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Am AI ready?

Investigating the impacts of Artificial Intelligence on business within the automotive industry

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Abstract

In today's world, technology is present everywhere, and it is progressing at such speed that it is increasingly hard for organizations to cope. The disruptive force and power of new technology are especially observable in how they can transform and fundamentally change businesses and their way of generating value. Artificial Intelligence (AI) is one example of such a technology that is believed to have the potential to unleash the next rush of disruption in many industries and the expectations on AI are therefore sky-high. However, from a business perspective, research on the actual impact of AI has lacked focus. Hence this research aims to investigate the impact of AI on business, looking at companies within the automotive industry. This is done by analyzing AI's specific impact on different components of the business model through the lens of both degrees of impact and time. The insights of the impact are gathered through a qualitative study of companies within the automotive industry or companies with the automotive industry as the primary focus of their business.

The findings show that AI is impacting business models within the automotive industry on a broad scale. AI is primarily enabling automotive companies to leverage data about their customer, intensifying the degree to which the companies collaborate with partners, both cross-industry and within the industry. Furthermore, the long-term expectations of the technology are impacting on strategic decisions and positioning made by automotive companies. AI is expected to enable fully autonomous driving which has led companies to reconsider their business models, and the impacts are likely to get even more observable as the technology matures further.

Keywords: Artificial Intelligence, Automotive Industry, Business Model Canvas, Technological Innovation, Technology impact on business.

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List of Exhibits

List of Abbreviations

AI Artificial Intelligence
AD Autonomous Driving
BMC Business Model Canvas
CRM Customer Relationship Management
CS Customer Support
ML Machine Learning
OEM Original Equipment Manufacturer
ROI Return On Investment

1. Introduction

This Chapter aims to provide the reader with the background, problem setting, the definition of AI and lastly the research question and the thesis disposition are presented to give a comprehensible understanding of what the thesis investigates.

1.1 Background

Technology is present almost everywhere in unlimited imaginable variations, and technological advancements are progressing at such speed that it is becoming increasingly hard to keep up. Although, technology by itself is argued to inherit no direct economic value, and its value only realized and adhered to the specific technology when implemented in some variety of a business model where it satisfies a demand or solves a problem (Chesbrough, 2010).

> *"The impact of a technological innovation will generally depend not only on its inventors but also on the creativity of the eventual users of the new technology."- (Rosenberg, 2004)*

Technological development is arguably one of the strongest drivers and creator of economic growth and what eventually lead to disruptive changes in many industries (Rosenberg, 2004). The disruptive force and power of technology are especially observable in how it transforms and has the ability to fundamentally change businesses and their way of generating value. The unexploited opportunities and value which new technology can unlock are huge and often followed by a highly disruptive process where some players adapt and other parishes (Manyika et al, 2013). Artificial Intelligence (AI) is one example of a technology that has the potential to unleash the next rush of disruption in almost every industry (World Economic Forum, 2018).

Artificial Intelligence is by many still considered a futuristic and somewhat sensitive subject, with a lot of emotions and opinions connected to it. While some think it is just a recurring overhyped buzzword, others see it as a tremendously disruptive force that will reshuffle the way we live as well as the way businesses operate and subsequently, how they generate and capture value. Regardless of opinion, AI is trending globally, the sheer number of academic papers with the keyword of AI has increased by more than nine times since 1996, and it seems to be mentioned in articles everywhere (Shoham, Perrault, Brynjolfsson, Clark, 2017). In 2017, Venture Capital investments in artificial intelligence doubled, from $6 billion in 2016 to more than $12 billion (KPMG, 2018). The expectations on Artificial Intelligence and what it can contribute with are understandably sky-high, where AI is believed to enable machines to exhibit cognition like humans, drive our vehicles and increase productivity tremendously (Copeland, 2012; McKinsey, 2017)

> *"It seems that AI is preparing for business, but are businesses ready for AI? "- McKinsey (2017)*

Even though the concept of AI currently is trending globally, it is not a concept new to the world. It has been discussed on numerous occasions previously, discussions filled with beautiful promises followed by disappointing results. As early as 1948, the famous British mathematician and code-breaker Alan Turing commented on intelligent "thinking machines",

and the concept has been brought up many times ever since, although, the term "Artificial Intelligence" is acknowledged to be coined by John McCarty in 1956 (Copeland, 2012; Accenture 2016). However, the consensus this time around in comparison to the other periods where it has been a hype around the technology is that AI for the first time is sufficiently backed with sophisticated tools to succeed and be competitive (Copeland, 2012; McKinsey, 2017). The increase in computing power combined with the increase in understanding of the technology finally provides a solid foundation to build upon (McKinsey, 2017). Further, experts in the field are considering and arguing that AI as technology stands out in comparison to other cutting-edge technologies and trends. Firstly, since it, more than any of the other is capable of performing the same tasks currently performed by humans. Secondly, that all the other technological advancements are contributing to an even more productive and efficient AI experience where AI bridges and augments other technologies and vice versa (Bouée, 2017; EY, 2017). AI is sometimes considered a General Purpose Technology which is characterized as a technology imposing an aggregated impact through its implementation, mainly due to its wide variety of application areas and many applicable industries and sectors (Bouée, 2017; Jovanovic & Rousseau, 2005; Helpman & Segerstrom, 2001)

Business leaders around the globe are currently seeking to understand how AI is transforming their business and are strategically planning with this in mind (Burgess, 2017). According to a report by BCG and MIT (2017), business executives today firmly believes that AI is an excellent opportunity for business and will bring several new potential applications and opportunities to exploit. It is further argued that AI not only is going to speed up and deepen the transformation initially started by the digital era. Instead, it has the potential force to change the rules of the game and enable companies to develop business and organizational patterns to gain competitive advantage and increase the value proposed to customers (Bouée, 2017; Accenture 2016). AI is considered to bring value both through its ability to replicate labor tasks to a great extent, but even more importantly by performing duties and developing capabilities that exceed what can be executed by a human presently (Purdy & Daugherty, 2016).

While we just have started to get familiar with the change that our economies and corporations have undergone as a result of the rapid digital technological development, it would be satisfying to think that we can slow down for a while, exploit the low hanging fruits and adapt further for a while. However, it is argued that the next wave of technology partially already has arrived and will strike even harder and faster, the wave is the one of Artificial Intelligence (Bouée 2017). The AI wave and the vast diffusion of AI are being enabled by the extreme increase in harvested data from the digital revolution, and AI is now able to create value from all this data in a better way than ever before (EY, 2017).

> *"We had the computer revolution, the smartphone revolution, and the internet revolution but AI will probably be the biggest technological shift we have ever seen." Edouard d'Archimbaud (BCG & MIT, 2017)*

1.2 Artificial Intelligence in the Automotive Industry

The discussion in the automotive industry has during the last couple of years centered around four disruptive and mutually reinforcing significant trends, namely; autonomous driving, electrification, connectivity, and shared mobility. The expectations on these trends are high, and it is believed that they will fuel growth within the market for mobility and spur transformation from traditional towards disruptive technologies and innovative ways of doing business (McKinsey 2018).

The common denominator and a central technology enabling these four trends are Artificial Intelligence. AI is central in both creating and sustaining the market for autonomous driving since it heavily depends on AI-systems in that it must ensure that the car navigates safely and convenient enough to earn the trust from both passengers and drivers (McKinsey, 2018). The actors within the automotive industry are all reportedly investing heavily in the technology and capabilities that enable a major shift, from assisted to autonomous driving (Volvo Cars 2016; Fortune, 2016; Stanford, 2015). To complete the journey towards truly autonomous decisions, the use of modern AI approaches will become a prerequisite. It is expected that autonomous vehicles will stand for around 10-15% of global sales already in 2030 (McKinsey, 2018). Even if a major use case for AI within the automotive industry lies within autonomous driving, AI also provides opportunities to e.g. reduce cost, optimize operations and generate new revenue streams (BCG & MIT 2017).

1.3 Empirical Setting

This research is conducted as a standalone project without any external partnering organization providing initiative. However, several automotive companies, AI-experts and Management Consulting firms constitute the majority of the data collection, and their perspectives and insights will, therefore, be the base of the thesis findings. By understanding that most of the research is conducted in the Gothenburg region, which has become a cluster of tech and automotive industry collaboration, it is possible to understand some reasoning being affected by this innovative environment. By gaining insights from both automotive companies, AI-experts and Management Consultants, it is plausible to believe that we will get different perspectives on the phenomenon. It will not be a single case study of one automotive company; instead, this research aims to provide more general insight of AI's impact on business within the automotive industry by interviewing several different actors with slightly different perspectives and therefore attempt to increase the generalizability of the findings.

1.4 Problem Setting

It is discussed by the World Economic Forum (2018) that AI inherits the potential to profoundly disrupt the automotive industry through autonomous driving improvements as well as improvements in manufacturing processes and customer relations. Albeit the existence of vast amount of research and reports done on the potential opportunities introduced by AI for business, we found that there was a lack of research investigating what parts of the organization that are perceived to be impacted the most and how they will be transformed. This perceived research gap is what this thesis wants to put under the spotlight.

Even if the beliefs and hopes for AI are high, it is considered to be a significant gap between ambition and realistic execution to chase these opportunities. While most of the executives interviewed in a survey conducted by BCG and MIT (2017), believed that AI would be able to give them a competitive advantage and enable the creation of profitable new business models, only one in five companies has presently taken strategic decisions and action of implementing AI in some of their offerings. Thus, started to exploit and reach for the technology's believed potential value (BCG & MIT, 2017).

The magnitude of the imposed transformation AI is introducing is accompanied by risks, challenges but also opportunities. By understanding these changes imposed by AI, a firm gets better positioned to plan and act accordingly. Even if it is the automotive industry that is being investigated, there are insights that could prove valuable to other industries as well due to the general characteristics of AI. This motivated our selection of the topic since we believe that the research could nourish insights and hopefully create ideas for the readers.

The motivation and relevance of the thesis's research are further strengthened by AI's potential impact on society along with its capabilities to affect and change the firm's logic of how to generate value. Technological changes are driving the economy forward and creating growth if correctly utilized, and it is of importance to prepare and understand how the technology can impact and affect a company's business model to be able to act accordingly (BCG & MIT, 2017).

1.5 Research Question

The purpose of this thesis is to investigate the impact Artificial Intelligence has on business within the automotive industry. This thesis will try to reach that answer by analyzing different components of the business separately and investigating what AI technology is affecting and can contribute to each of these sections. To better present and visually explain our findings, a slightly modified model of the Business Model Canvas, originally created by Osterwalder and Pigneur (2013), is used as a framework to examine the impact of AI. Therefore, the thesis problem formulation and empirical setting along with the objectives generated the following research question:

What are the impacts of AI on companies business within the automotive industry?

1.6 Limitations

Since the plan and structure of this thesis are intended to only investigate AI´s impact on business within the automotive industry and by looking to contribute research to this specific industry, other industries are per definition excluded. Both the theoretical framework, empirical finding and analysis chapters will be formed around the revised Osterwalder's Business Model Canvas Framework with the aim to answer the research question sufficiently by analyzing the business sections by section.

Since the thesis only aims to investigate the impact of AI on business to better understand and address strategic decisions and increase the understanding of how an industry is affected, it will not dig deeper into the technicalities of AI.

Further limitations consider the exclusion of some parts and aspects surrounding the AI discussion currently, namely, the thesis will not consider any ethical dilemmas considering the implementation of AI regardless if it is ethical dilemmas of automation or the ethical critique and fear about a dystopic future where AI has outrun humans. Further, the data collection regarding reports and case studies of AI technologies is limited to not be older than from 2012 in an attempt to stay relevant and keep up with the latest trends and research since the area of AI is subject to continuous change.

1.7 Disposition

Firstly, the introduction provides a background to the topic and motives behind the choice of research area. Further, it states the research question that guides the research process which eventually the thesis tries to answer sufficiently. Secondly, the theoretical framework introduces and links Technological Innovation and its impact on business, Artificial Intelligence and the Business Model Canvas thoroughly. Thirdly, an extensive explanation and reasoning of how the study has been carried out are provided in the methodology section to explain the research quality and ease research replicability. It will also be providing a deeper understanding of the reasoning and findings for the reader. After the methodology chapter, the empirical findings are being presented using the Business Model Canvas Framework. Following the empirical findings, the analysis chapter contrasts theoretical and empirical findings in relation to each other, providing a strong foundation and reasoning for answering the research question. Finally, the conclusion summarizes the findings and answer the research question as well as suggestions for future research in combination with a section of discussion. Exhibit 1 visually illustrates the research process and the outline of the thesis.

Exhibit 1

Research Process

Source: Developed by authors

2. Theoretical Framework

This chapter presents the theoretical basis for the thesis and the frameworks used throughout. It is divided into three sections in relation to our research question. Initially, we present the impact technology has on business, then the concept and definition of Artificial Intelligence is described, continued with theory around Business Models and Business Model Canvas and lastly studies on AI impact on business.

2.1 Technology impact on business

Technology is present almost everywhere and is progressing at such speed that it is becoming increasingly hard for organizations to cope (Copeland, 2012). However, technology on its own rarely inherits any direct value, and its real economic value is only monetized and adhered to the technology when successfully implemented in some variation of a business model (Chesbrough, 2010). Technology's impact on business performance has been discussed and investigated, and the effect on business performance is well-documented (Christensen and Bower, 1996, Zaheer & Bell, 2005).

New technology can create and nourish new business models and has historically done just that (Baden-Fuller & Haefliger, 2013). To make it more illustrative, historical examples of how technology changed business; the steam engine and its enabling of mass-production, the internet reducing the distance gap globally, and the introduction of electricity (Baden-Fuller & Haefliger, 2013: Jovanovic & Rousseau, 2005). As stated, technological innovation has observable positive effects on business performance which is argued to potentially create a myopic view that diverts focus away from the synergy between the business model and technology, and instead focus on business performance only (Baden-Fuller & Haefliger, 2013).

2.1.1 The role of time and expectations in technological impact

It is argued that new technology only is fully realized when the technology is widely diffused and used (Hall & Khan, 2003). The diffusion process of a technology constitutes of the series of individual decisions to begin using the technology for which the decisions are the outcome of an analysis and study of the uncertain benefits and costs of the technology (ibid). The diffusion of a technology is not happening overnight, but at different stages, at different times, to different degrees, and in different contexts. Hence the adoption and impact of a new technology can be observed from a perspective of both time and degree of impact (ibid).

Technological change is not something that pre-exists on its own, except in relation to the expectations and vision that shape its potential (Borup et al., 2006). Hence, analyzing the dynamics of the expectations of the technology is essential to the understanding of technological change (ibid). The expectations are essential in the coordination of different groups and levels within an organization and shape the outcome of the change (ibid). Expectations are subject to changes over time in reaction to e.g. new conditions in the surrounding environment (ibid).

2.1.2 Technological innovation and value creation

Traditionally, companies are creating value through new ideas and exploration of technologies in synchronization and alignment of their existing business model. The business model is an explanatory tool to understand the relationships between different functions within the company and by aligning it with technology it can mitigate the friction and result in increased firm performance (Amitt & Zott, 2001). While technologies are being a recurring investment-destination for companies, they often miss or lack the ability to foresee potential required changes in their business models accordingly to be better suited to the new technology for which their investments are being made (Chesbrough, 2010).

Technological development and innovations are what drives economic growth in both society and for business, and subsequently what could lead to disruptive changes for companies (Segerstrom, 1991). Further, Chesbrough (2010) thoroughly investigated the relationship between business models and technology innovation, his research covers the disruptive force and power of new technology where it is especially observable how technology transforms and fundamentally change businesses and their business model founding logic. The value potentially unlocked by technology is to be considered huge. However, it often comes with a highly disruptive process that affects business (ibid). It is argued that the basis of any successful commercialization of new ideas and technology is through an alignment between technology and the company's business model (ibid). Subsequently, the implication is that an identical idea or technology can yield entirely different economic outputs depending on the business model (Chesbrough, 2010). Thus, technological innovations and breakthroughs are strongly linked with the business model innovation of companies, hence highlighting the importance of understanding how and in what way technology affects and impact current business.

> *"A mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model"- Chesbrough (2010)*

An additional aspect which is important to consider is the struggle companies faces when implementing a new technology or when they address the required reaction to a disruptive technology commonly doesn't lie in the ability of actually conceiving the disruptive technology and its existence. Instead, it is connected to the ability to align the technologies inherited capabilities with the already existing business model, which often leads to that established technologies are prioritized since the initial gross margins of a new technology often are lower than the established (Christensen & Raynor, 2003; Amitt & Zott, 2001). They further argue that this conflict of existing business models and new technology often creates strategic inertia which could affect the performance of a specific organization tremendously (ibid).

The bridging between business and technological opportunities enabled through innovation is something that firms currently are struggling with, and it needs to be considered while dealing with new technology. Also, it needs to be recognized that the technology itself has different characteristics that will influence the business possibilities presented. This is further strengthened by the fact that technology often requires a synergetic relationship with

complementary support to reach and deliver the intended value which is to be proposed to the customer (Christensen & Raynor, 2003; Amitt & Zott, 2001).

The business model aspect is frequently understated by strategy scholars while investigating the relationship between technological innovations and the performance of organizations. (Baden-Fuller & Haefliger, 2013). Instead, assumptions are commonly made to believe that the enhancement of a product or service is enough to lead to increased profits for the firm (ibid). However, it is considered that the alignment between technological innovation and the business model is crucial to attain the potential of new technological innovation. (ibid).

Complementary benefits between a technology are enabled and based on the business models where it is implemented, and together they create a possible way of generating increased profits and competitive advantage (Leonardi, 2011). As a result, the business model may need to be adjusted to fully appropriate the offered characteristics of a new technology to monetize, and by just changing certain elements to create a fit between the customer and value offered. (Hienerth et al., 2011). In this research, technology and its impact on business are examined from a perspective of Artificial Intelligence impact on business within a given industry, namely the automotive industry.

