which is a key driver of differentiation. Again, the design and development of the system will be a focus topic for BMW while the components itself will be produced by new suppliers (Participant 2, 26.02.20, p.11, line 10-14).

The experts see the value driver hardware and software directly interrelated (Participant 8, 01.04.20, p.9, line 17-19). BMW needs to align two worlds in one collaboration form[57]. According to Participant 6, BMW needs to define two value streams which have two different approaches to working. The hardware, especially the ones which are critical for security, definitely needs to follow the German engineering belief of launching only 100% ready solutions while the software, especially regarding a possible operating platform for the vehicles, can be approached in a more agile and minimum viable product approach where continuous improvement is possible through OTA updates (Participant 6, 13.03.20, p.11, line 15-20). Predefined interfaces between these two value drivers are critical to ensure a sufficient alignment since "the topic of software is, of course, something that can no longer be viewed in isolation from the topic of hardware" (Participant 8, 01.04.20, p.9, line 17-19). As previously described, BMW is urged to build up a higher level of software competence since it is the key enabler of all following value drivers[58]. This relevance of software competence in the new value chain is also outlined in the research of Winker et al.[59]. The execution of the Level 5 autonomous driving framework of Eliot requires excellent skills in the field of software development: The software system of the autonomous vehicle needs to enable in-car commands and interaction, a vehicle to environment communication and an artificial intelligence based on deep learning that can capture and fusion sensor input, draw a virtual world model from it and derive action plans that are executed by the controls activation (Eliot, 2017). Especially cloud computing is a critical software enablement to ensure these functionalities (Liu *et al.*, 2018).

This implies that BMW needs to be able to capture, process and analyse data from the car itself and the environment (Participant 3, 06.03.20, p.11, line 19-21). This factor might be limited by the strategic implication from 4.3.1 that new infrastructure platform players will have the data

[57] "One must also find new forms of work and cooperation, how to orchestrate the whole thing", Christoph Steiger, 09.04,20, p.13, line 2-6.
[58] "Software and intelligent algorithms are probably the key asset and the USP. The car around it is perhaps a minor matter", Participant 7, 26.03.20, p.1-2, line 23 p.1 - line 1 p.2.
[59] "Embracing a software-led future, so that companies make building the critical digital capability and skills needed a central part of their strategy, rather than something that is dealt with as just an innovation project", Winkler et al., 2019, p.25.

sovereignty and, hence, BMW does not easily access the relevant database (Christoph Steiger, 09.04.20, p.17, line 17-25).

Data analytics competencies are especially important for value drivers that are directly located at the interface to the user. For the service and content value drivers, it is critical to capture data from the user's behaviour and preferences within the mobility experience to ensure continuous delivery of quality[60]. Today's leading digital content and service companies have all the data management competence in the core of the offering. BMW needs to become more and more familiar with the life of the user to deliver the promised lifestyle brand experience and individualisation. The customer should think BMW is my partner in my mobility life.

However, Dr. Christoph Steiger emphasizes that BMW will not be able to deliver these values on its own (09.04.20, p.9, line 21-24). The experts have the opinion that the areas service and content have to be orchestrated as a platform structure by BMW. BMW needs to establish a digital platform structure where providers can offer content and service offerings. The vehicle needs to be perceived as a platform itself (Christoph Steiger, 09.04.20, p.4, line 19-23). Only a platform structure ensures the opportunity to offer heterogeneous services since BMW cannot develop all services on their own (Participant 8, 01.04.20, p.9-10, line 28 p.9 - line 3 p.10). Participant 7 confirms that German OEMs need to think towards structures like Apple or Google have established with their operating platforms and application stores (26.03.20, p.11, line 3-6). Participant 6 sees first moves towards this structure[61]. BMW needs to build modern competencies in terms of orchestrating and curating new content and service providers for users. Again, deep customer understanding is the key competence for a platform approach (Participant 8, 01.04.20, p.15, line 25-28). This platform idea is, additionally, highly valued by the interviewed target customer Thomas Appel. He sees the idea of a car as a platform as "enormous potential in the future" (Thomas Appel, 06.04.20, p.2, line 3-5). The study of Winkler et al. confirms this platform approach since heterogeneous use case like e-commerce, banking, entertainment or wellness services need to be enabled by BMW (Winkler et al., 2019, p.20). As described above, BMW can also act as a provider on its platform. Based on the new competencies in the field of data analytics and software, BMW can enable own services and applications related to mobility or beyond mobility services that fit the lifestyle brand BMW in the future. An intelligent recommendation system of destinations might be an initial example (Participant 2, 26.02.20, p. 11, line 20-23). However, experts like Participant 6 doubt that BMW has the critical mass of users to establish an own user platform. As Prof. Dr. Mark Kuhn says: "One should build on the systems that almost

[60] "We definitely need much more knowledge about how the customer uses the vehicle", Participant 7, 26.03.20, p.11, line 12-13.
[61] "This is exactly the model that is currently being driven. You have an operating system and a navigation system with radio and board computer. There are also apps that the user can use", Participant 6, 13.03.20, p.6, line 17-21.

everyone already uses anyway" (25.02.20, p.13, line 26-27). Participant 3 names, in this context, Apple's iOS and Google's Android operating platforms (06.03.20, p.6, line 14-17). These platforms have such a significant critical mass that it is almost impossible to build up a new platform only for BMW. Participant 6 concretely defines this effect as the "Winner-takes-it-all effect" (13.03.20, p.6, line 26). He argues that service and application developers only have scarce resources and cannot develop their offering on many different platforms (Participant 6, 13.03.20, p.6, line 22-26). Prof. Dr. Mark Kuhn adds that cooperation would also be aligned with the customer preference (25.02.20, p.13-14, line 27 p.13 - line 2 p.14). Thomas Appel confirms this view (06.04.20, p.5-6, line 23 p.5 - line 1 p.6). He wants one operating system and a compatible vehicle. However, Participant 6 argues that BMW has to bargain that the DNA and brand identity of the interface is still integrated[62]. Additionally, BMW needs to be in the lead of content and service curation since BMW is perceived as the main mobility experience provider (Nicolas Kesselmeier, 12.03.20, p.9, 13-17). The arguments show that this point is highly discussable. Apple and Google have such a market power that they would not accept the fact that they provide the platform as a white label solution. However, BMW might lose relevance with an Android or iOS platform within the car since the interaction with the car is a key future differentiator.

In summary, the holistic key competence of BMW will be the orchestration of an ecosystem that can react fast to new technological developments and consumer preferences. Suppliers in all five value drivers need to be much more integrated than before (Christoph Steiger, 09.04.20, p.13, line 2-4). Especially hardware suppliers will be much more integrated into the development and conceptualization of the holistic autonomous driving system (Nicolas Kesselmeier, 12.03.20, p.8, line 13-17). BMW needs to be in the lead in all five value drivers to ensure the desired value proposition. These five value drivers are interrelated and complex. Therefore: "I need ecosystems for that" (Christoph Steiger, 09.04.20, p.9, line 20). Ecosystems require a deep integration of multiple partners in all value drivers. As Participant 8 summarises: "So I see the danger that the sales potential or margins will simply decrease and that you have to work more closely with other stakeholders in an ecosystem to create a successful overall construct" (01.04.20, p.9, line 21-25). BMW as a whole will be much more understood as a platform which has key competencies in the software and hardware development enhanced by strong data analytics skills.

(2) Key structures to enable the new value creation mechanism

A sufficient structure needs to enable the usage of this new competencies. Nicolas Kesselmeier proposes to use Google as a role model. Google's horizontal process organisation is focused on the key processes and not on business units like marketing or research and development. The

[62] "You can't refuse such cooperation and you have to make sure that you define the ground rules and don't just hang on the drip from them", Participant 6, 13.03.20, p.8, line 2-4.

organisation should be more aligned with the five proposed value drivers (Nicolas Kesselmeier, 12.03.20, p.13, line 23-26). Participant 7 confirms the importance of cross-sectional collaboration. However, he also describes that these key processes orientation is not integrated into today's OEM organisations. The overall thinking is focused on silos and not on key value drivers (Participant 7, 26.03.20, p.11-12, line 27 p.11 - line 5 p.12). This process-oriented organisation needs to consider the customer as the centre of every decision. Participant 8 concretely mentions Amazon as a role model which is highly customer centred and agile in the decision-making (01.04.20, p.17, line 1-3; 01.04.20, p.16, line 23-26). Participant 7 argues that the overall German automotive industry is too much focused on the industry itself and not on their customers (26.03.20, p.9, line 20-21). Hence, the new value chain of BMW needs to change the culture from engineering to customer centricity.

The analysis of the new value chain shows that significant changes in terms of value drivers, core competencies and enhancing organisational conditions need to be established to deliver the above described new value proposition. Especially the software, Human2Machine interaction and data competencies need to be developed. BMW also needs to establish a platform structure in terms of content and services to ensure high customer relevance in heterogeneous use cases. The new value drivers need to be enabled by a customer-centric and agile horizontal process-organisation. The following figure summarizes the implications of the autonomous driving future in the typical value chain model. A bigger version is attached in appendix N:

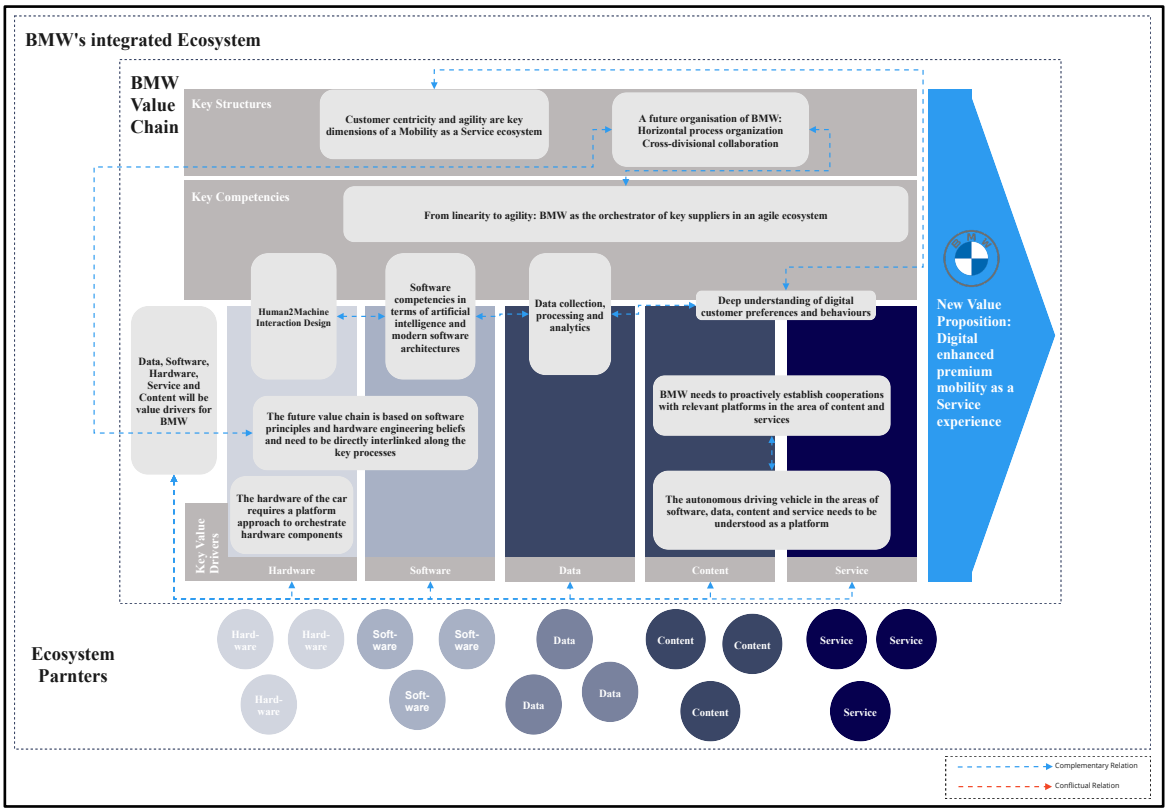

Figure 37 - The autonomous driving value chain of BMW.

4.3.4 The future profit mechanism

The last dimension of the predefined business model framework is the profit mechanism. It discusses the revenue model and cost structure of the business (Gassmann *et al.*, 2014). This part of the business model answers the question of how BMW could capture value from the newly developed business model (Johnson *et al.*, 2008).

The experts mainly discuss two options in terms of a case-fitting revenue model. The first one is the ride-hailing structure similar to Uber where the customer purchase per time or route length. Participant 4 sees, especially for urban mobility, ride-hailing combined with a people mover concept (6-10 people in one vehicle) as the proper offering (Participant 4, 12.03.20, p.4, line 1-4). Participant 8 supports this assumption since Robo shuttles can enable improved urban mobility through fewer vehicles on the road (01.04.20, p.7, line 6-11). This will save time for the customer since the traffic is less intensive (Participant 8, 01.04.20, p.5, line 18-22). The customer pays a fixed price per minute and receives improved price conditions the more he or she shares the ride. "Mr. Müller logs in again on a platform, as it can be done with Uber, and then the vehicle comes to me. I already know then that the trip costs 10€" (Participant 4, 12.03.20, p.3, line 19-21). The customer can easily book per mobile device (e.g. smartphone) the required mobility time and the vehicle will pick him or her up at the proposed time (Participant 2, 26.02.20, p.6, line 3-5). However, Participant 3 and Nicolas Kesselmeier doubt that this ride-hailing revenue model could work for BMW (Nicolas Kesselmeier, 12.03.20, p.7, line 13; Participant 3, 06.03.20, p.8-9, line 25 p.8 - line 1 p.9). The issue of the ride-hailing revenue model is that it does not imply any brand commitment. It has the character of a quick mobility service where the customer does not need any additional premium services. The intention of the customer is to reach the destination instead of experiencing a premium feeling.

The other model proposed by the experts is the modern revenue structure of a subscription model. This form of revenue structure was the most confirmed model by experts. It is structured comparable to service providers like Spotify, Apple with its service portfolio or Netflix where the customer pays a monthly or annual price to access the service. Participant 7 describes a scenario where the customer pays a monthly fee and he has unlimited access to different types of vehicles. He argues that this subscription is also a tool to reinforce brand loyalty (26.03.20, p.8, line 22-25). He further argues that this big investment in a single asset, the car, would not be required. The customer would be financially more flexible (Participant 7, 26.03.20, p.4, line 4-6). Participant 2 confirms that ownership, especially in urban regions, will be increasingly irrelevant for future customers[63]. The subscription model would fit this decreasing relevance of ownership

[63] "And if we can move more and more in urban areas and still be able to get everywhere, the thought "I want my own car" will disappear more and more", Participant 2, 26.02.20, p.6, line 17-20.

and the trend towards Mobility-as-a-Service. Dr. Christoph Steiger confirms this and locates the use case of a subscription model in the urban regions (09.04.20, p.6, line 19-27). However, some experts from the consultant, supplier and employee panel group argue that the complex cost structure of a subscription-based service makes it unattractive (Participant 3, 06.03.20, p.9, line 9-12; Participant 4, 12.03.20, p. 8, line 3-7; Nicolas Kesselmeier, 12.03.20, p.7, line 13-21). For instance, Participant 3 argues: "(...) From a cost perspective, you would have to provide so many vehicles that a wide variety of car series are constantly available. Production planning would be very difficult" (06.03.20, p.9, line 9-12). However, Participant 7 sees this issue as an internal one which is solvable by intelligent cost management[64]. He confirms that the subscription is also a base for further services which can express premium and joy of driving (Participant 7, 26.03.20, p.10, line 3-6). Finally, Participant 8 adds that a subscription model can help to position BMW as a modern lifestyle brand since the focus of the revenue model is on the service and not on the one-time asset buying (01.04.20, p.12, line 8-20). He sees that this can enable the shift from "car for everything to the topic for every purpose the right car" (Participant 8, 01.04.20, p.12, line 8-20). BMW has a broad product portfolio and can offer every size of a car even today. The experts argue that BMW can differentiate its service by offering different stages of the subscription. For instance, starting at a standard subscription (e.g. today's car size of the 1-series) up to a luxury subscription (e.g. today's 7-series). Even a B2B subscription with the car sizes of a today's 3- or 5-series is possible (Participant 6, 13.03.20, p.5, line 1-7; Participant 4, 12.03.20, p.7, line 8-11). The differentiation between the different classes can be done in the areas of interior quality and design and the Human2Machine interaction design. Connectivity should be standard in every class.

Additionally, BMW should consider monetization strategies in the fields of the value drivers content and service (Participant 7, 26.03.20, p.10, line 3-6). BMW could launch own services for a fee or could raise a percentage of sales generated on the BMW platform. This would be again aligned with today's structure of Apple where a percentage of all revenues from Apple's app store are raised. Highly valued OTA updates for each customer account could also be monetized.

The analysis shows that the experts' opinions are highly heterogeneous in the field of a proper revenue model. The dominating opinion is that a subscription model fits better the new life-style focused brand of BMW and it enables the company to deliver a premium mobility experience. However, BMW needs to consider additional beyond mobility revenue streams to achieve outperforming profits. Autonomous driving services might enable premium providers to charge higher subscription fees. Thomas Appel confirms that he would pay a premium for a high-end

[64] "How the whole thing is mapped is an internal and complex problem, but the customer doesn't care. I think that's an internal blocking argument. Sooner or later there will be someone who will do it", Participant 7, 26.03.20, p.9, line 11-15.

autonomous driving service (06.04.20, p.4, line 20-21). This opinion is backed by the research of Winkler et al.[65]. Additionally, the automation of these mobility services promises a significant decrease in costs (Mark Kuhn, 25.02.20, p.5, line 3-5; Participant 4, 12.03.20, p.4, line 16-18).

