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Generation of Digital Revenue Streams in an Automobile Firm

Master's thesis in the master's program Quality and Operations Management

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SUMMARY
There are several underlying trends in society that are affecting the automobile industry. Some authors claim that OEMs are unable to transform and adapt their business models to encompass digital revenue-generating practices. This observation, paired with practitioners expressing a need for their organizations to further develop digital revenue streams is the main motivation and originality of this thesis.

Therefore, the purpose is to study how digital revenue streams are generated and monetized in an automobile firm. Only direct sources of digital revenue streams were studied, meaning that only exchanges of value for a digital product or service were considered. Indirect sources such as digital product, process, or reputational improvements which could increase traditional sales of cars are not considered.

The thesis is a case study that studied a company associated with the automobile industry. Non-probability sampling was used, and 20 people were interviewed within four divisions related to 1) business, 2) procurement, 3) R&D, and 4) regulation. In parallel, a literature review was conducted where 95 articles were analyzed. The empirical data from the interviews was then compared to the reviewed literature on the topic.

Three main areas of direct digital revenue streams were identified from the literature review. The main revenue stream areas are 1) in-car commerce, 2) data monetization, and 3) autonomous drive. In-car commerce is a term which the company uses and relates to the academic area of m-commerce. Hence, in-car commerce is defined broadly as transactions taking place through a mobile network. Data monetization can be broadly defined as exchanging data for something of value. Finally, the autonomous drive is a software-based service that allows limited human interaction while driving a vehicle.

From a managerial perspective, the findings of the thesis are important since it identifies use cases associated with digital revenue streams in an automobile firm. Furthermore, from a policy perspective, it highlights the importance of privacy and the increasing use of consumer data in an automobile firm. Finally, from an academic perspective, the thesis contributes with in-depth knowledge to how digital revenue streams can be generated in an automobile firm and provide areas to further research. Some of areas to further research are 1) increasing quality of products, 2) retention of customers, and 3) technical requirements.

Keywords: automobile industry, digitalization, digital revenue, m-commerce, data monetization, autonomous drive, data, connected vehicles, connectivity.
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A special thanks go out to the organization in which the case study has been conducted and the representative which identified the problem, gave it to us for analyzing it, and finally providing support at the company along the way. Thank you, without you, we would not be able to start our thesis on such an exciting subject.

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Sincerely,

Milton Bark & Rami Sheik

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1 Introduction

In this chapter the background, aim, limitations, and research question is presented. The purpose of the introduction is to provide the reader with an adequate understanding of the topic and what the thesis studies.

1.1 Background

In recent years, trends in society have changed consumer preferences and behaviors. Some of those trends are increasing servitization (Neely, 2008), advancements in sensor technology (Glasgow et al., 2004), and digitalization (Gray & Rumpe, 2015). Moreover, due to these trends, private enterprises have experienced competitive pressures to adapt their capabilities to stay competitive. In the technology sector, an increasing emphasis on investments in the automobile business can be observed, where 7 out of the 10 largest tech firms are increasing their presence in the industry (Seiberth & Gründinger, 2018). In parallel, the automobile industry is impacted by the above-mentioned trends (Hallac et al., 2016; Hanelt et al., 2015; Opazo-Basáez et al., 2018). Moreover, sensors are becoming more capable, affordable, and increasingly more complex in the way they interact, allowing for a vast amount of data to be collected (Perera et al., 2014). The sensor capability improvement has been exploited in the automobile industry, which in 2017 collected on average 25 gigabytes of data per day per car (Aboagye et al., 2017). Most collected data are used for product-centric purposes such as internal telematics (Aboagye et al., 2017). Moreover, telematics data can be used to develop digital services such as autonomous drive functions which require large sets of training data (Geiger et al., 2012). However, as customer preferences in the automobile industry are shifting from a hardware product-centric driving experience, favoring the in-vehicle experience (Aboagye et al., 2017; Gauger et al., 2017; Seiberth & Gründinger, 2018), automobile firms will have to focus on the customer experiences. The car could use servitization as means of creating additional revenue streams from their already existing vehicles by providing additional offerings within the cars. An intuitive way to provide additional offerings is through the utilization of Digitalization - by providing consumers software, the in-vehicle experience can be enhanced with limited hardware changes. Furthermore, a push from the automobile industry towards software offerings such as GAS (Google automobile service), navigation, and autonomous drive can already be observed (Mikusz et al., 2017; Seiberth & Gründinger, 2018). These software offerings can then be sold directly to the consumer through the car resembling an m-commerce experience (Varshney, 2004).

One way for automobile firms to capitalize on all aforementioned trends is through developing new digital revenue streams. Sensors has become more widely adopted allowing for Big Data data driven software for instance, navigation utilizes Big Data to provide additional services, and Digitalization has created a space where consumer data has a market. This thesis examines the drawbacks and benefits for an automobile firm studied, associated with the monetization of customer data by selling raw data directly, providing data-driven services, or selling analytics. However, efforts to increase digital revenue streams are becoming an increasingly important topic for OEM managers (Seiberth & Gründinger, 2018), yet most OEMs fail in their data monetization efforts (Aboagye et al., 2017). Riasanow et al. (2017) and Yoo et al. (2010) note that there exist a gap in theory for digital technology transformation in the automobile sector. Practitioners has also expressed a need to the researchers of this thesis for their organization to further develop digital revenue streams. The theoretical gap noted by Riasanow et al. (2017) and Yoo et al. (2010) in combination with the reviewed literature show the gap in theory between academeia and OEMs practices to transform operations into sustainable data-driven business models. Hence this study aims to provide in-depth knowledge to minimize the current gap in theory between academia and OEMs. Moreover, this research explores digital revenue streams from an academic and case perspective which places this research in between academia and an OEM, precisely the gap in theory identified by Riasanow et al. (2017) and Yoo et al. (2010). This leads to the originality of study and results which shall add to theory.

Due to the sensitive nature of the research, the firm studied in this thesis has asked not to be elaborately described. Thus, they will only be referred to as an automobile firm.

1.2 Aim and Research Question

The aim is to understand the topic of digital offerings in the automotive industry and its potential to generate revenue for the OEMs. Thus the question addressed in the thesis is:

1) **How can digital revenue streams be generated in an automobile firm?**

To gain in-depth understanding it is better to study a single firm trough a case study in accordance to E. Bell et al. (2018). Therefore, to answer the aim the research question will provide knowledge of a singular automobile firm.

1.3 Limitation

- The study is limited to a sample size of around 20-30 interviews.
- The study is limited to direct sources of digital revenue streams which are based on a direct transaction from a customer for a digital product/service.
- The thesis will be a case study and is limited to one firm which lowers the generalizability of the results. More information on this topic is provided in section 2.4 Research Quality and section 6.2 Generalizability of Findings.

2 | Methodology

The research is a case study, where thematic analysis was used to analyze data and identify patterns. The structure of the methodology chapter begins with an explanation of the data collection, followed by the research design, data analysis, and lastly addressing research quality concerns.

2.1 Data Collection

The data collection has been conducted through a literature review and an empirical data collection. Furthermore, the literature review combined with the empirical data collected was the basis for the analysis.

The literature review was conducted to develop an in-depth academic understanding of the following three main areas: 1) in-car commerce, 2)autonomous drive, and 3) data monetization. Specifically, these areas with connection to vehicles and the case study will be studied in more detail. The literature review was conducted through a combination of academic research databases, consultancy market reports, and academic search engines.

The empirical data collected for this thesis aims to develop a practical understanding of in-car commerce, data monetization, and autonomous drive. A qualitative approach is suitable for this aim as Flick (2018) states that a common feature of qualitative research is approaching the world out there. The qualitative method chosen was semi-structured interviews. The semi-structured interview ensures that the pre-picked topic is covered in each interview. Moreover, the semi-structured interview allows the researchers to explore new pathways and areas that cannot be attained through a structured interview (Adams, 2015). DiCicco-Bloom and Crabtree (2006) state that semi-structured interview usually lasts between 30 minutes to several hours. But with telephone interviews, Gillham (2005) notes that interviewees will have less patience. This implies that interviews not held face to face may need to be of the shorter variety. In this thesis, the semi-structured interview was conducted by video meetings through the software "Teams". The interviews lasted between 30 and 45 minutes as Gillham (2005) might suggest.

Interview questions for the different divisions were brainstormed and revised as the literature review progressed. Further revision of the questions was made based on feedback from peers. The interview template can be viewed in Appendix A. The participants were chosen based on their work experiences and knowledge. This means that individuals were chosen based

on their expert knowledge by non-probability sampling. This can be identified as purposive sampling also referred to as a judgmental or expert sampling (Lavrakas, 2008).

A general introductory email about the topic studied and interview questions were sent to interviewees prior to the interview. Participants of these interviews mainly worked within the four aggregated divisions 1) business, 2) regulation, 3) R&D, and 4) procurement. For an overview of the aggregation, see table 2.1. The empirical data collected through interviews will then be transcribed and analyzed through coding.

Table 2.1: Specific & Aggregated Divisions

Specific Division	**Aggregated Division**
Business development	Business
Compliance	Regulation
Connected experiences	R&D
Digital product management	R&D
Legal	Regulation
Marketing Intelligence	Business
Software and electronics Procurement	Procurement
Strategy and business ownership	Business
Web UX	R&D
Vehicle infotainment	R&D

2.2 Research Design

Systematic combining is the intertwining of a framework, the empirical world, the case, and theory through matching, directing, and redirecting (Dubois & Gadde, 2002). According to Dubois and Gadde (2014) matching, directing ,and redirecting are core parts of systematic combining. Matching is a nonlinear process with the "ultimate objective of matching theory and reality" (Dubois & Gadde, 2002, p. 553). Triangulation, the "combining sources of evidence while shifting between analysis and interpretation" (Dubois & Gadde, 2002, p. 556) is an important step in any research (Blaikie & Sadeque, 2000). In context for systematic combing, it is used to direct and redirect the study based on discoveries. Another key to systematic combining is the evolving framework (Dubois & Gadde, 2002). The evolving framework is based on the idea that theories and concepts should be used as guidelines (Dubois & Gadde, 2002). Systematic combining is applicable in non-linear and non-positivistic contexts when replication is hard due to the study relying on a single case (Dubois & Gadde, 2017). The major alternative would be the linear model of case research that is written by Eisenhardt (1989) and Yin (2011).

Systematic combining was identified as an appropriate method for conducting the analysis.

Further, the analysis was an ongoing process where continuous matching of conceptual theory and the empirical data was matched with the theory and frameworks. Due to this, the theory was developed continuously as more empirical observations were studied. Moreover, triangulation was done throughout the research to help direct and redirect the study.

2.3 Data Analysis

The data analysis was conducted through thematic analysis of interview transcripts. Through thematic analysis, several objectives can be achieved (Mills et al., 2010). The objectives that are most interesting for this dissertation are to systematically observe a case, find relationships, and analyze the data. Furthermore, a generic style of thematic analysis is the template analysis (King & Brooks, 2018; King & Brooks, 2017) which this thesis has been modeled on. Template analysis has several typical steps, these are: 1) familiarization with data, 2) preliminary coding, 3) clustering, 4) producing an initial template, 5) applying and developing the template, and 6) final interpretation (King & Brooks, 2017).

A strategy commonly applied within the thematic analysis is coding (Mills et al., 2010). An inductive approach to the identification of codes will be used. Themes emerge from the data itself through constantly comparing data against codes and then applying the emerged themes against the transcripts (Mills et al., 2010). Coding is used in the practice of sorting and labeling data which is an underlying need to conduct the analysis (O'Reilly, 2009). Using coding as a data analysis allows for quick identification of the transcripts segments that relate to the research question and themes (Atkinson, 2002). Coding intends is to sort and identify what segments of the interviews are relevant to the research. Coding coupled with systematic combining, supports the process of matching, directing ,and redirecting the study.

Several authors have brought up the strengths, weaknesses, and limitations of template analysis. One of the biggest strengths that are brought up is the flexibility and adaptability that template analysis enables (King & Brooks, 2017; Nowell et al., 2017; Thorpe & Holt, 2008). A flexible data analysis method enhances systematic combining by allowing for directing, redirecting, and matching. Template analysis may use prior themes for the primary coding round but due to the structure of the framework, this coding is continuously revised (King & Brooks, 2017; Thorpe & Holt, 2008). Prior themes are appropriate when the research question is as clearly defined as it is in this thesis. Thus, prior themes based on a literature review have been applied in this thesis. Specifically, template analysis encourages higher depths of coding (King & Brooks, 2018). Furthermore, template analysis allows for a balance between openness and structure (King & Brooks, 2017). This openness and stricture enable the template analysis to be adapted to the specific case study while still having a general framework to guide the work forward. Template analysis allows for efficient data analysis making it possible to carry out double the number of interviews in comparison to other qualitative data analysis methods (King & Brooks, 2017). Considering the limited amount of resources dedicated to this thesis an effective data analysis method is preferable. In general, thematic analysis has a lower barrier for prior theoretical and technological knowledge than other qualitative approaches (Nowell et al., 2017). The chosen methodology has the benefit

of not being demanding in time and expertise at the start of the research. Furthermore, systematic combining says that full knowledge of theory is not necessary, which aligns with the chosen methodology. Even though both thematic and template analysis have flexibility, this flexibility is also a disadvantage (King & Brooks, 2017). The flexibility can cause "inconsistency and a lack of coherence when developing themes derived from the research data" (Nowell et al., 2017, p. 2).

2.4 Research Quality

This section aim to showcase and address the quality issues of qualitative research. To do so the quality criteria: Credibility, transferability, dependability, and confirmability will be analyzed and related to the study in accordance to E. Bell et al. (2018).

2.4.1 Credibility

Credibility is a quality criteria in qualitative research which refers to the degree readers will accept the results of a study (E. Bell et al., 2018). This is especially important in this study due to its qualitative nature. Moreover, the chosen methodology of having a case study limits the respondent to the same firm which could create a bias in the results. Triangulation has been used to limit the probability of any one point of data misguiding the results of the study. Accordance to E. Bell et al. (2018), triangulation is that multiple different data points are used to narrow down the results. In this thesis, investigator triangulation is carried out in accordance to Denzin (2017) who identified four types of triangulation in 1978. Investigator triangulation uses multiple researchers to study a single phenomenon, in this thesis both of the authors have confirmed insights derived from the results. Thus, increasing the credibility and decreasing bias (Denzin, 2017).

2.4.2 Transferability

Transferability refers to the generalizability of the results of the study outside of the scope of the thesis it was brought up in (E. Bell et al., 2018). As a case study limits the results to its situational context the transferability of the results is likely low. However, while the methodology does not allow for breadth, it allows for depth. Thus, the transferability and generalizability of the results will be dependent on context. Therefore, to increase transferability, a rich description of context has been made in the introduction of the thesis, which allows the reader to better understand if the results are applicable in their own situation. In summary, the OEM industry is rapidly changing fast due to several macro-trends in society such as: 1) servitization, 2) sensor technology, and 3) digilatization. This is likely not completely unique to the OEM industry, and thus some findings will likely be transferable to other situations. However, keep in mind that different macro-trends will affect different company's, industries, and context differently. Thus an individual assessment must be made before applying this thesis findings on other situations. For a concluding discussion about this thesis findings generalizability see section 6.2 Generalizability of Findings.