2.2 Artificial Intelligence

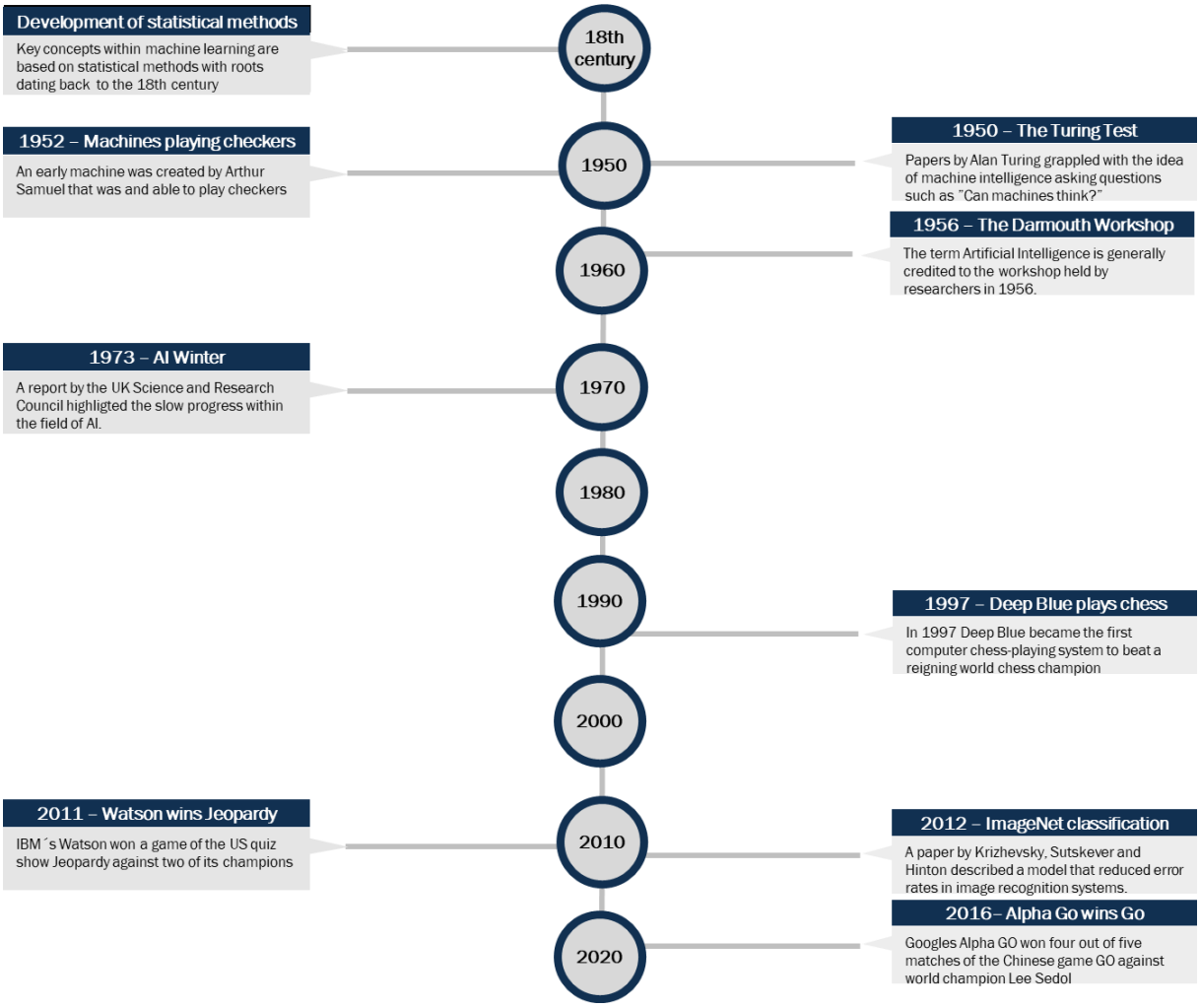
In the Artificial Intelligence-driven industrial revolution that is currently occurring, machines are getting smarter by the day and are being augmented with embedded intelligence to perform heavy data analysis, root problem solving and create valuable insights (Accenture, 2016 & Capgemini, 2017). AI is commonly defined and referred to as the ability of machines to perform and exhibit human-like behavior and intelligence, such as solving difficult problems without detailed instruction embedded in the software along with specific action commands (Copeland, 2012). Following, a definition of AI from the Oxford English Dictionary:

> *"The theory and development of computer systems able to perform tasks normally requiring human intelligence" – Oxford English Dictionary*

2.2.1 A brief history of Artificial Intelligence

Exhibit 2

The development of Machine Learning and AI



Source: Royal Society (2017)

2.2.2 Definition of AI

Trying to define AI as some precise technology is fraught due to a number of different reasons; basically, since AI is a concept that covers and combines a broad range of technologies and the vast amounts of application areas are making a precise and distinct definition even more fraught (McKinsey, 2017). Some of these technologies and applications areas are groundbreaking and disruptive, while others impose only incremental improvements of previous existing techniques, processes, and operations. Further difficulties connected to the AI definition lies in the lack of general theory of what and how one defines "intelligence", what it really is constituted of (Burgess, 2017). Lastly, an ongoing definition problem of what is recognized as machine intelligence changes based on previous advancements in the area, so what was considered intelligent yesterday is the standard today and therefore is no longer consider intelligent to the same degree (McKinsey, 2017 & Capgemini, 2017).

Regardless of the discussion about the precise definition, AI's core foundation constitutes a string of algorithms which a sequence of instructions or a number of limitations rules. The algorithm combined creates an AI model which based on given rules and probability extracts the best output from any given input (Burgess, 2017). Even though the technological aspect of AI is hard to grasp, an overview is needed to better prepare for the understanding of what impact AI can impose. Burgess (2017) are categorizing AI in Supervised AI and Unsupervised AI with focus on how it functions, while Barrat (2013) is talking about the three types of AI based on intelligence level; Artificial Narrow Intelligence, Artificial General Intelligence, and Artificial Super Intelligence. Necessary to understand, the latter two of Barrat's (2013) definitions is yet to be invented and only theoretical expectations and theorizations of what AI could develop into. With this acknowledged, this thesis will look at Narrow AI which really excels at specific tasks but not to be compared to human intelligence.

Supervised Learning:
As argued by Burgess (2017), supervised AI is the most common AI solution implemented. It builds on a large set of data where an AI algorithm is trained to find specific patterns which are predetermined by humans.

Unsupervised Learning:
In contrast to supervised learning, the unsupervised algorithm receives a significant amount of data input but with no particular pattern to find. Instead, the algorithm is looking connections, patterns to create clusters, and once these clusters are obtained, a new unsupervised learning process is initiated based on the findings from the first run (Burgess, 2017)

AI algorithms have the ability to make sense of information systems, analyze and act their surroundings. The inherited foundational benefit among most types of artificial intelligence and their solutions is their ability, enabled mainly by machine learning, to adjust and adapt their actions, based on experience instead of being explicitly told to perform that specific action (Burgess, 2017). This concept is referred to the self-learning and is often compared to human students, in the way that they are provided with the material of education and then, can learn on their own (Accenture 2016b).

2.2.3 Machine Learning

Since AI, as stated, is not a smart machine which merely just learns to analyze, instead, it is built and trained by evaluating and comprehend vast amounts of data patterns. Therefore, companies that are early in AI implementations are suggested to reconsider existing data structures and to build robust informational infrastructures and create capabilities to analyze and structure their data to exploit the opportunity given by AI (BCG & MIT, 2017). A considerable difference between pioneers in AI technology adoption and laggards are often connected to the understanding of the relationship between AI and data, where many of the laggards have their data stored in " organizational silos" where the internal synergies never are revealed and therefore never fully utilized (McKinsey, 2017). There exists an evident paralyzing effect spurring from limited data input, and the quality of AI algorithm must be extraordinarily high to attain any value from poor data (BCG & MIT 2017).

Machine Learning (ML) theory circulates the creation of algorithms that inherits the ability to recognize patterns in large data sets, and from this recognition, being able to draw conclusions from previous experience and thus exhibiting human-like problem-solving analytical cognition, although at a fraction of the time needed for humans. (World Economic Forum, 2018). This is commonly what people refer to when discussing Artificial Intelligence and not the dystopic super robotics that potentially would be superior to humans and extinguish this. Machine Learning is today the most active and most implemented use of AI according to World Economic Forum (2018), and it is frequently used in a wide range of application such as search engines and in developing self-driving cars.

Machine Learning has undergone a categorization and sub-parts of the learning process has evolved. The most recent and most widely referred topic is the "Deep Learning Algorithms". Since the advancements in computing power have boosted it and enabled machines to in a blink of an eye analyze a vast amount of data and to be even more accurate than the human eye in analyzing visual data (World Economic Forum, 2018). Deep Learning is the algorithm that provided a machine with tools to beat the World Champion in the Chinese board game Go (Royal Society, 2017)

The underlying benefits of machine learning in comparison to human learning, and an aspect that experts believe to be reasons to why it will dictate the business going forward is that once a machine learns, the knowledge is never forgotten and always accessible in a fraction of a second (Burgess, 2017). Further, the knowledge attained by one machine can easily be copied to another in a short time compared to the learning process of humans which is quite time-consuming (ibid). Subsequently, when several parallel machines are performing tasks and learning, the continuously update their insights to other connected machines which then develop simultaneously Burgess, 2017; Accenture, 2016). Considering this in the automotive industry, if one car learns to driver better deepening on that cars experience, it can instantly teach millions of other vehicles same skill.

2.2.4 AI application and implementation areas

Artificial Intelligence is applicable in a wide spectrum of areas and is used to optimize workflows, supply chains and product development (McKinsey, 2017). The technology is impacting the manufacturing cycle tremendously since it inherits the ability to work optimally for 24/7 in optimizing the operations of the whole organization (ibid).

2.2.5 AI Limitation

AI is a catalyst for ethical discussions and fears. Central to the fear of AI originates from the belief that AI will replace humans in the Value Chain, by performing our tasks better and faster and more accurate and through that make us redundant (Barrat, 2013). AI can admittedly perform a number of actions and achieve a lot of things that humans can do in isolated tasks, such as analysis of data sets and scenarios to make critical decisions. However, it can't generate new insights or predictions, or it can't replace us in delivering judgment or skepticism (EY, 2017). Barrat (2013) further discusses how scientists have reached a milestone in that they have created something that is more intelligent than a human. Artificial superintelligence as Barrat (2013) describes it is currently thousand times more intelligent than the most intelligent humans and it is solving problems that are million times faster than humans. Barrat (2013) fear that AI cannot be controlled, and eventually might be the end of the human era (Barrat, 2013). The concept of the increase in AI power is something that not just Barrat (2013) fear, but that many worries or are skeptical towards, but companies need to prepare for the future development of AI to not be left behind by competitors.

Although there are some concerns regarding the investments needed to attain this state, and even if the results and impact are widely acknowledging. AI is still considered by some theory to be in need of further advancements from its rather primitive state and develop into a state where it is even smarter and more efficient than today (BCG, 2017). The following quote further strengthens this:

> *"We believe the juice is not worth the squeeze." - CIO of a large pharma company (BCG & MIT, 2017)*

2.2.6 Summarized AI

The AI applications this thesis mainly is investigating, are considered as "narrow" AI which application performs improvements on narrow tasks and not the conceptual AI that tries to imitate human intellectual tasks (McKinsey, 2017). Hence, this thesis arguably aims to primarily investigate AI that is affecting business today and/or has short-term business potential and solves business problems.

A consequence of the broad nature of AI is its potential of affecting a wide variety of the value chain and all parts of a firm's business in several different ways. However, some parts of the business are receiving more attention than others; it is observable from reports that customer service functions such as marketing and CRM together with operations and manufacturing are cited the most in AI literature where general and financial management are left somewhat behind (McKinsey 2017).

2.3 The Business Model

The business model can be traced back to pre-classical times as it has been essential in, e.g., trade; however, the concept became prevalent first during the mid-1990s as Internet emerged (Teece, 2010). Since then, it has gained momentum and ideas revolving around the concept have resonated with both scholars and business practitioners, which shows the number of publications, articles, and books that mention the concept.

In terms of definitions, the business model is generally defined or referred to as, e.g. a representation (Morris, Schindehutte, & Allen, 2005; Shafer, Smith, & Linder, 2005), a statement (Stewart & Zhao, 2000), a description (Applegate, 2000; Weill & Vitale, 2001), a conceptual tool or model (George & Bock, 2009; Osterwalder, 2004; Osterwalder, Pigneur, & Tucci, 2005), architecture (Dubosson-Torbay, Osterwalder, Pigneur, 2002; Timmers, 1998),a framework (Afuah, 2004). Although there has been a rush in the amount of literature concerning business models, there is an apparent disagreement of what a business model is between researchers. The definitions are to a large extent dependent on the researchers aim with the study, hence defines the business model to fit with their research. Overall, the business model generally can be referred to like (see quote), and which is how this research interpret it:

> *"The heuristic logic that connects technical potential with the realization of economic value" - Chesbrough & Rosenbloom, 2002*

There exist differentiating factors between the traditional focus on competition, competitive advantage and value capturing between firms in comparison to the attention of business model framework seemingly focus more on partnerships and joint value creation (Magretta, 2002; Mäkinen & Seppänen, 2007). Further, the focus seems to have shifted from a product-centric approach to a more customer-centric approach through the business model concept, which according to Chesbrough & Rosenbloom (2002), isn't as represented as much in other strategy literature.

> *"The method by which a firm builds and uses its resources to offer its customer better value and to make money in doing so "– Afuah & Tucci (2001)*

Traditional frameworks used to address value creation, often through a somewhat isolated nature, such as the alteration of Porter's value chain, analyzing networking partner and looking at Schumpeterian innovation opportunities. Amit and Zott (2001) argue that these frameworks used in isolation present shortcomings in addressing total value creation which can be sufficient appropriated by a wider-spanning business model framework. This is further strengthened by Hamel (2000) that companies with an ambition to thrive in revolutionary, and transformational phases need to develop explicit business models where both value creation and value capture occur in the same value network. This should also address aspects that transcends a business's resources which are attained through partnerships and coalitions. This is also argued by Zott & Amitt (2007) where they present the business model as the ", boundary spanning transaction with external parties," (Zott & Amitt, 2007). They look at a firm and analyze the value creation potential of the business as well as the potential appropriation ability the firm inherits.

The argumentation for considering business models as important is brought forward by Markides & Charitou (2004) who argues that a profound business model is a source of competitive advantage and create superior value. Studies conducted by Giesen, et al. (2007) on firm performance and business model creation, they identified that business model innovation is more effective in older companies in comparison to younger ones, and especially the boundary-transcending activities where synergies and efficiencies can be found.

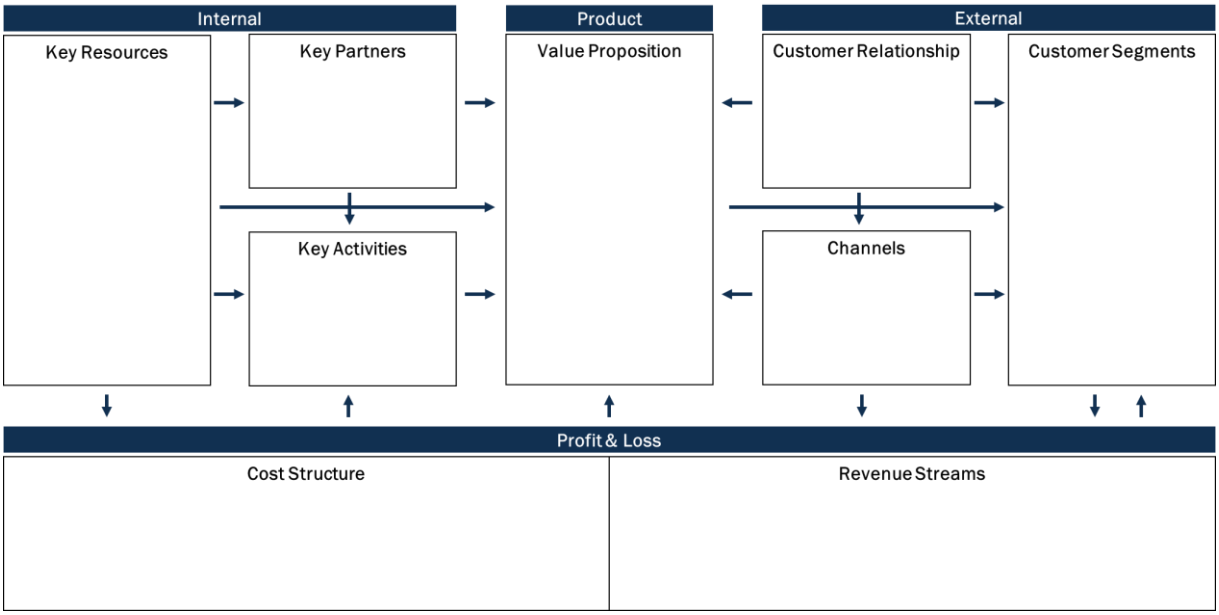
2.4 The Business Model Canvas

Previous sections have introduced and defined AI, explained the relationship between technological innovation and business models. This particular section of the thesis focuses on the Business Model Canvas Framework. Subsequently, the nine categories of the Business Model Canvas are presented, discussed and paired with what literature and reports currently highlight regarding AI's impact. Lastly, after the framework is presented, the subsequent section will present general indications on the actual impact of AI within the automotive industry based on two recent studies.

Companies have always been subject to competition. However, globalization, internet and rapid technological development (such as Artificial Intelligence) have increased the speed that new competitors and offers add to the market (Teece, 2010; Copeland, 2012). It is no longer enough for companies to only have an edge in an area such as being successful in product development or having an efficient production. It is believed, that in today's world, companies, to a large extent competes with their business models than just with products and services (Casadesus-Masanell & Ricart, 2010). This change has led companies to increasingly consider the model for which they create and deliver value (Teece, 2010). As previously mentioned, a Business Model can be described as the rationale behind how companies and organizations create, delivers and capture value (Osterwalder & Pigneur, 2013). The Business Model Canvas, created by Osterwalder & Pigneur, can to a considerable extent be seen as a blueprint for the strategy to be implemented. The Business Model Canvas can be seen as a strategic management tool that enables companies to design, describe, challenge and formulate their current business model (Osterwalder & Pigneur, 2013). It is often best described by breaking it down into nine basic building blocks that explain how the company plan to make money, called The Business Model Canvas. These nine blocks are highly interconnected and constitute the four main areas of a business: Internal, Product, External, and Profit & Loss (for details see Exhibit 3).