Finally, a subscription model combined with intelligent internal cost management could be a well-functioning value capturing mechanism for BMW. The mobility service and the newly gained free time of the customer can enable BMW to explore additional revenue sources. However, the profit mechanism dimension is the one with the highest ambiguity in the panel group which might be caused by the uncertainty of the topic. The following figure summarizes the gained information in the two dimensions of the revenue model and the cost structure implications (grey boxes):

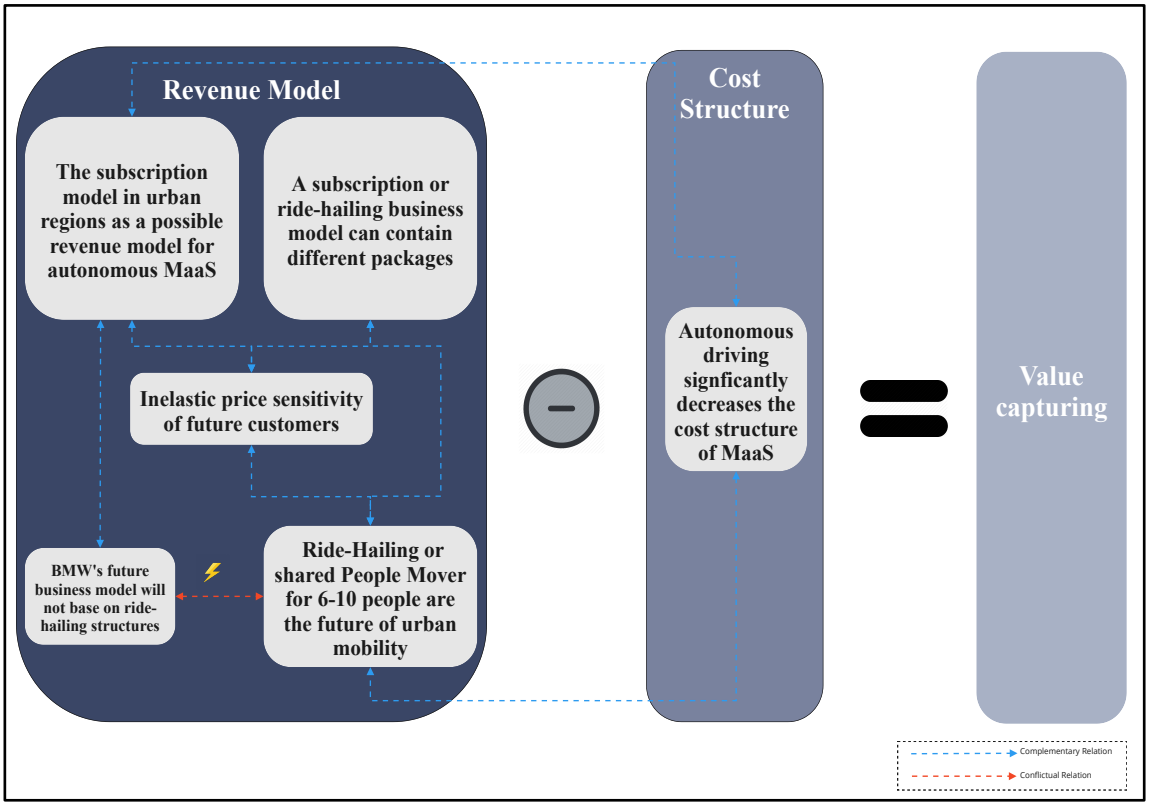

Figure 38 - The future profit mechanism of BMW.

[65] "Will be willing to pay a higher premium for a self-driving car: 48% early adopters will be willing to pay a premium of more than 20% over their current budget vs. 19% overall" (Winkler et al., 2019, p.12).

4.3.5 Holistic business model implications by autonomous driving

Chapter 4.3 shows that BMW definitely needs to conduct a business model innovation since all four dimensions are changing enormously. BMW needs to remind itself that the DNA of BMW is innovation and leading technology. Hence, BMW should be perceived as a pioneer in terms of autonomous driving. However, this pioneering needs to consider the strategic implications to defend digital interfaces and that the disruptive technology requires a reconsideration of current business model structures. The brand differentiation will be achieved by completely new elements like highly satisfying mobility services and up-to-date software. The new value proposition of a digital enhanced premium Mobility-as-a-Service experience is initially focused on younger, sporty, successful and digital affine customers in urban regions. These customers and related groups are served by the five key value drivers of hardware, software, data, service and content creation. BMW should build up and focus its core competencies on hardware, software and data creation while content and service should be orchestrated in a digital platform structure. A customer-centric and cross-divisional organisation which is focused on the core value drivers and not on silos is highly required to enable the successful collaboration between the five value drivers. Overall, BMW is the key orchestrator of an agile ecosystem which is able to respond to new customer preferences and technological changes. Responsiveness will be the new efficiency. BMW needs a value chain that develops itself from linearity towards agility. A subscription model with different stages (from standard to luxury) is useful to capture a part of the produced value from the customers. A subscription model might shift BMW more towards a life-style mobility brand than a car producer. The vehicle as a living room needs to enable many different use cases which imply “beyond mobility services”. The cost structure of these robo taxis might decrease significantly which could reinforce the attractiveness of new mobility solutions like subscription models. Finally, the result of the analysis is that only business model innovation combined with the autonomous driving technology can help BMW to achieve the desired long-term viability. BMW needs to be able to transform itself from a hardware creator towards a life-style mobility service provider with completely new competencies. The conceptualization of BMW’s future business model helps to see the coming disruptive innovation in a holistic context and helps to identify relations of different trends of the new mobility wave.

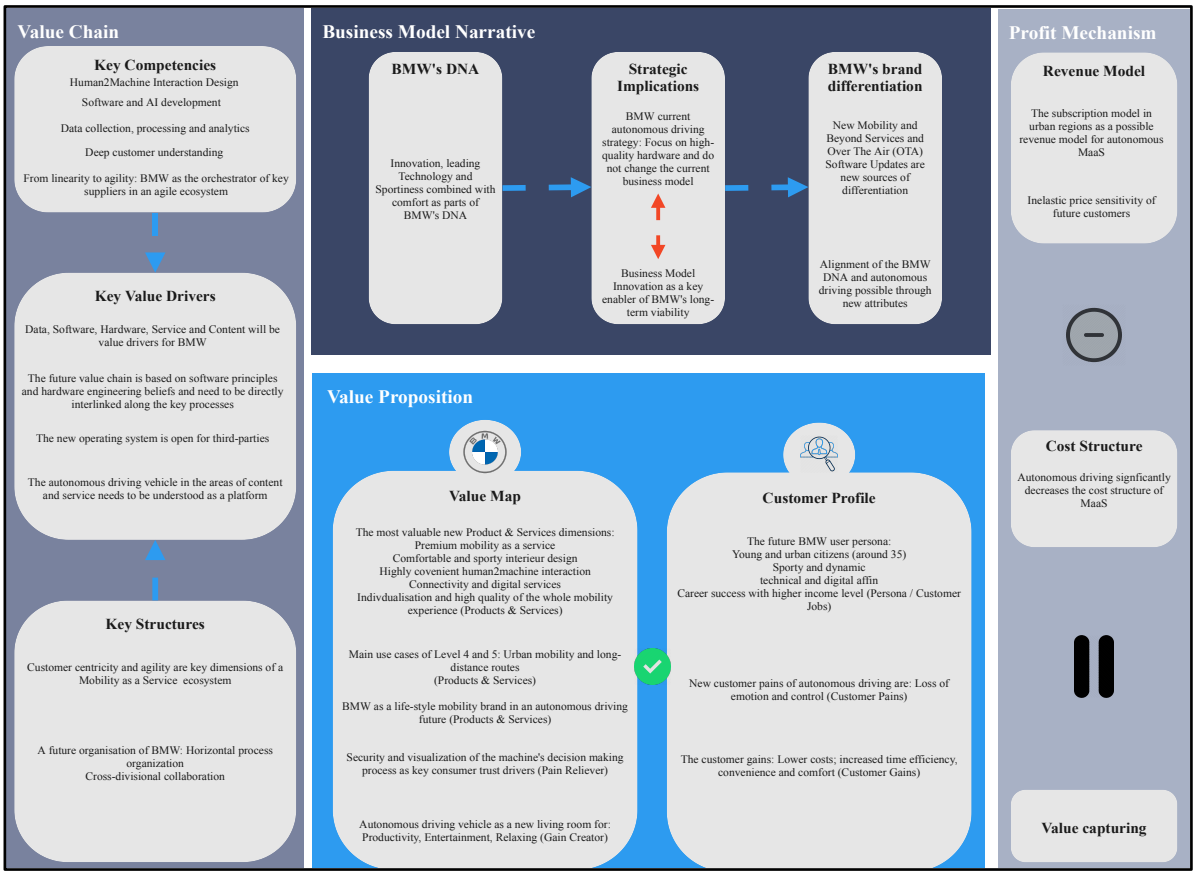

Figure 39 - The holistic business model innovation aspects of BMW (see appendix O).

4.4 Enabling conditions for organisational exploration

Chapter 4.3 has outlined that business model innovation allows BMW to align the company with the new requirements of the autonomous driving technology. To describe it in Schoemaker et al.'s framework: The opportunity was seized by assessing the business model innovation potential. The next step is to clarify how BMW as an organisation can enable this business model development towards the above-described target state. It is the last step of Schoemaker et al.'s framework: *Transforming the current organisation* (2018). The following chapter wants to clarify which organisational conditions have to be established to enable such a significant business model transformation in a big sized organisation like BMW. This approach is directly interlinked with the fact that only an adaptive organisation can survive in the long-run (De Wit, 2017). In this context, the theory of the dynamic capability ambidexterity has been discussed in the literature review. It mainly says that a company needs to be able to balance the exploitation of existing markets and, simultaneously, the exploration of new opportunities (O'Reilly and Tushman, 2008). This dynamic capability is the key source of competitive advantage in a time of thriving disruptive technologies (Tushman and O'Reilly, 1996). As chapter 4.2 showed, BMW is very strong in terms of exploiting existing markets through production efficiency and incremental development of the product portfolio. However, BMW will face an Innovator's Dilemma in the future of autonomous

driving and, hence, is urged to explore this technology with the related business model innovation implications. The analysis of the experts' voices focusses on the organisational conditions for successfully exploring the new opportunities of an autonomous driving business model of BMW. The three identified organisational conditions (explorative business unit; corporate commitment and autonomy and open innovation concepts) are used as a foundation for exploring additional conditions in the data set (Kauppila, 2010; Hill and Birkinshaw, 2014; Christensen, 2015; Curley and Salmelin, 2017).

The following chapter is structured in four key layers. The first one is the identification of BMW's exploration approach today. It assesses what identified layers can already be used for the design of the autonomous driving exploration mode. In the second chapter, the analysis outlines the role of the senior management in this exploration of the technology and business model. The next key enabler dimension is the organisational structure. The experts' voices are analysed focusing on which organisation form might enhances the exploration. Finally, chapter 4.4.4 describes possible collaboration implications to ensure an aligned working form with external and internal requirements. All findings are summarized in one final summary chapter and a final model.

4.4.1 BMW's exploration approach today

The first dimension of the organisational conditions is to define the current state of BMW's approach.

The first dimension discussed by the experts is the degree of openness of BMW's development approach. Dr. Christoph Steiger, as a former BMW employee in strategic departments, sees an "enormous strength of BMW that they can orchestrate so many partners at all" (09.04.20, p.12, line 6-7). He outlines that BMW already has an open ecosystem approach for a long time (Christoph Steiger, 09.04.20, p.12, line 1-3). Participant 6 confirms this strength and describes that BMW has multiple publicly unknown cooperations with firms like NVIDIA[66]. He describes that especially autonomous driving development units are designed openly. Nicolas Kesselmeier confirms a tight collaboration between suppliers and BMW as the orchestrator of the ecosystem[67]. Participant 4 describes that also OEMs like BMW and Daimler collaborate in terms of autonomous driving[68]. All these perceptions of the different experts show that BMW might already adopt the concept of open innovation.

[66] "Well, there are many cooperations that are not known and are not communicated in the media. I am very sure that BMW is in a lively exchange with others. Above all, because BMW is also a customer of suppliers, especially when it comes to autonomous driving. When it comes to sensor technology or image evaluation from NVidia. These are all cooperations that already exist", Participant 6, 13.03.20, p.12, line 13-19.
[67] "(...). But it is really the case that the developers from BMW are with us and we are sometimes on-site at BMW. We develop together", Nicolas Kesselmeier, 12.03.20, p.8, line 20-24.
[68] "The whole issue of autonomous driving towards level 4, they joined forces with Mercedes and founded a joint venture together. (...)", Participant 4, 12.03.20, p. 11-12, line 25 p.11 - line 4 p.12.

However, the degree of openness of BMW and other OEMs is seen as critical from other experts. Participant 3 has a different internal perspective: “BMW is currently pursuing a very closed development approach” (06.03.20, p.13, line 22-23). This means that BMW mainly develops new product features and technologies on their own and barely integrates third parties. Participant 7 has the same impression for his company and the rest of the German automotive industry. He argues that a lack of open innovation between the German automotive landscape is present. Every company wants to make it in its way and do not want to collaborate deeply with other producers (Participant 7, 26.03.20, p.14, line 11-15). Participant 8 adds that openness towards suppliers is not given. His perspective is that German OEMs do not want to share too much knowledge to protect intellectual property (Participant 8, 01.04.20, p.18, line 3-5). As a result, the degree of BMW’s openness in the exploration and innovation approaches is diametrically discussed by the experts. However, the majority of the experts argue that BMW is moderately open for third parties in its innovation process.

Participant 2 describes that BMW always establishes new business units for new technological trends. Concretely, he mentions the i-series of BMW, which is only focused on shaping the electrified future of the engine (Participant 2, 26.02.20, line 11-13). He emphasizes the aspect that BMW grants the business units like the i-series a high level of autonomy[69]. Based on this fact he recommends using this structure for an autonomous driving business unit or integrate this part in the i-series (Participant 2, 26.02.20, p.17, line 13-15). Participant 3 adds that BMW has already founded an autonomous driving campus and a venture capital fund called “iVentures” (06.03.20, p.12, line 15-18). iVentures is used to explore the external start-up ecosystem and to acquire quickly new relevant knowledge for BMW. The autonomous driving campus is relatively autonomous from the rest of the company. This campus is only focused on enabling autonomous driving use cases (Participant 3, 06.03.20, p.12, line 15-18). The campus directly reports to the chief development officer (Participant 3, 06.03.20, p.12, line 22-23). The overall goal of the campus is to research and to finally derive a catalogue of requirements for the suppliers of autonomous driving components (Participant 3, 06.03.20, p.13, line 10-14). This shows that BMW has already implemented a relatively autonomous unit for research in the field of autonomous driving. The iVentures fund is used to integrate innovative thought leadership in the development.

However, as the literature review has shown, the success of such research units highly depends on the corporate commitment to a future topic. Participant 6 emphasizes that BMW commits a

[69] “(...) These are all independent from each other. When you're travelling in Munich, you have your own areas you work for”, Participant 2, 26.02.20, line 12-13.

significant budget to the development of autonomous driving use cases even today[70]. Dr. Christoph Steiger confirms that BMW has the topic on its strategic agenda (09.04.20, p.3, line 14-16). However, as described in chapter 4.3.3, he doubts that the strategy is the right one and if the commitment is really high. It requires a much more transformative concept to remain relevant in times of Level 5 autonomous driving.

The initial analysis of BMW's exploration approach of autonomous driving today shows that the concepts of open innovation and autonomy of an exploring business unit are already considered at BMW. However, the autonomous driving strategy and the ambiguous statements of the experts show that real commitment of BMW towards autonomous driving is only moderate. This is supported by the insights from chapter 4.2. BMW does not build up relevant capabilities and internal structures that enable the successful development of a business model for autonomous driving combined with the technology. Nevertheless, the open ecosystem approach of BMW, the structures of the venture capital fund and the autonomous driving campus might be tools that are useable for the further development of the autonomous driving exploration units.

4.4.2 The enabling role of the senior management

The second dimension is the enabling role of BMW's senior management. The experts argue that an exploration of such a disruptive transformation of the current technological foundation and business model requires leadership which is visionary and establishes a clear vision of future individual mobility. Prof. Dr. Mark Kuhn gives insights into the automotive industry. He criticises that not a single OEM has a clear vision for the future and that not a single one has a clear path to go the way towards a high-end autonomous driving[71]. He explicitly emphasizes that every OEM has these innovation labs, but no clear vision aligns these approaches (Mark Kuhn, 25.02.20, p.8, line 11-17). Participant 7 concretely argues that this is exactly the task of senior management: "It takes visionaries who sit at the top of the company's management and then set very clear guidelines and make the impossible possible, see Elon Musk. People like Steve Jobs or Bill Gates. If you have such visionaries who also understand the material, then the impossible can be made possible" (26.03.20, p.12, line 8-14). The technological disruption will be so transformative that a lateral thinker with the required knowledge, responsible for the exploration of the new business model and technology is required. Dr. Christoph Steiger substantiates that "(...) it can only work with a visionary equipped with great power and strength. He has to push issues through even against the resistance of the existing organization" (09.04.20, p.17, line 5-8). He adds that this role might be focused on one person with significant influence in the organisation and the power

[70] "It is definitely one of the most important directions in the automotive industry and BMW is fully aware of this. They are also investing so that they can be at the forefront" (Participant 6, 13.03.20, p.14, line 8-10).
[71] "(…) Nevertheless, none of the companies shows a clear target picture of where the company wants to develop and wants to invest there at full speed", Mark Kuhn, 25.02.20, p.8, line 11-17.

to push the organisation towards his or her vision (Christoph Steiger, 09.04.20, p.16, line 21-25). Participant 7 adds that this leader needs to align the middle management, for instance, project managers or business unit managers, with his or her vision of BMW's future (26.03.20, p.16, line 21-24). This fact mainly deals with the described misaligned management beliefs (see chapter 4.2). BMW needs a visionary that refocuses the exploration part towards a long-term vision and not short-term earnings expectations. He needs to be the one that pushes the transformation of core competencies in the company. The leadership aspect has a direct influence on the other two aspects of enabling senior management.

The senior management of BMW needs to commit itself to developing BMW towards a digital enhanced premium mobility provider. This corporate commitment mainly contains time, investment budget and human resources (O'Reilly and Tushman, 2008). As already discussed in chapter 4.2, the commitment of BMW today is limited according to the experts. Yes, BMW has a strategy and invests a moderate part of the investment budget, but experts like Prof. Dr. Mark Kuhn have the impression that "(...) all new tests and experiments are carried out with the brakes on. None of the major manufacturers currently wants to go completely in this direction" (25.02.20, p.8, line 1-4). Furthermore, he confirms that the companies are not even interested in that since today's business model and rationale is working quite well (25.02.20, p.4, line 14-15). However, the experts confirm that this disruptive technology requires a high level of commitment (Participant 7, 26.03.20, p.12-13, line 23 p.12 - line 1 p.13; Nicolas Kesselmeier, 12.03.20, p.17, line 3-11). Participant 6 recommends that the senior management in this exploration should focus on long-term objectives aligned with the leader's vision (13.03.20, p.13, line 20-21). Again, the visionary plays a key role in this commitment part. As Dr. Christoph Steiger outlines, the visionary needs to push his or her vision through the organisation and business rationale of the organisation. Hence, he or she needs sufficient resources (time, people and investment budget).