2.4.3 Dependability

Dependability refers to the ensurance that records are kept and are accessible during and after the research process (E. Bell et al., 2018). This includes transcripts, selection of participants, problem formulation, and data analysis decisions. All of which are presented in this thesis with the exception of interview transcripts due to confidentiality concerns. A strategy employed to increase dependability is having the thesis peer reviewed in accordance with E. Bell et al. (2018) recommendation.

2.4.4 Confirmability

According to E. Bell et al. (2018), confirmability refers to the perception that the researchers have conducted the research in "good faith". In summary, the researcher should not allow their own biases, values, or personal ambitions to affect the findings of the study. One strategy to increase confirmability is to have a study audited (E. Bell et al., 2018). Before publishing this thesis supervisors, peers and examiners will provide feedback. Thus, bias which the authors would not be able to recognize themselves can hopefully be minimized which would increase the confirmability.

3 Literature Review

In this chapter, the results of the literature review will be presented. The purpose of the chapter is to provide theoretical knowledge which the analysis will build on.

The topic for the literature review is digital revenue streams within the automobile industry. By reviewing academic literature, it is clear that researchers vary in their definitions and areas which they think are included within the topic. In actuality, few researchers directly define the topic of digital revenue streams as identified in table 3.1. However, several themes are frequently brought in relation to digital revenue streams. By mapping out areas brought up in relation to digital revenue streams by several researchers underlying themes were identified. These themes are presented in table 3.1. For a more detailed description of how the areas were identified see Appendix B.

Table 3.1: Themes Identified in Literature Summary

	Mikusz, Schäfer, Taraba, & Jud (2017)	Guptha & Sandu (2018)	Viereckl, Ahlemann, Koster & Jursch (2015)	Frost& Sullivan(2019)	Varshney, Vetter & Kalakota (2000)	Hartmann, Zaki, Feldmann & Neely (2014)	Seiberth & Gründinger (2018)
In-Car Commerce	x		x	x	x		x
Increasing Quality of Hardware	x	x	x				x
Retention of Customers	x						x
Autonomous Drive		x	x				x
Technical requirement		x	x				x
Data Monetization	x		x				x
Other					x	x	x

As shown in table 3.1 no clear breakdown of digital revenue streams can be defined. However, certain common themes can be identified. These six themes are: 1) in-car commerce, 2) increasing quality of products, 3) retention of customers, 4) autonomous drive, 5) technical

requirement, and 6) data monetization. Indirect revenue streams that might increase business performance long-term are considered such as quality improvements, reputation, and goodwill will not be considered. Hence, this thesis will study the following categories: 1) autonomous drive , 2) data monetization, and 3) in-car commerce. These three mentioned categories are not clearly defined and similarly defined by all researchers. This shows that the academic body is not aligned on the topics. Furthermore, Yoo et al. (2010) note that there exists a gap within literature on how digital technology transformation has impacted industry physical products. Riasanow et al. (2017), adds that the gap identified by Yoo et al. (2010) is especially apparent within the automobile industry. Moreover, Hanelt et al. (2015), noted that a holistic analysis is missing on the topic of digital transformation within the automobile industry. The lack of research and literature stated by Hanelt et al. (2015), Riasanow et al. (2017) and Yoo et al. (2010) in combination with a lack of literature on the topics within the automobile industry identified in the literature review shows the gap between the academic literature and the automobile industry. The gap is specifically subject to the areas of data monetization and m-commerce where literature on the topics is well studied but has not been related to the automobile industry.

Connected cars and Vehicles-to-everything (V2X) are enablers for the areas of in-car commerce, autonomous drive, and data monetization (Martínez de Aragón et al., 2018). The common denominator identified that enables digital revenue streams in cars is the prospect of the connected cars and V2X (Chen et al., 2017; Coppola & Morisio, 2016; 'Department of Transportation's Hazardous Material Regulations', 2015; Kleberger et al., 2011; Wang et al., 2019). Some authors such as Kleberger et al. (2011) and the 'Department of Transportation's Hazardous Material Regulations' (2015) limit the phenomena of connected cars as only having access to a network and not necessarily the Internet in the car. Authors such as Brookes and Pagani (2014), and Coppola and Morisio (2016) stress the integration of IoT between software and functionality in vehicles for connected cars. Furthermore, V2X also emphasizes the integration of different types of networks in the academic literature. V2X is defined as the communication between vehicle-to-vehicle (V2V), vehicle-to-pedestrian (V2P), vehicle-to-infrastructure (V2I) ,and vehicle-to-network(V2N) (Chen et al., 2017; Wang et al., 2019). The main difference between the concept of connected cars and V2X is that V2X emphasizes the communication between the connected car and its external environment.

3.1 Autonomous Drive

With regards to autonomous drive, there is a discrepancy between different sources. While some sources such as Duffy and Hopkins (2013), Krasniqi and Hajrizi (2016) and Schellekens (2015) define autonomous drive interchangeably with other concepts such as self-driving vehicles other sources such as Howard and Dai (2014) makes a clear distinction. Furthermore, the variety in definitions increases as some sources choose to define autonomous drive individually as a single concept, such authors include Duffy and Hopkins (2013), Howard and Dai (2014) and Krasniqi and Hajrizi (2016). The common theme identified when authors define autonomous drive is vehicles that need little or no help from humans to drive. However, the most common definition used in academic literature tends to be based on dif-

ferent levels of autonomous drive predefined by either an academic body or authority. Such sources include BASt, NHTSA, and SAE (Gasser & Westhoff, 2012; NHTSA, 2013; SAE, 2014).

The common denominator of the definitions of such sources is that they do not define autonomous drive statically but rather as a dynamic concept which changes depending on the circumstances. For instance, authors differentiate between the definition of a vehicle that in part can drive itself and a car that need no human supervision. In table 3.2 different academic definitions are summarized.

Table 3.2: Definitions of Autonomous Drive

Authors	**Definition**
Duffy & Hopkins (2013)	Vehicles that can drive themself with limited human interaction
Krasniqi & Hajrizi (2016)	Vehicles that allows for driver functionality with no or limited human interference
Howard & Dai (2014)	Motor vehicle capable of navigation and drive with no help from human input
Gasser & Westhoff (2012)	Defines 5 levels of automation, ranging from driver only to fully autonomous
NHTSA (2013)	Defines 4 levels ranging from no automation to fully self-driving cars
On-Road Automated Vehicle Standards Committee (2014)	Defines 5 levels of automation ranging from no automation to full automation

With regards to this thesis research question, it is important to connect autonomous drive use cases with additional digital revenue streams which could potentially be generated by the automobile industry. Within the academic body of the autonomous drive, this is a relatively unexplored area. A willingness to pay survey from Daziano et al. (2017) estimates that customers are willing to pay on average $3500 for partial automation and $4900 for full automation. One could imagine that the sale of an autonomous drive service package could be connected to the in-car commerce topic previously discussed. However, the additional revenue could be incorporated into the base price of the car which would be outside the scope of this thesis. As thesis is more focused on the use cases which would generate additional digital revenue, and thus such autonomous drive uses cases will be presented below.

Most authors on the topic of providing business models to autonomous drive are connected to Mobility-as-a-Service (MaaS) which emphasizes areas such as car-sharing and taxi services. In essence MaaS could provide a value proposition to both B2C and B2B channels (Attias, 2017; Bagloee et al., 2016; Bernhart, 2016; Gandia et al., 2019; Kaltenhäuser et al., 2020; Liang et al., 2016; Maurer et al., 2016; Rodrigues, 2018). B2C value can be achieved where drivers share their cars with other drivers to reduce fixed costs. B2B value can be created for taxi companies due to them being able to reduce variable costs by not having to pay wages to drivers. However, other areas for revenue streams are also explored by academia such as parking, where the use case is based primarily trough optimizing space to increase the productivity of existing parking lots (Maurer et al., 2016; Rodrigues, 2018) and the technical feasibility of it (Zhang & Guhathakurta, 2017; Zhang et al., 2015). Finally, Maurer et al. (2016) identify the cargo transportation industry as a potential customer of autonomous cargo vehicles, the main benefit for the transportation industry is the reduced cost of drivers.

Another disruptive trend that can be observed in society is the increased standardization of hardware (Church & Gandal, 1992). In parallel, the evolving IoT trend has increased the need to support over-the-air software updates (Bauwens et al., 2020). Given the shifts in the industry, customers are likely needed to be educated. Moreover, a study with a sample of more than 2000 customers showed that customer education was significantly related positively with customer loyalty; by increasing the customer's expertise they became more loyal (S. J. Bell & Eisingerich, 2007).

One major obstacle for the implementation of the autonomous drive is to acquire and update HD maps (Seif & Hu, 2016). A promising strategy is to use onboard sensors in connection to cloud-based HD maps to help the car make decisions (Seif & Hu, 2016). The HD maps can in turn be updated with real-time information from several sensors. For autonomous drive to work, there is a need for different sensors. Jo et al. (2014), points out that radar and lidar are essential sensors for autonomous drive and need to be combined with GPS and a map. In addition, Ross (2014), states that radar, infrared images, sonar, and other sensors are needed for the autonomous drive function.

3.2 Data Monetization

The academic literature about data monetization diverges in several aspects. The one similarity different definitions share is that data should be converted into value. However, how data should be converted differ between authors. For instance, Alfaro et al. (2019), Gartner (2019), Liu and Chen (2015), Najjar and Kettinger (2013) and Prakash (2014) all say that data should be "used", "managed" or "converted" implying that how it is used has lesser importance for something to be classified as data monetization as long as data is taken advantage of in some way. Other authors are more specific in the way that data should be used to give rise to the phenomena of data monetization. For instance, Prakash (2014) says that data should be processed into usable observations and insights indicating that data monetization is limited to intangible assets. Furthermore, Prakash (2014) definition is thus in stark contrast to Woerner and Wixom (2015) who defines data monetization as providing services and products based on data, and thus implies that data monetization is when you create tangible assets based on data.

Secondly, how value is achieved within the context of data monetization also differs between different authors. Once again, some authors such as Najjar and Kettinger (2013) and Woerner and Wixom (2015) take a general approach and say "value", "equivalent value" or "real value" leaving interpretation of what value is to the reader. However, the majority of authors such as Alfaro et al. (2019), Gartner (2019), Liu and Chen (2015), Prakash (2014) and Walker (2015) clarifies that it is some sort of economic value, by either stating it directly or referring to the generation of revenue.

In summary, the academic disagreement on the topic gives rise to some concerns when analyzing data monetization. It is unclear from the articles read if improving existing products using data, and thus demanding a higher price when selling products is within the scope of data monetization. However, we can see that most authors define data monetization as

broader than exclusively the practice of selling raw data to a third party which opens up several opportunities for how data monetization can be achieved. To avoid confusion this thesis will define data monetization as "generating revenue directly from data-based products and services". This definition allows for products and services developed from data to be sold but excludes improving internal processes or generating retail revenue from selling more cars through enhancing existing products. In table 3.3 different definitions from several authors are showcased.

Table 3.3: Different Definitions of Data Monetization

Authors	**Definition**
Najjar & Kettinger (2013)	Data monetization is the ability to converting intangible value into real value using data
Gartner (2019)	Data monetization is the practice of using data for quantifiable economic benefit
Liu & Chen (2015)	Data monetization is creating value and managing data that generates additional revenue by selling it externally or improving internal operational efficiency
Alfaro, Bressan, Girardin & Murillo (2019)	Data monetization is the phenomena of converting data and analytics to financial return
Prakash (2014)	Data monetization is the means of using data to create revenue by processing data into usable observations and insights
Walker (2015)	The implementation of business models that enables the capture of the economic value of data
Woerner and Wixom (2015)	The practice of exchanging services and product based on data for something of equivalent value or legal tender

Most academic literature on the topic of data monetization does not take the perspective of the automobile industry. Several authors such as Baecker et al. (2020), Laitila (2017), Najjar and Kettinger (2013) and Walker (2015) have proposed general frameworks for data monetization. All of the aforementioned studies provide general frameworks of data monetization structure their framework in similar components. These components are summarized and sorted on their potential value beginning with the least amount of value: 1) selling data directly, 2) selling insights or, 3) selling services. Some studies such as Baecker et al. (2020) provide additional components such as asset sale, process improvements, product innovation, contextualization, individualization, relationship management, data enrichment, and privacy & control guarantee. However, most of these aspects could be argued to be a part of generating insights or services. One of the more deviating sources on general data monetization strategy framework is Walker (2015), who propose four key strategies for data monetization: 1) keep the data proprietary, 2) trade the data to business partners for shared benefits, 3) sell the data product (to a host of possible clients), and 4) make the data available (and even free) to many users. Walker (2015) fourth strategy is an unexplored strategy in the other sources and is hard to categorize as either insight or as a service. However, Walker (2015) states that providing data to many users allows for the provider to become a data broker and thus collect more data on the users which can then be monetized. Hence, this thesis interpretation of the practice is that it is a data generation tool rather than a data monetization strategy.

Moreover, data monetization use cases identified in literature specifically for OEMs are sparse. However, several studies by authors such as Opher et al. (2016) and Seiberth and Gründinger (2018) notes that having control over hardware and the corresponding data generation is becoming increasingly important to gain the ability to monetize data. Opher et al. (2016) state that OEMs have increasingly invested in data collection capabilities, where the next logical step is to establish platforms where customers can gain information on their products - thus, providing OEMs the opportunity to collect more data on customers. This is in line with Walker (2015) fourth strategy of providing platforms to customers as a tool to generate additional data. Opher et al. (2016) further identify three use cases for data monetization in the automobile industry which all are based on selling telematics data to 1) insurance companies, 2) preventive maintenance, and 3) service repair shops. In addition to using telematics data for data monetization Aboagye et al. (2017) also emphasize consumer data as a source for data monetization, key use cases identified in the article are: 1) target adds and content, 2) cost reductions through autonomous vehicles and 3) services. These services include areas such as automatic searches, concierge services, and payment for parking Aboagye et al. (2017).

However, with regards to using consumer data, there are some concerns. Firstly, privacy is one of the most important issues for Americans (Gandy Jr, 2003). Thus the importance of cybersecurity's will likely increase. Furthermore, there are data protection laws in place in most nations which limits the use of personal data to its original purpose which consumer agreed to (Rubinstein & Hartzog, 2016; Stalla-Bourdillon & Knight, 2016). Since consumer data use cases have substantial value, data need to be anonymized in order to comply with data privacy regulations (Rubinstein & Hartzog, 2016; Stalla-Bourdillon & Knight, 2016). Such regulations could include the European GDPR which defines an entity that determines the original purpose of the data collection as a data controller (REGULATION(EU)2016/679, 2016). Given that the automobile industry collects on average 25 gigabytes of data per day per car (Aboagye et al., 2017), there is likely substantial compliance processing.

3.3 In-Car Commerce

In-car commerce is terminology that is not prevalent in academia. However, it is a term used in the automotive industry (Frost & Sullivan, 2019) and thus deemed appropriate to use.