Exhibit 3

Business Model Canvas



Source: Developed by authors, inspired by Osterwalder & Pigneur (2013)

2.4.1 External

2.4.1.1 Customer Segments

In essentially all companies, the customers are considered to be the logical focal point of the business. No company will survive without its customers (profitable) for an extensive period. Hence, companies are urged to do everything in their power to identify their customers, satisfy their needs and discover demands imposed by the customer (Osterwalder & Pigneur, 2013). Therefore, this section of the Business Model Canvas defines the customers that a company intends to reach by recognizing the customer segments where the most prominent growth and value generating potential exists. Afterward, the company can design its business offering according to the specific customer needs within that segment (ibid).

As the joint report from BCG and MIT (2017) enlightens, it is estimated that the value proposed and offered to the customer will include some AI involvement in the process. This further highlights the impact AI will have on customers in one way or another in a short-term future. Data-sets provide behavioral insights about the customer leading to value creation (Erevelles, Fukawa & Swayne, 2016). Further, AI is enabling, through its data analytical skills, a more precise segmentation possibility of the already existing customer base as well as identification of new customers to attract (BCG & MIT, 2017; EY, 2017). By understanding the priorities of customers and adjust the production of vehicles accordingly in a tailored way, AI can reduce the need to offer sales and thus have the possibility to improve total revenue (McKinsey, 2018). By enabling a more efficient and predictable demand-analyzing tool through AI augmentation, customers could be identified and segmented even further, and the value proposed to them could be customized to a higher degree (EY, 2017).

2.4.1.2 Customer Relationships

Since customers, as previously stated, are essential to almost all companies, the relationship that the company establishes with specific customer segments is of significant importance, which is what the Customer Relationship block describes (Osterwalder & Pigneur, 2013).

Companies often refer their activities to customer relationship as to Customer Relationship Management (CRM). CRM is the combination of the people, processes, and technology that enable a company to understand its customers better (Khodakarami, F. Chan, 2014). Artificial Intelligence-embedded solutions for CRM-systems can be seen as analytical, and these systems provide the most useful support and knowledge about the customer in comparison with traditional static CRM-systems (Khodakarami, F. Chan, 2014).

The underlying driver of an analytical CRM system is data, and AI-embedded solutions require customer data to generate insights. An implication of the use of customer data will as of 25 of May 2018 be new rules concerning the treatment of personal data and stronger rights for individuals when it comes to personal integrity (European Commission, 2018).

2.4.1.3 Channels

Every company needs to reach, and in some way, communicate with its customers. Hence the Channel block tries to explain and describe how the company is communicating its value proposition (Osterwalder & Pigneur, 2013). The importance of having a reliable channel to reach customers is an essential part in delivering the proposed value of the product or service to the customer and realize the profit and enhancing the customer's perception of value provided.

AI-solutions which can analyze data of how the customer prefers to be reached and what channels that are effective, are capable of creating a tailor-made channel based on the gathered data which is being analyzed (BCG & MIT, 2017). By using AI for targeting marketing activities, studies performed by Capgemini (2017) on 1000 companies found out that this dramatically could improve the return on advertisement spending (ROAS). By targeting and mapping of customers with same characteristics as the previous high-value customer, AI is believed to contribute to increased revenues and profit margins. By generating these customer leads, AI implementation connects the company with customers that are highly valuable and profitable based on existing customers (Capgemini, 2017; McKinsey, 2018).

2.4.2 Product

2.4.2.1 Value Proposition

The Value proposition can be described as the package of product and services that creates the value for the specific customer segment determined in the Customer Segment block. The Value proposition consists of two major components, Customer Profile, and Value Map. The customer profile examines and explains how the customer experience the current relation and exchange with the company while the value map considers the potential additional value which a combination of product/service could provide to the customer. (Osterwalder & Pigneur, 2013)

The Value proposition is essentially explaining the reason of why a customer chose one company over another. Since the section is focused on the value which the company is offering to its customer per definition which affects the customer's willingness to pay (Osterwalder & Pigneur, 2013). By letting AI decipher previously indecipherable data from the customer behavior, and combine these into comprehensible data, it is perceived to enhance value offered to customers even further by adjusting according to these insights and tailoring the offering formed to the individuals' particular need (BCG & MIT, 2017).

By adopting AI in the offering towards the customer, the OEM's can propose improved products which are augmented through AI integration such as new intelligent driver/vehicle features for an improved experience for the customer like advanced driving assistance. They discuss the possibility for real-time response to changes in the specific surroundings and the ability for the car to analyze and adapt accordingly, as well as collision avoiding assistance based on both neural AI and machine vision that analyze the proximity (Gusikhin et al., 2016). These would enhance the safety and overall customer experience with the product when consumed (McKinsey, 2018).

The notion of Autonomous Driving would also fit into the category of Value Proposition and it is argued by McKinsey (2018) & Gusikhin et al. (2006) argues that Autonomous Driving will completely change the way cars are being sold and owned and disrupt the current way business is generating value. People would then rather buy mobility as a service rather than a product which they need to own. The concept and development of Autonomous Driving are with present knowledge only enabled through AI implementation (BCG & MIT, 2017; McKinsey, 2018).

2.4.3 Internal

2.4.3.1 Key Partnerships

The Company´s partnerships are the cornerstone of many business models. They form alliances to, e.g., optimize their business, lowering their risk or acquire resources. The Key Partnership block try to explain and describe the network of both partners and suppliers that make the company's business model tick. (Osterwalder & Pigneur, 2013)

AI development and implementation require specific abilities and knowledge which is hard to attain and quite expensive to acquire. Companies are investing in AI technology, therefore, are urged to attain talents with the digital knowledge to improve operational processes and algorithms as well as initiating collaborations (Geissbauer et al., 2017). Hence, companies within the automotive industry are starting to collaborate across industry boundaries, to be able to reduce the limits on investments required and fill out the missing generate value from the opportunity spurred from AI. By setting up a partner ecosystem, companies can minimize the difficulty of development, but through collaboration, sustainable and synergetic partners could provide with a way of turning buzz around AI into bucks (Mckinsey, 2018).

These reinforcing trends have led global automakers like Volvo Cars, GM, and Toyota to invest heavily in joint-ventures, start-ups, and increased tech-collaborations to bring in or develop the technology and technological capabilities necessary for the future generation of cars, enabled

by AI technology. For example, Volvo Cars announced that they would join forces with Uber in 2016 to jointly develop autonomous driving cars (Volvo Cars 2016). Earlier that year GM acquired a Silicon Valley-based start-up that worked with development driverless vehicle technology (Fortune, 2016). Furthermore, already in 2015 Toyota announced how they would partner with both Stanford University and Massachusetts Institute of Technology to research artificial intelligence with the purpose to develop fully autonomous cars (Stanford 2015).

2.4.3.2 Key Resources

For every company, resources allow it to create and offer its value proposition, reach the right markets, maintain and create relationships with customer segments and generate revenues. This block, therefore, describes what assets that are required to make the business work properly. (Osterwalder & Pigneur, 2013)

Key resources are the resources that are essential to the overall companies' ability to generate a positive revenue stream. It is highly dependent on what industry that is being analyzed, and different companies need to focus on different resources to attain competitive strengths and profitability. They are often categorized as following: Physical, Intellectual, Human & Financial. Moreover, to address the increasing need for AI one needs either the financial to outsource and to develop in-house, the Intellectual and human resources must be capable of performing the challenging task. (Osterwalder & Pigneur, 2013)

Regarding AI, it is not only driven by the constructed algorithm, and it is crucial to understand that there is nothing AI can do without sufficient data (BCG & MIT, 2017). Thus, there is an evident paralyzing effect spurring from limited data input. Consequently, the quality of AI algorithm must be super-high to attain any value from poor data (BCG & MIT, 2017). It is considered as one of the larges reasons to why some AI investments does not return as the investors initially believed, namely the lack of understanding of the importance of data infrastructure to build AI upon (Bughin et al., 2017).

2.4.3.3 Key Activities

Even if the company have all the key resources necessary, it is still required to perform specific activities to make the business work. Therefore, the Key Activities block try to describe what these crucial activities are and how they connect to the rest of the model. (Osterwalder & Pigneur, 2013) Similar to key resources mentioned in the previous section, key activities are equally important in creating and retaining value from customers. These activities focus on production and creating new more attractive and efficient designs with high quality to enhance the offered value to the customer. Further, it entails the concept of problem-solving and referring to the problem the customer wants a solution on by purchasing the product or service (Osterwalder & Pigneur, 2013).

The fusion between Artificial Intelligence and manufacturing technology enables opportunities of value enhancing manufacturing approaches and solutions. (Li et al., 2017). They further argue that AI-driven intelligent manufacturing is enabling considerable gains to be collected in

efficiency, safety, and reliability through extending the interconnectedness, responsiveness and predictive ability of the manufacturing process.

> *"This setup is helping manufacturing industries to move from repair-and-replace to a predict-and-fix maintenance model." - Kunal Parikh (2017)*

A report conducted by Accenture (2016b) is implying that AI will enhance the automation of routine tasks and through this, improve the productivity and general performance of a company. However, not all activities are a subject of automation, and then they are arguing that AI can augment these activities. Time-consuming tasks of analyzing enormous amounts of data are being tremendously improved and are augmenting the decisions making for employees in activities where a human, real-time analysis still is essential (ibid).

Within manufacturing and operations, predictive maintenance uses data extracted insights to increase the productivity by foreseeing and preventing machine breakdowns. Artificial Intelligence has the potential to spot and predict these errors and breakdowns and advise on how to move forward (McKinsey 2017). For automakers, matching supply and demand with a precise prediction of demand is essential. Long-established systems for both forecasting and replenishment get flooded with the vast amount of data that can be derived from, e.g., IoT devices. As a solution to this, Artificial Intelligence, and machine-learning methods can be used to enhance the forecasting precision and optimize replenishment (McKinsey 2017).

Autonomous vehicles or at least partly autonomous vehicles are predicted by theory to constitute a large number of total cars sold in a not so distant future, this focus of creating Autonomous Driving is affecting the key activities as well since new capabilities need to be incorporated within the manufacturing process. The area is receiving a lot of investment and focus, and it is believed to be a self-fulfilling prophecy which hugely affects the OEM's positioning strategy today. Autonomous Driving is only enabled through reliable, efficient data processing that only AI can perform (McKinsey, 2017).

2.4.4 Profit & Loss

2.4.4.1 Cost structure

This section of the BMC tries to explain and describe the essential cost that occurs while operating a specific business and it entails all the costs of producing the product or service and provides the value to the customer. (Osterwalder & Pigneur, 2013) This includes all the cost aspect of a company, and they could be controlled or decreased by exploiting economies of scope, scale, and other cost efficiency practices.

AI has the ability to dramatically reduce costs in production stage by using current knowledge to increase efficiency to a level where humans cannot compete. Airplane manufacturer Airbus provided an example where AI implemented problem-solving and operation optimization in their operation, and overall supply chain management procedure improved their cost structure and led to a substantial increase in profit margins. AI empowered Airbus through improving their real-time business problem-solving skill. (BCG & MIT, 2017)

For most companies, it is hard to coordinate and effectively handle their R&D projects at high efficiency (McKinsey 2017). The projects are often long-term and characterized by a degree of complexity and uncertainty and companies struggle to determine when to call off a project in favor for another, leading to unnecessary cost and longer time to market. Artificial Intelligence can enhance the prioritization of R&D projects and increase overall project performance, leading to cost cutting and efficiency gains (McKinsey 2017). However, the cost structure section is experiencing more indirect effect originating from AI implementations within other parts of the BMC.

2.4.4.2 Revenue Streams

Without revenues, it is hard for any business to survive for long. The Revenue stream block describes the money a company generates from each customer segment. (Osterwalder & Pigneur, 2013) The revenue stream is the combination and correlation between the offer value and the payments acquired from customers. By understanding the customer segments their willingness to pay, a company will be able to attain more revenue by adjusting according to that knowledge (ibid).

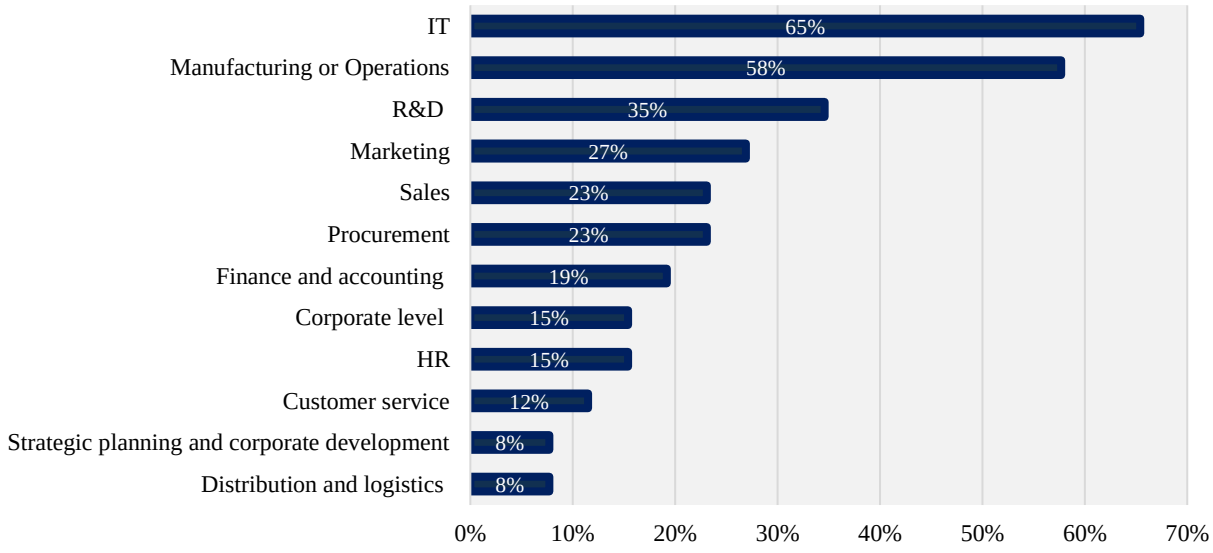
AI is commonly considered to be able to increase the revenue stream by including the increase of revenue captured by increasing value of a product through AI and thus reach an increase of sales, as well as improving the process of reaching the customer and proposing a more attractive value for the customer. (McKinsey, 2017) By providing the customer with a richer digital experience in the touchpoints, they have with the company revenues could improve. (ibid). Furthermore, adding new features and mobility services, based on AI technology will generate additional sales and revenue according to McKinsey (2018). Similar to the cost structure, this section is more indirectly affected by AI implementations in other areas of the BMC.

2.5 General indications of AI impact within the automotive industry

Overall, the adoption of AI is gearing up in most industries, and the automotive industry is certainly no exception. In a survey from Tata (2016) a consultancy, based on responses from 29 automotive companies, 90 % stated that they used AI in some part of their organization in 2016, while the remaining 10% said they would use it by 2020. However, in contrast, as presented in the joint report between BCG and MIT (2017), very few organizations have adopted AI beyond the pilot stage. According to Tata (2016), the automotive companies most frequently applied cognitive technologies (AI) in IT or manufacturing functions, 65%, and 58 % respectively. Furthermore, automotive companies apply AI in their R&D, e.g. product design, development and engineering (35%). Automotive companies are also using AI heavily to improve their marketing function. As an example, BMW Group used artificial technology to respond to inquiries about their first electric cars in less than 24 hours (BCG & MIT, 2017). Within the sales organization, AI is also used, 23 % of the respondents pointed that out. Other areas where AI is used is procurement (23%), finance and accounting (19%), HR (15%), and corporate level decision making (15%) (see Exhibit 4) (Tata, 2016).

Exhibit 4

Percentage of automotive companies using AI per business function



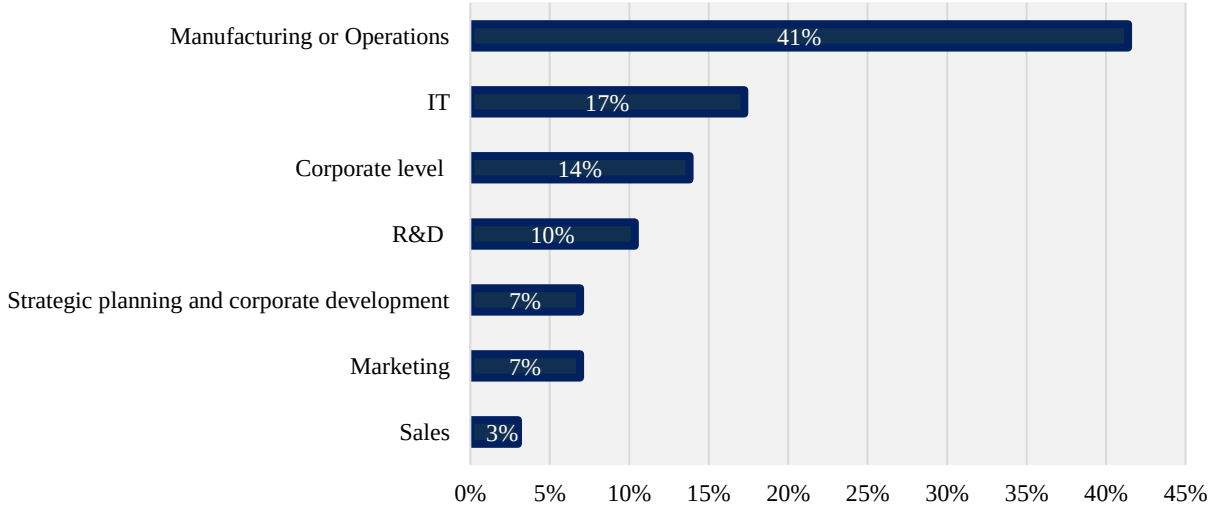
Source: Tata (2016)

Concerning AIs impact on cost and revenue improvements, the automakers in Tata (2016) study reported a 12 % increase in revenue on average in the area of their AI actions. From a cost reduction perspective, areas of AI actions reported cost reductions of 10% on average.