Especially the dimension of people and skills development will be even more important for BMW. The exploration of the proposed business model and the related technology require completely new key competencies (hardware, software, data, content and service creation) of the organisation. Therefore, new people with new skills are required. Participant 3 confirms that it is today very difficult for BMW to hire people with relevant competencies like software development or user-centric service design (06.03.20, p.11, line 23-24). The excellent people want to work in more agile and high-tech oriented organisations like start-ups (Participant 3, 06.03.20, p.12, line 6-8). This shows again the urgency of building up more agile and autonomous subunits aligned with a vision that attracts the excellent people all around the world to work for BMW and its vision for the individual mobility of the future. Additionally, Prof. Dr. Mark Kuhn adds that the transformation will not be achieved by simply hiring new people. He argues that significant internal personnel development and qualification measures are required (25.02.20,

p.10, line 7-8). He sees that the demand for software developers will rise and the demand for classic engineers will decrease at an OEM like BMW (25.02.20, p.10, line 1-3). This will be a clear task of the visionary. He has to identify internal and external talent, acquire it for his vision-related projects and allocate it in a way that all relevant talents from hardware to service creation are present.

As a result, it can be said that BMW needs a visionary that can significantly develop the exploration of his or her autonomous driving vision for BMW. The corporate commitment and the required talent development are dimensions which need to be pushed by the leader. The experts emphasize that this leader needs enough decision-making power and the organisational influence to do that. The development and communication of a clear vision regarding the exploration of the disruptive technology of autonomous driving are highly required to align the overall organisation. Today's strategy and commitment of BMW regarding autonomous driving are, according to the experts, insufficient. The coming change will have a much bigger impact than today's senior management expects. No expert has identified a visionary at BMW who can push the organisation towards the described future. However, a visionary as a core leader at BMW, the future disruptive impact of autonomous driving appropriate commitment of resource and internal knowledge and external recruiting management are the key aspects of the senior management to enable the exploration of a business model with autonomous driving as the core technology base.

4.4.3 Key enabling organisational structures for exploration

The next layer of the key conditions is the organisational structure of an exploring business unit. The first aspect of the experts is the fact that autonomous driving requires a greenfield approach. The exploration of this disruptive technology requires a structure which is autonomous from other exploiting initiatives in the parent company. Dr. Christoph Steiger argues that this kind of innovation has such far-reaching implications that it cannot simply be integrated into the exploiting product development planning (09.04.20, p.15, line 12-14). It needs a sufficient autonomy to ensure that the technology is understood and used for a new business model since autonomous driving will change the perception of individual mobility especially in urban regions (Christoph Steiger, 09.04.20, p.15, line 12-14). Prof. Dr. Mark Kuhn confirms that the autonomous and complete rethinking without any biased management layers can help to find real innovation in the new landscape of the technology. He argues that Tesla is a role model in that context (Mark Kuhn. 25.02.20, p.16, line 7-10). They have completely redesigned how a car's software architecture and interior design should look like. Exactly this unbiased and autonomous perspective on the coming disruptive technology is required (Mark Kuhn. 25.02.20, p.15, line 19-22). The question is now which organisational design can enable this greenfield thinking and development.

According to the experts, two ways are possible. The first approach is the one with the highest autonomy of the exploring business unit. BMW could establish a completely new legal entity with a new branding. Nicolas Kesselmeier would prefer this version. He argues that this new company could be founded in cooperation with key suppliers or other OEMs like Daimler[72]. Dr. Christoph Steiger confirms that the approach of a spin-off can be suitable for the development of disruptive innovation which might cannibalize the own parent's company (09.04.20, p.16, line 5-11). He also outlines that this new company would have a completely new brand with new attributes (Christoph Steiger, 09.04.20, p.16, line 5-11). However, he argues that the second version, to establish an integrated exploring business unit within the parent company, might be more suitable for the set-up of the technological requirements of autonomous driving (Christoph Steiger, 09.04.20, p.16, line 11-14). He describes that at the beginning of the exploration process, the newly established business unit requires a high autonomy from the rest of the parent company (Christoph Steiger, 09.04.20, p.16, line 11-14). However, if the exploration achieves later stages where the discussion is mainly focused on the execution and resource planning, he proposes that reintegration in the company has to be executed (Christoph Steiger, 09.04.20, p.16, line 11-14). Participant 2 confirms this approach[73]. This expresses the importance of the knowledge transfer between an exploring business unit and the overall company[74]. Participant 8 argues that an exploring business unit should be understood as a node in a network of internal and external ecosystem partners: "On the one hand, it is open to the outside world and not directly OEM-bound. On the other hand, we also know the internal development processes and the interfaces and the corresponding networks to connect what we do well with the exploring business unit as well. I think that is essential" (01.04.20, p.18, line 19-24). Concretely, he gives a best practice from BMW. The M-GmbH, the tuning business unit of BMW, is capable of exploiting existing resources and competencies of BMW as well as exploring new opportunities to enhance the engine performance of BMW cars. He limits that the example is focused on hardware development, but that the underlying structure would also be suitable for the extensive development of autonomous driving (Participant 8, 01.04.20, p.19, line 18-24). In this context, BMW's autonomous driving campus might be a suitable structure for the development of the technology and the related business model. However, the experts do not have deep insights about whether the autonomy of the campus is high and whether they already consider business model innovation interlinked with the technological development of autonomous driving. Nevertheless,

[72] "One could create a new brand together with another OEM or a supplier, through which they could then market the new automotive solutions", Nicolas Kesselmeier, 12.03.20, p.16, line 15-17.
[73] "Yes, you need independent divisions to deal with it and then be brought back to the whole company, as it then takes up so much momentum that it affects the whole company, but you don't have to found a new company for it", Participant 2, 26.02.20, p.17, line 7-12.
[74] "The question is always how to get the knowledge transfer to the mothership going", Christoph Steiger, 09.04.20, p.16, line 1-2.

BMW already has an exploring business unit which can be used for the proposed greenfield innovation approach for autonomous driving. Participant 4 adds that although autonomy is elementary, regular reporting, which checks whether the exploring business unit is still pursuing the management's vision, is essential to not explore wrong directions (12.03.20, p.14, line 2-5). Again, it is observable that leadership is a key enabler for a successful exploration. The visionary should be the responsible person for the business unit to ensure sufficient commitment.

Participant 8 summarizes that an integrated exploring business unit is in the context of the five key value drivers the correct approach[75]. The majority of the experts recommend this integrated structure to ensure the usage of internal capabilities. However, BMW needs to find a balance between the degree of autonomy and the integration of internal resources. Hence, Dr. Christoph Steiger proposes that especially at the beginning of the innovation path a very high level of autonomy is required while at the end of the path a higher integration of the parent company should be done. Besides the internal network of the exploring business unit, it also needs to explore innovative players in the external ecosystem of BMW. In this context, two experts mention the venture capital fund as a vehicle to explore and integrate external knowledge in the exploring unit. Nicolas Kesselmeier, for instance, explains that his company Hella already has established such structures: “We as Hella have a Hella Incubator System and offer Hella Ventures. We buy companies but also offer smaller companies the opportunity to grow with us, on our business premises” (12.03.20, p.12, line 1-4). Participant 7 confirms that this might be a tool to gain competencies in new autonomous driving-related fields (26.03.20, p.16-17, line 26 p.16 - line 2 p.17). BMW has the venture capital fund “iVentures”. However, today’s portfolio is broadly diversified and not only focused on autonomous driving (BMW iVentures, 2020). It might be useful to commit investment budget for single autonomous driving-related acquisitions by the exploring business unit. The following chapter will show that not only acquisitions are a tool to bring external knowledge into the exploring business unit. Tight innovation cooperations with new partners are also useable to explore external capabilities.

The analysis shows that BMW needs to establish an exploring business unit which perceives autonomous driving as an innovation that requires greenfield thinking. The experts’ voices fit the model of Kauppila (2010) who describes that an exploration maximizing business unit should be understood as a node in a network of internal and external collaborators As the business model innovation implications show, this unit needs not only to develop the autonomous driving levels but to develop a business model around it. Otherwise, BMW will face disruption in the future. BMW’s approaches of the autonomous driving campus and the iVentures fund can be used for

[75] “I think in the context of our discussion this is still the right approach because we want to bring software, hardware and service together and then you have to be more open and broader, then this is the right way”, Participant 8, 01.04.20, p.19, line 11-15.

this approach. However, key success factors are a high autonomy, well-working internal knowledge transfers and the commitment to see the autonomous driving from a disruptive innovation perspective. Autonomous driving requires a new business model to achieve long-term viability. This has to be the key belief of the exploring business unit.

4.4.4 Key principles of explorative collaboration for BMW

After chapter 4.4.3 has described that BMW needs to establish an autonomous driving exploring business unit, perceived as the key node of a network containing external and internal ecosystem partners, the last question is how this exploring business unit should collaborate.

The experts have confirmed that the external network is a key enabler for innovation development. Hence, open innovation concepts need to be discussed. In general, the experts have the opinion that Level 4 or 5 autonomous driving is such a complex and far-reaching technology that it can only be developed by a whole ecosystem with heterogeneous competencies. The open innovation concept described in the literature review is for Participant 8 obligatory. It is simply impossible to develop the technology on its own (Participant 8, 01.04.20, p.18, line 1-3). The experts mention multiple collaboration partners that are required. Dr. Christoph Steiger argues that boundaries between BMW and other OEMs will more and more disappear (09.04.20, p.12, line 11-16). He bases this thesis on the fact that enormous research & development and knowledge resources are required. Again, he mentions Apple and Google as role models which have an extensive innovation ecosystem where Apple or Google acts as a node in the network which assembles relevant technologies to launch innovative services and products (Christoph Steiger, 09.04.20, p.10, line 2-6). Participant 8 and Prof. Dr. Mark Kuhn add that the collaboration with the public sector will be even more relevant to enable a sustainable and modern urban mobility (Mark Kuhn, p.4, line 2-5; Participant 8, 01.04.20, p.5, line 22-23). The infrastructure is a key enabler for autonomous driving business models. Hence, Participant 2 sees the urgency to integrate infrastructure suppliers in the collaboration (26.02.20, p. 13, line 12-17). Participant 3 concretizes this and argues that telecommunication companies like the German Telekom with their 5G broadband technology are new key innovation partners of BMW (06.03.20, p. 3, line 11-14). Nicolas Kesselmeier demands that suppliers should be more and more perceived as innovation partners and not only component suppliers. They have the potential to develop highly specialized competencies, which BMW, as the ecosystem orchestrator, cannot develop on its own (Nicolas Kesselmeier, 12.03.20, p.17, line 22-24). The opinions of the experts show that BMW's exploring business unit needs to be able to orchestrate multiple collaborators from different backgrounds since autonomous driving affects multiple dimensions of the infrastructure and the design of the car. The exploring business unit should already adapt the orchestrator competency from the proposed future value chain. It needs to be able to set up collaboration structures that enable the unit to explore multiple ecosystem competencies. In order to achieve that, Participant 8 sees the

requirement of knowledge sharing within the overall ecosystem[76]. He outlines that the exploring business unit as the key node in the network needs to be the trust enabler in the ecosystem. To build up this trust, Nicolas Kesselmeier proposes to create clear non-disclosure agreement (NDA) processes and open test field approaches where all partners can collaborate in a trusted environment (12.03.20, p.15, line 11; 12.03.20, p.15-16, line 26 p.15 - line 3 p.16). This aspect is not further discussed by the experts. However, the exploring business unit needs to build up a collaboration framework which implies data integrity and expresses trust to all open innovation partners.

The last aspect is how the people of the unit should collaborate. As chapter 4.2 has shown, BMW's today's linear innovation process is not aligned with the new technology. This can be achieved by a more agile development approach (Participant 6, 13.03.20, p.13, line 1-3). Scrum or design thinking are concepts that ensure sufficient flexibility and creativity in the unit to react to new insights and developments. Participant 8 reinforces the importance of customer-centricity and faster decision-making. This exploring business unit needs to base on rapid testing and continuous learning in collaboration with the internal and external ecosystem (01.04.20, p.16, line 22-26). The collaboration model of the exploring business unit strongly correlates with the new value chain model of BMW in times of autonomous driving vehicles. Hence, the unit should be based on the five value drivers to ensure from the start that all relevant fields are discussed, and ecosystem partners are included in each value driver dimension. Furthermore, agile collaboration modes need to be established across the five value drivers to ensure consistency and dynamic in the development of the new business model of BMW in times of autonomous driving. Again, visionary leadership is required to align all employees and ecosystem partners. The leader and his or her vision is the key alignment tool for this.

[76] "I believe that here Open Innovation also means that I open myself up to other companies and I reveal things. In return, however, I also receive information and, of course, compensation, which can also result in added value. If an ecosystem exists in which all members believe, then it can work. Trust plays an enormous role", Participant 8, 01.04.20, p.18, line 7-13.

4.4.5 All organisational conditions for the successful exploration

The overall analysis of chapter 4.4 has shown that the literature-based organisational conditions of establishing an explorative business unit (based on cross-functionality and free-thinking), open innovation approach aligned with the quadruple helix system and, finally, a high corporate commitment to autonomous driving and the related future business model as well as a sufficient level of autonomy are key elements to enhance successful exploration. The experts have divided the conditions into three key layers. The first one is the role of senior management. The key enabler is one responsible visionary in the senior management which needs to be equipped with sufficient overall corporate commitment of resources, power and time. To enable such an exploring business unit, BMW needs to push recruiting and internal knowledge development forward. The clear vision of future mobility is, in this context, the factor to attract talent and to align the organisation. The visionary is the responsible agent for the success of the exploring business unit, which should be an autonomous one integrated into the existing parent company. The balance between a sufficient autonomy to ensure a greenfield approach and the usage of existing competencies in the exploiting parts of the firm is a key success factor. An integrated venture capital budget can help to integrate quickly new and highly valuable knowledge from innovative start-ups in the BMW ecosystem. This ecosystem needs to be deeply integrated into the innovation process since the challenges of developing the proposed innovation (incl. the high-end technology and the described business model) are very heterogeneous and ambiguous. Only a diversified portfolio of development partners can enable this kind of disruptive innovation. Hence, the Innovator's Dilemma of BMW is only solvable if BMW's exploring business unit is capable of managing a diversified ecosystem and integrating different knowledge segments in one solution. The key to that is the establishment of trustful and secure collaboration forms with the external ecosystem. Since the development of the technology is highly uncertain, the unit has to be agile and dynamic in the collaboration form. Linear and long innovation processes are not suitable anymore. The focus should lie on quick experimentation and agile collaboration forms to ensure the required creativity in the process. The five key value drivers should already be reflected in this business unit. Today's structure of BMW can be used for that. The autonomous driving campus and the iVentures fund are structures that might be similar to the proposed ones by the experts. BMW's strength of orchestrating multiple suppliers is one that can be used as a future competitive advantage. It is a key capability to enable the role of the new unit as a key node in an external and internal autonomous driving network. The following figure summarizes all mentioned and discussed conditions and related arguments:

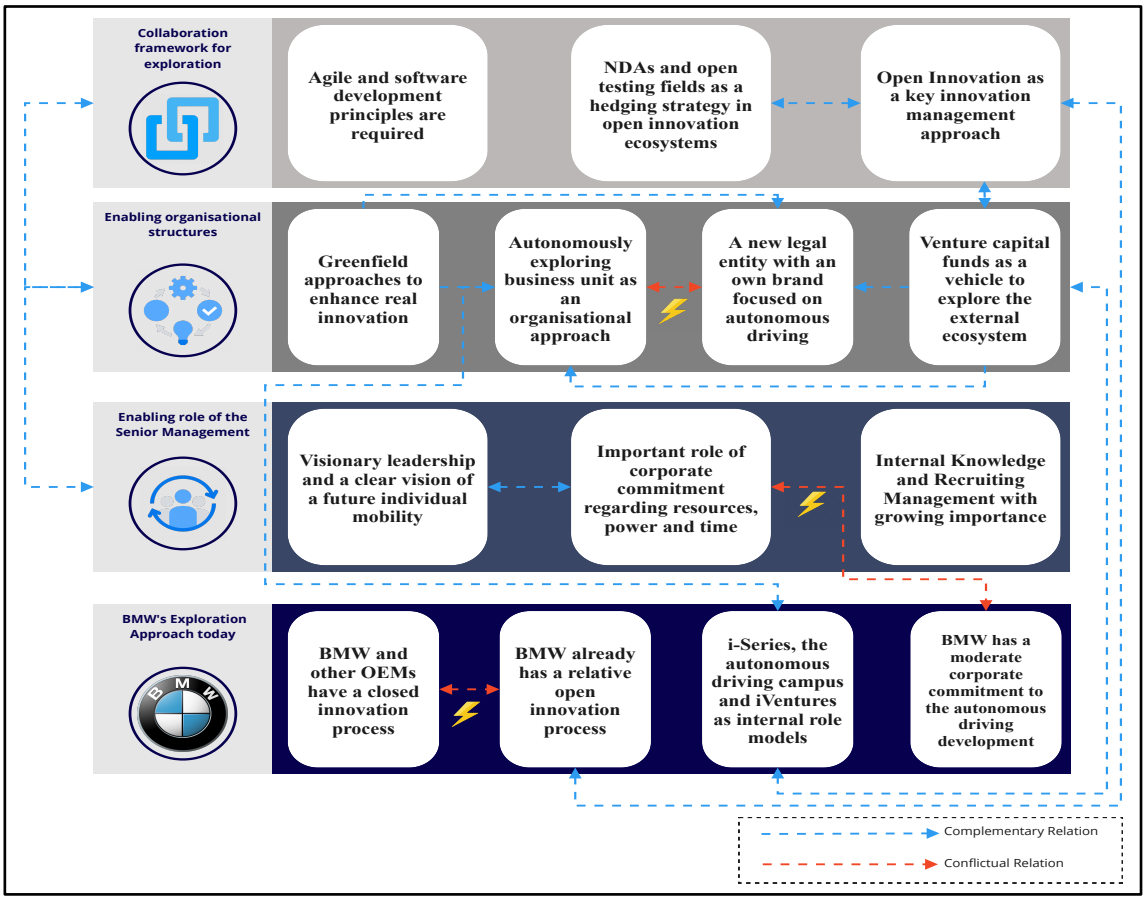

Figure 40 - Enabling conditions for organisational exploration.