According to Qin (2009), e-commerce is all commercial activities that are done through electronic means such as using the internet. Clarke III (2008) defines m-commerce as a subset of e-commerce where m-commerce allows the customer to make a transaction anywhere they have a wireless internet connection. The definition given by Clarke III (2008) is similarly defined by Kwon and Sadeh (2004) where m-commerce is defined as a type of transaction of economic value that uses a mobile network. Kwon and Sadeh (2004) further state that this definition of m-commerce makes it a subset of e-commerce in a similar way to Clarke III (2008). Ngai and Gunasekaran (2007) points out that mobile commerce can not be accomplished without wireless network infrastructure, mobile middleware (defined as software connecting network and operating system), and wireless user infrastructure. A

compilation of different authors definition of m-commerce and related topics can be viewed in table 3.4

Table 3.4: Definition of m-commerce

Authors	**Definition**
Varshney, U. (2004)	Vehicular Mobile Commerce is the sale of entertainment, business services, diagnostic, safety tools, and other services that can be accessed through phones.
Clarke III, I. (2008)	Mobile commerce refers to any transaction with monetary value that is conducted via a mobile network. It will allow users to purchase products over the interview without the use of a PC.
Ngai, E. W., & Gunasekaran, A. (2007)	Mobile commerce needs wireless network infrastructure, Mobile middleware, and wireless user infrastructure.
Tsalgatidou, A., Veijalainen, J., & Pitoura, E. (2000)	Mobile e-commerce transactions are any transaction of economic value that is done through a mobile terminal that uses wireless telecommunication to connect with e-commerce infrastructure.
Kwon, O. B., & Sadeh, N. (2004)	Mobile commerce is a subset of all e-commerce transactions
Ko E, Kim E, Lee E (2009)	Mobile commerce refers to any transaction, either direct or indirect, with a monetary value, implemented via a wireless telecommunication network.
Qin, Z. (2009)	Electronic commerce is online commercial activities where the main focus is the commodity exchange by the internet.

Ngai and Gunasekaran (2007), show that literature has identified several application areas within m-commerce: 1) location-based services, 2) mobile advertising, 3) mobile entertainment services & games, 4) mobile financial applications, 5) product locating & searching, and 6) wireless reengineering. Hew (2017) studied what research had been done on m-commerce between 2000 and 2015 and lists the seven most studied applications: 1) mobile services/mobile value-added services, 2) mobile payment, 3) mobile banking, 4) mobile advertising, 5) mobile applications, 6) mobile internet, and 7) mobile shopping. Further, Hew (2017) notes that several of these applications are application that has emerged since the paper published by Ngai and Gunasekaran (2007). The study done by Chhonker et al. (2018) supports the claim by Hew (2017), whilst also showing a more in-depth list of mobile applications.

In recent years, connectivity in vehicles has given rise to the phenomenon Internet of Vehicles (IoV). In parallel to IoV, in-vehicle infotainment (IVI) has been increasingly integrated into cars enabling further development of IoV (Choi et al., 2019; Contreras-Castillo et al., 2017). IVI has been a key part of the car, being the main interaction point for things such as navigation, radio, multimedia, and sensors (Choi et al., 2019). Current trends within IVI system applications include access to social networks, and future trends include personalized IVI (Meixner et al., 2017). These technical developments allow mobile commerce to take shape. Varshney (2004), discusses how vehicular mobile commerce is similar to mobile commerce conducted through the phone. However, cell phones are impractical and dangerous to use while driving, and thus there is a need to develop an m-commerce point of access for consumers while in the car (Varshney, 2004). With the implementation of voice recognition in the IVI, the danger that fiddling with the screen will be reduced (Varshney, 2004).

According to Parker and Van Alstyne (2014), the platform serves as a foundation for products and services matching buyers and sellers who transact with each other. Many of the platforms are affected by network effects (Hagiu, 2006). One of the largest obstacles facing platforms affected by network effects is reaching critical mass (Evans & Schmalensee, 2010). According to Parker and Van Alstyne (2014), without sufficient developers or consumers, the value of the platform can not be achieved explained as a "chicken and egg" dilemma (Evans & Schmalensee, 2010; Parker & Van Alstyne, 2014).

Parker and Van Alstyne (2014), point out several launch strategies intended to overcome the obstacle of attaining developers or consumers. One strategy available to firms with enough resources is to subsidize the platform to entice users to join the platform (Parker & Van Alstyne, 2014). Another strategy is to launch with your own service or implement an already existing service into a platform and then at a later point open it up to third parties (Parker & Van Alstyne, 2014). The micro-market launch is a strategy where the platform is launched for a smaller community to attain strong support and then expand to border communities (Parker & Van Alstyne, 2014). Finally, piggybacking is used for small companies that lack users and aims to borrow users from other networks (Parker & Van Alstyne, 2014).

McIvor (2008), discusses when to outsource, one of the situations that are deemed appropriate to outsource is if the service is critical to competitive advantage and a lack of capability to replicate the superior performance. On the topic of partnerships Lin and Darnall (2015), discusses that strategic alliances with a partner are done in the pursuit of either competency or legitimacy. If the partnership is developed with competency in mind, Lin and Darnall (2015) denote that the organizational learning will be done in an exploratory way, the partnership diversity will be heterogeneous, governance will be non-equity and the partner relationship will be conducted through a strong-tie. Moreover, product variety have an impact on customer satisfaction (Tracey & Tan, 2001).

Additional ways to generate revenue from in-car commerce is to use revenue sharing and premium subscription fees that provide service beyond the basics (Williams et al., 2008). Revenue sharing is a process that can be done between two parties in exchange for some service. An example given by Williams et al. (2008) is an agreement for visibility where one of the parties has a large user base and by providing the other party visibility may get a part of the revenue made from this visibility.

4 Results

In this chapter, the results from the data analysis of the empirical data collection will be presented. The chapter provides empirical data which will be compared using thematic analysis to the reviewed literature in the analysis chapter.

4.1 Data Categorization

Several themes were found within the interviewee material. However, the three prior main themes identified from the literature review were autonomous drive, data monetization, and in-car commerce. These three main themes connect to each other on several points as seen in figure 4.1. For instance, this is especially apparent when looking at functionality derived from hardware such as data processing. Due to how the themes interact, a top-down hierarchical diagram was found suitable to present the information as seen in figure 4.1. For a more detailed mapping of the interactions of different codes see Appendix C.

Figure 4.1 shows how the different themes identified from the data interact and entangle with each other. The resulting themes, dependencies, affiliations, and their sub-themes will be presented in-depth, starting with autonomous drive as it has the fewest related identified themes and then expanding on that to data monetization, and lastly in-car commerce. Furthermore, the researchers do not claim the external validity of how the themes are interlinked and connected in the figure. Both the themes identified and the linking between them are subjective, based on the researcher's interpretation of the data collection paired with the literature review. Moreover, the researchers are aware that several of the themes could in theory be connected in other ways than what has been presented in this chapter. Note that the links provided in the schematics figures in this chapter are either categorized as "part of" or "associated with". "Part of" denotes that a theme is a subsection of a broader theme while "associated with" means that there is overlap between the themes.

It is important to note that several underlying shared themes interact with several of the main themes. Subsequently, the themes identified are not mutually exclusive nor completely exhaustive. This affects the presentation of the results since a theme will only be presented multiple times in-depth if the researchers believe it is justified to do so. Hence, common themes will not be presented twice or three times even if they are a part of two or more main themes. Instead, themes that are a part of several main themes will be presented in the main theme where the researchers have found them most suitable.

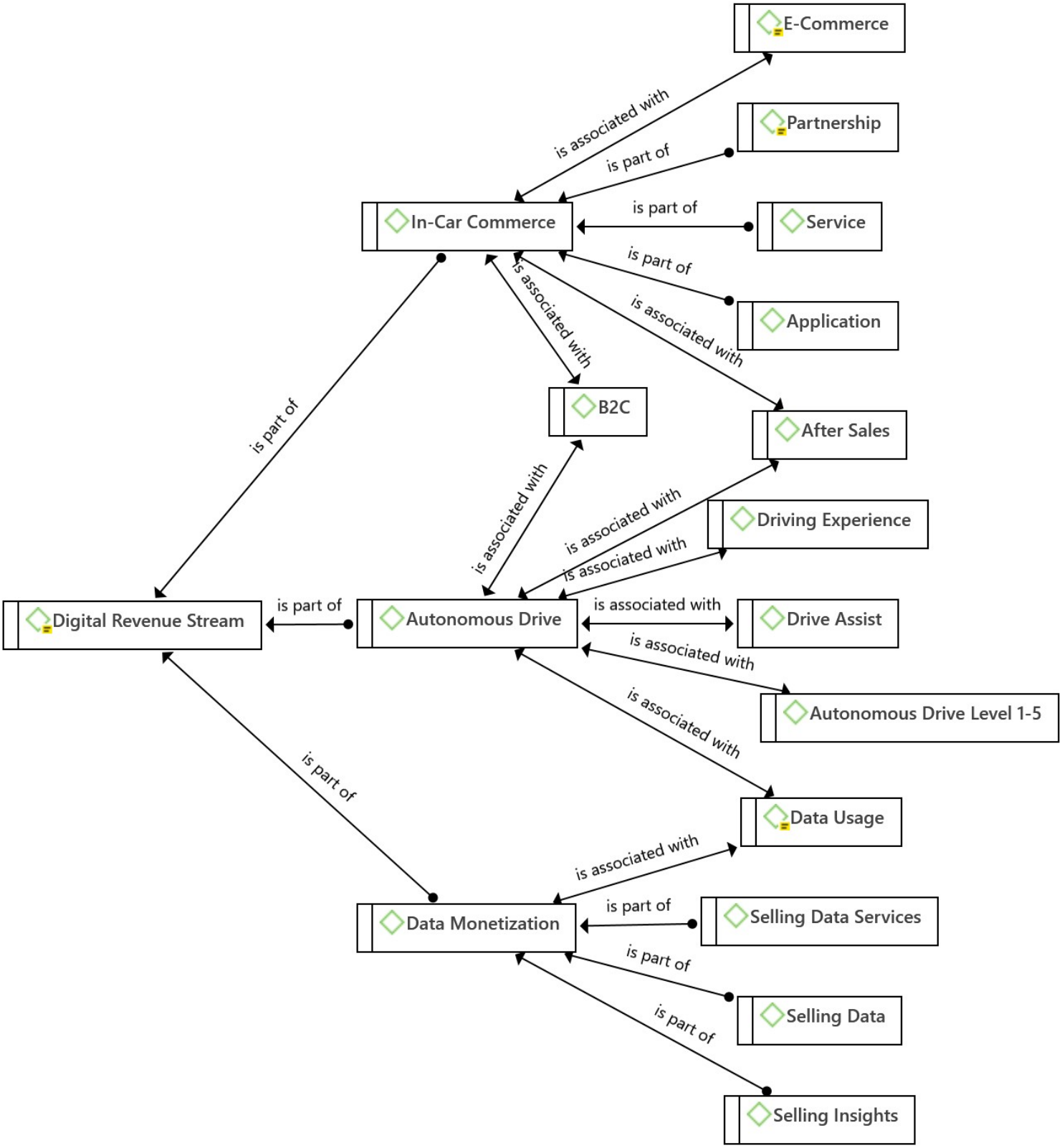

Figure 4.1: Data Categorization Aggregated Themes

4.1.1 Autonomous Drive

The first of the three main themes which relate to digital revenue streams are autonomous drive. The theme autonomous drive relates to the purchasing of a product which can completely or in part take over the driving capability of a car. In essence, the autonomous drive can be seen within the scope of the interview material as a software package coupled with corresponding hardware. This section will present autonomous drive, the underlying themes which relate to it, and corresponding interactions between themes these can be seen in figure 4.6. The structure of the section is presented below:

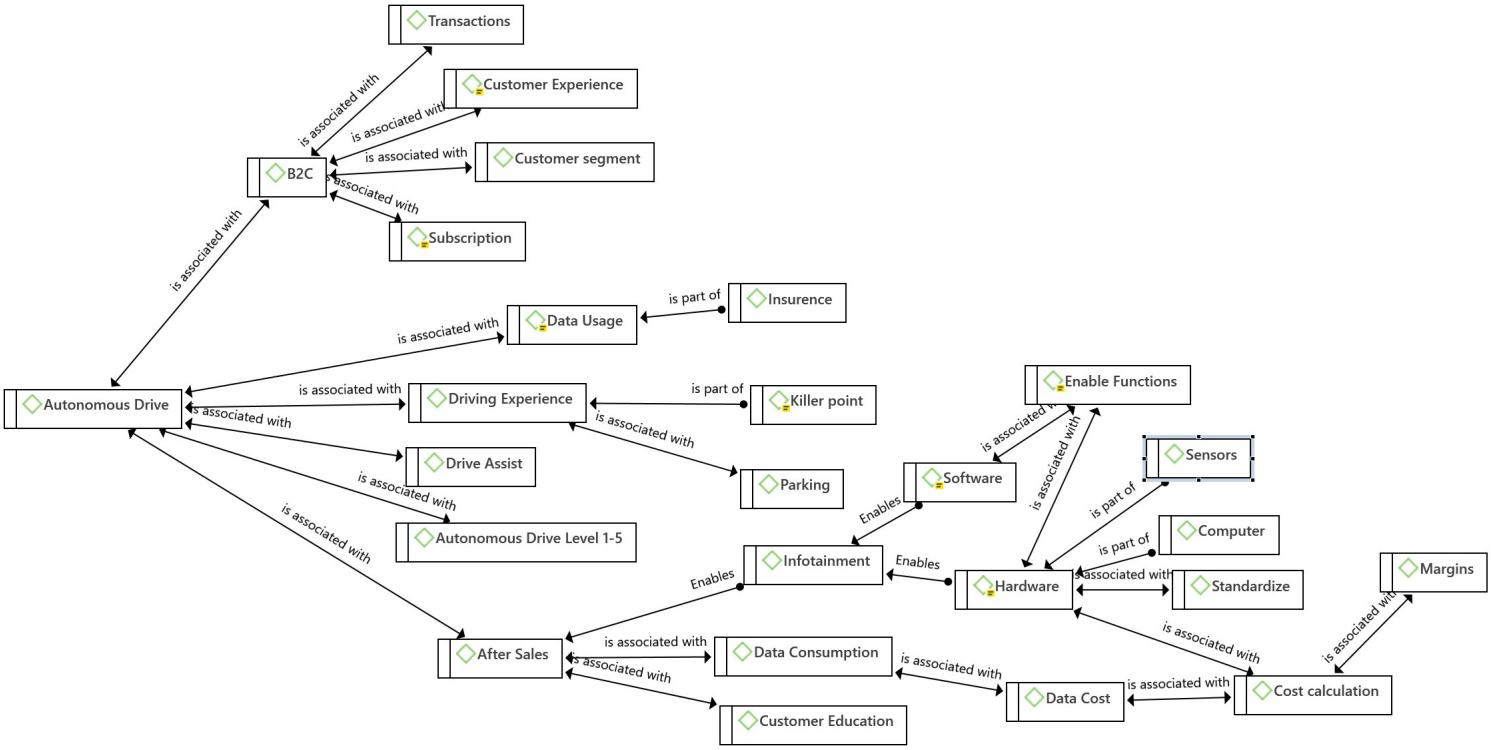

Figure 4.2: Autonomous Drive Themes

(1) Autonomus Drive Level 1-5

(2) B2C*

  (I) Transaction

  (II) Customer Experience

  (III) Customer Segment

  (IV) Subscription

(3) Data Usage*

  (I) Insurance

(4) Drive Assist

(5) Driving Experience

(I) Killer Point

(II) Parking

(6) After Sales*

(I) Infotainment

(A) Hardware

(i) Computer*

(ii) Cost Calculations*

(iii) Enable functions*

(a) Margins

(iv) Standardize

(B) Software

(i) Enable functions*

(II) Customer Education

(III) Data Consumption

(A) Data Cost

(i) Cost Calculation*

(a) Margin

Autonomous Drive Level 1-5

"Autonomous drive Level 1-5" is the categorization of different degrees of autonomy in cars, where 1 is the lowest and 5 is the highest. Only one interviewee at the procurement department spoke about level 1-5 autonomous drive. Furthermore, the company plans to bypass a level of autonomous drive using data cars are currently gathering. This is exemplified by one of the interviewees stating:

"...we are on basically level 2. And then we think that we basically will skip three and jump into the level 4 in one step." - Interview 28 procurement

B2C

"B2B" is a larger theme that is interconnected to other main themes than autonomous drive, specifically in-car commerce. This area will be further explored in chapter 4.2.3 In-Car-Commerce.