Looking forward, it is expected that automotive companies will continue to invest in AI, robotics, and other actions aimed at manufacturing. The respondents in Tata (2016) study expect that the business functions where AI will have the most significant impact by 2020 is within manufacturing and production (41%) (see Exhibit 5).

Exhibit 5

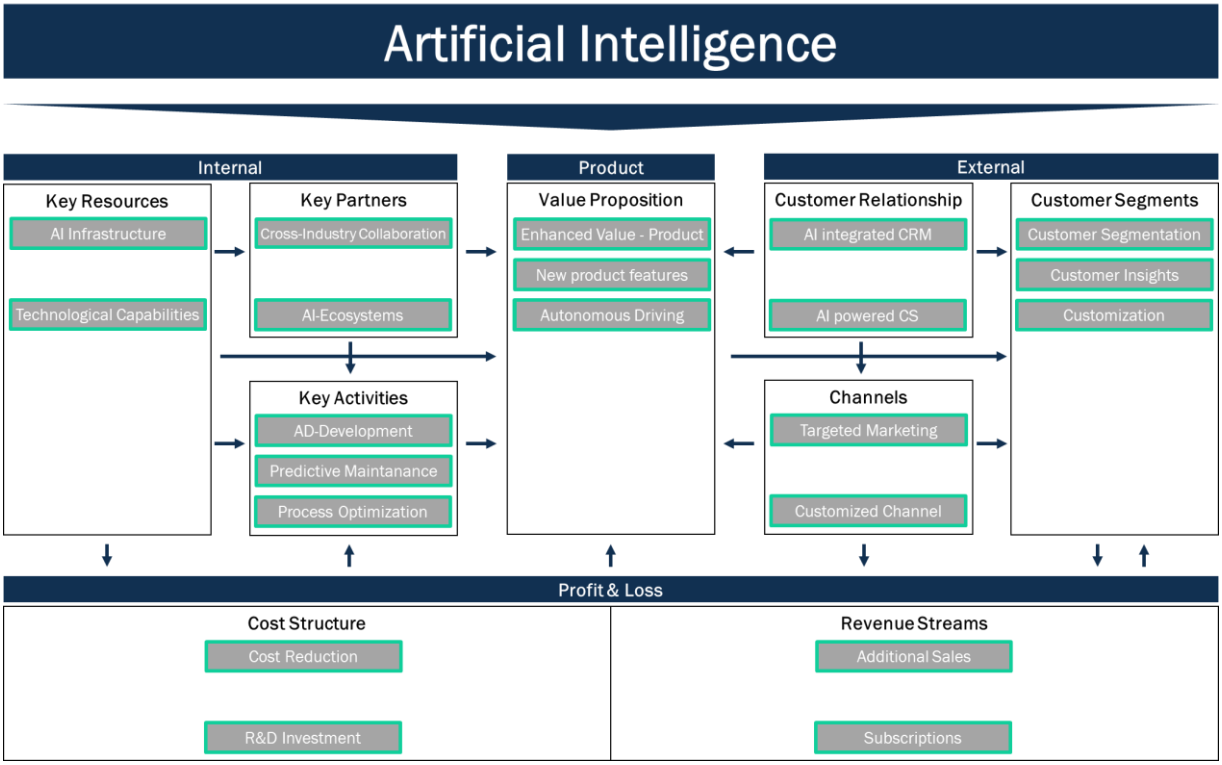
Predicted business function where AI will have greatest impact by 2020



Source: Tata (2016)

Exhibit 6

Summary of Theoretical Findings / Reports



Source: Developed by authors

3. Methodology

Following chapter explains the methodology and the path chosen when conducting this research. The research strategy and research design are motivated and overall performance described and discussed. This chapter will also try to answer how the concepts of validity and reliability were handled to produce a relevant result. The chapter ends with a presentation of how the empirics have been gathered and how the analysis has been performed.

3.1 Research Strategy

This thesis aims to investigate how the technology (AI) is impacting business within the automotive industry, and the selected viewpoint of this research is based on the respondent's perspective of the subjective reality. The research strategy selected for this thesis is of a qualitative nature, mainly motivated by the novelty of the attempted research area and the limited existing research of the topic it aims to investigate. Even though a quantitative study could increase the transferability of the findings, (Bryman & Bell, 2015) we selected a qualitative approach since;

i) The study aims to explore patterns and emerging themes in an area were previous research is scarce, as well as the thesis is attempting to create theory rather than test it, the qualitative approach is deemed more appropriate (Bryman & Bell, 2015; Yin, 2010).

ii) Since the research perspective is at an organizational level, and logical reasoning of impact entails beliefs, norms, and values, a qualitative study was deemed appropriate (Friedland & Alford, 1991)

iii) An interviewed based qualitative approach creates openness and adherence to individual's perspectives on found patterns and impact areas (Bryman & Bell, 2015).

The selection of a qualitative method is further strengthened by Bryman & Bell (2015) as they state that it can understand the phenomenon through the examination of the participants' interpretation of the particular phenomenon. Thus, by conducting qualitative research, it is argued that insights about how the perception of how a phenomenon affects over a longer time horizon is allowed to be obtained (Bryman & Bell, 2015). Thus, the qualitative selection came quite naturally since the findings are not measurable in a quantifiable nature (Collis & Hussey, 2009). Additionally, the anticipated difficulty to be able to reach and collect data from a large number of respondents with sufficient knowledge and understanding of the topic favored the qualitative approach over the quantitative (Bryman & Bell, 2015).

Although, the qualitative strategies impose some difficulties and short-comings, such as the ability to generalize the findings as well as the researched own interpretations during the interviews might present some bias into the conclusion (Bryman & Bell, 2015). However, since the aim is to understand the impact of AI on the automotive industry and no intention of cross-industrial generalizability is set as a goal, the outcomes of the research are focused on answering the research question. Further, the interviewees might give biased answers if they either don't

fully understand the questions or if they think that their answers might present them unfavorable (ibid). Although we have tried to mitigate these risks by ensuring anonymity in our research findings, performed cross-checking on the answers obtained by all interviews, these risk cannot be rejected and could still affect the outcome of the thesis.

3.2 Research Design

The overall purpose of this study is to analyze data from conducted qualitative interviews and compare insights from the respondents. As argued by Bryman & Bell (2015), this collection of different sets of data and then compare these insights constitutes the strength of qualitative research. Furthermore, the research is defined as exploratory due to the limited amount of previous research on Artificial Intelligence´s impact on business (ibid). The Business Model Canvas framework provides a solid foundation for the research and enables a clear and structured process in both analyzing and drawing conclusions from the data. A slightly revised Business Model Canvas from the origin created by Osterwalder & Pigneur (2013) is used throughout the thesis (see Exhibit 3). Due to the limited amount of previous research, a holistic perspective has been taken to generate adequate results. In an attempt avoid biased results, data have been collected from different companies with additional insights from experts within the area.

3.3 Research Approach

The research approach establishes how theory and empirical findings are combined and analyzed to create the best explanation of the investigated reality (Patel & Davidson (2011). According to Bryman & Bell (2015), there are three major approaches, which will be discussed in the following section.

The inductive approach starts from empirical gathering and then the theory is created, the deductive approach is formulating the empirics based on existing theories then testing that theory, the abductive approach is a combination of the two previously mentioned and the approach this thesis is using. It entails theory generation that is the base of the empirics, then in an iterative nature the theory is regenerated with insights from empirical findings in mind (Bryman & Bell, 2015)

The research was started by mapping out relevant theories and literature connected to the overall research topic. After careful consideration, the most relevant was chosen. First, we conducted pilot interviews to make sure that the interview guide was appropriate. Thereafter, the semi-structured interviews were executed as part of the data collection. After the interviews, findings were mapped, contrasted in coherence with the found theories and reports and new theories were added. As a final step, conclusions were determined and an overall quality check of the whole thesis where performed.

Exhibit 7

Research Approach

Source: Developed by authors

3.4 Research Methods

According to Bryman & Bell (2015), the research methods entails the process of data gathering, such as the creation of interview guides, selection of participants in the study as well as the respondents to interview. Hence, this section will explain the reasoning behind choices made throughout our data gathering phase thoroughly. Primary and secondary data collections have been used which will be further described in the following chapter.

3.4.1 Primary Data Collection

The primary qualitative data collection was conducted through semi-structured interviews since its nature appropriately suits the explorative study and is deemed preferable when gathering data based on general information of the subject (Bryman & Bell, 2015). Performing semi-structured interviews, enabled an openness towards unpredicted insights and broader coverage of the topic which was sought after by the exploratory research question. Based on the extensive literature review along with relevant information from the pre-collected data, relevant topics were highlighted and used during the interviews.

The interview guide was structured in themes related to the Business Model Canvas framework and was analyzed accordingly (Appendix 1). By this thematic pre-categorization of the questions, it was straightforward to cover desired parts of the topic in the semi-structured interview, and the guide was used more as a basis for discussion rather than as a script.

Selection of Industry, Companies and Respondents

The focus on the automotive industry was taken after carefully analyzing what the literature highlighted as industries were the impact of AI is perceived highest. The automotive industry is exposed to AI both on the manufacturing side as well as the product trough self-driving cars (BCG & MIT, 2017). Additionally, being a student in Gothenburg and West-Sweden, where the automotive industry is one of the region's most important economic drivers, it was both convenient and relevant from a research perspective. Furthermore, consultancy reports frequently highlight AI development within the automotive industry making an academic thesis researching the subject an adequate compliment for a richer understanding.

To find relevant companies and persons to reach out to that could bring value to the research, reports, and companies that suited the topic were scanned, and this search gave us a list of relevant persons from which we would like to get insights. Additionally, the individuals were

examined based on their position, competencies, and background to make sure that we were focusing on the right persons. This information was mainly attained by Google searches and by LinkedIn, later, additional respondents were given through initial interviews. The primary search was for people that worked with strategy within automotive or other experts of either AI or automotive, or both. These persons were believed to have an understanding of how AI impacts business within the automotive industry. The potential candidates were approached by mail explaining our purpose and how they could contribute.

Pilot Interview

Before conducting the interviews, we tried our interview guide with two classmates to get feedback and input on potential improvements that would make the following interviews more efficient and valuable.

Exhibit 8

List of interviews

Position	Company	Time	Date	Type
Corporate Strategy	OEM	55 min	12/3-18	Face-to-face
Software Engineer	OEM	55 min	12/4-18	Face-to-face
VP	OEM	55 min	14/3-18	Face-to-face
Partner	Consultancy	55 min	27/3-18	Face-to-face
CEO	ML start-up	55 min	4/4-18	Face-to-face
Technological Consultant	Tech Giant	55 min	12/4-18	Skype
Consultant	Tech Consultancy	35 min	10/4-18	Face-to-face
Consultant	Tech Consultancy	30 min	10/4-18	Face-to-face
Consultant	AD Company	30 min	10/4-18	Face-to-face
Senior Researcher	Research Institute	15 min	10/4-18	Face-to-face

3.3.1 Interviews

The conducted interviews were semi-structured which made it possible to ask broad questions and direct the focus on the most important parts of the interviews dependent on the interviewee. By performing semi-structured qualitative interviews, responsiveness towards unexpected answers and findings during the interviews is created, which enabled us to adjust and re-focus our discussions accordingly based on the specific interview as well as re-adjust our interview guide (Bryman & Bell, 2015). This approach was deemed suitable since the thesis aims to understand the subjective opinions of the respondents of how AI is affecting their business. It was decided that this was the best approach since our knowledge about AI was relatively limited and we performed interviews with experts in the field. Therefore it would have been unwise to limit the whole interview to a detailed and specific interview guide based on our limited understanding at the time. The qualitative strategy provided us with the possibility to be open and flexible to unexpected answers which allowed us to learn things that we could not anticipate beforehand due to lack of initial insights and knowledge (Bryman & Bell, 2015; Morgan 1998).

When performing a qualitative study, we need to be aware of our effect on the research subject and our interviews, and the risk of biases (Bryman & Bell, 2015). Based on the fact that face-to-face interviews are recommended since they leave the interviewee less likely to respond with an "I do not know" answer as well as it enables a more in-depth approach (Bryman & Bell, 2015). It was highly desirable to conduct as many interviews as possible face-to-face in the respondents own environment. All our respondents were freely participating in our interviews, which is an important ethical consideration according to (Bryman & Bell 2015). Due to possible sensitive information from the interviews, we decided to keep all interviewees anonymous.

Practicalities

Pre-interview, a short description of the research focus and what was planned to be discussed was sent out. We started our interviews with a short presentation of ourselves as well as our project to create a connection, then allowed for the respondents to introduce themselves as well as a short description of their role. We then started asking questions about the topic with the interview guide as the basis for discussion. The interview guide was developed on the structure of the Business Model Canvas, and theoretical findings and the interviews were based on the same structure, however, taking different perspectives and slightly different directions depending on the interviewee. Subsequently, the interview followed the structure of the Business Model Canvas. During all interviewees, both researchers were present which allowed for a split of tasks, as one's primary focus was to ask questions and keep the interview on track while the other could focus on taking notes. As presented in Bryman and Bell (2015) it is crucial to code and categorizes data, something that has been emphasized in that all interviews have been recorded and noted down.

The interviewees were all contacted after the interviews to show gratitude for their time as well as allow for complimentary questions to be asked and receive possible contact information for other potential interviewees. Many of the interviewees provided us with material that could be used as secondary data which was highly appreciated.

3.4.3 Language

The thesis's interviews have been conducted in Swedish when the respondent's most fluent language has been Swedish and then translated into English at a later stage. The translation part of a qualitative study has been argued to be somewhat problematic (Xian, 2008). The role of the author is that of an objective translator that only translate from language A to Language B. However, some translation by the authors has been made with some changes due to linguistic problems and grammatical differences in the language to make it understandable, which also is within the recommendations of Xian (2008).

3.4.2 Secondary Data Collection

As previously mentioned, this study originates from a thorough and extensive literature review of the topics. By delving into articles, reports, and information about Artificial Intelligence and Business Model Theory as well as the relationship between new technologies and their impact on business, the plan was to create a sufficient foundation for both the theoretical framework and the forthcoming data collection. The majority of the secondary data collection is based on

articles and reports. These are to be extracted from scientific electronic databases that are available. The most frequently used search words were: Artificial Intelligence, AI impact on business, Technologies impact on business models, Business models, Business models in the Automotive industry. For information regarding AI´s impact, recent consultancy reports have mainly been used to highlight relevant case studies and concepts concerning this thesis research. Further, we are aware that some articles and models are given a majority of the space and basis of the thesis, such as the Business Model Canvas by Osterwalder & Pigneur (2013) and the technology impact on business by Baden-Fuller and Haefliger (2013). Lastly, we are also aware that the hype and believe of AI's impact on business are affecting both respondents as well as researcher and consultants to incline some positive bias about the findings, this has although been acknowledged and considered while analyzing the data and during the interviews to mitigate it to some degree.

3.6 Data Analysis

The Business Model Canvas framework and its nine blocks were used throughout the process as a structured way of analyzing and contrasting the theoretical and empirical findings. Our emergent findings were combined and matched as they were observed, and from this, our conclusions are being deducted. We are aware of the importance of critically evaluating the gathered data and its analysis, and by dividing the initial presentation of data and analysis between us before a joint analysis, we tried to protect us from the interpretation from the other researcher initially. If opinions of interpretation did occur, we had most interviews recorded, so in that case, we could go back and re-evaluate the situation and answer. To further strengthen the analysis and allow for a deeper understanding of the impact of AI within the automotive industry, the impact was analyzed from a perspective of both time and strength in addition to the blocks within the Business Model Canvas. It was done by highlight if the impact is current (short-term) or future (long-term), and to what degree. The data was analyzed continuously during the data collection. Recording of the interviews allowed for a more straightforward process in transcription and provided overall more validity to the study.

3.7 Research Quality

Regarding the quality of the research, issues of assessing the quality of a qualitative strategy are not as clear-cut as for the quantitative strategy. Different writers argue that the research quality of a qualitative study is better examined by analyzing them in concepts of trustworthiness and authenticity. These categories are presented by Guba and Lincoln (1994) as well as Lincoln and Guba (1985) to present another perspective of approaching research quality, and they are arguing that the realistic approach of that there exists absolute truths is not for them to decide, rather that it could be several different reasons and accounts. Since the alternatives to the more traditional way are not presenting a better solution we, therefore, have selected the traditional measurements presented in Bryman & Bell (2015) of Reliability, Validity, and Replicability to measure our research quality.

Preconceived assumptions and ideas of the authors inherit risk of affecting the result of the study, and the fact that the authors characterize the data gathering, and structure is opening up the possibility for various biases. According to Bryman & Bell (2015), several factors need to

be considered to determine the research quality and to assure consistent research and to a large degree, namely; Validity, Reliability, and Replicability. This is not a limitation per se, rather than essential factors to consider while trying to understand if any biases have affected the result, the gathered data and its analysis, as well as the understanding of the general quality of the study (Merriam 2009). The chosen topic of this thesis is beside literature interest is also based on a personal interest in the topic. Hence, an attempt to increase the quality of the study was achieved by understanding that we are two authors of the research which both can unconsciously write analysis with assumptions being made. Therefore we often switched the part that was being worked between us, to protect our results from these assumptions made from either one of the authors. Additional observations told us that our interviews became more fluent and better performed after a while, both when we learned and understood what was important within the topic and by our development of interview techniques. By performing most of the interviews in our mother tongue, Swedish, our respondents were not obstructed by linguistic limitations, and we felt that our dialogue reflected that. Lastly, all our participants had an occupation which was well suited to answer the strategic business model question as well as they had sufficient understanding of AI capabilities and its potential impacts.