4.5 Concluding interpretation of the results

The conducted findings analysis targeted to find answers to the key lead questions of the dissertation:

(A) Does the BMW Group face the typical Innovator's Dilemma in regard of autonomous driving technology?

(B) How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?

(C) Which organisational conditions need to be established today to enable this kind of Business Model Innovation and the development of the autonomous driving technology?

To achieve this, the ten conducted interviews from the predefined expert panel and the secondary data source from the Capgemini Research Institute have been analysed with the help of a combination of deductive and inductive thematic analysis. The conducted literature review has helped to give the first guiding frameworks and dimensions to frame the explorative research approach of this dissertation. Theses deductive aspects of the research have been verified by the analysis of the experts' opinions. Additionally, their statements have been categorized and mapped in a way that new categories and aspects could be derived. This reflects the inductive part

of the analysis. Together, both approaches have to find appropriate answers to the research questions. Schoemaker et al.'s dynamic capability framework to manage an environment highly influenced by the VUCA dimensions has guided the answering of the lead questions.

The first lead question deals with sensing the change (Schoemaker *et al.*, 2018). The autonomous driving levels of 4 and 5 are highly disruptive for BMW since it triggers a strong technology push as well as a market pull through new competitors, changing customer preferences and a decreasing relevance of today's brand value and hardware creation of BMW in the future. Additionally, through misaligned management beliefs and capabilities, BMW will not be able to adopt the new technology and related business model implications. Hence, the three main dimensions of the Innovator's Dilemma market push, technology pull, and internal misalignment of structures, assets and management approaches can be confirmed. Therefore, the lead question of whether BMW faces the Innovator's Dilemma in times of high-level autonomous driving can be answered with "Yes". BMW's structure and competencies are not aligned with the coming technology pushes and market pull. According to the experts, the sensed change can be highly disruptive not only for BMW but also for all German OEMs.

Based on the sensed change, the question is how the change can be used as an opportunity. In Schoemaker et al.'s framework, this part is defined as seizing the opportunity (Schoemaker *et al.*, 2018). The key finding of this part is to which extent business model innovation is required to achieve viability of BMW even in times of potential disruption by autonomous driving. The extensive literature review of the research field business model innovation has resulted in the fact that business model innovation is a key tool to enable the access of customers to ground-breaking technologies. In this context, four key dimensions of a business model have been identified: Business model narrative, value proposition, value chain and the profit mechanism to capture a part of the value. Based on the experts' opinions, all four predefined business model dimensions will change significantly. Gassmann et al. define that business model innovation is required when two or more dimensions have to change (Gassmann *et al.*, 2014). Therefore, BMW will need to innovate the business model level to achieve alignment between the company and the future technology landscape. BMW needs to remind itself that the corporate DNA is to enhance dynamic premium mobility through innovation and leading technology. The value proposition will be based on new customer gains and pains from technology. Autonomous driving promises to enable a more comfortable, time- and cost-efficient mobility for a customer field in the urban regions which is digital affine as well as sporty and equipped with a higher than average income. To serve these customers, BMW needs to redefine its brand towards a lifestyle brand which offers a digital enhanced premium mobility experience. Digital services, a well-designed interior combined with innovative ways of Human2Machine interaction and a sufficient level of individualisation are the new offerings that express premium mobility in the future.

To enable that, BMW needs to construct a value chain that contains five key value drivers: Hardware, software, data, content and service creation. Only these five together will enable future premium mobility for BMW customers. The trend of establishing platform business structures plays a key role of enabling the new value drivers for BMW since the complexity of the new requirements rise exponentially and only an ecosystem of providers can ensure the value creation in all parts. Especially the areas of service and content need to be understood as a platform where BMW facilitates the interaction between producers of services and content with the users of the BMW mobility service. BMW needs to build a whole service and content ecosystem around the core mobility service. However, BMW needs to develop its core competencies in the dimensions of hardware, software and data creation to enable the new value of the business model: Self-driving vehicles which bring the user securely from A to B. BMW will need a deep integration of suppliers in all of the five layers. Therefore, BMW has to be capable of managing a very complex ecosystem of different partners. Today's silo thinking is inappropriate for a new landscape where customer preferences and technological requirements will change fast. Hence, a more customer and key processes centric organisation are required. The new value chain will be much more focused on maximizing the responsiveness and less on minimizing the cost structure.

Finally, through subscription models (standard to premium packages) a part of the produced value will be captured by BMW. Autonomous driving vehicles will change the consumer perception of individual mobility and promise to reduce the cost structure per journey. Other revenue streams like participating at the revenues from third parties if services and content will be sold through the BMW mobility platform need to be additionally considered. Today, this is also the case where BMW and other OEMs can establish additional revenue sources around the core product car (e.g. maintenance or financing the purchase of the car). The interpretation of the findings shows that business model innovation can help BMW to achieve long-term viability. However, it requires a significant transformation of the current state. All aspects of the business model need to be realigned with the new technological landscape.

Exactly this part is represented by the last lead question. In Schoemaker et al.'s framework, the last step is all about transforming the organisation (Schoemaker *et al.*, 2018). It clarifies which organisational conditions are required to enable an exploration of business model innovation like the one described above. The literature mainly argues that an exploration business unit with high autonomy and corporate commitment and an open innovation approach is required to use new opportunities. Based on the data set, three key layers can be derived. The first one is a visionary in the senior management that has the organisational power to commit a sufficient level of time, knowledge and money in the exploration of the technology and the related business model. In BMW's case, the senior management needs to push the recruitment and internal employee development management towards the requirements of the future business model. For all these

approaches a clear vision is required. This is the key criteria to align the organisation and external partners. The second layer is the organisational structure of the exploration. The experts argue that a greenfield innovation approach is required which needs to be enabled by an autonomous business unit. It is focused on the autonomous driving technology and the related business model innovation. Especially at the beginning of the development, high autonomy is required. However, internal competencies should be exploited. The exploring business unit should be understood as the key node in a network containing internal and external partners. Therefore, open innovation is a key concept of collaboration within the unit. New partners from the parent company or the external ecosystem need to be directly integrated into the exploration process. This exploration process is organized similarly to today's software development ideas. An iterative and agile collaboration of a cross-divisional team is required to ensure a sufficient level of flexibility. BMW already has an open innovation approach and organisational structures like the autonomous driving campus that wants to enhance the exploration of autonomous driving. These can be used as initial organisational set-ups. However, BMW should use the derived factors and validate whether all conditions are implemented in existing structures and approaches.

As a result, all lead questions were sufficiently answered. The ten interviewed experts have been all relevant for the lead questions since all of them have a strong relation to BMW or the overall German automotive industry. The heterogeneity of the experts helped to identify conflicts and consent within the panel group. In general, many dimensions, deductively identified in the literature, have been confirmed by the experts. However, the reviewed literature lacks in delivering a clear case study research which applies all three steps analysed in this dissertation. Hence, the outcomes of the dissertation can fill a gap in the literature. In this context, it needs to be said that the three-steps of the analysis are all interrelated. The causes of BMW's Innovator's Dilemma are, simultaneously, dimensions that need to be renewed in a future business model. The future value chain set-up of BMW has elements which are relevant for the explorative business unit. An open ecosystem approach enhanced by agility and new competencies in all five value drivers is also required in the exploring business unit. The structured approach starting with understanding the change over seizing the new opportunity through business model innovation towards transforming today's organisation helps organisations like BMW to manage coming technological disruption in a systematic way.

A key starting point for BMW will be to define a clear vision of how individual mobility of BMW in times of Level 5 autonomous driving should look like. The developed future business model can be used as a target state for the explorative business unit. BMW's senior management should review the current set-up of the autonomous driving campus if the described organisational conditions are fulfilled. If all of them are given, BMW can start to develop autonomous driving use cases and, simultaneously, the related business model innovation aspects. Disruptive

innovation is only possible if a disruptive technology is accessible for users through an aligned business model. The analysis shows that the current autonomous driving strategy of BMW might not be suitable. Hence, BMW should start again with the sensing of change since this analysis implies that disruptive change will occur and that this requires a significant shift in the perception of individual mobility and the internal set-up of BMW's structures and competencies. BMW, similar to companies like IBM, need to be capable of transforming the company from a hardware manufacturer towards a premium service provider. The Apple strategy of combining high-quality hardware with software and services might be a strategy that could fit BMW's set-up. However, autonomous driving will shift individual mobility from ownership to a shared concept where the customer will be a member of BMW and not only a client. Hence, the analysis proposes that BMW needs to see itself as a digital enhanced premium mobility provider.

All in all, the senior management should start today with perceiving autonomous driving as it is: Without any business model innovation enabled by organisational exploration, autonomous driving will cause a technological disruption that will dramatically affect the future relevance of BMW.

5 Concluding Thoughts

5.1 Implications in terms of the research questions

As previously discussed, within the interpretative conclusions of the findings, the results suggest clear answers to the three interrelated lead questions on how autonomous driving will impact BMW's future business model.

The insights gained from the heterogeneous expert panel show that high-end autonomous driving will cause an Innovator's Dilemma for BMW since its internal structure is misaligned to this oncoming technological breakthrough. A newly emerging market threatens to draw sales to new competitors better aligned to customer preferences. BMW will face the threat of losing today's market relevance since new core competencies and forms of collaboration are required for BMW to thrive in a world of autonomous driving.

The key to solving the Innovator's Dilemma will be innovation on a business model level. The historical DNA of BMW – to enable sporty and comfortable mobility through innovation and cutting-edge technology – needs to be reenergised. The new value proposition of delivering a digital enhanced premium mobility experience implies the shift from a car manufacturer towards a mobility experience provider. It can be enabled by the five value drivers of hardware, software, data, content and service creation. These drivers need to be delivered using a completely new set of competencies and structures which are more customer-centric and agile. The orchestration of the overall mobility ecosystem will be a key competence of BMW in the future. BMW needs to be perceived as a premium mobility experience platform – rather than just a car manufacturer. Among others, this can be reflected in the value capturing mechanism of a subscription model. It is a typical revenue model of today's leading platform companies like Apple, Amazon or Microsoft. Subscription fosters the impression that a renewed BMW brand identity will be more lifestyle focused than engineering oriented. Hence, the degree of joy of driving will be defined by the mobility experience of the customer and the possibility to use the time spent in the car the way the customer wants.

BMW needs to start today with the exploration of the developed business model innovation fields to ensure its relevance in the future. BMW's existing structures like the autonomous driving campus und the venture capital fund iVentures need to be aligned with the discussed organisational conditions that are key to successful organisational exploration. A visionary figure in senior management, with a clear vision of the future mobility, is an important element for the success of the exploration. Autonomy, corporate commitment and an agile collaboration approach are further criteria for the successful creation of business model innovation. Additionally, external

partners need to be directly integrated into the development processes. BMW might not be able to manage the technological complexity of the topic on its own.

The analysis shows that the three questions guiding the research are interrelated and needs to be considered together. The gap in the literature was that the concepts of (i) the Innovator's Dilemma, (ii) business model innovation and (iii) organisational exploration of new opportunities were not analysed in one context. Most of the models in these three dimensions derived from the literature review were validated by the experts' opinions. However, additional aspects of the concrete case of BMW were identified and, hence, have complemented the reviewed literature.

5.2 Limitations of the research

This research was conducted over 14-15 weeks. This time constraint led to a limited number of interviews. Additionally, the COVID-19 crisis negatively impacted the data collection process. This external constraint was difficult to manage in advance. However, it would be recommended to schedule more interviews in advance of the research period to accommodate for such risks. The author was still able to conduct ten valuable interviews with relevant experts. The strategy of including multiple stakeholders was aimed at reducing bias and to identify controversies. It ensured that different perspectives were discussed and weighed. The significance of the research could have been improved by interviewing more BMW employees directly involved with autonomous driving. This could have provided even deeper insights into BMW's current autonomous driving strategy and the design of the autonomous driving campus. Furthermore, the panel group contained only German experts. It would have been valuable for the research to integrate international experts from, for instance, new Chinese or American automotive players like Tesla, Byton or Google Waymo. BMW is a global automotive player and, hence, needs to consider international perspectives on a case setting. However, access to these experts was limited not least due to COVID-19.

Nevertheless, the density of opinions on the different key questions leads to the impression that a sufficient level of saturation was achieved. All interviewed experts had a clear opinion on the different building blocks of the research. The amount of mutually exclusive codes and themes derived from the data set show that a sufficient base of relevant knowledge was developed by the research method.

5.3 Recommendations for practice and future research

In general, the research needs to be seen as an initial platform for further research and practical developments. In terms of practical developments, it would be interesting to test the innovation readiness of BMW based on these findings. The insights can be used as a basis for strategic discussions within BMW. The research provides a holistic and strategic overview of the possible impacts of Level 4 and higher autonomous driving on the business model of BMW in the future. Hence, it can be the foundation for the derivation of strategic project initiatives within the company.

Furthermore, many experts suggested that the case setting of BMW is similar for other premium OEMs. Hence, the framework might be used to assess the long-term viability of other OEMs in times of autonomous driving as well. Especially the German companies like Mercedes Benz, Audi and Porsche will face similar challenges. They all have to rethink how they can achieve the business model transformation from producing and selling cars towards Mobility-as a-Service. Many of the arguments for BMW might apply to other brands as well. The practical value of the research can also be extended. In a business world of VUCA, more and more companies will face technological disruption as the example of Nokia or Kodak showed. Therefore, the three-step framework of firstly sensing the future change with the help of the derived Innovator's Dilemma model, seizing the opportunity through mapping business model innovation dimensions and, lastly, transforming the existing company through conditions that enhance organisational exploration can be helpful for multiple industries. The initial industries would be mobility-related ones like aviation. However, in today's world, many heterogeneous industries face technological disruption. Hence, the framework could be considered even for non-mobility related industries.

Additionally, the dissertation is also a platform for further research in the field of business model innovation in times of technological disruption. The initial field would be the validation of the different models and frameworks. The used research design in this dissertation focused on developing the models. Hence, their validation for BMW and other premium OEMs requires a completely different research approach with a different panel group. For instance, to validate the model for BMW more executives from related business units of BMW and, in the best case, parts of the senior management need to be interviewed.

The validation of the models is not the only additional research field. The holistic models and frameworks enable further in-depth research in multiple aspects. For instance, the hypothesis that short-term earnings expectations have a direct impact on the willingness to innovate in the long-term could be analysed by a quantitative comparison of different company performances. Another example would be the question of how BMW could close the talent gap within its ranks. This

research suggests that completely new competencies (correlating with the five value drivers) are required and that BMW faces the issue that, even today, they are not able to hire the new required talent portfolio. Another alternative would be the research on how the open ecosystem in the future value chain of BMW should concretely be managed. A modern supply chain management needs to be designed. A further example would be quantitative research regarding the in-depth understanding of the future target group, including the multiple jobs of the new service, of BMW. The value proposition canvas could be used as a framework.

These examples show that this research is a platform for multiple further topics in the areas of management. Other related research fields are psychology (the psychologic aspects of building up customer trust regarding the usage of self-driving vehicles), software engineering (solving concrete problems of the autonomous driving use case development) or legal aspects (who is liable for accidents of the autonomous vehicle). All these examples show that the thriving technology has an impact on a wide range of research fields. This research can be seen as an initial platform for many of them.

5.4 Final conclusion and reflections

The analysis of the three interrelated lead questions shows that potentially disruptive technologies need to be managed today to ensure viability tomorrow. It also shows that disruption requires not only the adoption of the technical requirements but also a shift in the perception of how a company will do business in the future. The iPhone was so disruptive because it was able to combine new technologies with smart business models, like the App Store, enabling customers to access the new, ground-breaking technology. This is exactly what BMW needs to understand. The expert panel has confirmed that autonomous driving will change how premium mobility is perceived. If BMW does not acknowledge this fact and is not willing to build up a new business model, disruption will occur, and BMW will serve as another example of Christensen's Innovator's Dilemma. The research also shows that this destiny might not only affect BMW but also the overall German automotive segment as the key industry of the national economy. The research emphasizes again how important it is to achieve a balance between exploiting existing markets and exploring new future opportunities in one company. The impression, based on the conducted interviews, is that BMW mainly focuses on the short-term exploitation of existing markets and are not equally committed to exploring future opportunities. Autonomous driving can be a future opportunity for all stakeholders of BMW if the company now shows a willingness to rethink a former successful business model and commits itself more towards organisational exploration. They need to rethink its role in the future individual mobility game and this research helps BMW to find answers to the strategic questions:

"What is the role of an OEM in this future game? What does the chessboard look like? Which figures are on it? And who is the king and the queen and who are the pawns?"

– Dr. Christoph Steiger.

(09.04.20, p.17-18, line 25 p.17 - line 2 p.18)

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Appendices

Appendix A – Informed Consent Form

GRIFFITH COLLEGE DUBLIN

Griffith College GBS
Sample Template – Informed Consent Form

An Informed Consent Form should generally contain the following information. Section 3 onwards should be written in the first person, e.g. "I will be asked to attend…I may withdraw from the research study at any point…..I am aware that the data…etc." The headings are there for guidance and do not need to be included in your form.

I. Research Study Title: Explorative analysis of how the autonomous driving technology impacts the business model of the automotive premium segment: A case study of the BMW Group

University: Griffith College, Dublin (Graduate Business School)

Principal Investigator: Dr. Garrett Ryan (Graduate Business School Programme Director Griffith College Dublin), E-Mail: garrett.ryan@griffith.ie, Tel.: 01 4163324

II. Clarification of the purpose of the research

The objective of this Research Study is to gain new knowledge that will help to understand how disruptive technologies are arising, how a business model needs to be amended and how this strategic innovation can be organized today to keep relevance in the future. This Study may therefore be of benefit to you by providing you with the opportunity to contribute to the development of this research fields so that you and other decision makers may benefit from derived insights concerning strategic innovation in a VUCA environment. The insights of the research will be shared with the participants by sending summaries of key insights to the single participants if they want.