Data Usage

"Data usage" is a theme that is interconnected to other main themes than autonomous drive, specifically data monetization. This area will be further explored in chapter 4.2.2 data monetization.

Drive Assist

Based on the interviews, what is meant with "drive assist" within the context of the data collection is the company's driver-assist software such as cruise control. The key takeaway from the code drive assist is that it is a preconstitute to further develop autonomous driving, and sequentially need some of the hardware and software that autonomous drive assist functions would need. Complicating the situation one interviewee stated:

"We still lack quite a lot of data in terms of, for example, how much is the pilot assist used" - Interview 1 R&D

Which in turn indicates that there might be some knowledge gaps in the area of drive assist.

Driving Experience

Based on the interviews, the theme "driving experience" refers to the customer experience with regards to driving the car. To clarify, the theme is limited to experiences that are directly connected to driving, and thus areas that would enhance the customer experience such as the infotainment systems are not considered. Interesting to note is that only business or procurement personnel ever brought up the driving experience, one of which stated:

"You know amazing driving experience, which is highly, highly important, but it is not the only aspect of owning a car." - Interview 3 business

Interview subjects seem to agree that the driving experience is important, but they emphasize other customer experience aspects such as the in-vehicle experience more. This leads into the theme "killer point" which means within the context of the data collection the single most important aspect for customers when choosing a car. Furthermore, when the topic of killer point was brought up by interviewees, they emphasized innovation and the in-vehicle experience rather than the actual driving experience. One interviewee said:

"...one of the killer points is to actually come with (digital) services that would be breakthroughs in the benefits that customers are looking for." - interview 22 Business

On the topic of such innovations which are connected to the driving experience the theme "parking" emerges. Based on the interviews, the theme parking describes areas related to parking such as: getting a parking space, automatic parking, the requirements of it, and corresponding potential business opportunities related to it. Both the procurement, R&D, and business functions talk about several different aspects when it comes to parking. R&D emphasizes the integration between different software services such as external apps with the hardware of the car. This is coupled with procurement

emphasizing the different software suppliers. Finally, business functions tend to talk more about the customer experience when parking. For instance, one businessperson within the context of what people do when charging their EV's said:

"Most people sit in the car and actually just check their email or play a game or actually watch Netflix. Now, what happens when you're able to stream live Netflix to your vehicle while you're charging? Totally different than Netflix. It is an amazing opportunity to test this already in Netflix. Netflix is already in Tesla." - interview 3 Business

Thus, the prospect of opening to third parties to enhance the customer experience, either to park the car, during parking, or develop automatic parking seems to be high up in the agenda of the organization.

After Sales

The theme "after-sales" is a theme that connects directly to autonomous drive, in-car commerce, and indirectly to data monetization since the theme can be connected to data processing which is coupled with all the main themes. What is meant with after-sale within the scope of the data collection is the continuous improvement of cars after they have been sold. This is primarily done through software upgrades similar to the updates of a smartphone or a computer. Both R&D, procurement, and business personnel alike talk about the subject in the data collection. However, these different groups emphasize different things within the theme. The R&D and procurement personnel talk extensively about the capabilities needed to have a car that can improve over time with updates. Key in such operational discussions is the concept of Over-the-air (OTA) updates, this will be brought up and examined closer in section 4.2.2 Data Monetization. On the other hand, business personnel talk more about software packages and how such packages in updates can build upon the customer experience. For instance, one business participant said:

"...the value of this new types of business models are within software features that evolve overtime... customer is expecting new features when they get the next update of software, that there is something new and better there." - Interview 2 Business

About the customer experience and the capabilities needed for the theme after-sale, three themes emerge. These three themes are 1) data consumption, 2) customer education, and 3) infotainment.

Firstly, the theme of data consumption will be explored and presented in section 4.2.2 Data Monetization.

Secondly, the theme of customer education is directly connected to the theme after-sales. The theme of customer education is related to more aspects than just standardization of hardware which has been presented previously. Interesting to note is that it is only people at R&D who bring up what specific aspects customers need to be educated in, and they tie the subject specifically to different business models such as a subscription business model and lack of car ownership. These business models will be explored and presented more in-depth in section 4.2.3 In-Car Commerce.

Thirdly, the theme of infotainment relates to the infotainment system of cars. An infotainment system is the integration of hardware and software in a car that allows users to gain audio and video entertainment. The infotainment system enables the driver or user to interact with the car to potentially approve an update and is thus linked to the after-sale theme. To emphasize how important the infotainment system is one business participant said:

"The (our) car is good and among the best, but the infotainment system is the best and it should be staying on that top because that is what outperforms the competition" - Interview 7 Business

Consequentially, a theme that was identified as critical to the infotainment system was "hardware". After all, the infotainment system relates to the integration between hardware and software. Both business, procurement, regulation, and R&D subjects talk extensively about hardware. However, they bring up different aspects of it and at some points even contradict each other. In general, business personnel emphasizes the connection between hardware and services. For instance, one interviewee within a business department said:

"The traditional way of going as an OEM has always been if you select a certain feature, that feature is connected to certain hardware and without the hardware, you do not get the features and vice versa of course, and that is how we build our cost models" - Interview 2 Business

The business division's viewpoint can be also connected to the themes of cost calculation and margins which will be further explored in chapter 4.2.2 Data Monetization. Moreover, the data collection brought up from the business division is in line with the opinions and data collection from people in the procurement department who also emphasize bundling of hardware to enable functions for end-users. However, the main difference between the two departments is that procurement also talks about specific sensors which are needed to full fill capabilities of specific functions more in-depth, indicating a better operational knowledge on the subject. For instance, a person at the procurement department said:

"We will have, of course, other more advanced autonomous software and the HD map. And then we need an extra computer actually. In order to make the platform redundant, so if one computer goes down, the other computer needs to take over and drive the car..." - Interview 12 Procurement

Furthermore, showing the similarities between the procurement department and business department with regards to bundling hardware to support functionality one procurement interviewee said:

"Our vision is to make the vehicles hardware prepared already. So that you basically can sell this function when it is developed and ready, then you can sort of OTA it. You can send it out with over-the-air updates, so the customer opens up for that digital revenue later on" - Interview 17 Procurement

In essence, by standardizing the hardware in the car they can enable software functionality to be sold separately later as a package. In practice, this means that customers buy a car with hardware they cannot use immediately. This is caused because customers are unwilling to buy additional features, or additional features designed to run on the hardware have

not yet been developed. This is also connected to what people associated with the R&D functions said. R&D personnel emphasized the technical difficulties & requirements, and the standardization of hardware in cars. For instance, one person said:

"Having thousands of different variants of hardware makes it more complex, so moving towards having more of simplified configurations and fewer variants of hardware on the market, I think that that would be one of the key things..." - Interview 1 R&D

With regards to the theme hardware in connection to the code standardize R&D, procurement and the business functions are inline. However, with regards to other areas which should be standardized they diverge. Specifically, R&D emphasizes the standardization of software and consolidation of suppliers. Supporting this one R&D interviewee said:

"...to push things out to the car where you have different sets of software to different cars means that we have to test them. The way to do that is really to use the same software on many cars... If we test every single alternative that we want to deploy or sell we have a challenge. And it is really, about the test and integration part and a secure integrity of the complete system." - Interview 1 R&D

And when the same interviewee was asked if he meant that he wanted to limit variety in the software he responded by saying "Absolutely.". The R&D department sees this as a possibility to lower the work burden by integrating different systems. Which in turn would free up resources to pursue other endeavors. However, this conflicts with the procurement department who wants as many suppliers as possible to drive down costs, since more suppliers mean more leverage. Exemplifying this one procurement interviewee said:

"A problem with procurement is that people try to show a lot of competition in order to please our management. Because management is always challenging and wants a lot of suppliers" - Interview 16 Procurement

Moreover, R&D is also in conflict with the business divisions with their desire to lower variety in software. The business divisions emphasize a variety of different types of software packages to gain a broader customer reach. However, with regards to the standardization of hardware in all cars, there was some concern expressed by interviewees that customers are not yet ready to accept a business model where they buy a car with the hardware they cannot use.

4.1.2 Data Monetization

Data monetization is one of the three main themes identified which related directly to the topic of digital revenue streams. Within the scope of the interviewees, data monetization is the practice of using data to gain something of value. Generally, there was a clear divide between interview subjects who either had a favorable view of the subject or an unfavorable one. Hence, some disconnect existed between both employees and top management policy on the topic. This section will showcase the different themes and sub-themes which relate to the main theme of data monetization. The themes which will be presented are structured as follows:

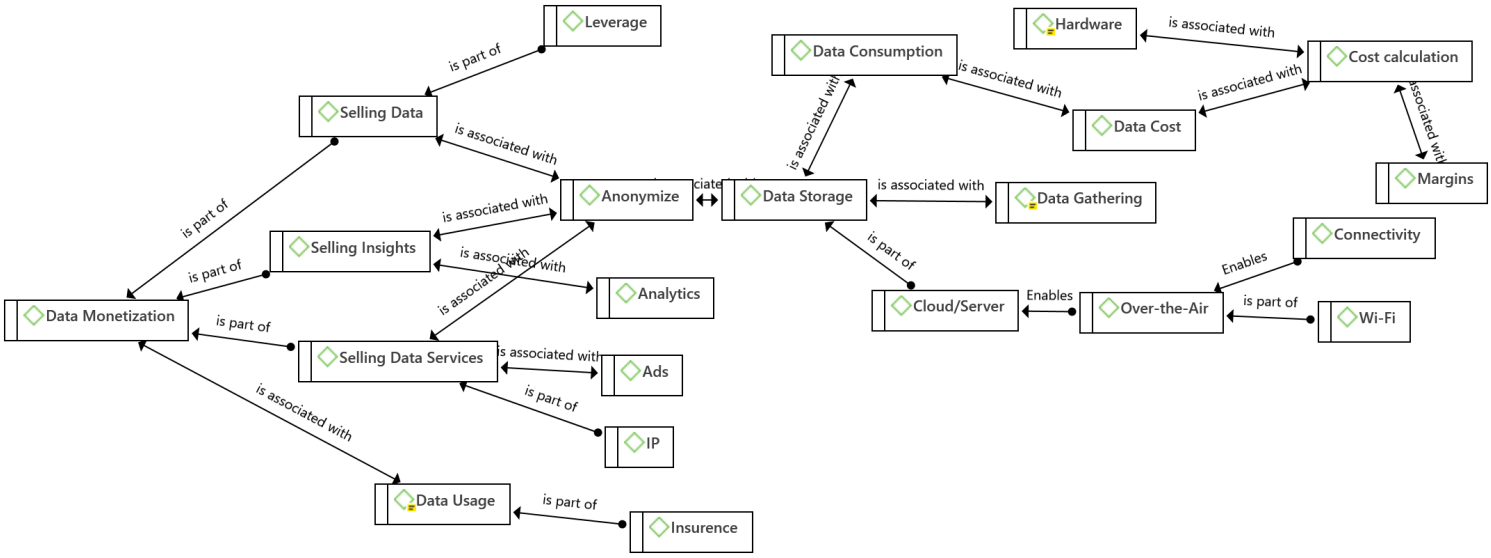

Figure 4.3: Data Monetization Themes

(1) Selling Insights
   (I) Analytics
   (II) Anonymize
(2) Selling Data Services
   (I) Anonymize
   (II) Ads
   (III) IP
(3) Selling Data
   (I) Leverage
   (II) Anonymize

(A) Data Storage

(i) Cloud/Server

(a) Over-the-Air

(1) Wi-Fi

(2) Connectivity

(B) Data Gathering

(C) Data Consumption

(i) Data Cost

(ii) Data Calculation

(a) Margins

(b) Hardware*

(4) Data Usage*

(I) Insurance

Selling Insights

Selling insights was one of the themes identified that could be directly linked to the main theme of data monetization. The theme was briefly explored by several interviewees, including all the aggregated divisions of regulation, R&D, procurement, and business. According to the interviewees, selling insights is the practice of creating and selling data-based knowledge to a customer. Some of the key highlights from the data collection were use cases and situations where selling insights based on data was appropriate. For instance, one interviewee said:

"You could feed data mapping companies or municipalities and city authorities in order to patch holes in the street. There are so many use cases that can be derived by looking at this data right, and that will, I think, lead to a lot of these emerging spaces in the automobile industry." - Interview 3 Business

Indicating that potential customers of such services could include municipalities and city authorities. Other customers or users identified from other interviewees included suppliers and business partners. Furthermore, the themes of "analytics" and "anonymize" were found to be associated with selling insights based on data. What is meant with analytics in this context is the use of data-driven decision-making to improve the company's own products, processes, or other internal workings. There were several instances of interviewees bringing up such observations. What is meant with anonymize within the context of this thesis is the practice of decoupling personal data from the person it is collected from. Data is anonymized when the data can no longer be related to the source it came from, even if it is paired with other sets of anonymized data.

Selling Data Services

Selling data services was a sub-theme that was directly linked to the main theme of data monetization. Moreover, as mentioned previously the topic of selling data services is closely interlinked by other sub-themes of data monetization making it hard to present mutually exclusive results. For instance, one interviewee said:

"if it's raw data, it's usually not that valuable. If we have done something with it, it goes up quite a lot. We want to have more cooperation's where we make a service together because that's where the real money is." - Interview 8 Regulation

This indicated that the value of data is not within the data itself but rather what you do with it. Three sub-themes to selling data services were identified, are "anonymize", "ads", and "IP". The theme anonymize has previously been described briefly and relates to several themes. However, ads and IP are exclusive sub-themes to selling data services. Ads denote the practice of communicating commercial information to drivers in the cars. Interviewees see ads as a potential revenue stream by allowing third parties to provide subtle ads in the car. Several interviewees had concerns about intrusion and spam by such an endeavor. Only R&D and procurement personnel talked about the subject. Exemplifying the concern of using ads excessively one of the interviewees said:

"We should have advertisements that are related to partners that we have a strong relationship with. Not the Google/Facebook model of just spamming people to death with stuff, but things where we actually have a really strong partnership that makes sense based upon the car you have" - Interview 8 Regulation

In contrast, the theme IP (intellectual property) was only mentioned by people associated with regulation divisions. Only one participant outside of regulation mentioned the word IP one time, all other instances of mentioning IP came from regulation divisions. Furthermore, one of the key takeaways from the theme IP is that the organization does not differentiate between IP and data. Exemplifying this one participant said:

"We do not distinguish between the data sharing or the IP sharing because data is IP." - Interview 8 Regulation Furthermore, the regulations departments also saw them-self as having a responsibility to educate the organization on the topic. Indicating this, one participant said: "We have a quite a lot of problems with the company not understanding the values of IP. This is a huge problem." - Interview 6 Regulation

Moreover, the topic of raw data being less valuable than data-driven insights is linked to the topic of selling raw data. This theme is explored more in-depth in the next section.