3.7.1 Validity

The validity of the thesis is concerned with the concluded theories that are generated through the research and if the researchers are observing what the believe their observing. Validity is mainly concerned with the internal and external validity (Bryman & Bell, 2015)

Internal validity

Refers to the issue of causality, and questions if a conclusion about a causal relationship between variable to be robust and not affected by something else, and basically, it tells us if the study measures and investigates what it intends to measure (Bryman & Bell, 2015). Since having a focused Research Question and have built or study around the Business Model Canvas framework we feel that we are answering the Research Question within feasible limits. Secondly, we believe that our internal validity is increased through the selection of participants for the interview since they have relevant positions and experiences to answer our questions sufficiently. Further, in an attempt to increase the validity and limit the biases of our respondents, we did not share answers gathered from other interviews to avoid unintentionally nudging our subject in a specific direction (Bryman & Bell, 2015).

External Validity

Refers to the issue of the ability of the findings to be generalized and applied in other circumstances and cases (Bryman & Bell, 2015). The possibility of generalizing our study might be argued to only limit to firms with a connection to the automotive industry, however, since we are addressing the technological impact of the entire business, there are lessons to be learned and insights to be gathered by companies, either with potential collaborations within the automotive industry. However, industries with similar characteristics as the investigated industry. All Manufacturing firms would plausibly be able to look at what is impacted on production areas while B2C firms could learn something about AI impact on customer segmentation.

However, although the generalizability of the research could be questioned due to a qualitative approach with few respondents within a specific industry, precautions have been made in attempts of increasing our validity. Since we have selected respondents with relevant knowledge and experience and their answer, in turn, validate each other while analyzing our findings. Additionally, we have avoided putting too much focus on things that were rarely mentioned of just mentioned by one of our respondents in the analysis. By aiming to perform the interviews face to face at the respondent's natural environment, we tried to achieve high ecological validity (Bryman & Bell, 2015).

3.7.2 Reliability

Reliability is mainly concerned with the consistency of the study, and by performing a qualitative study as this thesis does, it refers to the obstacle of environments and aspects that is not possible to be accurately copied in other studies (Bryman & Bell, 2015). It is argued that high reliability of qualitative research is difficult to achieve due to its inherited evasive nature and the ever-changing environment which affects the findings. We believe that our way of performing the research has been done before and will be done in the future, then of course, by analyzing a rapid developing area such as AI, the results could change or fluctuate if one perform the research at different times and in different contexts. Further, we believe that by letting the observed findings from interviews validate each other, and thus, the reliability of the thesis is at least internally strengthened by this form of triangulation (Bryman & Bell 2015).

3.7.3 Replicability

The concern of replicability is closely related to the previously explained reliability concept. By making research replicable and enable for other researchers to use the findings in their research or the test our results and see if it is applicable we can contribute with further insights and value (Bryman & Bell 2015). To strengthen the replicability of the thesis, it is essential that the procedure of performing our study is explained in detail and transparent enough for a researcher to perform similar study within other circumstance (Bryman & Bell, 2015). This is achievable by structuring and explaining our research design and research strategy thoroughly which previously has been done. Our study is per definition as a qualitative study not generalizable in a numerical way. However, since the study is focused and analyzed different parts of the business model section by section, other readers or future researcher can conveniently judge the replicability in different contexts.

To summarize the thought of Reliability and Replicability, we suspect that our chosen topic within a fast-moving technological area is affecting these concepts of research quality. As the time passes from when this study is finished, we believe that the ability to replicate our findings in a reliable manner is getting increasingly complicated as a consequence of this rapid and constant development within our investigated topic.

4. Empirical Findings

This chapter present the findings from the conducted semi-structured interviews. To make sense of the gathered data and create an alignment with the other chapters within the thesis, we are structuring the answers in the 9 blocks of the Business Model Canvas. Further, while performing the interviews we got some insights that wasn't suited for the canvas which is presented separately.

This research focuses on how AI is impacting business within the automotive industry, therefore we have asked the respondents to elaborate on how they perceive the impact of Artificial Intelligence based on an interview guide (Appendix 1).

Below follow summarized findings based on the interviews conducted, structured into the blocks of the Business Model Canvas.

4.1 External

4.1.1 Customer Segment

The customers are a logical focal point since a company needs customers to survive long term. It is therefore believed that companies must do their best to identify, satisfy their customer as well as their specific needs and demands.

When asked to elaborate on how AI is impacting and could impact the customer segment within the automotive sector, most of our respondents indicated that this is an answer that could be divided in short-term and long-term impact.

The companies within the automotive industry own enormous amounts of data regarding their customers and their usage behavior of the car, and through this they can and are currently applying AI solutions to better segment and identify their customer. It is evident, based on statements of our interviews, that AI within the customer segment is what is happening right now and what currently is believed to be impacting business the most. This since AI is built to make sense of a significant amount of data, and data exists for every user and the driving pattern. Analysis of this data creates insight of how a product is used and if it is used and perceived as intended. AI is according to our interviews, currently used to create proactive sales by analyzing data and behavior of the customer. However, the respondents stated that even though AI is applied in the segment, there is still a lot of untapped potential and large amounts of unused data still waiting for exploration, such as further enhancement of product development based on these insights. This is further argued more specifically by findings from two of our interviews which stated that AI within the industry and its application on customers is far behind companies within, e.g., retail. Some of our respondents have a historical relationship with dealers on various geographical locations and are not concerned to the same degree as the others of how the short-term customer identification and segmentation are done. Instead, their AI focus lies on increased demand prediction of sales and more dynamic pricing of products and analysis of spare parts requirements. AI applied on customer data is believed

by our respondent to create more information and understanding of the customers and something they are applying as we speak since the technology already exist and is ready to deploy.

The long-term consensus of all our respondent regardless of their position or the company they work for, believe that improvements of the product in relation to Autonomous Driving will radically disrupt the whole customer/provider relationship. All of the respondents expressed a long-term scenario where the current ownership model where the customer owns their car is to be transformed into a scenario where the customer pays for transportation as a service instead. Companies are strategically aware of this and are currently trying to establish their position in this long-term scenario which is by all our respondents believed to be a tremendous change of the current business models within the automotive industry.

4.1.2 Customer Relationship

The customer is essential for almost any company; hence a company's relationship with its customers is of specific importance. All respondents highlighted AIs impact within Customer Relationship Management (CRM), where AI especially has impacted the customer support area. Other industries such as, e.g. retail have already, partially or fully implemented AI solutions to their customer support function and this is something all respondents agree that the automotive industry also will. One respondent from an automotive company points out how they are looking at implementing a simple chatbot to deal with simple matters as well as providing a seamless handover to a human for more complex tasks in different areas of the company. Currently, much of the work is in a pilot-stage, hence exploring the outcome and effectiveness. One respondent with experience from other industries points out that an AI-based CRM-system is indeed much more effective than current systems, as he expresses:

> *"AI-based CRM systems are much more effective, better and allow for customization compared to current static systems. Implementing AI solutions will give a direct improvement as the technology for this use case already exists"- Consultant, Tech Giant*

From the automotive companies' perspective, there is talk and projects in pilot-stage considering a Virtual Personal Assistant (VPA) in the car. This AI-based solution will function as a digital assistant using speech recognition to support the driver with matters. Other respondents think that this integration will be fruitless due to similar systems in the phone and by that, other developers will make this technology much better and more effective than automotive-companies since a VPA is a very complex AI-solution. They highlight how iOS Siri and Google Assistant are examples of this hence think that the development of such a solution would be more effective if they would integrate an already existing solution to the car. However, the current focus is to create platforms where AI capabilities are possible to be integrated on different levels, and currently, several initiatives are being developed.

4.1.3 Channels

The way that automotive companies reach and interact with its customers have for decades been very much the same. As the importance of having a trustworthy channel in reaching the

customers is essential in delivering the proposed value of the product or service offered, this activity cannot be neglected.

Overall, the general opinion of the respondents is that this will change with a more and more digitalized product, where AI is functioning as the tool or toolbox enabling this change.
One respondent expresses:

> *"AI enables the use of more specific marketing channels and is used today in that way. AI can both identify the customer better, but also in what to direct towards that customer which is made possible through AI, leading to a much more customized marketing channel than before." – VP, OEM*

Furthermore, respondents note that within marketing intelligence, AI let you be more proactive and much more context-aware in what type of marketing activities that you are conducting. This is done by analyzing (data) of how the customer prefers to be reached, resulting in a customized channel based on the customers' preferences. From a revenue perspective, it is also highlighted how AI by the use of customized channels, allows the companies to target and reach the most desirable and profitable customers. Many of the respondents highlight retail as one industry where AI is applied in such way, where market leaders are creating an "omnichannel", and by that reaching the customer in the customers most preferable way. They are witnessing the same trends within automotive hence the use of AI solutions in marketing intelligence is argued to be essential to survive competition from other companies, as other industries have seen companies with such capabilities prosper and erode competition.

4.2 Product

4.2.1 Value Proposition

The Value Proposition can be described as the package of product and services that creates the value for the specific customer segment determined in the Customer Segment block (Osterwalder & Pigneur, 2013).

Even though it is alluring to talk about Autonomous Driving, most of our respondents' present and highlight how such solutions still are in an early phase. However, in our interviews, it became clear that various AI solutions are working behind the scenes of creating the current value that meets customer demands. Some of our respondents discussed advanced driving assisting software applications that made driving more efficient and safe for the customer as application areas. Further, a majority of the respondents discussed how AI is applied in product development to be able to satisfy the trends (Mobility, Automation, Digitalization, and Electrification) that are occurring in the industry today. In the near future it is believed that AI enhancing solutions will be applied to increase the satisfaction of the customer experience while in a car, examples of such solutions are, e.g., within voice recognition regarding a virtual personal assistant.

A majority of the respondents emphasized the fact that leveraging on customer data to increase the customer experience. For example, tailored offerings based on such data efficiently gathered by AI algorithms would allow for such an increase.

Some of the respondents viewed the impact of AI on the value offered to the customer through the lens of the change in the product offered. They state that the current offering of a car is delivering premium value to the customer based on features and preferences of the car, will be replaced and instead include value-adding services for the customer, packaged in a service which provides mobility effectively. Rather than selling a transportation product, they will be selling a solution of transportation and mobility. This radical change is partly due to the anticipation of autonomous driving where such model is expected to become normality.

However, a majority of the respondents raised a concern about automation and the fact that it potentially can disrupt the value generation from customers since it might make the ownership more efficient. It was put in context that a car, e.g., is currently unused for the majority of a day's 24 hours and with changes in the value proposition, will the same number of cars be sold?

4.3 Internal

4.3.1 Key Partners

As described in the Business Model Canvas section, the partnerships of an organization are considered to be a cornerstone of the business model. By forming alliances and collaborations, organizations can optimize their business and diversify the risks to some degree.

Our respondents all agreed upon the importance of collaboration to create success, and one of the interviews generated following statement;

"Only collaborators win" - Corporate Strategist, OEM

When discussing AI, the findings from our interviews highlighted the increase in collaboration this has presented to organizations, both due to the applications areas of AI as well as the complexity of the topic. Our respondents indicated that few companies outside of the tech crunch are capable of producing, training and implementing AI entirely on their own without collaborative partners. A company that was mentioned in a majority of our interviews was Zenuity AB (perhaps the frequency of mentions of Zenuity was due to interviews being conducted in Gothenburg), which is a joint venture between Volvo and Autoliv which solely are focusing on Autonomous driving and safety innovation. The newly started tech-fund from Volvo Cars AB which focuses on finding and funding technology startups to get access to otherwise unfeasible, unattainable knowledge is another example that came up during the interviews. The consensus of all respondents was that AI and other technologies as well currently are too complicated for OEM's to produce in-house and attract the talent with adequate competences. When the discussion shifted to the nature of collaborations, there was according to a majority of our respondents an increase both in collaboration with large tech giants such as IBM, Microsoft and Google but also an increase of funding of smaller startups.

There was also an increased focus on cross-industry collaborations to create standards within the industry and a platform for all the OEM's to perform upon. It was stated by two of our respondents that there is a dire need for standardizations within the industry to avoid a technology slow-down due to fear of investing too much in a technology that might lose the standard war. This standard negotiation is according to some of our insights ongoing. One

respondent working with AI-implementation, consulting automotive companies, highlighted how they had seen an increase in demand for AI-related consulting and also a shift towards applying AI in more and more critical business stages.

While moving into more collaborative nature of the tech innovations, it was also some discussion about current partnerships that might experience a decrease of collaboration.
Our respondents represent both the "traditional" OEM as well as newly started automotive companies. A difference between their way of selling the car was discussed, and while the traditional OEM still is hugely reliant on dealerships to sell cars, newly started automotive companies are selling the cars online instead. Our respondents discussed their future understanding that the reliance of dealers would decrease, partly due to autonomous driving, which is expected to shift the business focus from product to service.

4.3.2 Key Resources

Key Resources allows a company to create and offer its value proposition, reach the right markets, maintain and create relationships with customer segments and generate revenues. This block, therefore, describes what assets that are required to make the whole business model work properly.

The key resource is believed by our respondent inheriting the potential of improvements, and our interviews generated following:

> *"The car exists, the data is available and generating. However, AI is required to connecting these and present new opportunities and insights" – Corporate Strategist, OEM*

When talking about resources, data was evidently the most valued asset of all our respondents, some focused on the ownership of data and the generating of new data, one discussed the quality of the data available to train machine learning algorithms, but all shared the same view of data. They described data as the fuel of any AI algorithm. However, it is believed by our respondents that sometimes the mindset is not clear enough about data and there is little understanding of how to approach this fast-growing mountain of data. The conversion from useless data to valuable data is not efficient enough, and a lot of potential and benefits are unfulfilled due to this.

A discussion about data infrastructure naturally followed this clear focus and understanding of the value that can be aggregated from data. It is currently, according to all respondents an ongoing hunt for data and they witness that the automotive industry is no different. By gathering the vast amount of data, it has become increasingly important to be sure how to store and how to utilize all off this, many respondents explained that they experience that a considerable amount of all data is just waiting to be utilized to aggregate value. The focus is still to gather data to large degree, but our interviews show that it is a focus on capturing the right data and make it available immediately. AI solutions are currently applied to make sense of these datasets, but there is still data which is not being touched by AI solutions, mainly because of the quality and standards of the data. Our respondents with more technical background and

roles within the industry argue that the raw data currently used both with and without AI involvement is quite useless and are hugely preventing better AI implementation. Although, they believed that this issue recently had been taken more seriously and investments are being made to overcome this and improve the data infrastructure. By connecting information silos such as usage of cars and the predictive demand for spare parts, a better foundation for planning and value increasing activities are built according to our respondents.

"AI is useless without qualitative data input" – CEO, ML Start-up

Further, it was discussed what is being done right now to ride the AI wave that is occurring, and the response stated that it was now observable how much more OEM's where investing in AI Capabilities and talent acquisition. As previously stated, joint ventures with a strong focus on AI are created to create an attractive workplace for AI talents. Our interviews with people from the OEM's revealed that the persons with AI capability and such as e.g. data scientist are being deployed to make sense of all the gathered data and create and foundation for AI to be applied upon.

4.3.3 Key Activities

For a company to make the business model tick, it needs to engage in specific key activities. The empirical findings are divided into three areas covering the automotive companies' key activities, namely, product and services, manufacturing and operations, and business processes.

Products and services

The most apparent impact according to the respondents is regarding autonomous vehicles. Currently, enormous investments are being made in connection to autonomous vehicles, something that all respondents indicate. The crucial technology behind autonomous vehicles is AI, which accordingly has spurred investment in AI related capabilities. The most significant impact of AI and the most obvious one today is considered within mobility and therein, autonomous vehicles. Much of this trend has made automakers to reconsider their business model since fully autonomous vehicles will eventually have enormous impacts on how automotive companies conduct their business. This change is not fully here yet, but the respondents agree that much of the investments and consideration in going from product to service is due to this anticipation.

Manufacturing and operations

Something that is buzzing right now in the automotive industry is predictive maintenance which was mentioned by almost all interviewed. It was brought forward how the data already exists and how that data easily could be used to predict and anticipate machine breakdowns. It is believed that AI-solutions will be able to sort the information from the data and by that give guidance and predict future events. One auto company explains how this is already done today but how that activity will intensify in the coming 1-2 years.

Since the automotive industry is dependent on smooth manufacturing processes, every stop and inefficiency in the production is a loss of revenues. Further, since the operation in most OEM's runs 24 hours 7 days a week, these downtimes could not be compensated by working over-time.

A majority of the respondents describes these yield losses in manufacturing and other production processes as low hanging fruit for AI. However, as two respondents highlights (working for an OEM), there are already highly sophisticated systems that control the manufacturing and production processes, hence strong evidence and high ROI is needed for AI-solutions to be fully implemented. The consensus is that the whole industry along with other manufacturing industries are all investing in AI-solutions that lead to yield enhancements.

Business processes
The supply chain is in many ways the backbone of any automotive company. The respondents working at automotive companies explain how they are looking into optimizing their supply chain by AI application. This is not done today, however, and many sophisticated systems and models already exist, but the potential is definitely there since the data already exist. The overall aim is to increase forecast accuracy and optimize replenishment. Some of our interviewees gave examples of how entire business processes where crunched by AI solutions with the focus of reducing spillovers and lower costs, with the results of costs going down as soon as they implemented the solution. Further, they highlight that the technology exists and is useful, however, since OEM's are good at manufacturing, the ROI must be higher to justify investments our respondent stated.

Within the automotive companies' key resources lies business support function such as Finance, HR and IT. These functions are all key for the automotive companies to function effectively hence the activities performed are essential for a smooth operation. The respondents all agree that some of current AI impact and projects lies in optimizing processes and in many cases automate processes and therefore see business support functions as natural user cases for AI-implementation.

4.4 Profit & Loss

4.4.1 Cost Structures

This building block tries to explain and describe the essential cost that occurs while operating under a specific business model and it entails all the costs of producing the product or service and provides the value to the customer.

By approaching what impact that AI solutions can have on cost structure, the respondents talked about it as a way of reducing costs, churn and minimize waste beyond human capability. Cost minimizing was considered as an important aspect when deciding to invest in AI by corporate leaders. However, the realization that AI can provide is more than just cost reductions according to few of our respondents, as it overall creates and unlocks values beyond cost reduction.