III. Confirmation of particular requirements as highlighted in the Plain Language Statement

I will be asked to attend a semi-structured interview to discuss BMW's business model implications in times of autonomous driving vehicles. I am able to withdraw from the research study at any point and I am aware that the data gathered in the interviews will be analysed an used in the final dissertation.

Participant – please complete the following (Circle Yes or No for each question)

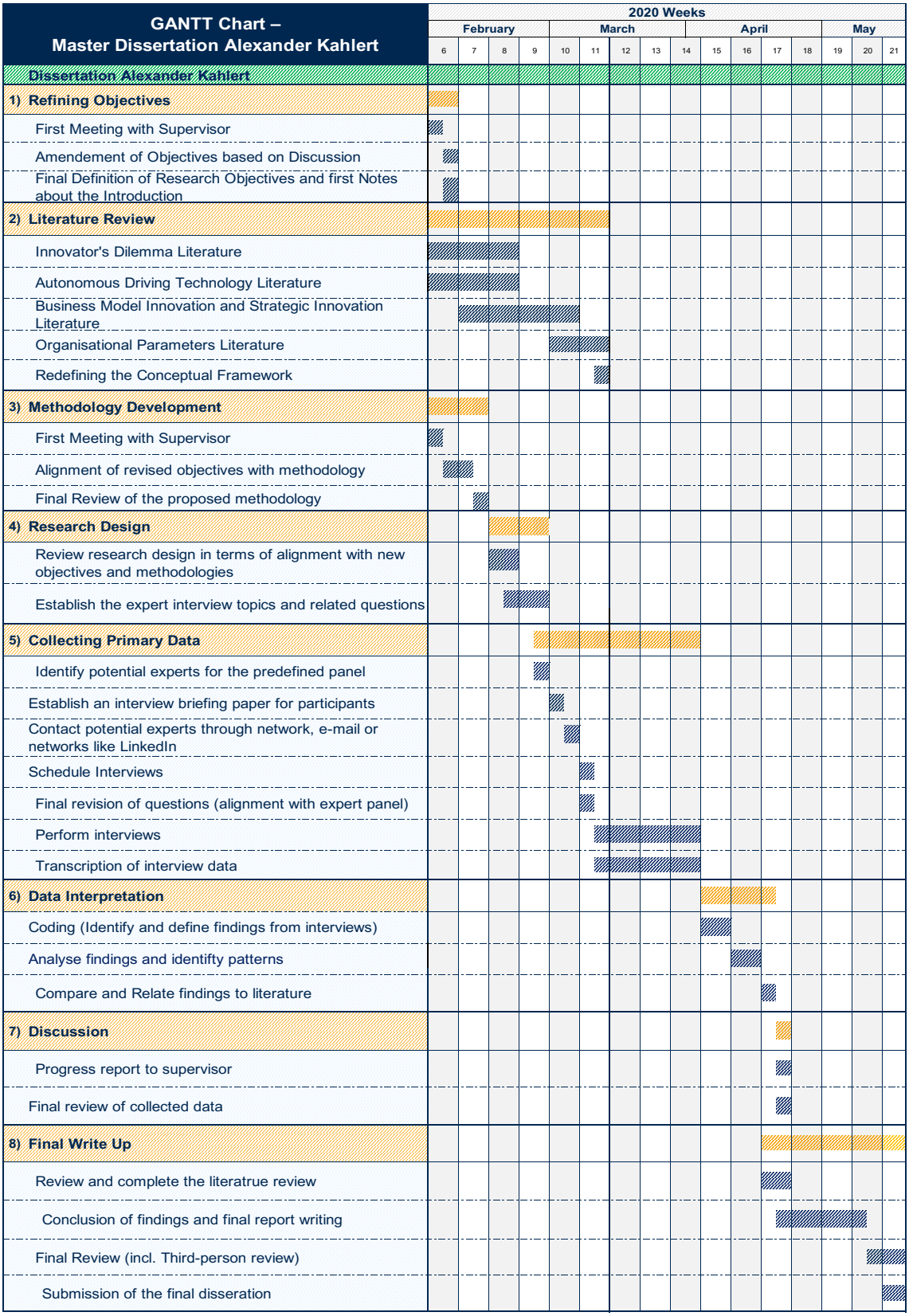
I have read the Plain Language Statement (or had it read to me)	*Yes/No*
I understand the information provided	*Yes/No*
I have had an opportunity to ask questions and discuss this study	*Yes/No*
I have received satisfactory answers to all my questions	*Yes/No*
I am aware that my interview will be audiotaped	*Yes/No*

IV. Confirmation that involvement in the Research Study is voluntary
I may withdraw from the Research Study at any point.

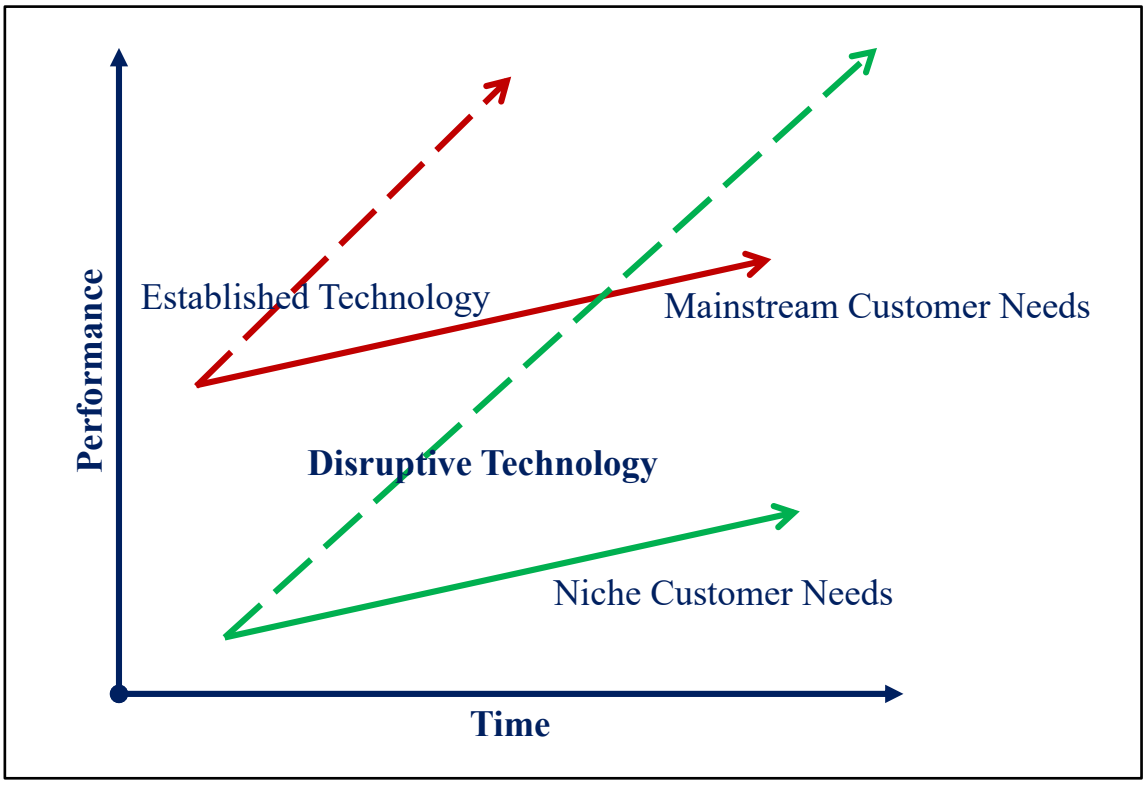
V. Advice as to arrangements to be made to protect confidentiality of data, including that confidentiality of information provided is subject to legal limitations

Every effort will be made to ensure confidentiality of participants. The taped interviews will be downloaded to a password controlled computer, and typed transcripts will be held within password controlled documents. Audio tapes and hard copies of transcripts will be held in a locked filing cabinet. Biographical details will be omitted in the final report to protect participant's identity if participant requires that. Confidentiality of information provided is subject to legal

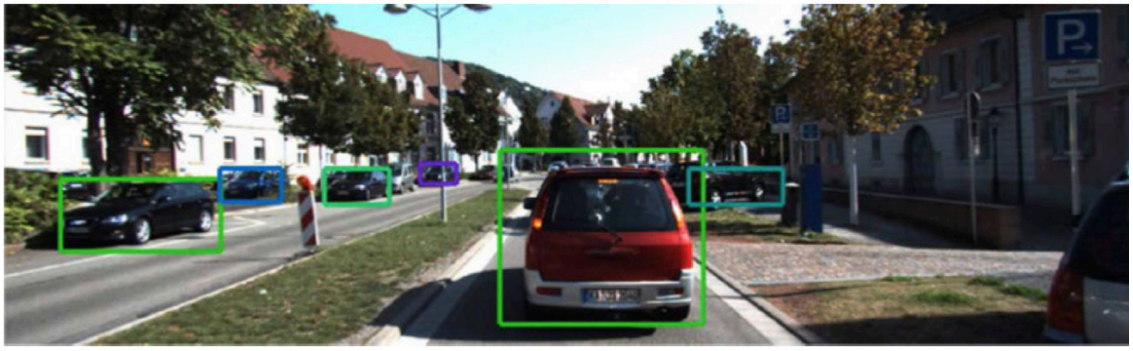
Appendix B – Time Schedule Dissertation

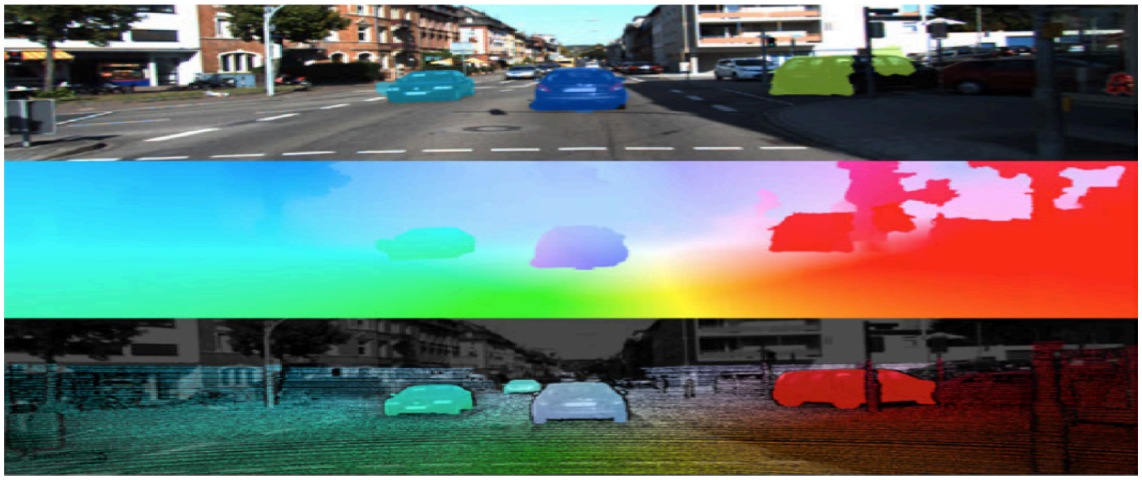


Appendix C – The progress of low-end disruptive innovations (based on Henderson, 2006).

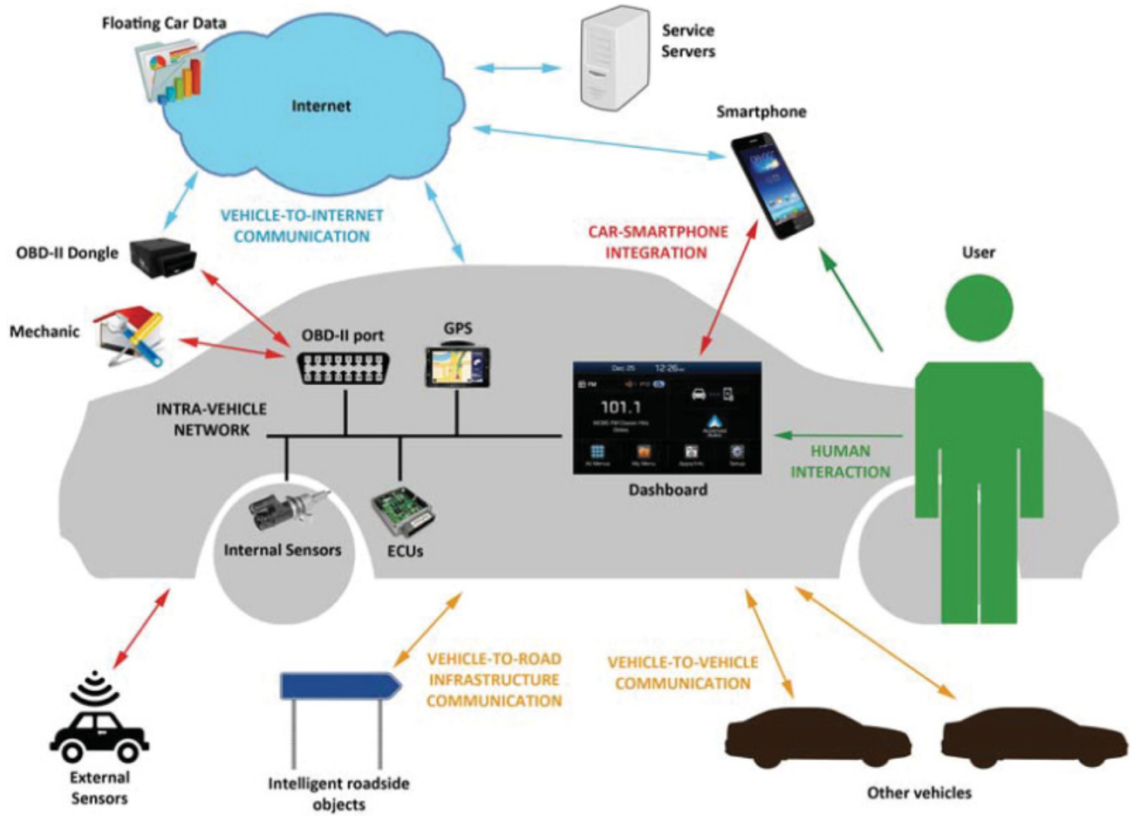


Appendix D – Perceptions of an autonomous driving vehicle (Liu et al., 2018).

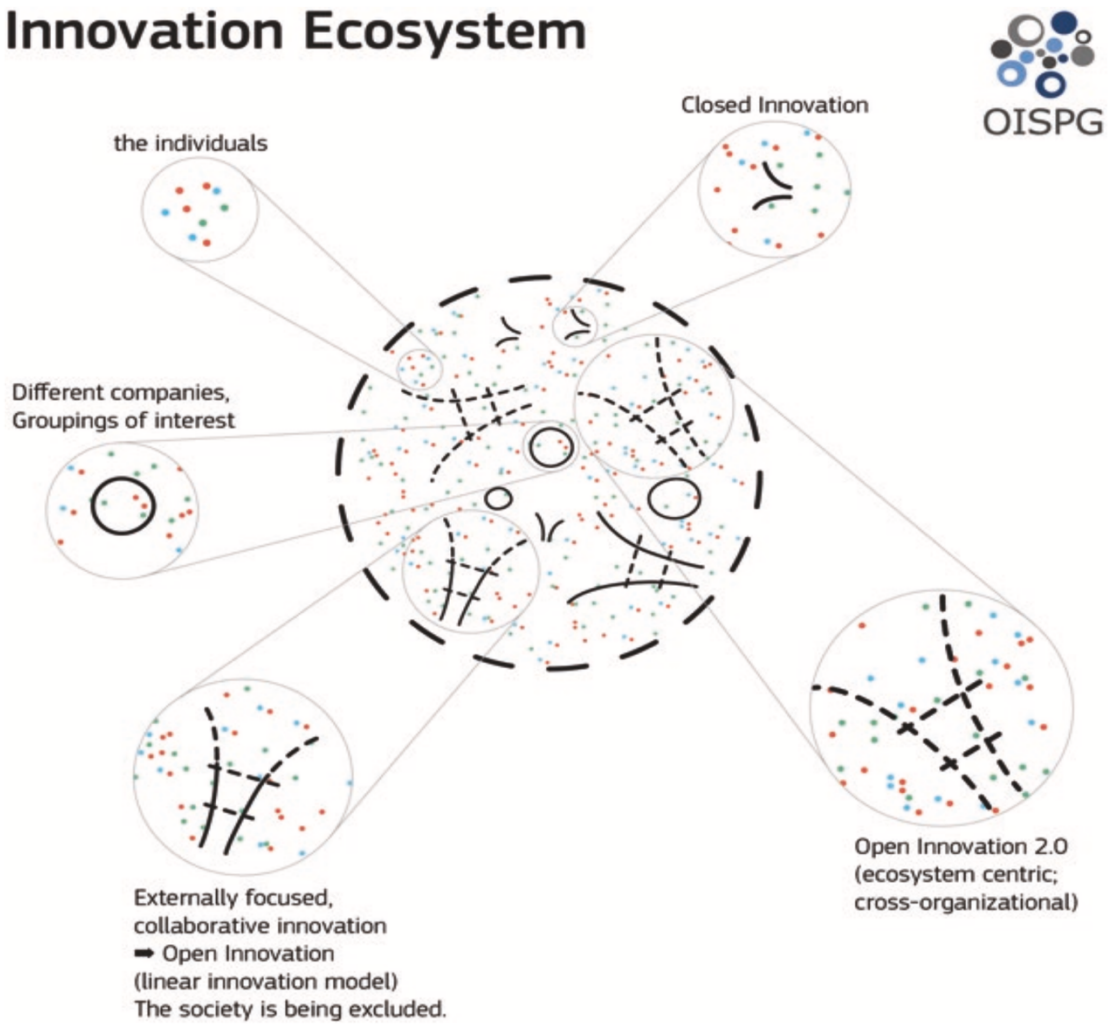




Appendix E – Overview of the connected car system (Coppola and Morisio, 2016).



Appendix F – The quadruple helix system and Open Innovation 2.0 (Curley and Salmelin, 2017).