Selling Data

Selling data is one of the themes related to the main theme of data monetization. The theme selling data includes the sale, trade, or transmission of information in exchange for something of value. What value is differed across different interviewee subjects but could include selling raw data to third parties, providing suppliers with data to get discounts, and providing data to marketing agencies. Exemplifying this connection of how the theme selling

data materialize, one interviewee said: "Data is value. I would say it's an asset that you don't want to give away for free. We are discussing what we can give our suppliers in order to get better prices or partnership data" - Interview 16 Procurement

In addition, the quote can be related to the sub-theme of "leverage" which specifically targets the use of monetizing data through discounts with suppliers. It might not be surprising that leveraging assets to gain a discount on suppliers was primarily discussed by people who were associated with procurement. However, one person from regulation also brought up the theme.

Finally, all the three presented themes are connected to anonymize. The theme of anonymize is interconnected to several aspects of data monetization and more specifically to the back end of it. Hence, several sub-themes to anonymize have been identified during the interviews. Three themes related to anonymize: 1) "data storage", 2) "data gathering" and finally 3) "data consumption".

Firstly, data storage is the storage of data that has been generated by a car. The theme data storage relates to the theme anonymization since data needs to be anonymized before storage. The key takeaway from the theme data storage is that all data which is generated by the car is not stored. Exemplifying this, one interviewee said:

"We can't collect everything in the vehicle. We can't transmit everything to the back end either." - Interview 2 Business

There are several reasons why this is the case related to several underlying themes such as "cloud/server", "over-the-air", "Wi-Fi" and "connectivity". Data storage is in essence not free. To store data, you can either store it locally on the car's memory or store it in the cloud. Both these options come with their benefits and drawbacks. For instance, storing data in the cloud requires car connectivity and sending information over-the-air. The theme "over-the-air" relates to the capability to send information over-the-air like data roaming with a mobile phone. The main concern with this is the costs associated with sending large sets of data over-the-air. One interviewee said:

"...once we get to a point where you're streaming YouTube and streaming Netflix (in the car), then suddenly the cost for that internet access is going to be substantial." - Interview 3 Business

Smaller sets of data such as GPS position data and other non-complex data have a low cost associated with sending it over-the-air. However, the problem arises when you send HD pictures or videos. As of now, the organization includes several years of free roaming for their customers when they buy a car and thus covers the cost through the initial sale of the car. Hence, the decision to store data in the cloud is a decision that will be associated with increased costs. On the other hand, storing data locally on the car's memory is free in comparison. The main issue with such a method is the lead time for data to be sent back to the company's servers. Today, such data can and is downloaded when a car is serviced for maintenance and then transmitted to the organization's servers with Wi-Fi. Hence the granularity and frequency of such data will be low since most vehicles do not regularly go to maintenance.

Figure 4.4: Data Gathering Process

Secondly, data gathering refers to the process of collecting data following the schematics in figure 4.4.

According to the interviewees, the theme data gathering relates to anonymize in the same way data storage is connected to the topic. When data is gathered it needs to be processed to anonymize it. When it comes to personal data the customer needs to agree on what data can, and by whom be collected. This enables third parties to gather data using the car's equipment where the company is not a controller. The final theme that is related to anonymize is "data consumption". The theme data consumption refers to user's consumption, use of data, or in other terms how much data customers use. This theme was only brought up by R&D and procurement personnel. While both R&D and procurement had much in common on the subject, two different viewpoints by the two groups could be observed. Both groups agree that data consumption will rise in the future with one person at the R&D department stating:

"We are looking at an average of 2.5 gigabytes of data per month per car. In just a couple of years we will see an increase in more than a factor of 1000" - Interview 19 R&D

The main difference between procurement and R&D is the discussions about associated data costs. One participant from the procurement department voiced his concern about internal silo thinking and conflict between the procurement and R&D departments. The participant said that there are incentives for departments to cut costs in their department at the expense of others, and this is especially true with regard to data consumption. The participant said:

"The unfortunate part is that the cost for connectivity is paid by the local markets. So, the local sales brand in Sweden is paying for the cost of connectivity for Swedish cars. R&D is the one deciding and developing the solution and they don't pay for it. What happened is that even though you are an organization, of course, if you are an R&D manager, your focus is the cost for development and overhead and not cost for data cause you're not paying for it." - Interview 5 Procurement

Data Usage

"Data usage" is a theme directly linked to the main theme. Data usage refers to use cases centering around how data collected from the cars can create value without necessarily selling it. The theme is intertwined with other large themes that directly relate to data monetization. For instance, it could be argued that you must use data to apply the themes selling data, services, and insights. This is true; however, it is justified to bring up data usage separately since areas brought up by the interviewers which did not directly fit into the former presented three large themes.

Five use cases related to data usage were identified, these are telematics, decision making, compliance to regulation, development of products, and insurance. It is important to note that the theme Data usage does not only link to the main theme of data monetization but other main themes as well. On the same note, all the use cases brought up except for insurance have also been classified as their codes which are more appropriately linked to other areas seen in Appendix C.

4.1.3 In-Car Commerce

In-car commerce was discussed by the business, R&D, and procurement divisions. Several themes were identified and related to in-car commerce the main areas that will be covered in this section are business-to-consumer, service, apps, e-commerce, partnership, and after sales with their identified sub-themes seen in figure 4.5, the structure of the section is presented below.

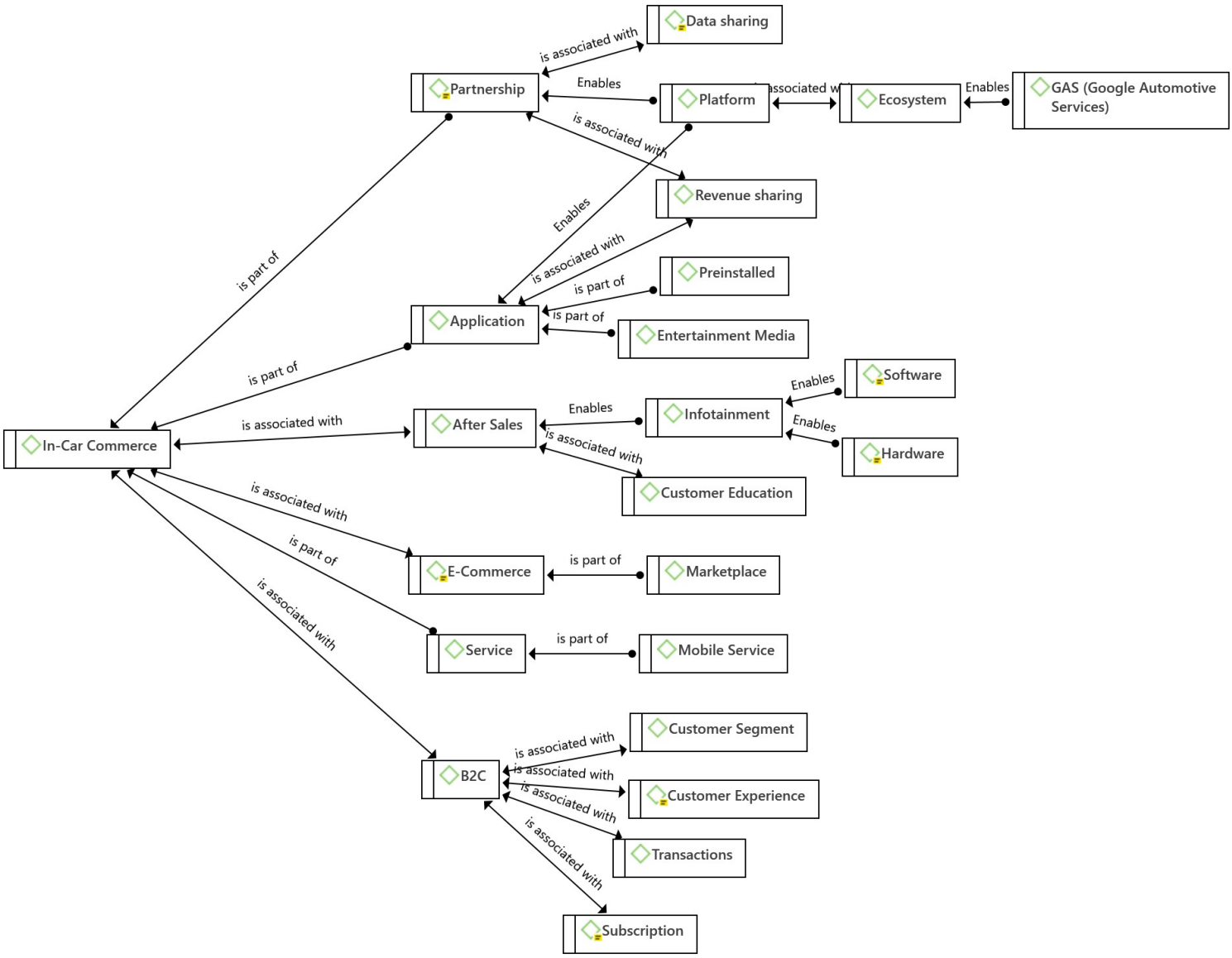

Figure 4.5: In-Car Commerce Themes

(1) B2C*

(I) Customer Experience

(II) Customer Segment

(III) Transactions

(IV) Subscription

(2) Service

(I) Mobile Service

(3) Application

(I) Entertainment media

(II) Pre-installed

(III) Revenue sharing

(IV) Platform

(4) E-Commerce

(I) Marketplace

(5) Partnership

(I) Platform

(A) Ecosystem

(i) GAS(Google Automotive Services)

(B) Data Sharing*

(6) After Sales

(I) Customer Education

(II) Infotainment

(A) Hardware*

(B) Software*

"I think (in-car commerce) it's an internal working term that we've used for some of the projects to look at. I haven't seen it outside of the organization and I think that the actual concept of in-car commerce triggered us to think about, well what are the different types of commerce that might happen in or around the car where it's still related to the vehicle but might not actually take place in the car" - Interview 20 R&D

The above quote shows that the term in-car commerce was understood to be something specific to the company in question. Not all interview subjects of the case had an understanding of the term. The term in-car commerce encapsulates commerce that is sold in or around the car. However, a division on in-car commerce within the organization was identified. This divide is also apparent within the R&D and business division, one view of the interviewees is that even though a marketplace will exist in the car they do not see the organization building services for the marketplace. Rather they see the organization building services

that are specific for their automobile vehicle such a service would be the autonomous drive service.

B2C

"All those things need to be developed because we've never sold it that way before. It's always been at the dealership" - Interview 2 Business

Business-to-Consumer (B2C) is an aspect of in-car commerce and as seen in the quote above B2C customer interactions are somewhat different from what the traditional sales route of the company has taken historically. Both the business division and the R&D division are aligned that the company has mainly been working with Business-to-Business (B2B) sales where the main interactions with the end customers have been through dealerships. Furthermore, the business division agrees that B2B sales historically occurred through dealerships are shifting to B2C interactions. This is due to online sales becoming more prevalent and the addition of in-car commerce creates these new interaction points directly with consumers for the company.

"So that's our target 5,000,000 direct consumer relations" - Interview 11 Business

According to the quote above, the organization has set a goal of reaching a specific amount of direct consumer relations. This would be in line with what other divisions have touched upon of the organization increasing its B2C interactions. This has changed the way the company interacts with its customers. According to the business division, customer interaction has changed from a short-term encounter to a long-term relationship with several interaction occasions. Still, both from a business and R&D perspective it is important to understand the customer experience. Furthermore, it is important to have an in-depth understanding of the sales channels used. According to the business division, it is within the companies policies of creating excellent experiences for the end-user.

Therefore, according to the business division, it is important to understand customers and what they want. However, according to the business division you cannot wait for the customer to tell the organization what they want. Furthermore, another member of the business division, pointed out that you have to capture the customer behavior that is shifting, it is not about delivering to customer demand, you have to capture what the customer does not yet know what they want. The business division sees potential in making people enjoy spending time in their cars even when it is standing still. This would mean that the car is more than just a vehicle of transportation.

"I mean, I think that it's going to be the subscription purchaser. Because I think they are the type of customer who is a little unsure about what they specifically want, and so they're more accustomed to trying things out. Having the freedom to cancel whenever they want, and I think if we allow a customer to opt into things and opt out of things that are the target audience. We've done some research to show their willingness to subscribe to over-the-air features is high. Also, they have a higher likelihood of trying new car features than our standard shopper, they also tend to be younger." - Interview 20 R&D

As seen above the R&D division points out that a subscription program does not work for

everyone. Specifically, younger customers are less likely to need customer education to enjoy the subscription type model. The procurement division ponders if customers of the company are similar to the customers of Tesla. If so, will the customer of the company be willing to do similar things with their products as they are willing to do with a Tesla.

According to the business division, customers in different countries have different expectations. Furthermore, the business segment points out that with the company operating in many countries, the customer segment varies geographically. To build on that, the business division knows that the organization has to deal with users that are used to different platforms in their other digital appliances.

"Like all the software companies today, they don't earn the money by subscription, it's actually other things that generate the revenue" - Interview 18 Procurement

The above quote states that the revenue retrieved from subscription does not stand for a substantial amount of the companies profits. An interpretation of that is that the revenue from subscription is done in a manner to cover the cost and then use other revenue streams to generate profit. This is in line with one view from the business divisions that because the subscription model may result in a low revenue gain, they argue that it may be wiser to spend efforts to improve the car instead. According to the procurement division, one way to generate revenue through subscription services is to partner with third parties to provide customers with additional offerings. A part of the R&D division suggests the coupling of third-party subscription services into a product subscription service. Furthermore, the R&D department states that subscription will be a method that may be used for different functions, but refers to the business divisions for information on the company's plans on the subject. However, all divisions are unsure how to implement subscription services as it is a new avenue for the company. To enable all this the business and R&D perspective tells us that the organization must learn to decouple hardware from software to provide some core subscription offers. This is true since there is a need to be able to turn on and of functions for the subscription business model to work according to the business division.

"It's a technical possibility to pinpoint certain functionality to the degree that customers can't use specific things inside the car if they don't pay for it. Is that good for our customers? We don't believe so." - Interview 7 Business

The above quote shows us that there is a divide within the business department on the topic of in-car commerce and subscription within the business division. The quote is in stark contrast to the data collected from other interviewees from the business division.

The topic of how transactions for in-car commerce should be accomplished has rarely been brought up by the interviewees and if so only briefly. The business division points out that the owner of the transactions that will happen in the car will not be the company itself. These transactions will happen through the platform partnership and be taken care of by the partner according to the business and R&D division.

"So how do you make a transaction happen in that (micro-moment) short period of time? And what would be the use case?" - Interview 20 R&D.

This quote points to the uncertainty from the R&D side, there is a lot of uncertainty about

when and where the transactions should take place.

Services

Services is a general term used in relation to in-car commerce when discussing software and hardware in different forms that might be offered to a customer. Consumer software products can take different forms for the organization, these take shape as applications according to R&D.

According to the business division, it is important to provide good service to the customer and the service level can be raised through the platform because that will allow third-party suppliers to develop experiences for the customer. This leads to specific needs being fulfilled that otherwise would be to niche for the organization itself to develop. Furthermore, from the business division, it is acknowledged that these services bring value to the customer and will therefore hopefully make the customer happy, yet they are not making any money on these services. However, according to the R&D division, it is important to figure out the use cases for the customers. The discussion of services is in connection to several different things, it is connected to the platform services offered by the partnership, it is also the experiences that are offered by the company as well as third-party application providers.