Further highlighted by the respondents was how the automotive industry is a very competitive industry; hence much of the focus is on keeping costs low which have reinforced the industry is looking at what AI can do regarding cutting costs.

It was an understanding among all our respondents with an insight of the cost structure of an automotive company that AI definitely could increase uptime of machines and make workflows

better. However, it was also stated that this is an area where the automotive sector is good at, and not considered to be a bottleneck.

4.4.2 Revenue Streams

Without revenues, it is hard for any business to survive for long. The Revenue stream block describes the money a company generates from each customer segment. The revenue stream is the combination and correlation between the offer value and the payments acquired from customers.

Just as described in theory, the revenue stream is more like a passive block dependent on the value proposed to the customer segment. It was evident when discussing this that our respondents believed that AI's impact on revenues would be derived from the AI solutions applied in product development, customer segmentation, and predictive maintenance. While discussing revenues with the respondents, the focus swiftly shifted back to one of the other blocks while discussing the real creation of potential revenues. It was stated that the structure of revenues would change, partly due to AI involvement and its impact of positioning for future autonomous driving as well as the changing trends of ownership that simultaneously forces the company to change how they attain value from their product. It was discussed that revenue streams would be more stable and predictable with an increase of leasing and subscription options in contrast to today's one large transactions. This will according to our respondents affect how the financial structure of further investments are being considered.

4.5 Technology impact on business

There was quite a lot of discussions considering the impact of AI on business, that was not applicable to find a block within the Business Model Canvas that would justify the inclusion of these statements. It highlights that the business model only is an abstract tool to gain a good understanding of how business is done, but it has its limitation theory claims. To make additional information about how AI is impacting business observable, we have distinguished between short-term and long-term, just by asking the respondents of their belief of time horizon and triangulating this with theory and reports.

4.5.1 Insights about technology impact of business:

A common belief by all our respondent, either by highlighting it or mention in on the go, was the fact that AI is receiving substantial investments currently, both in getting a proper understanding of how to utilize it but also to understand what capabilities are needed for this utilization. It was understood during the interviews that the belief was that the automotive sector, (excluding tech-industry) is the industry which invested the most in AI development currently. The majority of our respondents considers this investment as an expected necessity of meeting the requirements of customers even to be considered as a viable option rather than something that gives any substantial competitive advantage, at least regarding the value offered. By offering a smart service then AI is not the overall technology that enables specific functions. However, it is expected by most of them that AI can further augment operations that is processing, generating or using data.

"I firmly believe that AI both is and will continue to be a disruptive fore for the automotive industry" – VP OEM

When discussing AI with our respondents, it is believed that AI has the disruptive force similar as when the steam engine was introduced and what it offered in artificial power. However, this was also discussed to have two sides of a coin, the steam engine in retro perspective was highly inefficient and useless in comparison to its developments, today's focus on Machine Learning is considered somewhat the same. AI is even though very high-tech, still in a primal state of seeing and acting, next step incorporates reasoning and perception.

It was stated in the interviews that AI is believed are going to fundamentally change how mobility and transportation are considered and consumed, as well as the cost of ownership and improved total uptime of cars/machines due to predictive maintenance. Moreover, it was believed that organizations are looking how to best position towards this.

Additionally, some of the more strategically positioned respondents talked about the major trends in automotive which are of disruptive nature: Mobility, Automation, Digitalization, Electrification. Where AI is, if not affecting primarily, it is present behind the scenes to enable these trends to change how a century-old industry has been looking according to the interviews. These trends are believed by the respondents to be the changing factor that fundamentally disrupts the role of the car which has been relatively unchanged since the T-Ford.

4.5.2 Implications

While talking with our respondents about the impact that AI can impose on business, there was naturally talk of what is currently affecting the impact negatively. By identifying these so-called obstacles or knowledge gaps, we can provide an understanding of where AI is facing difficulties.

Some of our respondents explained that AI investments are costly, much due to the requirement of a customized tailored solution which often is needed to get the intended results. Cost is not the single factor why investments in some places are abandoned, and our interviewees explained that most of the time it is hard to know where the investment should be made to get the highest ROI when investments are not clear of where to address the investment it is often hard to justify an investment. One respondent stated that the people with knowledge of what AI can do, sometimes don't have the skillset to present a complete business case that will convince management.

"My view is that AI can be applied across all functions and areas of the company going forward, at the moment however it is about finding the right focus and choose the areas that makes most sense at the moment". – VP OEM

While talking to our AI experts, they said that the technical knowledge and understanding, even though it is catching up, is lagging a bit behind. This gap between understanding and knowledge of technology has been discussed throughout all of the conducted interviews, where some stated

that many organizations say they work with AI while they are working with advanced statistical models.

This in combination with low data quality or sometimes even lack of data, was believed to be the most significant obstacles for AI to overcome according to our respondents. Naturally, this lead into the discussion of processing power and if that was any problem, and our more technically advanced respondent said that a lot a computing power is needed, and an investment are there to be made; however, it was clearly stated that the computing power exists.

5. Analysis

This chapter aims to present our gathered empirical data and compare with previously given theoretical framework. First, we are analyzing the data within the Business Model Canvas. Secondly, we will analyze all the topics that were discussed, deemed important but was not applicable to analyze within the Business Model Canvas framework.

5.1 External

5.1.1 Customer Segment

The first section refers to the customer segments of the automotive industry and the importance of understanding, finding needs and demand, and of course, retain customers for the companies to stay profitable within the industry.

Both theory, reports, and our empirical data underline that the customer segment is recognized to be hugely affected and affecting the organizations future strategy regarding AI implementations. The joint report by BCG & MIT (2017) states that the customer segment is an area that both is and will be an impact of AI, highlighted by how some industries already are affected hugely by different AI solutions that creates understandable value from all the existing customer data. This is further strengthened by our empirical findings where it was stated that the data generation of customer actions and behavior are vast, but it is not fully utilized due to the complexity of the data. It is believed that the segmentation, identification and more profound understanding of the customer enabled by AI solutions is something that is developed and investigated currently, driving considerable investments to create an insight-creating machine. Both theory (Erevelles, Fukawa & Swayne, 2016) and empirical data agreed that AI is having a significant impact in creating value from current invaluable data sets.

The interviews revealed a clear view of the companies that this collected behavioral data, e.g., How customers use the product should be back-tracked within the organization to create a collective aim, alignment, and influence how products and services are being designed. It shows that the gathered customer data can be used not only for segmentation but provides value for various areas within the organization.

Since the objective of the thesis is to analyze how AI is impacting business, it was found that it has at least a 2-step impact. First of all, it is to analyze existing and newly produced customer data to get a better understanding who the customer is and what the customer wants. This is a solution that is implemented today and is relatively easy, both according to theory (Erevelles, Fukawa & Swayne, 2016) and empirical findings to implement and create value. The obstacles that need to be considered regarding this is the privacy concerns that are connected to data ownership. Since data is the fuel of AI, it is essential to be prepared for, at least, for companies with customers in the EU, the GDPR laws (further discussed in customer relationship) that increase the responsibility of any company that stores data (European Commission, 2018).

In the long term, it was discussed and elaborated in all our interviews and frequently mentioned in reports (EY, 2017; McKinsey, 2018; BCG & MIT, 2017). It relates to the possible change of ownership structure of a car, and this is tightly connected with the focus of self-driving cars. The automotive industry of today is already strategically positioning themselves accordingly, with an increased focus on subscription models and alternative ownership structures. At the furthers, it is believed that no one will own a car and it is sold to "smart cities" or companies that offer mobility, this is the indirect impact that AI will impose on customer segments. The change that this could bring long-term is that the customer potentially will move from either being an individual or traditional company, towards being a "city" or mobility provider. It is clear how the automotive companies have this in mind when strategically planning towards the future with AI as a significant reason behind this.

5.1.2 Customer Relationship

For any company, not just automotive companies, the customer is essential, hence a company's relationship with its customers is of significant importance. From a company's point of view, this is often described as Customer Relationship Management, i.e., how a company manages its customer relationship.

Theory (Khodakarami, F. Chan, 2014) describes successful CRM systems as collaborative and analytical as they provide learning opportunities. The respondents also highlight this as they observe AI's impact within CRM especially noticeable. Within customer support, this is particularly observable with increasing possibilities of chatbots and other insight-driven support tools. Respondents discuss other industries use of AI-embedded solutions within customer support and how they are implementing similar initiatives at the moment. It is observable how some of the respondents firmly believe that AI-based CRM systems are more effective than traditionally used, more static systems. These beliefs are founded on the capability of AI to bridge the vast amount relevant data between departments and present the most relevant information at the right moment.

For the automotive companies, a potential implication will be the new EU-rules (GDPR) installed on 25th of May 2018 (European Commission, 2018). Since the rules concern the treatment of personal data and personal integrity, it will act as a significant implication for any automotive company with customers within the EU looking into leveraging customer data to access knowledge about the customer. Hence, using AI within customer relationship is not only impacting in the technical complexity and change in posing issues relating to the technicality of AI-embedded solutions and analytical CRM systems but also impacting regarding data compliance.

As the automotive industry currently is evaluating the actual outcome of such systems, it is hard to draw any real conclusions yet, however as other industries have shown, such systems are leading towards more seamless customer experience and relationship since it allows for more effective interaction. However, as GDPR-rules will be installed, the use of AI within customer relationship will most likely be impacted. It is presumably to believe that companies wanting to leverage customer data fully, need to hire people specialist in data compliance.

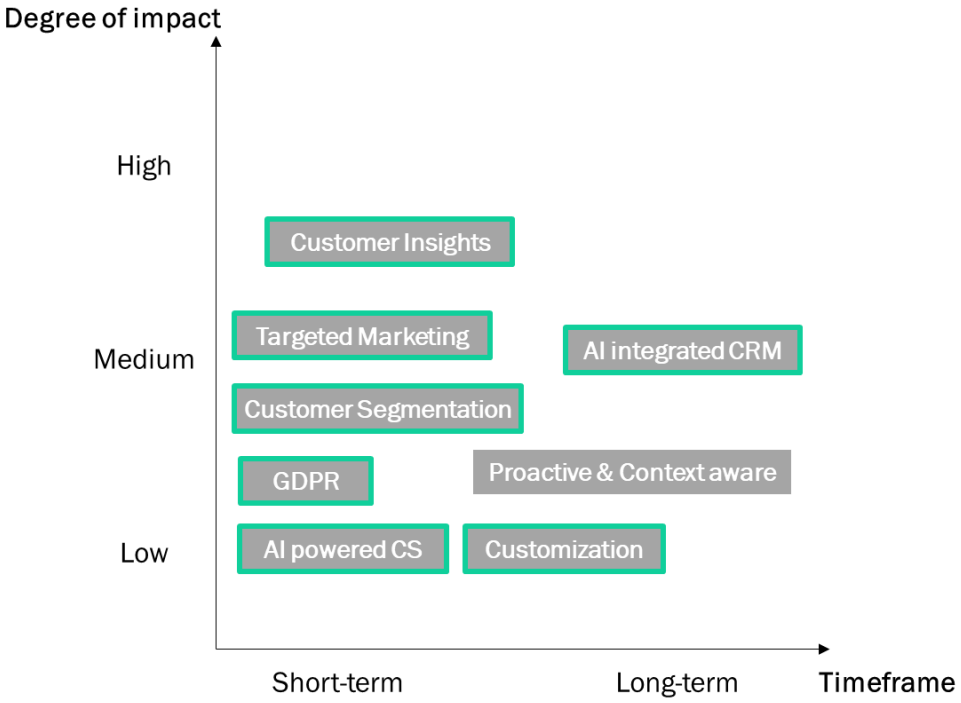
5.1.3 Channels

Automotive companies have for decades reached and communicated with its customers in the same way. According to our interviews, this is now changing and much so due to digitalization and other technological development such as AI. According to reports (BCG & MIT, 2017; Capgemini, 2017; McKinsey, 2018), predictive AI can analyze data of how a customer prefers to be reached and thereby what channels that are most effective for each customer, creating a tailor-made solution per customer, based on behavioral data. The effects are not only limited to enhancing the customer experience but also leading to higher return on advertising spending and overall higher revenues and profitability (ibid).

What is being reported by BCG and MIT (2017), Capgemini (2017) and McKinsey (2018) is in line with what the respondents saw as the overall impact. AI-enabled marketing intelligence is letting automotive companies be much more proactive and context-aware in what sort of marketing activities they conduct. The impact of AI is enabling companies to leverage data about the customers' preferences of how they want to be reached by analyzing data and thereby creating specific and customized channels for each customer. These customers facing initiatives allows companies to access the customer and thereby offering a more customized experience. The automotive industry has witnessed the effects other industries have had when using AI in reaching their customers, such as within retail. This has led the industry to view AI-solutions as essential to, just as described in consultancy reports, better deliver the proposed value of their product or service. Overall, the general opinion of the respondents is that the wsay automotive companies communicate with its customers will change due to technological development just as AI. From a revenue perspective, the effects and impacts are yet not observable. However much work is in progress even if other industries are well ahead in implementing AI in this aspect of the business model.

Exhibit 9

Summary Analysis Matrix - External



Source: Develop by authors, based on analysis by authors
Note: ▭ = Mentioned in Theory/Reports

5.2 Product

5.2.1 Value Proposition

The Value Proposition can be described as the package of product and services that creates the value for the specific customer segment determined in the Customer Segment block (Osterwalder & Pigneur, 2013). This block of the business model canvas is the bridge between the internal and the external part of the business model and is essentially the reason to why a customer chose one company over another. However, it is important to understand that the selection of a product or service is extremely subjective and that service/product improvements made possible by AI solutions only constitutes for one of several aspects of consideration. Although, by letting AI decipher data of the customer that previously was indecipherable and create a coherent understanding of the what is valued and what is less valued it becomes possible to tailor products and services accordingly to potentially deliver higher perceived value to customers.

Both theory, reports and empirical findings suggests that AI is having an impact on the value proposition towards customers. These impacts are observable today within product enhancements such as advanced driving assistance and in car features such as attention checks. However, it is believed to be increasingly impacting in the future along with the evolving adoption of the technology and the technology development itself. As of today, AI solutions are enabling optimization within development of new products and features of the car. Both our empirical findings and reports (McKinsey, 2018) suggests that AI is involved in developing

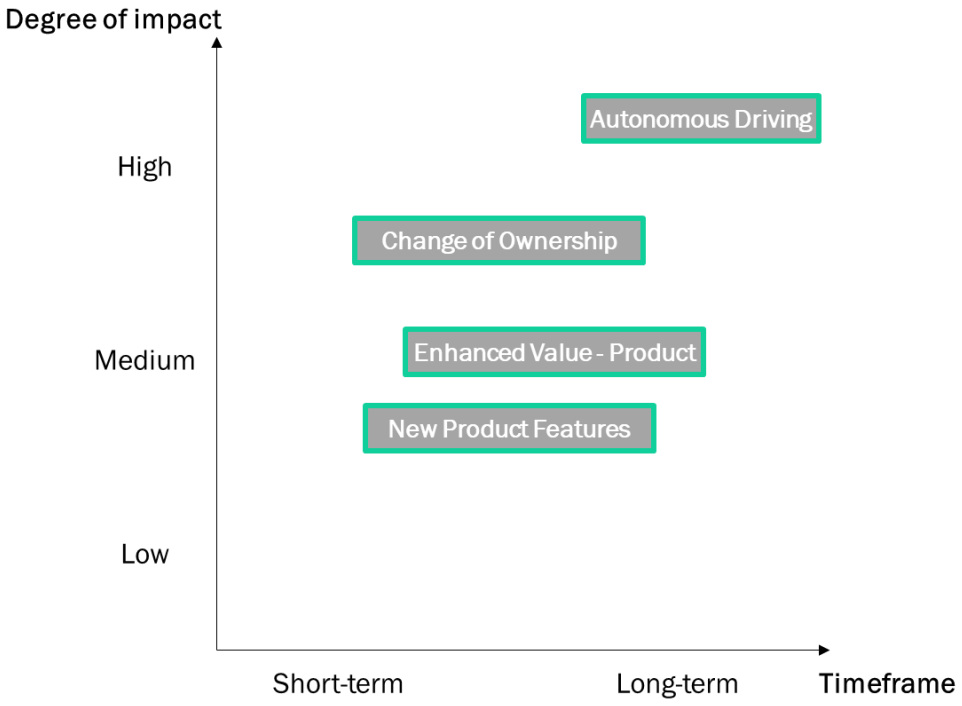
and running smart and improved driving assistance that augments the driving experience. By applying smart real-time systems that analyze the surroundings and adapt to it and communicate to its close proximity based on machine vision and neural AI networks, the value to the customer is expected to increase.

In our empirical findings, the focus of the increased value by AI was focused on the integration of the production line where manufactures could offer mass-customizability and shorter time to market, this is however not as fully integrated in organizations today as theory and consultancy (Gusikhin et al 2006: McKinsey 2018) are stating that it would be.

The derived analysis from our different data sources is indicating that since AI is not fully matured, therefore its impact of the value proposition is currently limited. It is however expected to increase dramatically as both investments and focus is gearing up and as development of autonomous driving progresses, the impact is expected to follow. What can be analyzed from the ramp up of investments is that the expectations from the industry beliefs that Autonomous driving will happen and they are therefore starting to strategically plan for this change to happen. However, the experienced value is extremely subjective and hard to quantify, as well as the increase imposed by one player always needs to be put in relation to what its competitors are offering simultaneously. We have got the impression from both interviews and reports that AI investments are crucial to stay relevant and competitive in the future. Thus, it is creating a kind of self-fulfilling prophecy of how the industry will form.

Exhibit 10

Summary Analysis Matrix - Product



Source: Develop by authors, based on analysis by authors
Note: ▭ = Mentioned in Theory/Reports

5.3 Internal

5.3.1 Key Partners

As mentioned in the theoretical section regarding the Business Model Canvas, the key partner sections refer to the explanation of the network of crucial partners that can and potentially are optimizing the organizations business. It is a description of all surrounding companies that makes the business model possible (Osterwalder & Pigneur, 2013).