Appendix G – Relation between interview questions and lead questions

	Lead Questions		
	A	B	C
	Does the BMW Group face the typical Innovator's Dilemma in times of the autonomous driving technology?	How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?	Which organisational conditions need to be established today to enable this kind of business model innovation and the development of the autonomous driving technology?
	Supporting Literature Concepts		
Number of Interview Question in each category	*The Innovator's Dilemma of BMW (see Figure 7)*	*Updated Business model framework of the dissertation (see Figure 19)*	*The three Organisational Conditions enhancing Business Model Innovation (see Figure 22)*
1	Autonomous driving: Revolution or Hype? The Google Waymo subsidiary has been using self-driving cars on U.S. roads for years and was one of the first companies to introduce commercial Level 4 Autonomous Driving. How do you assess the disruptive potential of autonomous vehicles for BMW and other car manufacturers?	In your opinion, what is BMW's value proposition and why do customers buy vehicles of this brand?	Many scientists and managers claim that the management of disruptive technologies requires specific organizational conditions such as corporate ventures, innovation labs or autonomous portfolio brands. In this context, what recommendation would you make to BMW to enable the development of autonomous vehicles and the accompanying business model and thus remain relevant for the future?
2	Would you agree with the thesis that BMW must strategically design a new business model, with the disruptive technology at its core, in order to be relevant tomorrow?	Many scientists and consulting firms are of the opinion that autonomous driving will help the Ride-Hailing or Car-Sharing business model to achieve a breakthrough. Would you agree with this and if so, why?	What role do BMW's suppliers play in implementing the new business model and the new technology? Will BMW develop more in-house or enter into closer cooperation with suppliers?
3	Would you agree with the thesis that the German automotive industry is undergoing an enormous structural change?	A car is considered to be the third place, next to home and work, where customers spend their time. Autonomous vehicles promise more time for social interaction, entertainment and productive time. In your opinion, how can BMW still maintain the brand essence of "ultimate driving machine" in autonomous cars? What does "premium" mean to you in the new technological landscape?	What role does the concept of open innovation (the opening of the innovation process of organisations and thus the active strategic use of the outside world to increase the innovation potential) play?
4	How would you assess the chances of success of the German automotive industry and BMW in particular? Can the German automotive industry maintain its quality leader status in the coming years?	Volvo and Audi have started experimenting with new revenue models based mainly on subscription models with monthly payments. Is this revenue model conceivable for BMW in the autonomous future? What other revenue models do you see for manufacturers like BMW?	The literature names five essential business models that emerge anew in times of autonomous, networked and possibly shared individual mobility: Data, Hardware, Software, Content and Service Creators. Which roles can BMW take on itself and where should BMW act as a platform to orchestrate different participants of the ecosystem? What role can Hella take on and support BMW?
5	What customer pains and gains do you see that autonomous driving could solve or enable?	Experts in the field of autonomous vehicles claim that completely new facets of knowledge, resources and skills are needed to be successful in the future. What would you mention specifically for autonomous BMW vehicles?	How do suppliers like Hella help to make these premium aspects and the interactions mentioned possible?
6	Why did you decide in favour of Tesla and against German premium brands like BMW when you last bought a car?	What role do BMW's suppliers play in implementing the new business model and the new technology? Will BMW develop more in-house or enter into closer cooperation with suppliers?	The autonomous vehicle is a complex project involving several organisations. Should BMW rethink its current closed innovation process and focus more on open innovation concepts? What role do suppliers like Hella play in the development of the BMW car of the future? How could a closer collaboration between suppliers and manufacturers look like?
7	What emotion does the thought of a self-driven car evoke in you?	What does a typical BMW customer look like to you?	What role does corporate commitment of resources and time play in relation to the technology of the autonomous vehicle to be developed and the associated business model? Is this a significant organizational enabler that enables BMW to remain relevant in the long term?
8	Would you trust a completely self-driving car without restrictions?	How would you describe the DNA of BMW?	The autonomous vehicle is a complex project involving several organisations. Should BMW rethink its current closed innovation process and focus more on open innovation concepts? What role do possible collaboration partners such as e.g. public infrastructure departments, telecommunications providers and customers?
9	How much value would you add to a premium brand that advertises with "joy of driving" if cars would drive themselves?	How would you describe a typical target customer of BMW including his/her characteristics?	How much commitment has BMW attributed to the topic of autonomous driving?
10	Are you looking forward to an autonomous driving future?	BMW has already presented the Vision iNext concept car, which is essentially based on autonomous driving. Does autonomous driving have a high priority within BMW's strategic road map? If so, what does the car of the future look like for BMW? What are the key aspects of this new vehicle?	Experts in the field of autonomous vehicles claim that completely new types of internal cooperation are needed to be successful in the future. What characteristics would you emphasize specifically for the development of autonomous BMW vehicles?
11	How can a brand like BMW, which advertises with "the joy of driving", even differentiate itself when the vehicles themselves are driving?	How would you describe a persona of a typical BMW customer?	What role do authorised dealers play in the development of the BMW car of the future? What might a closer collaboration between car dealers and manufacturers look like?
12	What customer problems could a fully autonomous vehicle solve and what additional benefits could it provide?	Welche Customer Pains und Gains sehen Sie, die das autonome Fahren lösen bzw. ermöglichen könnte?	Is the autonomy of the departments that develop the autonomous driving exploratory towards the rest of the OEM organization an elementary factor for a successful research & development work in this field?
13	Is the premium segment in particular (i.e. companies such as BMW, Mercedes and Audi) at risk from the new technology? Would you therefore agree with the thesis that autonomous driving forces classic OEMs to develop novel business models in order to be relevant in the future?	Many scientists and consulting firms are of the opinion that autonomous driving will help the Ride-Hailing or Car-Sharing business model to achieve a breakthrough. Volvo, Audi and Porsche, on the other hand, are currently testing a subscription model with monthly payments. The customer as a member of the car brand. How do you assess the individual models in the context of autonomous driving vehicles and BMW's DNA?	The autonomous vehicle is a complex project involving several organisations. How does your company organize the innovation process around the topic of autonomous driving? What role do open innovation concepts play?
14	As an external consultant, how do you perceive the initiatives of OEMs, especially BMW? Does BMW have a clear road map towards an autonomous future and a strategy how to remain relevant as a premium manufacturer in this time?	The literature names five essential business models that emerge anew in times of autonomous, networked and possibly shared individual mobility: Data, Hardware, Software, Content and Service Creators. Which roles can BMW take on itself and where should BMW act as a platform to orchestrate different participants of the ecosystem? What role can Hella take on and support BMW?	How do you assess the relevance of the following two organisational factors with regard to the development of autonomous mobility concepts: a. The autonomy of the business units that are exploratively developing autonomous driving, compared to the rest of the OEM organisation b. Senior management commitment to long-term innovation initiatives
15	Why did you opt for Tesla when you last bought a car and against German premium brands like BMW?	How do suppliers like Hella help to make these premium aspects and the interactions mentioned possible?	
16	What emotion does the thought of a self-driving car evoke in you?	Technology companies like Google have developed completely different tasks and processes for the development and marketing of new products. These are much more agile and faster than conventional processes. For example, Google was able to launch the streaming platform for video games Google Stadia within 6 months development and go-to-market time. In your opinion, which essential fields of activity and associated processes must be established at BMW to enable successful business models for the self-driving car?	
17	Would you trust a completely self-driving car without restrictions?	BMW recently introduced the Vision iNext concept car, in which the technology of autonomous driving is a focal point. In your opinion, how can BMW still maintain the brand essence of "ultimate driving machine" and premium in autonomous cars like the Vision iNext? Which essential interactions in the "Ease Mode" of the Vision iNext will be demanded by future customers?	
18	How much more value would you give to a premium brand that advertises with "ultimate driving machine" if cars would drive themselves?	Technology companies like Google have developed completely different tasks and processes for the development and marketing of new hardware and software. For example, there are UX Design, Data Science or Software Engineering departments. What are the essential fields of activity that make autonomous vehicles possible?	
19	Are you looking forward to an autonomous driving future?	To what extent must BMW's sales and revenue models change in an autonomous future? Is classic car sales still up to date then?	
20		In your opinion, how would customers use the free time in a self-driving car? Are there any focal points for the BMW customer groups described above?	
21		Technology companies like Google have developed completely different tasks and processes for the development and marketing of new hardware and software. For example, there are UX Design, Data Science or Software Engineering departments. What are the essential fields of activity that make autonomous vehicles possible?	
22		What is the main purpose of your current vehicle?	
23		What factors in relation to self-driving cars could encourage you to use/buy?	
24		An autonomous vehicle promises more time for other activities within the vehicle. How would you use the newly gained time? Examples would be productive work, Entertainment or relaxation.	
25		Would it be conceivable for you to do without your own car in an autonomous driving future, if mobility was still available on demand?	
26		Could you imagine subscribing to a monthly subscription with a car manufacturer to get exclusive access to the brand's autonomous mobility services and other benefits?	
27		In your opinion, how would customers use the free time in a self-driving car? Are there any key issues for customers in the premium segment?	
28		How can a brand like BMW, which advertises with "the joy of driving", even differentiate itself when the vehicles themselves are driving?	
29		The literature names five essential business models that arise anew in times of autonomous, networked and possibly "shared" individual mobility: Data, Hardware, Software, Content and Service Creators. What roles can OEMs such as BMW or Porsche take on themselves and where should OEMs act as a platform and thus orchestrate different participants in the ecosystem?	
30		What customer problems could a fully autonomous vehicle solve and what additional benefits could it provide?	
31		What revenue models are thinkable from your consultant's point of view for companies like BMW?	
32		How do you assess the organisational "readiness" of BMW? Is the existing organisation ready for the transformation through autonomous driving? If not, how would BMW have to align the organization in order to develop the technology of autonomous driving and a related business model in a leading position to meet its value proposition?	
33		What is the main purpose of your current vehicle?	
34		What factors relating to self-driving cars could encourage you to use/buy them?	
35		An autonomous vehicle promises more time for other activities within the vehicle. How would you use the newly gained time? Examples would be productive work, entertainment or relaxing.	
36		Would it be conceivable for you to do without your own car in an autonomous driving future, if mobility was still available on demand?	
37		Could you imagine taking out a monthly subscription with a car manufacturer to gain exclusive access to the brand's autonomous mobility services and to get further benefits?	

Appendix H – Exemplary interview sheet

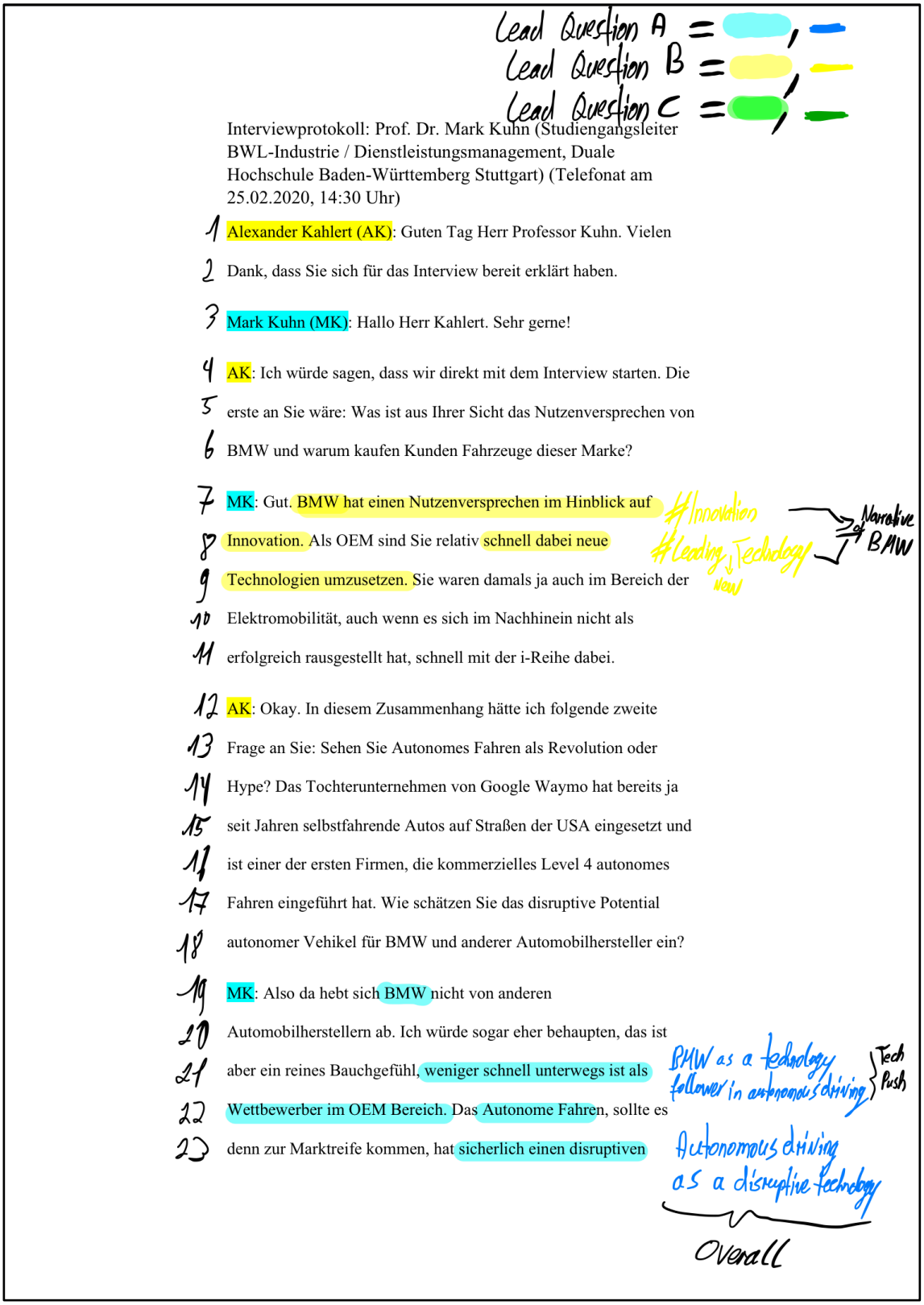
to derive business model implications for BMW (e.g. suppliers, scientists, consultants, BMW employees, customers, mobility start-ups).

- Questions

1. What do you think is the value proposition of BMW and why do customers buy vehicles of this brand?
2. Autonomous driving: Revolution or hype? The Google Waymo subsidiary has been using self-driving cars on U.S. roads for years and was one of the first companies to introduce commercial Level 4 autonomous driving. How do you assess the disruptive potential of autonomous vehicles for BMW and other car manufacturers?
3. Would you agree with the hypothesis that BMW must strategically design a new business model, with disruptive technology at its core, in order to still be relevant tomorrow?
4. Many scientists and consultancies are of the opinion that autonomous driving will help the Ride-Hailing or Car-Sharing business model to achieve a breakthrough. Would you agree with this and if so, why?
5. A car is considered to be the third place, next to home and work, where customers spend their time. Autonomous vehicles promise more time for social interaction, entertainment and productive time. In your opinion, how can BMW still maintain the brand essence of "The ultimate driving machine" in autonomous cars? What does "premium" mean to you in the new technological landscape?
6. Volvo and Audi have started experimenting with new revenue models based mainly on subscription models with monthly payments. Is this turnover model conceivable for BMW in the autonomous future? What other revenue models do you see for manufacturers like BMW?
7. Experts in the field of autonomous vehicles claim that completely new facets of knowledge, resources and skills are needed to be successful in the future. What would you call specifically for autonomous BMW vehicles?
8. What role do BMW's suppliers play in implementing the new business model and the new technology? Will BMW develop more in-house or enter into closer cooperation with suppliers?
9. Many scientists and managers claim that the management of disruptive technologies requires specific organizational conditions such as corporate ventures, innovation labs or autonomous portfolio brands. In this context, what recommendation would you make to BMW to enable the development of autonomous vehicles and the accompanying business model and thus remain relevant for the future?