"People often compare that we want to have the car as a smartphone. The intention might be the same that we would be able to use the car and have similar kinds of services in the car." - Interview 16 Procurement

When discussing in-car commerce, the commerce in question is according to the interviewees mainly services and software products. The above quote shows that the services that could be sold to the cars are in many ways similar to the ones that may be sold through phones. Next to that, you have services and software products that are specifically suited for a car. This can be services such as autonomous drive software package, and parking. Google Automotive Services (GAS) is a core enabler for the services that will be developed from third parties similar to the mobile services according to R&D. GAS will be covered in the next section partnership below.

Partnership

"The way that we're approaching it (in-car commerce) right now is that we don't believe (the firm) should be trying to build those experiences. We want to lean on partners to build those experiences for us." - Interview 10 R&D

The above quote shows us that the company in question has chosen a strategy where the added value for customer experiences has been chosen to be outsourced to partners. Several factors have been found from the interviews on why this is the case. Reasons include the cost to develop and upkeep these experiences for customers is somewhat high for the number of existing users. Furthermore, this is not seen as the core business by some of the interviewees in each division. Therefore the company has sought to create a partnership over bringing a platform to the car. The hope is that this platform will create an ecosystem where others car manufacturers join the platform and therefore creates a big enough user base to attract

third-party developers to create and maintain their products. In doing so, moving the cost of these experiences to outside the company.

The partnership topic has been brought up relating to many areas. In connection to in-car commerce, the partnerships have been discussed concerning the platform and applications that might be derived from different partnerships. The partnership around GAS is best described by one of the interviewees:

"Google Automotive Services are three core features, which is Google maps, Google Play and Google assistant" - Interview 14 Procurement

Google Play is the interaction outlet for the platform where consumers can download apps from third-party developers. Platform interactions with apps will be discussed further in the section Applications below. Partnerships also cover situations where a customer experience is not meet and the company cannot justify sourcing the experience from a third-party developer. This is similar to the traditional use case of the company where the company has identified a customer need, licensed API's to be able to develop these experiences for their customers. The idea is that cars have Google play pre-installed, therefore developers can themselves build apps and these can later be downloaded by the customers. One strategy to create revenue out of such partnerships is for the company to take a fee for pre-installed apps.

To have certain partnerships, there is a need to share data that is generated by the car. One example of data sharing would be the GPS location that would have to be shared with any partner that supplies the consumer with a navigation application. This data is currently shared for free as it provides customer value. But some of the interviewees question if the data sharing should occur in such a way as the provider of this service can collect and use this data for their own benefit.

Applications

The whole idea around the partnership and platform is to make more apps available for the customer as the apps are seen to give value. The apps that the company itself will develop are car-specific applications. But other applications such as entertainment media will be left for third parties to develop themselves. Entertainment media are in many cases related to music such as Spotify and video streaming such as Netflix in the car. Adding to that, by opening up the possibility for third-party developers they may see and develop services that the car company would not. Therefore, the organization would allow the services offered by the company to stay relevant.

"At this point no. There are no pre-installed third-party apps. The only pre-installed apps are Google Maps, Google Assistant and Google Play." - Interview 15 R&D

Most functions available inside the car through the infotainment system are considered apps from the organization. Such an application would example be by controlling the air conditioning. Many of these essential applications are pre-installed in the car, which means that they are there from the manufacturing of the car. As seen in the above quote only core third-party apps are pre-installed in the car. When it comes to the partnership around

GAS the cars must have the navigation, voice assistant, and play store app pre-installed in all cars. What makes pre-installed apps interesting is that the company may leverage the possibility to allow third-party companies to have their apps pre-installed to gain some sort of revenue sharing. The revenue sharing in this case could revolve around several different possibilities. One such possibility is to give the third-party partners a stronger presence in the car and in return getting some kind of share of the profits. Another partnership that could lead to revenue sharing could revolve around coupling subscription services together. For instance, if you subscribe to a car you would get some entertainment media subscription services included. This is enabled by the platform that allows third parties to develop apps for a large user base. The organization can then go to specific services and create partnerships with them to leverage these kinds of different options. However, the Business division have recognized that there is a trade-off between customer experience and some revenue streams.

E-commerce

E-commerce is associated with in-car commerce due to many of the car-specific services do not specifically have to be acquired through the car according to the interviewees. These services may also be available to be purchased through the phone but further, it may also be possible to purchase them through the web. This in turn means that the customer can be offered different services at appropriate times. According to the interviews you might not want to push some services to the customer as they are driving, that might be more appropriate to do as the customer is at their home. E-commerce is most cases were brought up in relation to other subjects and was not often discussed on its own.

Marketplace in turn is the ability for customers to purchase a product while driving through the car. The organization is uncertain if such opportunities will be available or even appropriate to do. Some of the reasoning is that it may be unsafe to multitask and with the company focusing on safety it might not be an appropriate strategy.

After-Sales

After-sales refers to several differently by the interviewees but the common thread is the commerce and continuous update of products that can take place after the car has been sold to the consumer. The commerce or product can be new features that are developed over time that gets sent to the car. The after sale aspect is something that will change the product life cycle and what type of revenue streams that is available for the company. With this customer education is needed. According to the interviewees, there are several reasons for the need of customer education, one avenue where this must be done is the customer understanding of who owns the problem if it occurs. With the platform model the company is chasing, if a service provided by a third-party company has a software malfunction it is needed that the customer goes directly to them and inform them of the problem, somewhat similar to what happens on the phone today. Customer education may also be needed to allow hardware to be sold before features are available so that later on the hardware can be used to unlock features that may or may not have to be purchased. This leads to the infotainment that will be the main interaction point for in-car commerce. These interaction points encompass

all the things that have been discussed so far, apps, services, B2C transactions for software, and potentially hardware. More than just an interaction point for the commerce itself the infotainment will also, be an enabler of some of these services such as video streaming.

4.1.4 Data Processing

The area of data processing is discussed by the regulatory, R&D, procurement, and business division. Data processing will be discussed through the three themes, compliance, map, and telematics. Within these themes, the sub-themes for each of these will be discussed. The data processing chapter will relate the themes to the subjects of in-car commerce, autonomous drive, and data monetization when applicable by the interviewees. The chapter will be structured according to the following themes:

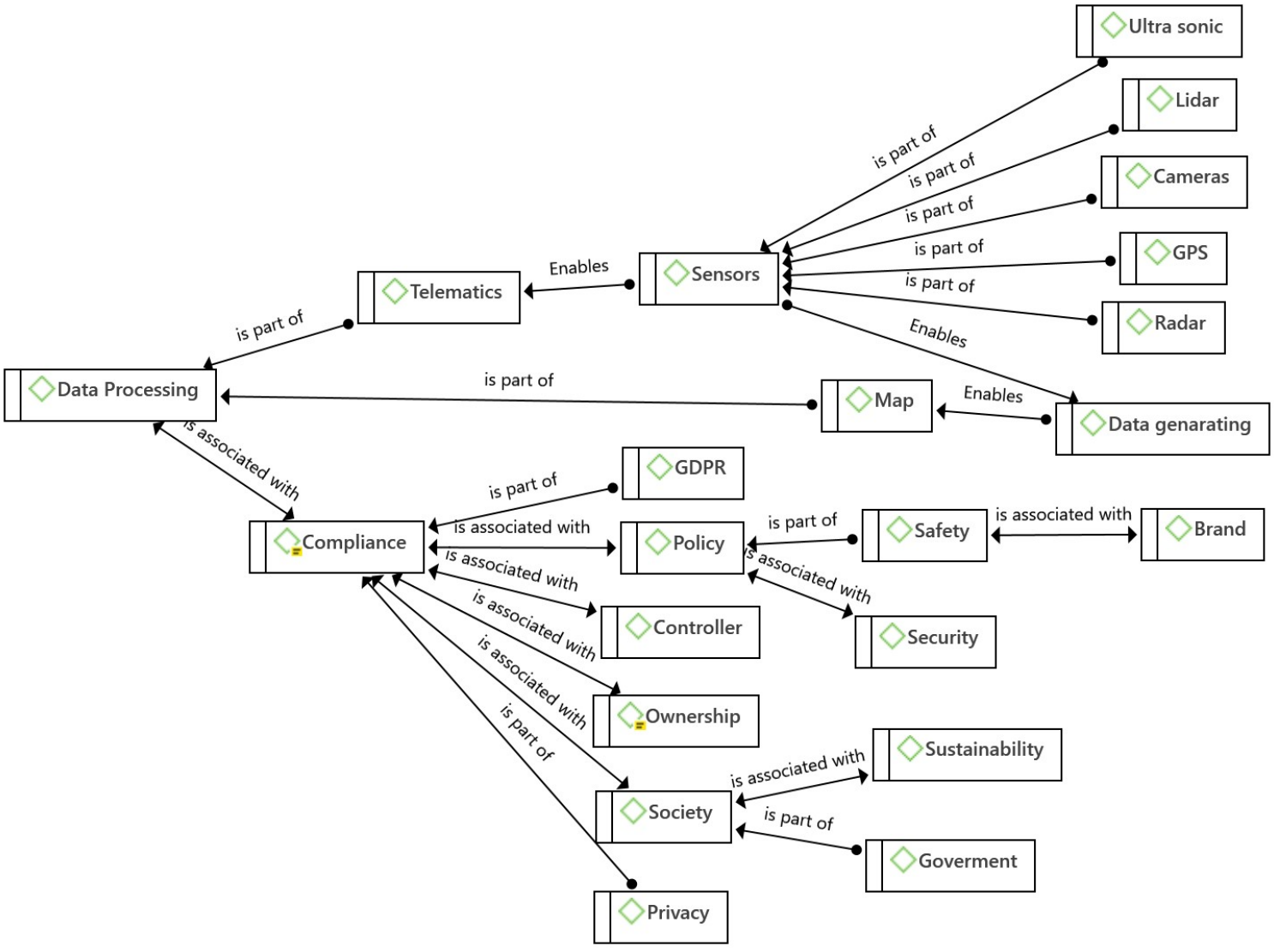

Figure 4.6: Data Processing Themes

(1) Data Processing*
    (I) Compliance
        (A) Controller
        (B) Privacy
        (C) Policy
            (i) Safety
                (a) Brand
            (ii) Security
        (D) GDPR
        (E) Ownership
        (F) Society
            (i) Sustainability
            (ii) Government
    (II) Map
        (A) Data Generating
            (i) Sensors*
    (III) Telematics
        (A) Sensors*
            (i) Radar
            (ii) Lidar
            (iii) Cameras
            (iv) GPS
            (v) Ultra Sonic

"So all these data is then processed through the computers in the car and here we have multiple computers and there is also a big debate and discussion on how you should design this electrical architecture" - Interview 18 Procurement

As the quote above states, data processing is an essential step where through the help of computer units within the car, data can be processed. According to the R&D division, several computers in the car divide the data processing, and these processes are taken care of by different units in the organization. From the procurement division, they state the importance of data processing to enable many of the car functions. With the huge amounts

of data, expensive hardware for data processing is required. However, throughout the organization, there is insecurity over what data is processed by whom and what data can be extracted.

Telematics

Telematics is associated with specific types of data generated by several different sensors. These telematics data can then be used by a computer to process the data to get insights or for services to work. Telematics data is generated from sensors, the types of sensors brought up across several interviews were, radar, lidar, cameras, GPS, and ultrasonic sensors. To enable autonomous drive the vehicle needs to have a specific set of different types of sensors. One problem that happens is that due to the amount of telematics data being generated, one needs to specify what data is sent off-board as it would be to hard to analyze everything according to the R&D division. Furthermore, telematics is divided silo-wise. In addition, it is possible to send this telematic data over-the-air to analyze it off-board. According to the procurement division, telematics is shared with third-party partners. But not all telematics data is shared with outside organizations. For instance, the location data is such an area, this data is generated through several sensors according to the R&D division. Moreover, according to the R&D department, the cars also create a lot of diagnostics data, for example for the engine.

Several different divisions discussed different types of sensors for different solutions. Sensors enable several functions in the car. Therefore, specific sensors are essential to specific functions. The location service relies on the GPS sensor according to the R&D division. The autonomous drive function relies on several cameras, lasers, and lidar according to the procurement division. Furthermore, the procurement division states that it is essential to have high performance of the sensor as regardless of how good the software is without a good sensor the function will not be good. The sensors hardware and software are supplied by third-party partners, the software and hardware do not necessarily have to be supplied by the same partner according to the procurement division. Furthermore, radar is mainly brought up by the procurement division. The interviewees at the procurement division agree that radar is going to be implemented in the car for AD. The laser radar (lidar) is also brought up by only the procurement division. Cameras are discussed by several of the interviewees. The information on what different types of cameras will be available in the vehicle is brought up by the business, R&D, and procurement divisions. The GPS is discussed by all divisions. The GPS telematics is used for navigation purposes as well as other possible things according to the business, R&D, and procurement divisions. The ultrasonic sensor is only brought up by the procurement division. The ultrasonic sensor is defined as the parking sensors in the car that measure the distance to objects according to the procurement division. Finally, the different divisions discuss the sensors concerning their own division. However, no major discrepancies were found between the divisions.

Map

The theme map becomes relevant in two different scenarios. Firstly, you have maps in regards to navigation service that can be provided by having maps of different areas. Secondly, is

what is called HD map, the main use case for HD map is for the autonomous driving function. The navigation service with the help of maps is something that has been done priorly at the company but will now be a service brought in through the GAS partnership. Both HD maps and navigation maps have an association with the theme data generating.

The procurement division points out that HD maps are needed for the autonomous drive function. According to the procurement division, HD maps can be purchased through a third-party provider. Furthermore, according to the R&D division, the navigation application is continuously improved with the help of customer data. Data that the customer of the organization generated will be shared with the supplier of the navigation application and they will be able to utilize this data to develop the map. However, people at the R&D division states that there is no possibility to swap out the partner surrounding navigation application provider. Before a driver can utilize the navigation service they have to first download the map from a server tied to a specific country.

Compliance

"We're still far away from where we should be applying a solution" - Interview 17 Regulation

What is clear from all divisions, is the need for the organization to stay compliant with any agreements and regulations that will be covered in this section. From the business division, they say that the organization is committed to upholding consumer privacy, laws, and regulation for different countries. Furthermore, the divisions' ad that if customers do not want their data sold, resold, or studied, then it is their choice to choose not to allow such practices. According to the business division, monetizing customer data must be done respectfully. Furthermore, the company must also take consumer privacy into account and make sure its practice is a fit for the company, security, and brand. From a regulatory division, it is especially important to design the systems with a privacy perspective in mind.

"Actually there is not much knowledge how to handle GDPR, they are quite afraid of doing it." - Interview 6 Regulation

As seen in quote above questions about compliance seems to exist throughout the departments studied but as the quote above notes the deep understanding of this is not widespread. The procurement division states that both the company and the GAS partner platform are controllers of the data. That would mean that both of them have to make sure they follow the laws and regulations on how the data that is being shared by both parties are used. According to the R&D division, the safety of data collection software infrastructure needs to be built to ensure that it is done in a compliant manner. Furthermore, the R&D division states that the storage of data coupled with consumers rarely happens as it is a sensitive thing to do. According to the R&D division, it is important to get the over-the-air updates correct otherwise it may lead to some security risks. Furthermore, from the R&D division the access third-party developers get to the car must be secure. Data protection should be looked at from a software and hardware perspective according to the regulatory division. It is further important to protect the car from any malicious attacks that can be done through the connectivity of the car. The importance is further increased with the cloud storage that

is being implemented by the company, this needs cybersecurity according to the procurement division. Furthermore, the R&D division states that it is then important to fully anonymize the data to make sure that there is no way that data can somehow be connected back to the user. The company is not interested in individuals data, but the aggregated level is much more interesting.