Reports was somewhat modest about the impact of the partnerships but there was clearly stated by McKinsey (2018) that when organizations develop capabilities which originally isn't their core process, there will be an increase in the partnering to attain these missing competencies. However, found during the interviews, was that due to the scarce resource that AI-talent is, the traditional automotive companies have difficulties to attain this talent. Our empirical and secondary data collection strengthened this understanding when mentioning that a joint venture solely focused on AI development was being started to attract talents, as well as we found out that even cross-collaboration between competitors had seen an increase of intensity to find data standards to develop AI solutions upon. The company Zenuity was brought up under these discussions, a joint venture between Volvo cars and Autoliv that attract talents to develop solutions for autonomous driving. These collaborative eco-systems were discussed both in reports (McKinsey, 2018) and during the interviews, it was also stated that only the largest tech giants are able to develop such ecosystems in-house.

"Only collaborators win" – Corporate Strategist OEM

The cross-collaborative standards are mainly focused on Autonomous Driving, and the internal AI implementation didn't receive the same cross collaborative spirit mainly due to its internal scope. The current impact of AI on organizational partnerships therefore lies within the realms of acquiring the right talent and capabilities. Further what was deducted from the interviews was the fact that OEM's in the automotive industries now are investing more in tech-funds. For these Venture Capital like funds, AI is receiving large amount of the investments, but it is important to understand that other technologies also are invested within, some relatable to AI and others not.

When discussing how the current partnering structure along the supply chain was being affected for automakers, the respondent talked about two trends affecting the role of the current dealership (where cars to a great majority are being sold and maintenance being performed). Partly, the development of autonomous driving has led automakers to rethink the use of dealers in that autonomous driving is expected to change the ownership structure of cars, moving from product to service -driven. Both interviews and reports highlight this change, requiring dealers to potentially reposition themselves in order to be strategically prepared.

While interviewing some of our AI experts and consultants, we found that they have experienced a transition in what they were hired for. First, they were hired to digitize and apply AI search algorithms to HR and more administrative stuff, but they have experience a shift where OEM's now are hiring them to analyze and provide AI-solutions within more core

business processes and key parts of the company. This alongside an experienced increase in request from automotive companies related to AI implementation can be analyzed as how the belief and breadth of AI is gearing momentum from actors within the automotive industry.

Development in AI along with other disrupting trends within the automotive industry has led companies to collaborate both cross industry as well as with tech-startups and tech giants. They have realized that the capabilities required for a successful AI implementation cannot be developed solely in-house, thus requiring them to step out and acquire it to successfully capitalize on AI.

5.3.2 Key Resources

A comanany´s Key Resources are essentially what makes the value offering towards customers possible, as well as the creation of customer relationships and in the end, what is enabling the generation of revenues. (Osterwalder & Pigneur, 2013). Although that it is highly dependent on what industry and differs in other selections, it relates to HR, Intellectual and Financial resources.

The human capital and the capabilities was discussed under the category of Key Partnerships, but essentially it refers to the need of talents that are able to develop AI and understand it completely, therefore this section will not go into a deeper analysis of this since it is being covered in that section.

The most apparent finding within the sections, which was both emphasized by consultancy reports and interviews is definitely data. Both the gathering of data, the quality of data and the infrastructure of this data was discussed with our respondents. The reports (BCG, 2017) states that AI is rarely better than the data it is presented with, and by asking our respondents, where some worked especially with training-data for machine learning it became evident that companies currently are focusing on making sense out of existing data to be prepared for the future. And the supposedly shift in focus discusses in our empirical findings it is an indication that this is on verge to change. Albeit, the change isn’t happening quick enough according to our interviews and compared to consultancy reports the conversion from data to valuable data just isn’t happening fast enough. In theory and reports data is often just considered something that exists and is just to exploit, often they miss to stress the data quality or format as undecipherable as a problem. Since some of the drawbacks of AI investments is argued by theory (Bughin et al, 2017) to be returns lower than expected are considered related to data quality for AI to run upon.

Further, it was stated in our interviews that the components are already existing within the automotive industry, data is owned and generated in large quantities and it is clear to the strategic management that AI has the ability to connect all gathered data and create value and opportunities beyond current levels.

This understanding and belief of what can be extracted through the data, and data being mentioned as the fuel of AI naturally followed a discussion about what is most crucial for this

ongoing development and what is being done at the moment. As mentioned, there is an ongoing hunt for data where it is gathered from all different aspects and parts of the company, but it is collected faster that it can be efficiently stored and utilized. This realization and understanding that data quality needs to catch up in levels of their data quantity gathering is something considered by our respondents to be the most impacting affect AI technology has on the key resources within organization in the automotive industry. Further, discussion about data infrastructure is discusses and once again taken for granted by reports (BCG, 2017), and by realizing that many organizations has their own developed information systems which are hard to convert knowledge from to another entity, either within the company or externally, there is a lot of attention on how to make these older systems becoming more transparent and understandable for other machines.

"Need to reduce data siloes within the company due to inefficient and non-communicating machines" – Consultant Tech-Giant

One example that was given to visually explain this was the fact that spare-part reservoir and their locational presence weren't connected to the cars driving data geographically, by connecting these, the organizations will be able to plan where the spare parts should be located in time when a car statistically would need it. According to our interviews, this is possible and could potentially increase the value perceived by the customer and increase efficiency of the organization. This is currently being addresses by companies to increase the hiring and integration of data scientist to make it a smooth transition and increase the exploitation of data.

5.3.3 Key Activities

For a company to achieve the purpose of its business, it needs to conduct certain important activities. These actions that a company needs to carry out are key in order to be successful (Osterwalder & Pigneur, 2013). The analysis of the impact of AI on automotive companies' key activities will be, just as in the empirical findings, divided into three areas covering the automotive companies' key activities, namely, product and services, manufacturing and operations, and business processes.

Products and services

One of the current major trends within the automotive industry is autonomous driving. It is expected to represent one of the biggest shifts in the actual product within the automotive industry. It is reported how automakers are all investing heavily in autonomous driving, hence spurring investment in AI and AI-related capabilities since AI is the key technology behind autonomous driving (McKinsey, 2017). The respondents highlight Autonomous driving as the most obvious impact of AI within the Automotive industry. This has not only led to heavy investments in autonomous driving but also made automotive companies reconsider their business model since it is anticipated that fully autonomous vehicles will dramatically change things. The impacts of this can be seen as a ripple effects in that AI is enabling autonomous driving, which in turn is expected to shift the whole business model for automotive companies. This anticipation has impacted automotive companies in that they due to the anticipation are e.g. looking into going from selling a product to selling a service since fully autonomous

vehicles would mean less incentives for owning a car. This is however not only due to AI and autonomous driving, but an overall trend in society. Overall the impact of AI for automotive companies' business is considered to be most obvious and strongest in terms of autonomous driving hence in the design of the automotive companies' products and services even if this impact currently mostly has led to investments in autonomous driving technology and a move towards a more servitized business model.

Manufacturing and operations

One of the cornerstones of any automotive OEM is their manufacturing and operations. Theory highlights the fusion between AI and manufacturing technology as value enhancing opportunities (Li et al, 2017) and how AI-driven manufacturing is enabling huge gains in terms of efficiency, reliability and safety. This is achieved by extending the interconnectedness, responsiveness and predictive ability of the manufacturing process. The respondents working for OEMs emphasize this value creating opportunity, however discuss how they already have systems and models in place that are not AI that are functioning well and question the actual return on investment if AI-solutions were to be implemented fully. The view from people outside OEMs (consultants etc.), highlight how the industry is dependent on a smooth manufacturing process for which there are efficiency losses that could be exploited by AI-driven solutions. Moreover, this discussion evolved around the automation potential that AI has especially within processes. Furthermore, it was greatly discussed how predictive maintenance could be used within manufacturing to predict machine breakdowns, also mentioned in consultancy reports (McKinsey 2017). The impact within manufacturing and operations can be summarized into two main areas, both mentioned in the theory: yield enhancements in manufacturing and predictive maintenance. The actual application of AI within these areas are as showed by the empirical findings currently minor, but heavy investments and pilot-projects are underway, and it is expected that AI-driven solutions will be fully implemented and replacing old systems within the next couple of years. And as stated by our empirical findings, these solutions exist today and have proven results of working efficiently. However, information of the ROI of the successful project wasn't disclosed and it feels that this is an area that needs to be investigated further.

Business Processes

Traditional business processes such as Supply Chain, R&D and other business support functions are also impacted by AI to different degrees according to our empirical findings. Reports explained how within supply chain, forecasting and replenishment, AI could be used to enhance forecasting precision an optimize replenishment (McKinsey 2017). This was validated to some degree by the respondents overall as they looked into optimizing their supply chain. It can be interpreted how these application areas are a low hanging fruit since the data necessary already exists. However current systems need to be replaced which always brings some hesitation.

Even if the reports mentions how R&D projects can be optimized by AI-solutions (McKinsey 2017), the empirical findings highlight no such evidence. It was merely discussed that AI would impact current R&D setup, however as AI can be applied on cases where large amount of data

exist it cannot be rejected that the impact within R&D could be big in the future.

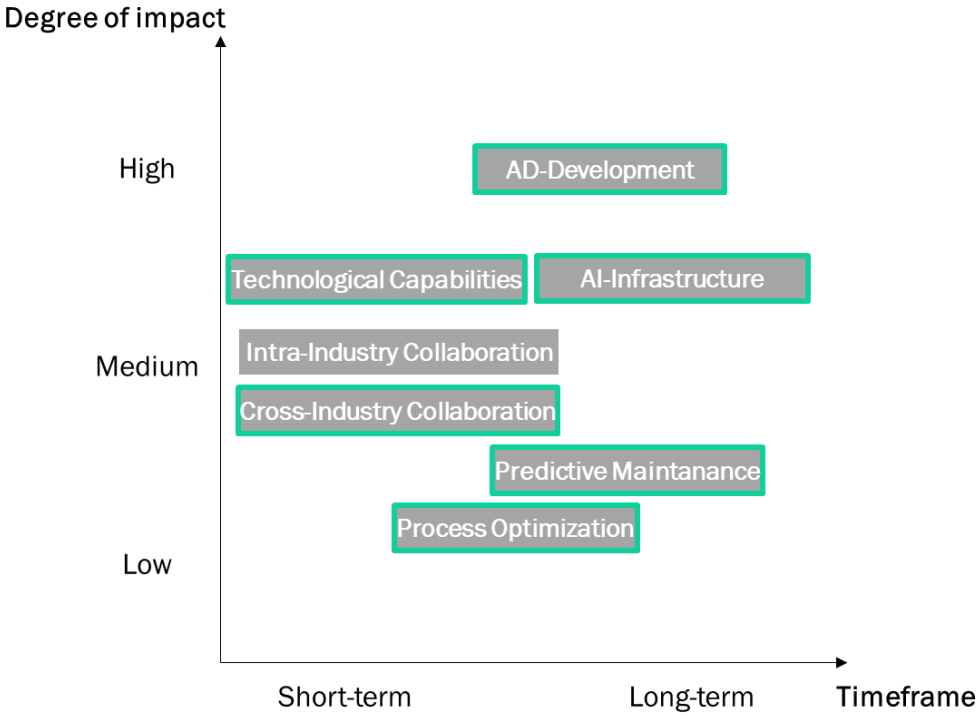
Key resources for automotive companies are within business support functions such as Finance, HR and IT. It can be found how the overall opinion is that such functions that are all key activities for the companies are impacted by AI in that they all consist of processes, hence natural user cases for AI-implementation. Automotive companies are looking into automate many of these processes however evidence of such implementation is minor, although the consensus is that the impact will be observed short-term. By analyzing or empirical findings, we understand that this is an area which is being addressed but recently more in creating smart internal search-engines and databases that adjust depending on who is searching, where role and security clearance dictated what is visible for each individual.

Summary of Analysis Key Activities

Even if the overall activity of producing and selling physical vehicles will remain key, there are elements within automotive companies' key activities that are impacted in different degrees by AI. Autonomous driving, fueled by AI, has already had huge impact in terms of investments but also in that the anticipation of fully autonomous vehicles have led automotive companies to move towards a more servitized business model, however the major impact of autonomous driving is still long-term. Within manufacturing and operations, the impact is short-term in both predictive maintenance and yield enhancements while for business processes the impact is yet unobserved in that limited evidence of such impact is found, however the belief is that these processes will be impacted in the coming years.

Exhibit 11

Summary Analysis Matrix - Internal



Source: Develop by authors, based on analysis by authors

Note: ▭ = Mentioned in Theory/Reports

5.4 Profit & Loss

5.4.1 Cost Structure

The cost structure is interlinked with the internal blocks in the BMC in that it covers all the cost of producing the product or service and providing the value to customers. Hence, findings in other blocks indirectly impact the cost structure to various degrees.

Much of the discussion with the respondents centered around how AI both is and could reduce cost. For the external part of the business model canvas, within marketing and sales, AI has the ability to decrease the cost and by that increase the return on, e.g., marketing spending and sales. AI-based CRM solutions are believed to be much more effective than current hence also reducing cost. Furthermore, for the internal part of the Business Model Canvas, within manufacturing and operations, and business processes, AI-solutions are viewed as a way of eliminating current efficiency losses, thereby reducing costs. These findings are all validated by consultancy reports (McKinsey 2017, BCG 2017).

The impact of AI on the cost structure is by the empirical findings not as significant as consultancy (McKinsey 2017; BCG 2017) highlights since much of the impact concerning cost reduction is yet to be observed. However, all AI-solutions represents an investment in both technology and time for implementation. Therefore, even if the effects of AI-solutions ultimately are to reduce cost long-term, it requires investments short-term. These investments are considered huge and cannot be discarded, which naturally asks relevant questions about the actual return on investments of AI-solutions. Since much of the AI-implementation currently is in pilot or at least in a very early stage, it is merely impossible to estimate the actual return on investment, even if it presumably to believe that long-term, such AI investments will be profitable.

Generally, it can be interpreted, as highlighted by both respondents and the report by BCG & MIT (2017), that the overall goal with AI is to unlock value, which often can be done by reducing cost. Since much of the AI-implementation is at a very early stage, the impact is in a short-term perspective is especially high regarding massive investment, due to a natural lag before the actual effects of the investments can be observed. The impact in terms of cost reduction will eventually be realized as the AI-implementation is finalized. This impact is expected by both respondents and consultancies (McKinsey 2017; BCG 2017) to be large, which the massive investment is indicating. Consequently, the actual return on investment of AI-solutions is currently vague and is something that future research potentially could address.

5.4.2 Revenue Streams

Without revenue, it is hard for any business to survive for long. The Revenue stream block describes the money a company generates from each customer segment (Osterwalder & Pigneur, 2013).

What can be found is that AI is believed both by consultancy McKinsey (2018) and empirical findings to affect the potential reach of new customers and creation of new opportunities for revenue for the OEM´s within this industry significantly. It is also firmly believed by both our

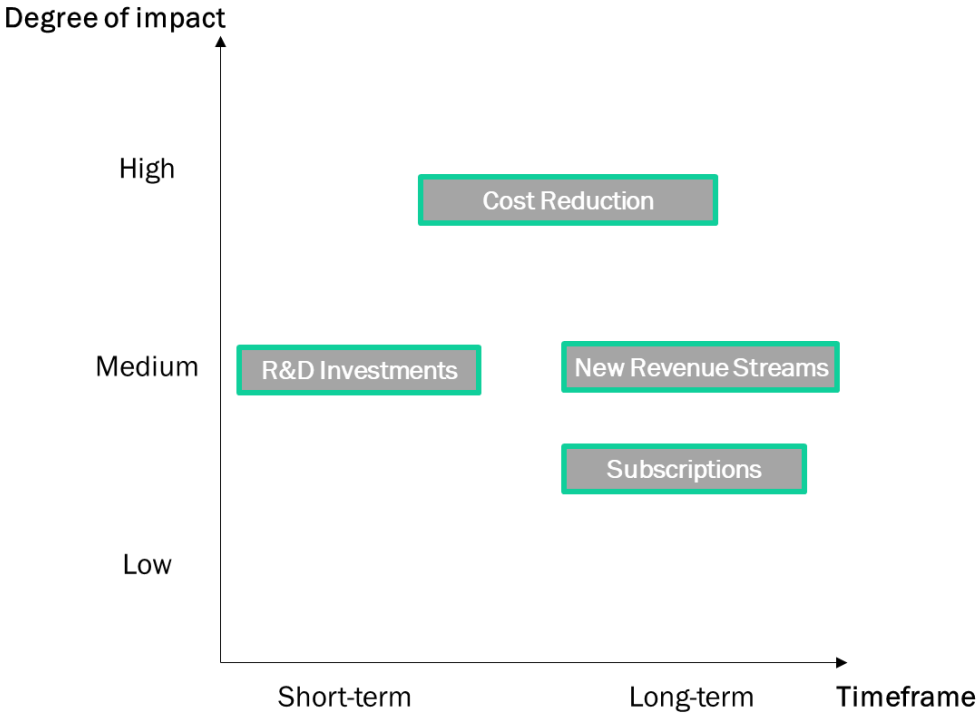
data collection sources that AI inclusion within product and service offering will bring higher proposed value to the customer and this increase of value is possibly related to an increase in revenue from already ongoing processes spurring from either increase of price or increase of sales. McKinsey (2017) in combination to some of our respondent believed that AI enhancement would increase the experience the customer has with the different touch points with the organization.

What can be analyzed based on the responses obtained is that the increase in revenues believed to originate from AI implementation and enhancement of product development, customer insights and predictive maintenance. Where predictive maintenance is being applied both to the data generated from the car as well as on machines within the internal process, thus affecting both revenue streams as well as cost structure simultaneously.

In the long term with the potential entrance of autonomous driving, the positioning about ownership of the car is already ongoing, and we can see most major car brands in the industry rolling out specific subscription models where the customer only signs up for the mobility service and leave the ownership out entirely. AI partly drives this since it is a strategy developed to position for the upcoming AD change. The impact it imposes on this block of revenue streams is the payment regularity will be, in contrast, large one-time payments. This will dramatically change the stability of the revenue stream, but with less of large incomes, it will probably affect other parts of the companies.