- Further remarks regarding Autonomous Driving and BMW

Appendix I – Exemplary curated transcript page



Appendix J – Extracts from the coding excel template

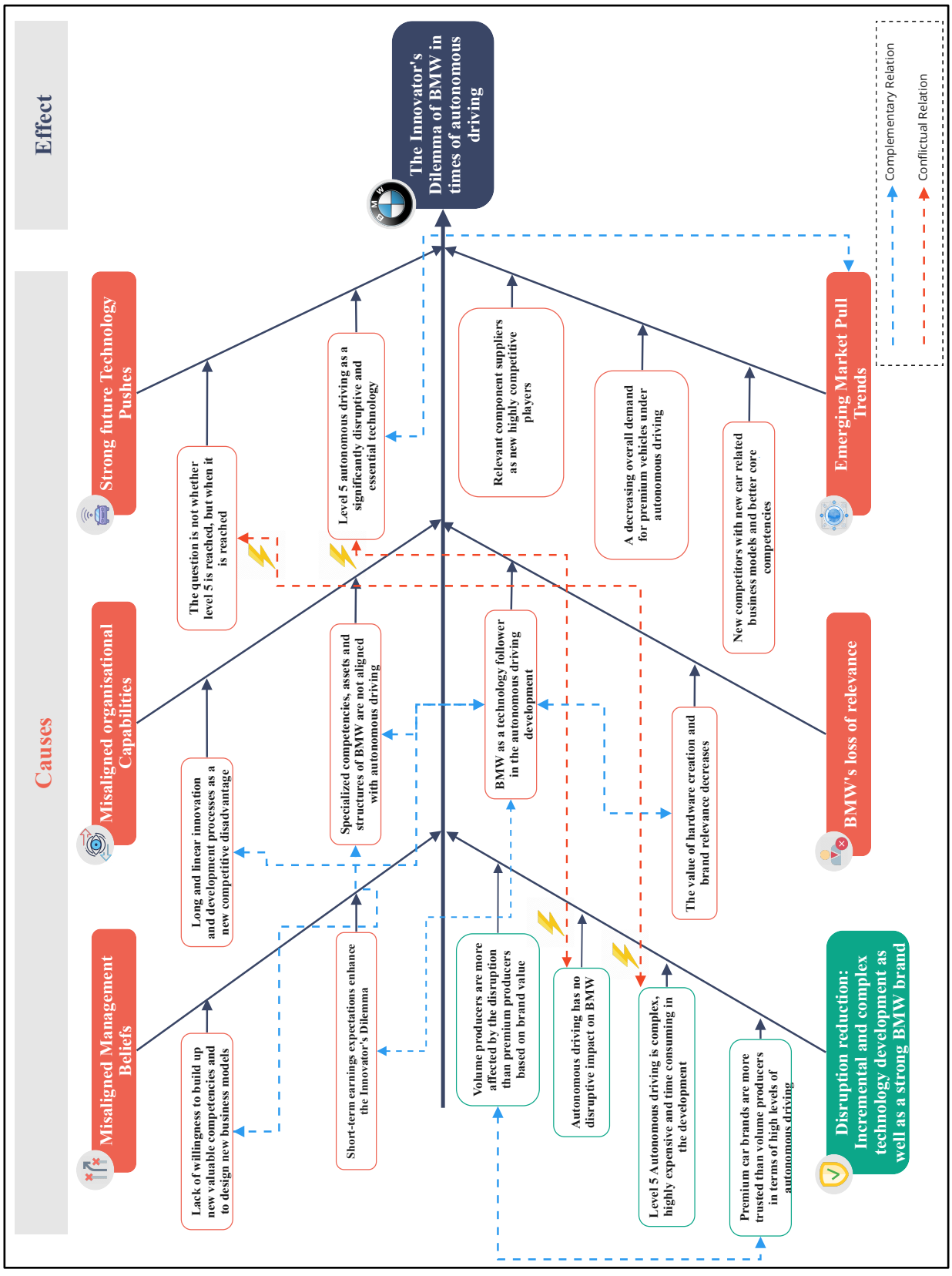
Number	Codes	Definition	Citations	Lead Question
2	**BMW as a technology follower in the autonomous driving development**	BMW is not a leading innovator in relevant development fields of today and the future (software, data, service and content)	"Ich würde sogar eher behaupten, das ist aber ein reines Bauchgefühl, weniger schnell unterwegs ist als Wettbewerber im OEM Bereich" (Mark Kuhn, 25.02.20, p.1, line 20-22) "Es wird immer eine Berechtigung für Automobilhersteller geben, aber da bin ich der Meinung, dass BMW sich schon sehr anstrengen muss da auch weiterhin relevant zu sein" (Participant 3, 06.03.20, p.15, line 5-8) "Sie müssen aber auch tatsächlich mehr Innovationen und Technologien hereinbringen" (Participant 4, 12.03.20, p.15, line 11-12) "AK: Für dich war Tesla tatsächlich innovativer als Marke im Vergleich zu deutschen Marken wie BMW? TA: Ja ganz genau" (Thomas Appel, 06.04.20, p.1, line 19-21)	**Lead Question A: Does the BMW Group face the typical Innovator's Dilemma in times of the autonomous driving technology?**
3	**Level 5 autonomous driving as a significantly disruptive and essential technology**	The development of the different levels of autonomous driving follows an incremental path. Steep learning curves will lead to significant progress steps in the coming years. The final Level 5 has a signficiantly disruptive impact on the business models of premium producers like BMW and will change how mobility is perceived. New competitors with new business models and competencies will serve new use cases.	"Das Autonome Fahren, sollte es denn zur Marktreife kommen, hat sicherlich einen disruptiven Charakter, weil es einfach unterschiedlichste Geschäftsmodelle ermöglicht, siehe auch die Aktivitäten, die Uber seit langem vorantreibt mit der klaren Zielsetzung Fahrer ad absurdum zu führen" (Mark Kuhn, 25.02.20, p.1-2, line 22 p.1 - line 3 p.2) "Das Level der Vollautomatisierung wird sicherlich einen disruptiven Effekt haben, aber es wird sich doch eher inkrementell entwickeln" (Mark Kuhn, 25.02.20, p. 2, line 23-25) "(...)weil wenn Shared Konzepte sich durchsetzen, dann kann das natürlich den Individualkauf von Autos beeinflussen" (Mark Kuhn, 25.02.20, p.4, line 18-20) "Ich glaube also schon, dass die Technologie disruptive Power hat, aber dass der Zeitraum bis alle Autos flächendeckend autonom fahren noch sehr lang ist" (Participant 3, 06.03.20, p.3, line 19-21) "Ganz absolut gesehen, technisch hat autonomes Fahren großes Potential. Es ist natürlich ein riesiger Hebel in der Veränderung des Automobils" (Nicolas Kesselmeier, 12.03.20, p.2, line 17-18) "Es wird auf jeden Fall einen großen Einfluss haben auf die Branche. Wichtig ist eine Lernkurve. Der Faktor Lernkurve muss sich entwickeln und man muss dem Ganzen Zeit geben für Tests" (Nicolas Kesselmeier, 12.03.20, p.18, line 8-10) "Wenn das so kommen sollte, ist das natürlich ein Wahnsinnsimpact, weil erstens: was macht der Kunde in der Zeit, wenn er das Auto garnicht mehr steuern muss? Natürlich in Form von wie unterhalte ich den Kunden während der im Auto sitzt? Deswegen sind natürlich Amazon und Google scharf auf die Schnittstelle ins Auto, weil wenn ich jetzt sage ich fahre von hier nach Hamburg mit meinem Auto, dann habe ich 8 Stunden Zeit Netflix zu konsumieren, Sachen zu kaufen und von Amazon berieselt zu werden" (Participant 6, 13.03.20, p.2-3, line 21 p.2 - line 3 p.3) "Aber die echte Disruption oder Revolution wird erst durch das autonome Fahren kommen. Wann das kommt weiß noch niemand so richtig. Ich sehe in den nächsten 10 Jahren ehrlicherweise die Disruption noch nicht so groß, aber es ist auf jeden Fall eine und eine, an der man unbedingt dranbleiben muss" (Participant 7, 26.03.20, p.1, line 17-18) "AK: Ja... es sollte also auf jeden Fall auf der heutigen strategischen Agenda ein großer Punkt sein, wenn ich Sie richtig verstanden habe. T7: Meines Erachtens ja!" (Participant 7, 26.03.20, p.2, line 6-8) "Das ist schon eine Revolution, wo neue Player gute Chancen haben in den Markt zu kommen" (Participant 7, 26.03.20, p.1, line 21-23) "Das eine ist, nach meiner Einschätzung dann auch disruptiv, der Bereich Sharing in dem Google Waymo ja auch unterwegs ist. Und zwar entstehen natürlich durch hochautomatisiertes Fahren oder auch autonomes Fahren neue Geschäftspotentiale, die das Thema Sharing heute, dieses Ride-Hailing, noch nicht bedienen kann" (Participant 8, 01.04.20, p.1, line 11-16) "Da sehe ich die Technologie auf jeden Fall als disruptiv an. Man sieht das ja auch an neuen Playern, die in den Markt antreten" (Participant 8, 01.04.20, p.2, line 1-3) "In diesem Bereich ist es eher eine evolutionäre Entwicklung der Technologie. Da gibt es ja bereits autonome Fahrlevel, die heute bereits erreicht sind. Sagen wir mal Level 2. Level 3 steht jetzt kurz bevor, man weiß zwar nicht genau wann es kommt, aber bis es zu einem Level 4 Fahrverhalten kommen ist es eben so eine evolutionäre Entwicklung" (Participant 8, 01.04.20, p.2, line 6-13) "Und wenn Sie auf das disruptive Potential eingehen, dann halte ich das für extrem groß. Das wird die Automobilbranche komplett umkrempeln und die Art Autos zu nutzen wird sich komplett verändern" (Christoph Steiger, 09.04.20, p.1-2, line 22 p.1 - line 2 p.2) "Deshalb total disruptiv" (Christoph Steiger, 09.04.20, p.2, line 15) "AK: Also verschiebt sich die Margendominanz weg von den OEMs Richtung diesen Mobilityplattformen. CS: Das wäre meine Vermutung" (Christoph Steiger, 09.04.20, p.6, line 1-3) "Also das Blech biegen wurde als absolute Kernkompetenz und Differenzierungsmerkmal dargestellt. Und das ist heute in weiten Teilen der Firma immer noch so angesehen. Ich persönlich glaube, dass das in Zukunft nicht mehr so sein wird" (Christoph Steiger, 09.04.20, p.9, line 6-8)	**Lead Question A: Does the BMW Group face the typical Innovator's Dilemma in times of the autonomous driving technology?**
5	**Level 5 Autonomous driving is complex, highly expensive and time consuming in the development**	The development of autonomous driving requires the collaboration of multidimensional partners and has high technical requirements. The development is highly depend on a sufficient infrastructure. The technology requires a big testing data set and the possibility to gather real-life mobility data.	"So, und daher stellt sich die Frage der Umsetzbarkeit. Da scheinen viele Zuliefererunternehmen und OEMs eher ernüchtert" (Mark Kuhn, 25.02.20, p.2, line 7-9) "Aktuell sehe ich die Technologie eher als Hype an" (Participant 4, 12.03.2020, p.2, line 25-26) "Die Komplexität des Themas hat man zu optimistisch eingeschätzt vor ein paar Jahren" (Participant 4, 12.03.2020, p.5, line 25-26) "Also zunächst einmal die Unsicherheit wie und wann diese Technologie irgendwann kommen wird, entscheidet allein schon mal darüber, was es für Auswirkungen auf das Feld hat. Von dem was ich vom Wettbewerb mitbekomme, sind alle noch relativ weit davon weg, auch wenn es schon als Autopilot beworben wird und manche Stimmen werden auch lauter, dass es relativ unwahrscheinlich wird, dass man von Haustür zu Haustür mit Parkplatz gefahren wird" (Participant 6, 13.03.2020, p.2, line 11-17) "Man muss nochmal ganz klar hervorheben, dass die Meinung über das autonome Fahren sehr verschieden ist" (Participant 6, 13.03.2020, p.14, line 13-14) "Ich glaube es ist eine absolute Revolution und der Grund weshalb es nicht so schnell voranschreitet und wir noch nicht hunderttausende oder Millionen selbstfahrende Fahrzeuge auf den Straßen haben, liegt einfach an der Komplexität der Technologie und der Infrastruktur, die gebraucht wird" (Christoph Steiger, 09.04.20, p.1, line 11-15)	**Lead Question A: Does the BMW Group face the typical Innovator's Dilemma in times of the autonomous driving technology?**

Number	Codes	Definition	Citations	Lead Question
1	**Innovation, leading Technology and Sportiness combined with comfort as parts of BMW's DNA**	BMW was considered as one of innovative and technology leading automotive companies in the industry. These attributes are the key elements of BMW's DNA "The ultimate driving machine"	"BMW hat ein Nutzenversprechen im Hinblick auf Innovation. Als OEM sind Sie relativ schnell dabei neue Technologien umzusetzen" (Mark Kuhn, 25.02.20, p.1, line 7-9) "Es ist die Sportlichkeit" (Participant 2, 26.02.20, p.1, line 21) "Die DNA ist ganz klar der Claim der Marke: The ultimate driving machine! Die Attribute dieser DNA sind darauf aufbauend Sportlichkeit und Dynamik. Diese Attribute sind in der gesamten Produktpalette konsistent impliziert" (Participant 3, 06.03.20, p.1, line 7-9) "BMW gehört weltweit zu den Premiumherstellern, also mit einem hohen Anspruch an Qualität und Komfort" (Participant 4, 12.03.2020, p.1, line 8-10) "Innovation war schon immer eines der Kerncharakteristiken von BMW" (Participant 4, 12.03.2020, p.1, line 8-10 "BMW kombiniert also Komfort und Sportlichkeit. Das ist für mich BMW. Das impliziert für mich alles das Nutzenversprechen von BMW" (Nicolas Kesselmeier, 12.03.2020, p.1, line 13-14) "Dass du als Kunde ein Produkt bekommst, wo du das Gefühlt hast, dass du etwas hast was wertig ist, was Ingenieursgeist verkörpert und Sportlichkeit" (Participant 6, 13.03.20, p.1, line 11-13)	**Lead Question B: How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?**
4	**Main use cases of Level 4 and 5: Urban mobility and long-distance routes**	Two main use cases of autonomous driving were identified. The urban mobility has the biggest disruption potential since it is the focus of many new competitors but also represents the most complex environment. It is preferrable for new mobility structures. Long-distance routes and urban mobility have the best scalability and cost-efficiency of the use cases.	"Dort macht man sich Gedanken über Transportkonzepte gesellschaftlicher Art, die heute noch garnicht möglich sind" (Mark Kuhn, 25.02.20, p.2, line 5-7) "Mega Cities, Städte, wo Sie sowieso viel Verkehr haben und dort kann man halt autonom fahren" (Participant 2, 26.02.20, p.2, line 21-23) "Wenn ich beispielsweise um 10 nach 6 fliege, ich setze mich um 4 ins Auto, im Auto habe ich Frühstück und alles, steige aus, mein Auto fährt irgendwo in die Garage, wenn ich lande, dann beordere ich es wieder zum Anflug und steige da wieder ein und fahre nach Hause" (Participant 2, 26.02.20, p.5, line 4-9) "Was BMW ja machen könnte, dass sie das autonome Fahren auf Langstrecken anbieten. Da ist Hella involviert mit der Applikation des Segelns" (Nicolas Kesselmeier, 12.03.20, p.10, line 13-15) "In den Metropolen wird es wahrscheinlich in diesem Jahrzehnt kommen, das kann ich mir sehr gut vorstellen" (Participant 3, 06.03.20, p. 3, line 22-23) "Der klassische Use Case ist: Du steigst morgens ins Auto, musst zu Arbeit fahren und sagst dem BMW Assistant, dass du gerne zur Arbeit willst. Lehnst dich zurück und lässt dich zur Arbeit fahren. Nebenher lässt du dir eventuell noch die Nachrichten vorlesen. Und beantwortest schon erste Mails" (Participant 3, 06.03.20, p. 4, line 14-18) "Da wird es auch genug von geben und da wird sicherlich auch das Geschäftsmodell, was ähnlich zu dem Heutigen ist, etwas adaptiert Richtung Mobilitätsdienstleistungen für Executives oder Business Class Kunden" (Participant 4, 12.03.20, p.7, line 8-11) "Hier in der Stadt, also in urbanen Regionen, gibt es große Probleme noch Parkplätze zu finden" (Participant 4, 12.03.20, p.8, line 26-27) "Im Gegensatz wäre das Szenario ein Pendler aus Hamburg fährt auf die Autobahn, schläft ein und wacht in München wieder auf, heute schon technisch machbar" (Participant 6, 13.03.20, p.4, line 9-11) "AK: Würdest du auch sagen, dass urbane Mobilität durch autonome Fahrzeuge verbessert werden könnte? NK: Ja absolut! Ich glaube, immer unter der Voraussetzung, dass es ausgereift ist, dass es da sehr helfen kann" (Nicolas Kesselmeier, 12.03.20, p.6, line 20-23) "Sofern glaube ich, dass aus dieser Perspektive es schon einen Fokus auf die Stadt gibt und das ist ja auch Google Waymo unterwegs. Aus der Sharing Perspektive ist die Stadt zunächst das interessanteste, weil es entsprechende Skalierungsmöglichkeiten bietet" (Participant 8, 01.04.20, p.4, line 13-17) "Die innerstädtische Skalierbarkeit über viele Menschen hinweg durch den Mobilitätsservice und beim Thema Ownership: Wo habe ich lange Verweildauern? Das sind eben die Langstreckenfahrten oder auch Stausituationen" (Participant 8, 01.04.20, p.5, line 1-4) "Du willst die Leute mit diesem shared, autonomen Autos ausstatten und gleichzeitig ist das der Use Case, der am weitesten von allen Use Cases in der autonomen Technologie entfernt ist. Die Stadt birgt die höchste Komplexität, weil die so viele unterschiedliche Szenarien hat" (Participant 6, 13.03.20, p.4, line 4-9)	**Lead Question B: How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?**
6	**Business Model Innovation as a key enabler of BMW's long-term viability**	Business model innovation is the key trigger to enable alignment between BMW and future requirements. Autonomous driving requires a new understanding of individual mobility and, hence, urges BMW to design a new business model for the autonomous future.	"Nein, das hinterfragt wahrscheinlich kein OEM mehr. Alle OEMs und Zulieferer machen sich mit großem Druck Gedanken über alternative Geschäftsmodelle" (Mark Kuhn, 25.02.20, p.3, line 4-6) "Ja sie versuchen es ja momentan mit diesen Mobilitätsdienstleistungen" (Participant 4, 12.03.20, p.6, line 12-13) "Dann würdest du ja quasi vorschlagen, dass man um die spezielle Zielgruppe ein Geschäftsmodell mit vollständig autonom fahrenden Vehikeln konzipieren sollte. Man muss dort neue Umsatzmodelle entwickeln.... NK: Ja klar! Es ist wichtig, dass man diesen Aspekt des Customizen nicht aus den Augen verliert!" (Nicolas Kesselmeier, 12.03.20, p.4-5, line 22 p.4 - line 1 p.2) "T7: Ich persönlich bin der Meinung, dass es so ist. Das ist, könnte ich mir vorstellen, sehr umstritten innerhalb von OEMs. Bei uns in der Firma ist es sehr umstritten" (Participant 7, 26.03.20, p.2, line 15-17) "Das Problem wird halt irgendwann sein, dass wenn sich das Geschäftsmodell soweit etabliert, dass man eben mit der heutigen Ausrichtung nicht mehr erfolgreich sein kann und dass das halt irgendwann so kommen wir und man heute schon den Weg dafür ebnen sollte. Dazu braucht es aber ein Umdenken wie es bspw. IBM gemacht hat, die sich von Hardware Provider zu einem Service Anbieter entwickelt haben" (Participant 8, 01.04.20, p.16, line 7-13) "(...) , aber ich glaube vom Gedanken her geht es genau darum: Rechtzeitig zu erkennen, dass der Markt sich verändert. . In dem Fall das Mobilitätsverhalten der Kunden und sich das Unternehmen und die Wertschöpfung daran anpasst" (Participant 8, 01.04.20, p.16, line 18-21)	**Lead Question B: How could Business Model Innovation help BMW to solve the Innovator's Dilemma in the future?**