"So essentially, if you crash a (our) car, it will automatically call either 911 or it will call to involve an emergency center." Interview 5 Procurement

As seen above, the procurement division informs us that when you crash a car produced by the company it will automatically call emergency services. According to the business division, the company shares some data with governmental agencies to increase security for their customers. According to the regulation division, it is important to educate customers to understand that sharing data can save lives, their own, and others. According to all divisions, the company has a vision around being considered a company that emphasizes safety. For this reason, R&D does not believe the organization has a brand that will delve into data monetizing by selling it to third parties. According to the business division, it is a tricky line between increasing brand strength versus earning money on data.

According to the R&D division, it is important to be very protective of customer data integrity. Furthermore, the R&D division states that they strictly follow the GDPR directives. This includes having a reason to collect data. From the regulatory division, fully anonymous data does not have to ad-hear to the GDPR. According to the regulatory division, there is not much knowledge in the organization about GDPR outside of the regulatory division and this makes the organization avoid GDPR. Due to GDPR, customers must opt-in to share their data with the GAS platform partnership.

According to the business division, customer ownership of the car has changed from being a one-time interaction with the dealership to be a long-term interaction with several business cycles. Furthermore, the dealerships are owned by third-party companies. According to the business division, the company does not intend to have ownership over electrical infrastructure. moreover, according to the regulatory division, the rights of the data will always lie with the customer if they have somehow generated it. The company itself can never own the data only have certain rights to it.

The business division has noted that there is an ongoing global debate regarding data and how to access it. The business division is also looking at a societal level how it changes. Aspects that the business division points to being important when discussing society are changing values of individuals, the role of mobility and the car, and how technology is developing. Interestingly only one person from all the interviews discussed sustainability, they point out that the sustainability aspect from customers is becoming larger and larger. It may then be hard to argue that it is a sustainable practice to include hardware in a car that will not be used.

According to the procurement division, governments have a large impact on the business in individual countries. From the business department, one must establish legal entities and follow the regulation of over 120 different governmental entities. Due to the different governmental entities, it is not possible to sell digital services in each country due to different

legal authorities. This makes the rollout of services slow according to the business division. However, cooperation with governments to share some data is vital to be able to attain some insights according to the procurement division. Moreover, some governments may also ask the company to gather information on its users or cars for different reasons according to the R&D division.

5 | Analysis

In this chapter, the thematic analysis based on the data categorization will be presented. The thematic analysis was carried out by combining and comparing the empirical results with the reviewed literature.

5.1 Autonomous Drive

When comparing the definitions identified in the literature to how the term autonomous drive is used by the researched company, there are both similarities and conflicts. Firstly, it was uncommon for interview subjects to talk about different levels of autonomous drive. This observation differs between academia where the most common definitions used to describe autonomous drive are sources such as Gasser and Westhoff (2012), NHTSA (2013) and SAE (2014). In practice, the organization overwhelmingly chooses to talk about autonomous drive as a single concept as Duffy and Hopkins (2013), Howard and Dai (2014) and Krasniqi and Hajrizi (2016). One could argue that this disconnect has real implications on how the organization sees and subsequently works with autonomous drive. For instance, it is observed in academia that the definition of autonomous drive differed from source to source, indicating a degree of subjectivity in its definition. Such subjectivity is likely to exist within the organization, potentially leading to conflict. By standardizing, or setting a common definition the organization could potentially align people on the topic.

However, within the topic of driving experience, academic works and the empirical results were compatible. Academic literature such as Aboagye et al. (2017), Gauger et al. (2017) and Seiberth and Gründinger (2018) and interview subjects agreed that the driving experience was important but the in-vehicle experience was even more important for the sales of the cars. The potential consequence of this is that resource allocation will go towards the in-vehicle experience rather than the historical driving experience. A developed and mature in-vehicle experience would not only allow for higher customer value but potentially allow for other sources of digital revenue streams. However, it is still worth noting that no interview subject explicitly mentions that the traditional killer point is the driving experience as stated by Aboagye et al. (2017). There could be several reasons why this could be the case, for instance, the organization could see the historical killer point as outdated practice and thus not worth mentioning. Furthermore, it was shown in the empirical findings that only business and procurement personnel ever mentions the word killer point. R&D personnel is likely to be less familiar with business terminology. Thus, the whole theme "killer point" is likely biased

toward business-oriented divisions which could decrease the validity of the results.

Moreover, another area where the data collection and literature agreed upon was on the topic of parking. However, different divisions within the company emphasized different aspects. For instance, the R&D divisions highlighted the integration of software services with the hardware of the car. This is similar to the authors of technical papers such as Zhang and Guhathakurta (2017) and Zhang et al. (2015) who study the technical feasibility of parking optimization. It is interesting to note that the business and the procurement divisions mention driving experience but the R&D divisions do not with regards to parking. There seems to be a gap between what different divisions see as the goal on the topic of parking. It is not surprising that R&D is looking into the technical details while divisions such as business and procurement are emphasizing use cases and business applications of parking. However, these business applications tend to be oriented towards entertainment which differs from academic use cases such as gaining revenue from increasing the productivity of paid parking by sources such as Maurer et al. (2016) and Rodrigues (2018). The implication of such discrepancy between academic and the organization's business use cases with regards to parking implies that the organization is either not up to date on the subject or that further research is needed within the field. In this case, the paper by Maurer et al. (2016) and Rodrigues (2018) is from 2016 and 2018 where certain aspects with regards to data connectivity might not exist in the same way it does today.

5.2 Data Monetization

When comparing the empirical findings to the literature concerning data monetization some interesting observations have been made. Firstly, how value is gained by data monetization is in line with authors such as Najjar and Kettinger (2013) and Woerner and Wixom (2015) which take a general approach to what value is. The implication of this is that data monetization is a broader field in the organization than generating direct economic value that authors such as Alfaro et al. (2019), Gartner (2019), Liu and Chen (2015), Prakash (2014) and Walker (2015) proposed. This opens up data sharing opportunities beyond gaining digital revenue. However, this is outside the scope of the research question but further research within such topic is highly relevant. Insights such as this would not have been possible if the interviewers defined data monetization to all the interviewees.

In addition, it was also found that the topic of data monetization tended to be a polarizing topic within the organization. Some employees saw data monetization as an unfavorable development while others were very positively oriented towards its development. In literature authors such as Gandy Jr (2003), Rubinstein and Hartzog (2016) and Stalla-Bourdillon and Knight (2016) states that consumers value their privacy and subsequently regulate it. In the end, the employees of the organization are also consumers and are likely to be skeptical of endeavors that could limit their privacy. However, the relevance of some of the literature on the topic could be questioned concerning the data collection. Firstly, a key piece of literature by Gandy Jr (2003) states that privacy is a key issue for American consumers. In our study, few Americans have been interviewed and thus it is questionable if similar conclusions could be attributed to non-Americans. Secondly, the study is from 2003, 2 years after 9/11 which

could have the affected American public opinion.

A study about public opinion might not be relevant 18 years later and thus any conclusions derived when comparing our study's empirical findings to it must be criticized. There was some clear alignment between the empirical results and the literature with regards to data monetization use cases. For instance, employees at the organization said that the value of data is what you do with it and data has little value when selling it directly. This is directly supported in academic sources such as Baecker et al. (2020), Laitila (2017), Najjar and Kettinger (2013) and Walker (2015) who say that raw data has a low value in comparison to what can be made of it. The implication of this is that the organization has a good understanding of how they can derive value as a data controller and thus show evidence that digital revenue streams can be derived and monetized in the automobile firm through other means than "simply" selling raw data.

Interesting to note is that the revenue streams derived from selling data, selling data-driven insights, and selling data-driven services had different use cases brought up by the organization when compared to academia. The organization mentioned use cases such as 1) municipalities & city authorities who wanted to buy information on road conditions, 2) suppliers who could buy telematics data to improve their product quality, and 3) other partners who could buy consumer data for targeted content and similar schemes. Selling telematics data is brought up in the literature review by Opher et al. (2016). Specifically, the empirical findings agree on 2 out of his 3 use cases in the OEM industry, preventive maintenance, and service repair shops. However, there is no mention of selling data directly to insurance companies. Furthermore, Aboagye et al. (2017) mention targeted ads as a potential source of revenue for OEMs which is in line with the organization.

5.3 In-Car Commerce

Comparing the term in-car commerce used by the organization with the literature around similar subjects it can be seen that the definitions are in line. Even though the term in-car commerce is lacking in academic literature, terms such as e-commerce, m-commerce, and specifically m-commerce in the automobile vehicle exist (Clarke III, 2008; Kwon & Sadeh, 2004; Varshney, 2004). As discussed by the interviewees and as defined by some, it is generally covering the same area. Extrapolated from this, it can be concluded that the topics discussed around in-car commerce by the interviewees relate directly to the topics covered in the literature review. Looking into the reasoning for this term being introduced, the interviewees cited the clarity of the term and how it has shaped the organizational thinking about m-commerce in the car. The area of e-commerce was also covered as according to the interviews many of the services that are provided in the car can be purchased outside of the car through a website. The whole web-based car sales that have emerged in the last 10 years for the company is purely e-commerce for now.

Adding to the newly founded perspective of m-commerce in the automobile vehicle for the organization is the subtle change from being a primarily B2B customer interaction company to an organization that manages direct consumer interactions. This stems from two sources according to the interviews, the introduction of e-commerce in the form of car sales through a website and the applicable sales that will be conducted through the infotainment unit. However, these interactions are somewhat new and untested. Furthermore, the organization is growing its capabilities to sell things directly to the consumer. Therefore a lot of uncertainty around e-commerce and more so m-commerce has been noted in the interviews. With the increase of B2C focus for the organization, a lot of interviewees urged the importance of improving the customer experience and that is done by catering to different customer segments and predicting customer needs. Something that stands out is the insecurities regarding m-commerce in cars. This may be one of the reasons the organization has chosen to outsource the marketplace to a third-party partner. Another aspect of this outsourcing is a fear of not reaching a critical mass of users to bring in developers. Previously, the development of in-car services was done mainly by the organization themselves. Trying to fit the intent of the strategic alliance with this partner according to the framework by Lin and Darnall (2015), the strategic alliance is mainly done for the competency that the partner brings. That is in line with McIvor (2008), that states that it is deemed appropriate to outsource if the service is critical to competitive advantage and there is a lack of capability to replicate it. Due to the partnership being intended to bring in other car manufacturers to increase the user base Parker and Van Alstyne (2014), would define the launch strategy as some sort of piggybacking. As the firm is considered a small actor within the automobile industry this would be in line with Parker and Van Alstyne (2014), the use case for such a launch strategy. In summary, the company's platform strategy is in line with what can be found in academic sources.

Chhonker et al. (2018), Hew (2017) and Ngai and Gunasekaran (2007) point out the areas and use cases for what applications m-commerce has. Interviewees discuss smartphones in relation to the infotainment unit whereas both are seen as tools for the consumers to

interact with applications. Many of the services that the phone provides are impractical and dangerous, therefore interview subjects saw the value in bringing many of these services over to the car, as has been done before with some entertainment media services and the telecommunication service. This means that the application in the car is quite limited compared to the possible applications brought up by Chhonker et al. (2018), Hew (2017) and Ngai and Gunasekaran (2007). The safety concern brought up by Varshney (2004) around the time and place to allow applications to be run on the infotainment unit is also brought up by interviewees. Should video streaming be allowed to be done while driving or does it have a better place as a way for consumers to pass time while charging their electric vehicles. For the organization, safety is a key sales point and therefore they lean more towards adopting a safer approach.

Comparing the use cases brought up in the interviews it can be noted that the focus from the organization is on the value entertainment media services may bring to their products. Due to the platform agreement the company does not have the opportunity to monetize any third-party application developed for the platform. A lack of revenue sharing combined with high associated cost and expertise needed to develop apps has lead to the company only developing critical apps in-house. The introduction of an open platform for development with a critical mass being able to easier be reached through the piggybacking strategy Parker and Van Alstyne (2014), also allows the needs of the customers to be catered to by a plethora of developers making the services flexible. One possibility for revenue sharing discussed is the possibility to partner up with companies wanting to market themselves on the platform for some sort of exchange. This is in line with Parker and Van Alstyne (2014), who discuss the exchange of visibility for revenue share opportunity. The opportunity to create partnerships around has only been acknowledged but not been sought after by the organization within the in-car commerce.

The interviewees described vehicle-to-network as an essential enabler for m-commerce in the vehicle which is in accordance with the view brought up by Chen et al. (2017) and Wang et al. (2019). M-commerce has a close connection to sales after the initial sale of core products. According to the interviews, it is through the connectivity of the car to the mobile network which allows software sales to be done due to the automobile vehicle. Furthermore, according to the interviews, connectivity allows the company to unlock features and upload features "over-the-air" often referred to as OTA. OTA is referred to any data that is sent over a mobile telecommunication channel. While limiting Nilsson and Larson (2008), discuss firmware updates over-the-air (FOTA) while similar to the definition of the interviewees, FOTA is more limiting since it only processes software updates. The interviewees discuss OTA concerning any mobile telecommunication.

There is an internal divide between different interviewees about the place that m-commerce in the car will have for the company. The views range from m-commerce only adding value through additional sales of cars, and thus should not be by itself be seen as a new revenue stream. Other interviews see the development as the company becoming a software-oriented company where in-car commerce is a core feature. Several interviewees have identified this transformation of the organization as the organizations' focus is slowly shifting. The implication of this that there might be some internal conflict within the organization that could

inhibit the in-car commerce development.

5.4 Data Processing

Although data processing was brought up in relation to the three themes discussed priory, data processing itself is not a digital revenue stream more so an essential enabler and back end for the three themes. Therefore, the topic is important to discuss in accordance to the three themes, however it has a clear distinction from the themes of direct revenue streams. Data processing is a step necessary for many of the services discussed in this thesis. The processing of data enables autonomous drive and requires computer units to be able to process large amounts of data. Data processing is done on the telematics data generated by different sensors in the cars. Sensors that are required for an autonomous drive level 4 or 5 are agreed upon by the interviewees and academic literature. Both note that radar, ultrasonic/sonar, lidar, and other sensors are needed (Jo et al., 2014; Ross, 2014). The responsibility for the different telematics data is divided into different business units making it hard to coordinate and to gain a holistic understanding of the telematics data in the car. Telematics data also enable several car services that can be developed by third-party companies, such a service is the navigation service. These services are conveyed by Ngai and Gunasekaran (2007), where many of these rely upon or are enhanced by telematics data.

However, not only sensory data is needed to perform some of these services, several of the interviewees urged that HD maps were essential for the autonomous drive function. This is in line with the Seif and Hu (2016), states that the acquisition of HD map and to continuously update them will be a major obstacle to overcome. The HD map is combined with telematics data and the navigation map to be fully utilized into a level 4 and 5 autonomous drive. This shows that the academic literature and interviewee subjects are aligned on the question of HD maps.