Exhibit 12

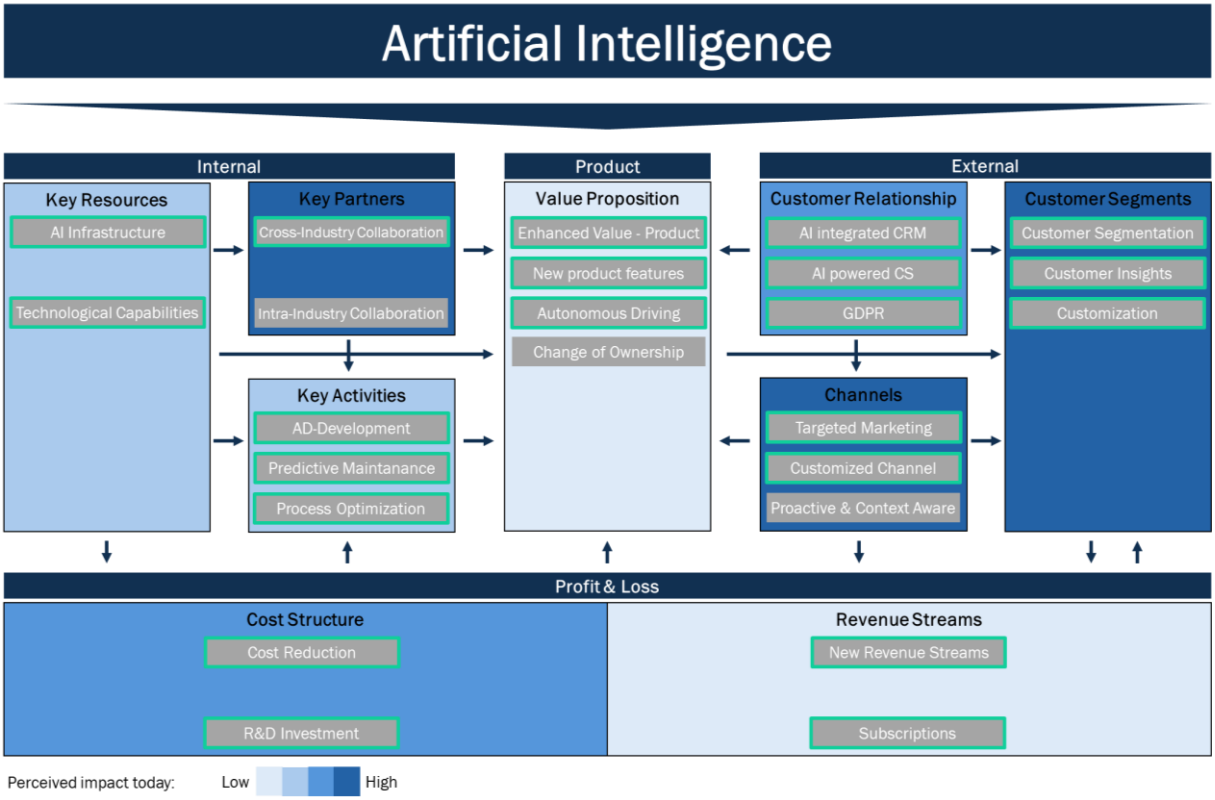
Summary Analysis Matrix - Profit & Loss



Source: Develop by authors, based on analysis by authors
Note: ▭ = Mentioned in Theory/Reports

Exhibit 13

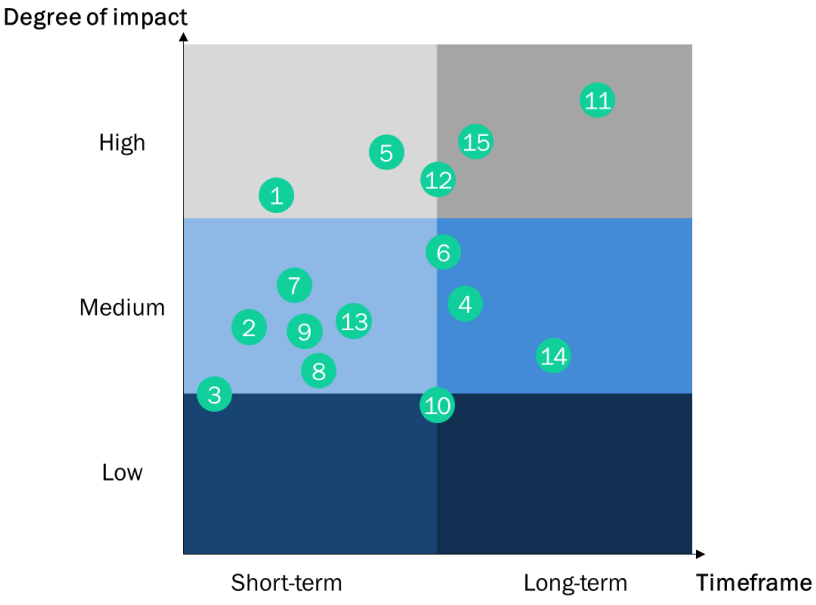
Summary of Analysis - Business Model Canvas



Source: Based on empirical findings and analysis by authors
Note: ▭ = Mentioned in Theory/Reports

Exhibit 14

Summary of Analysis Matrix – Key selected findings



Key selected findings:

1 Customer Insights
2 Customer Segmentation
3 GDPR
4 AI integrated CRM
5 AD-Development
6 AI-Infrastructure
7 Technological Capabilities
8 Cross-Industry Collaboration
9 Intra-Industry Collaboration
10 Process Optimization
11 Autonomous Driving
12 Cost Reduction
13 R&D Investments
14 New Revenue Streams
15 Change of Ownership

Source: Based on empirical findings and analysis by authors

5.5 Technology impact on business

The impact of technology on business has in this research been investigated from the perspective of Artificial Intelligence impact on business within the automotive industry. Theory (Chesbrough, 2010, Baden Fuller & Haeflier, 2013) highlights how technology on its own rarely inherits any direct value, and its first when coupled and aligned with a business model its true economic value can be monetized. Further, the disruptive force and power of technology is predominately the factor behind the transformation and change in businesses, in that its impact and questions the business model logic (Chesbrough, 2010). Empirical findings and analysis of the impacts of AI within the automotive industry, display evidence on such arguments. The empirical findings and analysis show how AI impacts business within the automotive industry on a broad scale. The impacts are however both different in terms of magnitude and in terms of whether they are current (short-term) impacts or long-term often based on expectations within the industry.

Expectations are according to theory (Borup et al., 2006) an instrumental factor that shape the impact of technology and what to a large extent determine the amount of investment from a company in a specific technology. Based on the findings of this research such evidence can be highlighted and validated in that much of the expectations of artificial intelligence has made the companies within the industry to reconfigure their business model or at least to plan to reconfigure their business model based on such believes. Such expectations are not only concerning AI in general but also concerning specific use cases of AI within the industry. By that notion, it is interesting to consider and highlight how the vast investments made in autonomous driving is based on such expectations. For that reason, at least using the notion of the theory (Borup et al. 2006), the expectations of autonomous driving are shaping its potential and ultimately affecting its outcome.

Another critical aspect to consider, at least according to (Christensen, 2003; Zott & Amitt, 2001) is the struggle that companies face when implementing a new technology such as AI or the reaction to disruptive technology. The struggle is connected to companies' ability to align the capabilities of the technology with the already existing business model, in such situations, established technologies often gets prioritized over new technologies since the margins and return on investment is unknown. This strategic inertia is evident in the findings of this research where respondents highlight how the hesitation towards AI technology is more significant within areas where there already exist sophisticated systems and models whereas the resistance is much less in areas where AI does not replace or compete with already existing technology.

6. Conclusion

This chapter aims to provide and final answer to our research question by discussing the concluded outcome of this thesis. This will be followed by our thought about future research to be made.

6.1 Answering the Research Question

This thesis's original aim has been to investigate the recent development of Artificial Intelligence and how it is impacting business within the automotive industry in a short-/ long-term perspective. Previous research of how AI is impacting business within the automotive industry is scarce, previous research mainly look at the long-term potential of AI or the science behind it. The whole process of this thesis logically ends by answering the initial and investigating question, which naturally makes it appropriate to present again:

What are the impacts of AI on companies business within the automotive industry?

By analyzing the findings from literature and interviews in a structured framework based on the Business Model Canvas, it is believed that the coverage of most potential impact areas at least is ensured and satisfied. Interviews with people within the automotive industry with relevant knowledge and experience have been conducted with people from slightly different backgrounds. The findings were then analyzed and compared with findings from literature, all presented within the selected framework.

6.2 Then, what are the impacts?

First and foremost, this study found that AI as a broad technology presents possibilities and opportunities of different solutions to be implemented within in almost every aspect of an automotive company where data is available, generated or used. Overall, the research found that short-term AI impact is observable within the external part of the business model regarding leverage of customer data as well as the intensified collaborative nature cross-industry and intra-industry. Long-term impact was connected with by the massive belief in autonomous driving, which is expected to cause significant disruptive changes in the future, where some already are unfolding.

To make the conclusion chapter coherent and more straightforward, it is structured in the four different categories which were presented when introducing the Business Model Canvas; *Internal, Product, External and Profit & Loss.*

6.2.1 External (Customer Segment, Customer Relation, Channels)

Most observable, AI impact occurs is the external part of the organization, these are the segments which are closely connected to the customer. By letting AI analyze data generated by the customer increased customer insights is achieved, as well as more in-depth understanding

of who the customer is and how the customer is using the product and service offered. AI-solutions enables further value creation throughout the entire organization by aligning AI generated insights of the customer with rest of the organization. To conclude, AI's impact is observed in how companies are improving how they leverage customer data to better understand, communicate with, and target the customer.

6.2.2 Product (Value Proposition)

In a short-term perspective, it was realized that AI is aiding in developing and making possible intelligent driving assistance and those are already up and running. These are incremental improvements of the product enabled through AI technology. What is evident based on the findings from this report is that the most significant buzz and potentially a tremendous impact of business related to the Autonomous Driving. Firstly, it is receiving a significant share of investments since the consensus within the industry sees this as an inevitable future to be positioned against. It will not only entitle an increase in product value; rather it is believed to fundamentally change the way OEM's operates and how they generate value compared to today. The expectations are that they will no longer sell a physical product; instead it is believed that they will sell the service of mobility, which is disrupting the current ownership structure. It is believed that the end user is not going to be a part of owning and the strategic question about where in the value chain the OEM's needs to position themselves are highly discussed. So this strategic repositioning is believed to be hugely affected by the expectations of AI's potential.

6.2.3 Internal (Key Partners, Key Resources and Key Activities)

Another clear trend of how the possibilities of AI is affecting business relates to the notion of partnerships. Few OEM´s have the talent and capability to develop AI in-house and are experiencing a difficult time attracting these talents. Therefore, an increase in collaboration has been observed, where attractive joint ventures are created, and tech-funds established to invest in the technology. It has also been observable that an increase in internal organizational investments on AI is occurring and most evident.

The understanding that data is not only to gather and pile up, rather than it is investing in increasing the data quality so that AI algorithms can create real value from it. Since AI is hugely dependent on data, the data infrastructure is identified in this report to be in need of improvements. This is something the automotive companies are aware of and currently working towards.

Within manufacturing and operations, the impact is short-term in both predictive maintenance and yield enhancements while for business processes the impact is yet unobserved in that limited evidence of such impact is found. However, the belief is that these processes will be increasingly impacted in the coming years.

6.2.4 Profit & Loss (Cost Structure and Revenue Streams)

Regarding the bottom line of companies, it can be derived from our thesis that AI in the short term primarily focus is on optimizations of processes and increased efficiency leading to cost

reduction. The impacts are observable in that AI is requiring massive investment which is observable currently while the return on investment of AI remains relatively unknown. Long term, the expectations are that AI will generate new revenue streams that are the effects of additional created value by AI. Concluding, short-term impact is most observable in investments costs, albeit the ROI are not yet visible.

6.2.5 Technology impact on business

To conclude, this research provides evidence on how AI impacts business within the automotive industry with its enhancing and disrupting nature. It was not only found how AI is impacting business models, but also that established technologies often get prioritized over AI. Furthermore, it was found that the role of expectations play a huge part regarding the impact of AI in both strategic- and investment decisions, providing evidence on how expectations shape the potential and outcome of a technology.

6.3 Discussion and Future Research

The results of this thesis highlight the technological impact of AI on the automotive industry on a general level. Even if it would be natural to run a similar study in a different industry, it is presumable to believe that results would be somewhat in line with the results of this research. Much since the application areas of AI are so broad and covers most parts of any company's business and not just the automotive industry. What we found most interesting was how the role of expectations inhabits such a power that it can make a whole industry invest heavily in relatively uncertain areas, e.g., Autonomous Driving.

However, we believe that this leaves room for more, in-detail research, which investigates the impacts and effects of AI on an even deeper level. For example, the role of expectations in shaping the impact of technology, as highlighted by both theory (Borup et al., 2006) and findings is undoubtedly an area worth investigating further. For example, how does it affect the investments in the technology? Also, what roles do consultants play in all this, who often leverage on technological expectations and anticipation of change?

Furthermore, since much of the observed impacts are in a very early stage, future research needs to address the actual outcome of both AI´s impact and outcome concerning what the actual return on investment of the technology is. AI is currently characterized by many promises; however, the actual monetization of AI is somewhat unknown, and the bottom line effects on companies remain unresearched even if this research highlights some of its impacts.

An additional aspect that we believe to be a future area of research is the implementation process of advanced technology. The findings of this thesis indicate that established technologies get prioritized over AI in areas where companies already have a sophisticated system in place. Therefore, it would be interesting to investigate if this is a general phenomenon and what affects this reasoning.

Lastly, even if it is possible to believe that qualitative research with ten respondents leaves many insights and opinions unheard, the general feeling is that the findings are in consensus with relatively much from theory and reports even if the gap between AI buzz to AI bucks still is observable.

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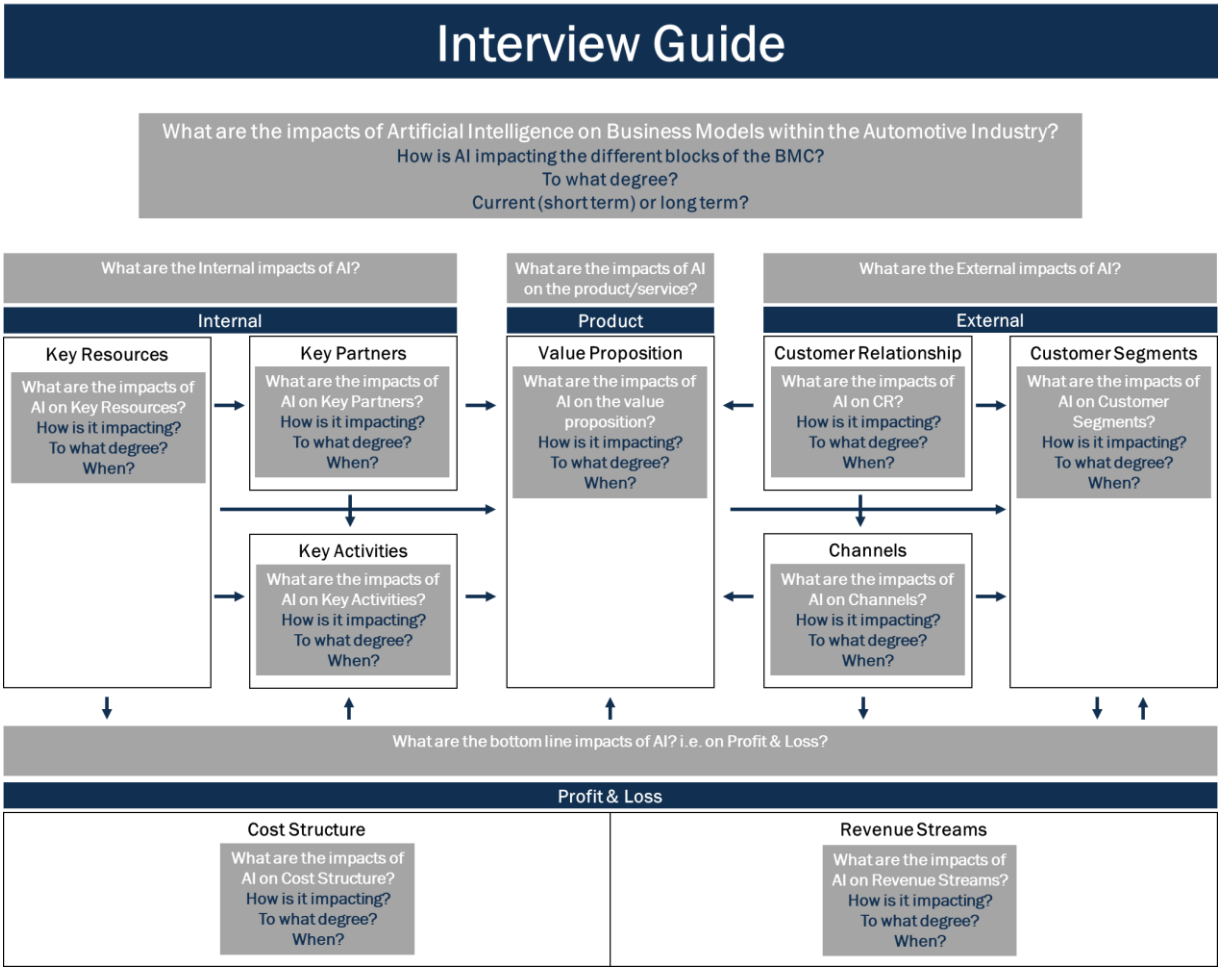
Appendix

Appendix 1.

Below figure shows how the semi-structured interviews were outlined. A description of the interview guide was sent to the interviewees before the interview. As an introduction to each interview the interviewee was asked about his/her background and position. The questions were not strictly followed and was adjusted depending on the respondent's role and background.

Exhibit 1a.

Interview Guide



Source: Developed by authors