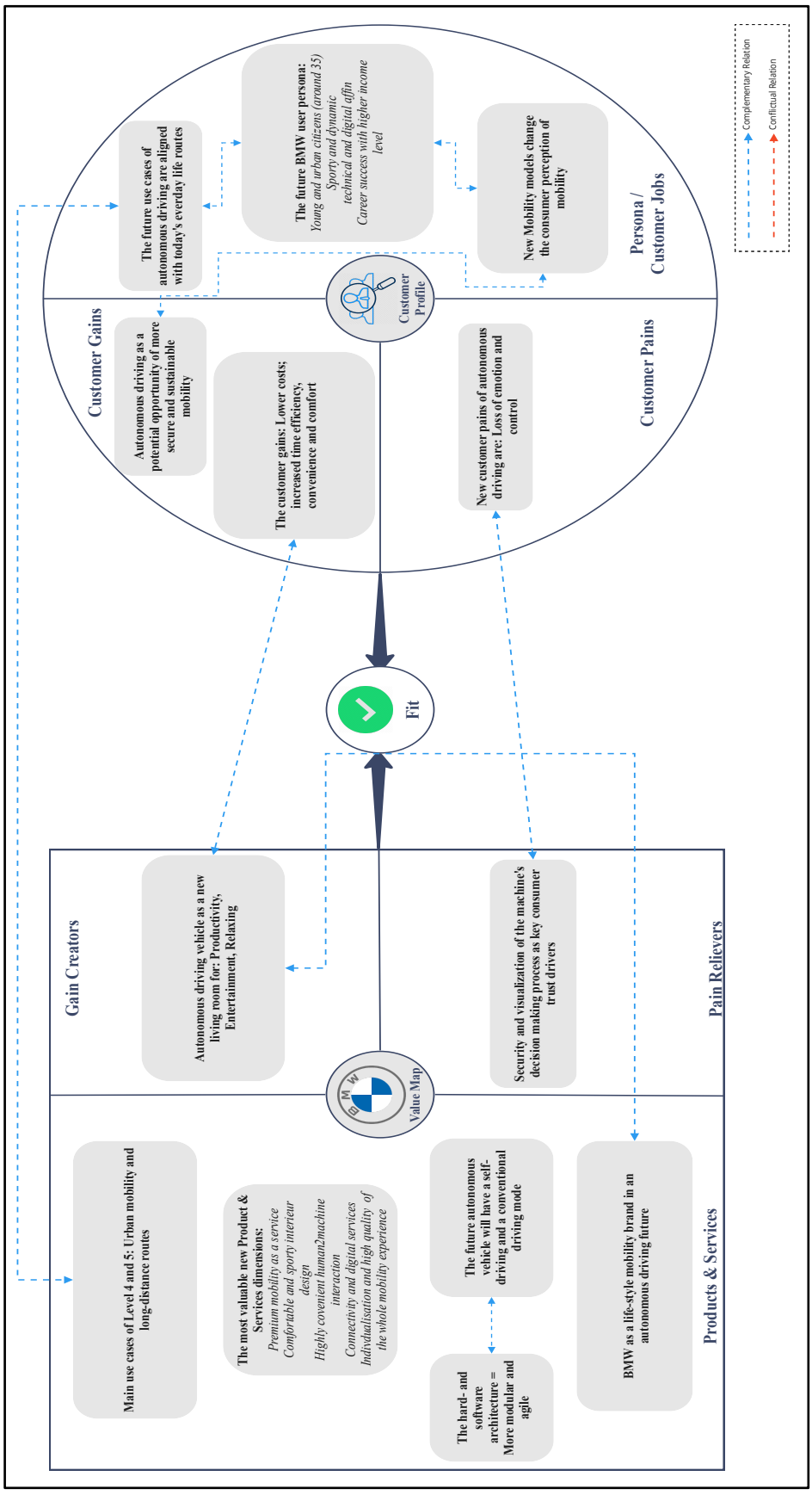
Number	Codes	Definition	Citations	Lead Question
8	**Open Innovation as an essential innovation management approach for autonomous driving**	Revolutionary mobility innovation requires an open ecosystem (new parnterships with public or telecommunication or high-tech sector) innovation approach with distributed core competencies and a free flow of information and knowledge. They key advantage of Open Innovation is the Cost-benefit effect and development speed	"Überall nur Robotaxis, alles ist irgendwie grün oder so. Das wird nur dann funktionieren mit einer wirklichen Mobilitätsrevolution, wenn wir gleichzeitig eine Revolution des öffentlichen Nahverkehrs erleben" (Mark Kuhn, p.4, line 2-5) "Die Fragestellung häng also schwer von der Infrastruktur ab (...)" (Participant 2, 26.02.20, p.6, line 7-8) "AK: Sie würden also eher sagen, dass es einen offenen Innovationsansatz benötigt. (...) T2: Ja genau." (Participant 2, 26.02.20, p. 13, line 12-17) "Solche Technologien können sich nur etablieren, wenn eine ausreichende Infrastruktur gegeben ist. Für autonomes Fahren benötigst du unbedingt 5G Netz (...)" (Participant 3, 06.03.20, p. 3, line 11-14) "Ich könnte mir aber sehr gut vorstellen, dass sich das wandelt. In diesem geschlossenen Entwicklungsprozess kommst du nicht mehr weit" (Participant 3, 06.03.20, p.14, line 4-6) "Ja ganz bestimmt. Da gibt es ja auch erste Tendenzen. Beispielsweise sitzt der CEO von Telekom, Tim Höttges, nicht umsonst im Daimler Aufsichtsrat. Da muss es natürlich mehr hingehen" (Participant 3, 06.03.20, p.14, line 13-16) "BMW sollte auf jeden Fall Richtung Open Innovation Prozesse übergehen und uns miteingeschlossen. Wir sind da auch noch nicht perfekt, aber gerade durch Hella Ventures und dem Inkubator versucht man eben das nach und nach bei uns zu etablieren" (Nicolas Kesselmeier, 12.03.20, p.15, line 12-16) "Die Frage in diesem Zusammenhang ist auch: Wie kann ich möglicherweise Ressourcen auslagern oder einfach weggeben, weil es einfach nicht die Kernkompetenz ist. Zum Beispiel, dass BMW uns damit beauftragt ein neues Fahrassistenzsystem zu entwickeln. Sie sagen uns welcher Content es implizieren soll, sagen damit aber auch, dass sie selbst es nicht können" (Nicolas Kesselmeier, 12.03.20, p.17, line 14-18) "Ich glaube, dass es ganze elementar ist Ressourcen und Zeit da eine optimale Allokation zwischen intern und extern zu finden" (Nicolas Kesselmeier, 12.03.20, p.17, line 22-24) "Da muss man wirklich viel mehr Open Innovation nutzen" (Participant 7, 26.03.20, p.14, line 19-20) "AK: (...) Dass man also das Ökosystem auch groß denken soll. Also nicht nur BMW mit Daimler, sondern auch ganz neue Kooperationen sucht. T7: Kann dem nur zustimmen" (Participant 7, 26.03.20, p.15, line 3-5) "Das ist aber nur dann der Fall, wenn man entsprechend konsequente Mobilitätsregeln aufstellt" (Participant 8, 01.04.20, p.5, line 22-23) "Open Innovation muss für mich kollaborativ in den verschiedenen Feldern stattfinden, weil nur die zusammen Mehrwert generieren können ist glaube ich ein Nobrainer. Das muss" (Participant 8, 01.04.20, p.18, line 1-3) "Das Thema Open Innovation kann man wahrscheinlich noch mehr stärken. Meines Erachtens ist da BMW voll dran. Sie öffnen sich ja auch Richtung Kooperationen mit Daimler, mit VW oder anderen Herstellern und ich glaube das wird sich weiterentwickeln. Grenzen zwischen Firmen werden immer mehr verschwinden" (Christoph Steiger, 09.04.20, p.12, line 11-16) "Ich glaube, dass hier Open Innovation auch heißt, dass ich mich für andere Unternehmen öffne und ich damit Sachen preisgebe. Im Gegenzug erhalte ich aber auch Informationen und eben Gegenleistungen, woraus dann auch ein Mehrwert entstehen kann. Wenn ein Ökosystem besteht, an das alle Mitglieder glauben, dann kann das funktionieren. Vertrauen spielt da eine enorme Rolle" (Participant 8, 01.04.20, p.18, line 7-13) "Das sind alles, aus meiner Sicht, Alibi Veranstaltungen, in die in guten Zeiten ordentlich Geld gepumpt wird, mega cool sind und Home-Office machen und keine Sitzordnung haben. Irgendwie jung und modern sind aus Sicht der Unternehmensleitung. So etwas haben alle. Die haben alle auch keine Krawatten an und alles ist cool. Ist auch ganz nett, aber am Ende herrscht bei der Unternehmensführung die Meinung, dass die eigentlich nur Geld verbrennen und hinten kommt nichts bei rum" (Participant 7, 26.03.20, p.15, line 18-25) "Wenn wir wirklich bei Level 4 oder 5 angekommen sind, dann impliziert das für mich, dass ich kein persönliches Auto mehr habe. Bis dahin habe ich halt viel Convenience, wenn mein persönliches Auto alleine fährt. Das ist gut. Aber wenn wir wirklich voll autonom sind, dann brauche ich kein persönliches Auto mehr" (Christoph Steiger, 09.04.20, p.2, line 19-23)	**Lead Question C: Which organisational conditions need to be established today to enable this kind of business model innovation and the development of the autonomous driving technology?**
10	**Important role of corporate commitment of resources and time**	Corporate commitment towards groundbreaking innovation intiatives is essential for the successful development and launch of full automated vehicles in the future.	"MK: Revolutionen liegen eigentlich woanders und ich bin mir nicht sicher, ob alle an diesen arbeiten. AK: Daran haben die aktuellen Player ja eventuell auch kein Interesse. MK: Ja genau" "Also ich glaube trotzdem momentan, dass alle neuen Versuche und Experimente mit angezogener Bremse durchgeführt werden. Keiner der großen Hersteller will aktuell komplett in so eine Richtung gehen" (Mark Kuhn, 25.02.20, p.8, line 1-4) "AK: (...) Das führt uns auch schon zur letzten Frage: Welche Rolle spielt dabei Corporate Commitment von Ressourcen und Zeit bezogen auf die zu entwickelnde Technologie des autonomen Vehikels und das damit verbundene Geschäftsmodell? Ist dies ein wesentlicher organisatorischer Enabler, der BMW ermöglicht langfristig relevant zu bleiben? NK: Ja, es ist ein elementarer Faktor. Klar, du musst halt da ein Optimum finden. Du musst genau herausfinden, wie wichtig ist das autonome Fahren als ein wichtiger Faktor für das Auto der Zukunft" (Nicolas Kesselmeier, 12.03.20, p.17, line 3-11) "Da wird also ganz anders geplant und gedacht. Da ist ganz klar der Fokus auf langfristige Ziele" (Participant 6, 13.03.20, p.13, line 20-21) "Die Credibility war nicht so da, weil die Innovationen, die man sich da erhofft hatte, ausgeblieben sind und die Leute festgestellt haben, dass es eigentlich nur Kostentreiber sind und keiner Profit Center" (Participant 8, 01.04.20, p.19, line 2-5) "AK: (...) Man spricht ja auch von diesem Commitment. Dieses Senior Management Commitment. Ist das wirklich einer dieser Enabler, um wirklich überhaupt in die autonome Zukunft zu kommen? T7: Ja, absolut! (Participant 7, 26.03.20, p.12-13, line 23 p.12 - line 1 p.13)	**Lead Question C: Which organisational conditions need to be established today to enable this kind of business model innovation and the development of the autonomous driving technology?**
14	**Visionary leadership and a clear outline of a mobility vision as key organisational enablers**	Importance of a well defined mobility vision and strategy as well as a strong leadership throughout the management hierarchies of BMW for the future Autonomous driving and its signficicant impact on mobility business models and consumer perception of mobility requires a leader in the senior management that has a clear vision and strategy for BMW and has the willingness to overcome organisational resistance.	"Jetzt laufen aktuell alle etwas verirrt umher und wollen zeigen: Ja, wir machen da auch was und wir implementieren neue Plattformen und neue Geschäftsmodelle. Es gibt mittlerweile sehr viele interne Start-Up Initiativen bei den OEMs oder Zulieferern. Trotzdem zeigt keines der Unternehmen ein klares Zielbild auf, wo das Unternehmen sich hin entwickeln will und dort dann auch mit Vollgas investieren will" (Mark Kuhn, 25.02.20, p.8, line 11-17) "Wir müssen uns heute an relevanten Stellen öffnen und den Blick soweit öffnen und sich fragen: Was kann ich mit meinen Kernkompetenzen selbst entwickeln? Und wo kann ich und muss ich von außen Wissen, Fähigkeiten und Ressourcen zu beziehen, um schnellstmöglich meine Ziele zu erreichen, die ich mir gesteckt habe" (Participant 2, 26.02.20, p.12, 16-21) "Es braucht Visionäre, die oben in der Unternehmensleitung sitzen und dann aber auch ganz klare Vorgaben machen und das Unmögliche möglich machen, siehe Elon Musk. Leute wie Steve Jobs oder Bill Gates. Wenn man solche Vordenker hat, die auch noch was von der Materie verstehen, dann kann das Unmögliche möglich gemacht werden" (Participant 7, 26.03.20, p.12, line 8-14) "AK: Würden Sie also sagen, dass es um Leadership und um dieses Commitment geht und dass man das von oben durch kommuniziert und fördert. Man muss also nicht extra gründen. T7: Und ich sags Ihnen, ich kenne Insights, dass ein Vorstandsmitglied von oben Ansagen macht, der hat schon Ideen im Kopf und hat Leadership Qualitäten" (Participant 7, 26.03.20, p.16, line 16-21) "Es gibt aber einen großen Bauch an Managern da drunter, die seit 30-40 Jahren das traditionelle Geschäft kennen und dadurch kommt Leadership unten bei der Basis nicht an" (Participant 7, 26.03.20, p.16, line 21-24) "Ich glaube, dass es Visionäre braucht und starke Führungskräfte braucht, wie zum Beispiel ein Steve Jobs, der so ein Thema treibt. Ich habe ganz viele Fälle gesehen, wo dieses Element fehlte und jetzt spitze ich das Senior Management auf eine Person zu. Irgendjemand muss im Unternehmen, wo Norden ist" (Christoph Steiger, 09.04.20, p.16, line 21-25) "Das heißt es geht nur mit einem Visionär, der mit viel Macht und Stärke ausgestattet ist. Der muss auch mal Themen durch pushen auch gegen den Widerstand der existierenden Organisation" (Christoph Steiger, 09.04.20, p.17, line 5-8)	**Lead Question C: Which organisational conditions need to be established today to enable this kind of business model innovation and the development of the autonomous driving technology?**

Appendix K – An exemplary inductive ideation board

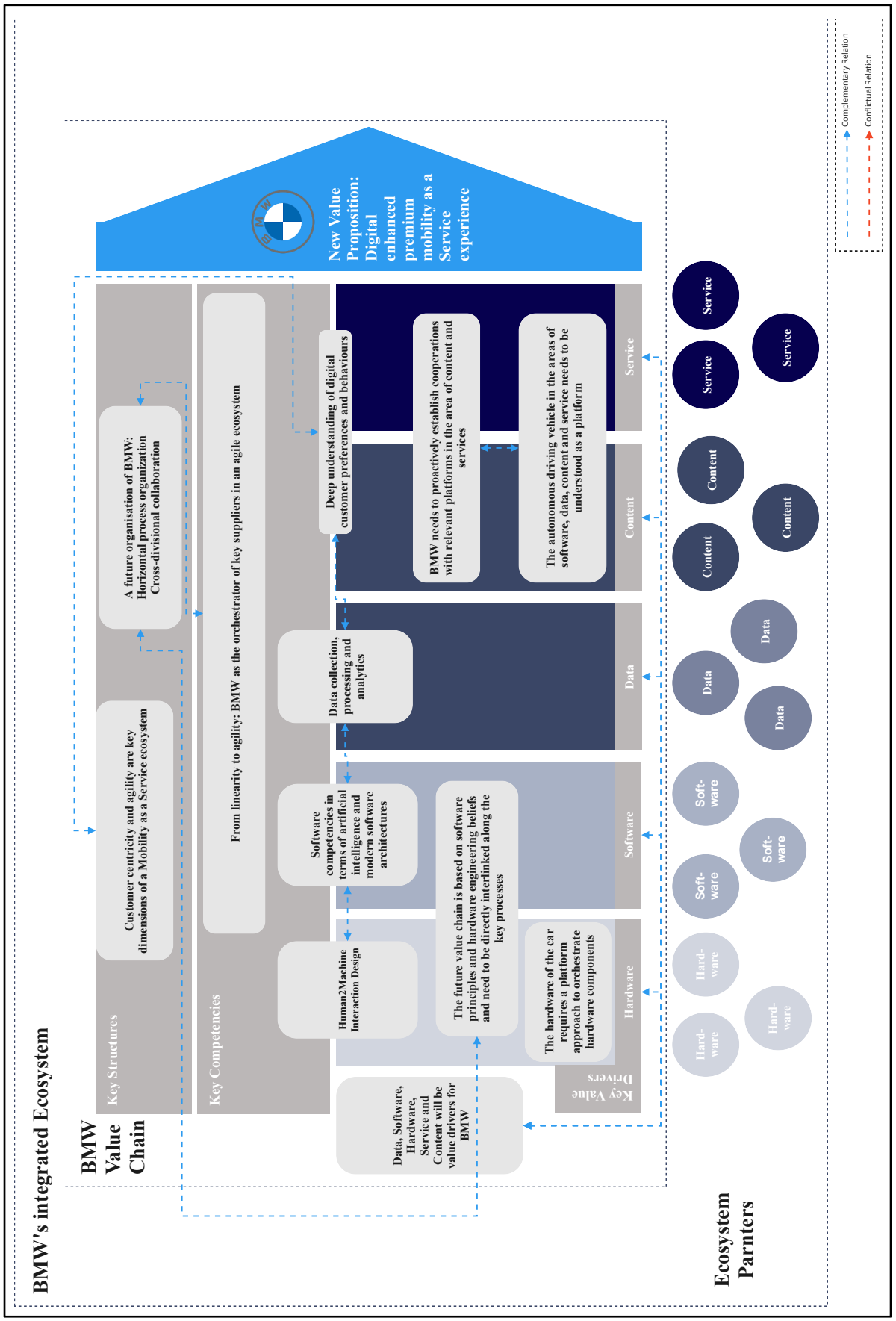
Appendix L – Fishbone-Diagram of the findings for Lead Question A



Appendix M – The value proposition of BMW's future mobility service.



Appendix N – The autonomous driving value chain of BMW.



Appendix O – The holistic business model innovation aspects of BMW