Moreover, because telematics data is generated by customers driving cars the customers have rights to it. These rights are given by different nations' rules and regulations (Rubinstein & Hartzog, 2016; Stalla-Bourdillon & Knight, 2016). The easiest way to get away from many of these rights is to decouple the data from the consumer, which means anonymizing them completely. This decoupling allows the data to be used for services that may be outside of the initial scope of the data collection. The controllers for this data are the organization that collects it and the platform partner which is in line with GDPR (REGULATION(EU)2016/679, 2016). Because the users have the right to data, it is also important to securely protect this data from any cyberattacks the cybersecurity needs to be increased. The increasing pressure to comply with regulation and the increased importance of privacy for consumers is therefore the basis of the decision to not go into business selling consumer data.

5.5 Combined Analysis

Thus far in the analysis, respective themes have been individually analyzed. To highlight the interactions between different themes, the themes needs to be analyzed together. In

figure 5.1 below a schematic relationship diagram is presented. The arrows in the diagram represent the flow of inputs and outputs. To summarize, in-car commerce creates consumer data that can be used in data monetization. In-car commerce also enables the after sales of autonomous drive. Autonomous drive creates telematics data that data monetization can use to monetize.

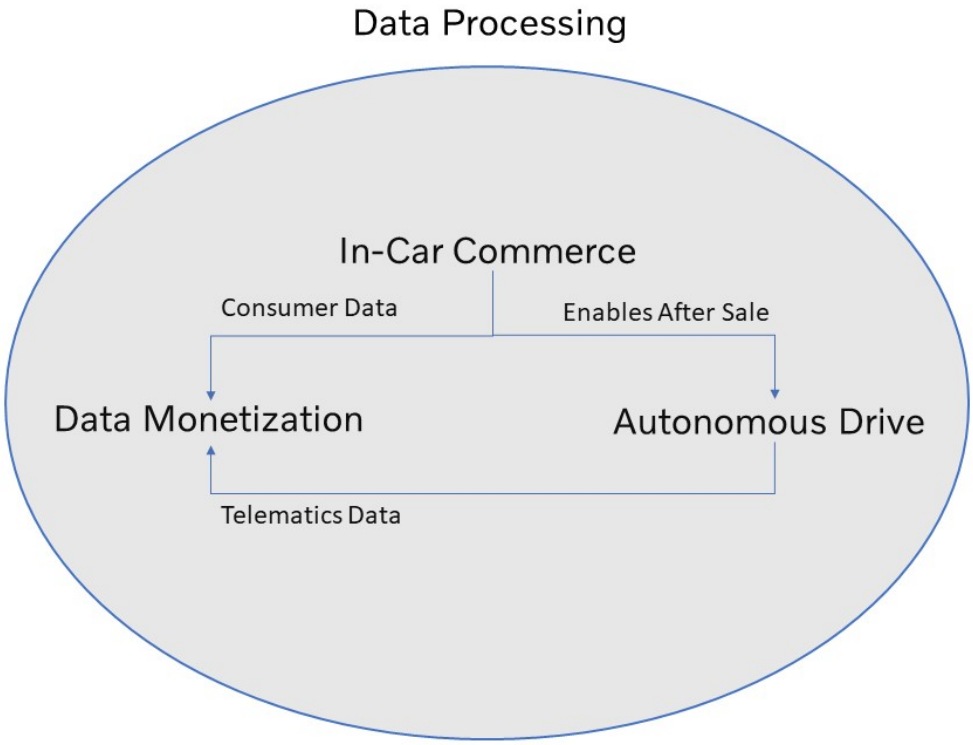

Figure 5.1: Schematic Themes Relationship Diagram

Beginning with in-car commerce, a one-sided relationship can be observed with data monetization and autonomous drive. Firstly, data monetization relies on consumer data which can be derived from in-car commerce. Since in-car commerce is in essence the ability to sell software services it allows for consumer interaction with services after-sales. This enables the potential to gather consumer data which in turn can be monetized. Secondly, autonomous drive currently relies on the ability to install software packages over-the-air this is enabled by the after sales that in-car commerce provides. Within the scope of this thesis, in-car commerce is defined as m-commerce that builds on connectivity. Such connectivity allows for the after-sale and installation of software services using OTA. To summarize, in-car commerce is an enabler in part for both autonomous drive and data monetization. Thus, the automobile firm needs to develop capabilities within in-car commerce to generate digital revenue streams, both directly and indirectly through the other themes.

Autonomous drive is an interdependent theme when putting it in the context of data monetizing and in-car commerce. It depends in part on in-car commerce due to the previously

described relationship where autonomous drive is reliant on after-sales services provided by in-car commerce. However, with regards to data monetization, autonomous drive is a contributor. Data monetization relies in part on telematics data, and the hardware which enables telematics data is the same hardware that enables autonomous drive. Thus, there is a relationship between the two main themes where the hardware is enabling both themes with necessary information and functionality. Moreover, it can be argued that the same telematics data which is used in the development and use of autonomous drive can be monetized. Thus, making the relationship more interlinked rather than one-sided.

Finally, data monetization is dependent on autonomous drive and in-car commerce, thus the relationship to the other two main themes can be categorized as dependence. Data monetization is completely reliant on the data it can monetize in different forms. In this study, the data which can be monetized is primarily telematics data and consumer data. Since these data categories are derived and generated outside of the theme data monetization, the theme becomes reliant on input from other areas. Data monetization is not alone in this type of reliance. All the main themes are reliant on the theme data processing for the same reason. Without the back end of data processing and what it encapsulates neither in-car commerce, autonomous drive, nor data monetization would be possible.

6 | Concluding Discussion

In this chapter, a discussion and summary will be presented. The discussion and summary are accomplished by answering the research question stated in section 1.2.

"How can digital revenue streams be generated in an automobile firm?"

The research question have been answered by combining findings from the literature review and the results of the study. In summary, three areas of direct digital revenue generation were identified in the literature review: 1) in-car commerce, 2) autonomous drive, and 3) data monetization. Within each of these themes, different avenues of generation are possible. However, each of these three areas must also be related to data processing which is seen as a vital aspect. For in-car commerce, the possible use cases brought up in the literature review and results are summarized in table 6.1. However, the focus of the firm is not to develop their own software except for car-specific applications. The result is that even though the firm has become more aware of its increasing B2C interactions, the only possibility for digital revenue streams within in-car commerce is through revenue sharing, partnerships, and subscription packages. Autonomous drive is an in-house software service that can be sold directly to consumers or businesses, the use cases can be viewed in table 6.1. The autonomous drive service is reliant on the cars having hardware previously fitted, allowing the installation of the autonomous drive service at a later date. Yet there is an internal divide within the firm on the topic of standardization of the hardware in the cars. Data generated from these two other themes allows the generation of data monetization. Data monetization can be primarily done through selling data, selling data services, and selling insights. The specific use cases for data monetizing can be viewed in table 6.1. A limiting aspect of data monetization is the numerous regulations in different regions that must be adhered to. The case firm operates globally and thus there were several challenges regarding areas such as sourcing internet access, compliance, and differences in local markets. For each of the three main areas, data processing can be seen as the back end which utilizes sensors and HD map that allow for the three main themes to exist. Thus, data processing is necessary for the generation of digital revenue streams. Our results contribute what digital revenue stream use cases that are appropriate in the automobile industry. The use cases identified can be reviewed in table 6.1. This thesis has showcased that use cases in literature and in empirical material are both similar and different.

Table 6.1: Use Cases Identified in Theory and Empirics

	Use Cases Identified in Theory	**Use Cases Identified in Interviews**
Autonomous Drive	Mobility-as-a-Service Car sharing and taxi services Parking lot optimization Cargo delivery	Getting a parking space Automatic parking After sales
Data Monetization	Keep the data proprietary Selling data to insurance companies Using data for preventive maintenance Selling data to service repair shops Target adds and content Concierge services Trade the data to business partners for shared benefits Make the data available (and even free) to many users	Ads Monetizing IP Selling road data to municipalities, cities, suppliers and business partners Selling telematics data Decision making based on data Compliance to regulation Development of products Selling data to insurance companies Data sharing for safety purposes
In-Car Commerce	Location-based services Mobile advertising Mobile entertainment services & games Mobile financial applications Product locating & searching Wireless reengineering Mobile internet Mobile shopping Payment for parking Automatic searches	Entertainment apps OTA Navigation apps App searching through marketplace

6.1 Recommendations

Finally, 4 recommendations to the researched automobile company are summarized bellow:

- Focus on revenue sharing with developers
- Standardization of hardware
- Develop data enhancing capabilities
- Align people through education, cross-functional teams, and common interpretations +Workshops

Firstly, the company has chosen a strategy where they outsource the development of "non-essential" software applications in the car. Given this proposition, they have limited capability to directly gain digital revenue from the car owners. Hence, to gain revenue streams from apps it is recommended that they try to partner with developers. For instance, charging a fee for having their apps pre-installed in the car or sharing specific data with the app and asking for a share of the revenue.

Pros

- Gaining digital revenue from apps
- Can focus development resources on other endeavors

Cons

- Lose some app development capability
- Becomes more dependent on third-party actors

Secondly, based on the prevalence of OTA and the company's capability to sell software packages after the sale of the car, standardization is recommended. Standardization allows the company to gain digital revenue streams in several ways such as 1) customers can buy the functionality of their hardware at a later date when needed, 2) R&D can more easily integrate hardware and software if variety is limited, and 3) the cars can be updated and improved increasing their life-time and thus allowing for a longer period of digital revenue from a customer.

Pros

- Lowers software-hardware integration costs
- Allows for an additional point of digital revenue

Cons

- Increases hardware costs
- Environmental costs associated with hardware not being used

Thirdly, given that the company is a controller of data and "raw" data has low value, they should develop data enhancing capabilities to gain additional digital revenue. Data-enhancing capabilities as described here refers to the capability to create insights or services on the data at hand to increase its value. The company should contact and discuss the needs, collaboration, and solutions of potential customers such as municipalities, city authorities, suppliers, business partners, and developers.

Pros

- Better utilization of the Company's data resources
- Increases data science capabilities

Cons

- Substantial sales and technical resources needed
- High risk associated with launching or developing new products

Fourthly, a lack of information sharing between departments was observed at the company, also ambitions regarding digital revenue streams varied depending on the division. It is important to align the company or at the least relevant personnel who work within the areas of autonomous drive, data monetization, and in-car commerce. Four improvement areas have been identified: 1) company education of digital revenue visions mission, 2) clear definitions of key terminology, 3) mapping out data available and what department has it and how it is used, and 4) create a cross-functional team to work solely with digital revenue streams.

Pros

- A better foundation for the company to develop digital revenue streams
- Better utilization of personnel and productivity with regards to the development of digital revenue streams

Cons

- Cost in both monetary and time aspects
- The current low digital revenue steam might not justify the costs associated with this recommendation

6.2 Generalizability of Findings

As previously mentioned in section 2.4.2 Transferability, the generalizability of this thesis will depend on the context in which the findings are aimed to be used. Moreover, some of the findings depend more on certain aspects of the context presented in the introduction of this thesis. Thus, while all of the findings may not be applicable in all situations, there could be some broader transferability in specific situations. One way to categorize such situations is to break down the situation OEMs are in. Some of the things that the researcher of

this thesis found important for the context the findings where the macro trends shaping the industry: 1) servitization, 2) sensor technology, and 3) digilatization

6.2.1 Servitization

Servitization is a macro trend that is affecting the automobile industry in particular, which can be observed by the shifting customer preferences which are increasingly emphasizing the in-vehicle experience over the driving experience. Based on the empirical findings of this thesis, the most feasible way for the automobile industry to adapt to such change is through digital means. In other industries this might not be the case, if there is more room for hardware improvements and that is more valuable for the customers in another context then any findings associated with the theme in-car commerce might not be transferable. In-car commerce is after all build upon the ability to allow end-users to interact with the car facilitating the in-vehicle experience.

6.2.2 Sensor Technology

Advancement in sensor technology is another macro trend that allows automobile firms to gather an increased amount of data, both in quantity and quality. Relating the trend to automobile firms, the trend is especially relevant for hardware manufacturers since they are positioned to take advantage of such a trend due to their historical use of sensors in their products. Thus firms in industries that do not use sensor technology might find some of the findings of this thesis non-transferable. Findings related to the themes of data monetization and autonomous drive are especially sensitive to this trend. Data monetization builds upon different types of data being readily available. If there exist no sensors in another situation then findings related to telematics data will be hard to generalize. In such cases, some of the findings related to monetizing consumer data could potentially still be generalized, given that consumer data exists within the context of another industry. Autonomous drive is on the other hand very dependent on the automobile industry. Perhaps there are scenarios in other industries related to transportation such as the railway industry, tramway industry, trucking industry, aviation industry, and marine shipping industry.

6.2.3 Digitalization

Digitalization is a macro trend affecting the automobile industry. In particular, increasing emphasis has been made on software offerings centered around the car as a product. Moreover, new entrants who are connected to the technology area are also entering the market, increasing competitive pressures. Thus, the generalizability of the findings related to digitalization might not be suited for industries with low competitive pressures, nor industries with no physical products. Thus the results could potentially be transferable to other OEMs outside the automobile industry. Digitalization is strongly related to all of the three main themes. All of the themes are ways to generate digital revenue streams, and thus there is an inherent connection.

6.3 Future Research

The thesis aimed to examine existing and literature and compare it to an automobile firms practices. While a completely exhaustive list of use cases and areas describing the generation of digital revenue streams has not been given, this thesis has provided a foundation that can be further built upon.

Whilst the focus of this research has been on direct revenue streams, further research dedicated to indirect revenue streams could provide readers with a different perspective on the topic of digital revenue streams in the automobile firm. The areas that may be of interest for further research include 1) increasing quality of products, 2) retention of customers, and 3) technical requirement found in figure 3.1. Furthermore, it is valuable to direct future research towards building a practical and strategic framework that the company can apply in its daily operations.

Finally, while this thesis has provided in-depth knowledge, a future quantitative study could provide broad knowledge. For instance, a quantitative study could incorporate more firms and thus be able to validate or refute the findings of this study in a generalized context. Furthermore, in this study the impacts of the respective themes have not been quantified, this could be done in a future study.

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A | Appendix - Interview Template

Ethical Considerations

- Are we allowed to record this session with the intent to use the recording to transcript the meeting?
- You will stay anonymous in the published material.
- The company in question will look through the thesis to be publicized before publication to stay in accordance with the NDA that we have signed.

General question

- Could you tell us more about your division [insert name of division] and what you do?
- Could you tell us about your division's vision of digital revenue streams?
- What are some of the major barriers to overcome in data monetization of personal cars?

Legal

- Data Monetization
  - Could you tell us more about your division [insert name of division] and what you do?
  - Could you tell us about your division's vision of digital revenue streams?
  - What are some of the major barriers to overcome in the data monetization of personal cars?

R&D

- Data consumption
  - How is data gathered from cars?
  - How do technical constraints limit data gathering?
- Data Monetization
  - How do R&D use data gather from the cars?

  - Is there any problem with using gathered data?

S&BO

- In-car commerce
  - Could you tell us about the ecosystem in connection to in-car commerce?
  - How do you generate revenue?
- Data consumption
  - What data is needed in the ecosystem?
  - What is your view on data collection?
- Data Monetization
  - What is S&BOs strategy and vision regarding digital revenue streams?

Market intelligence

- In-car commerce
  - What business potential do you see within the in-car commerce market?
  - What are the customer needs?
  - Could you give us an overview of "the firms" Digital ecosystem?
- Data Monetization
  - What trend do you see in the automobile sector with regards to data monetization?
  - How does the market for data look like?

B | Appendix - Areas in Literature

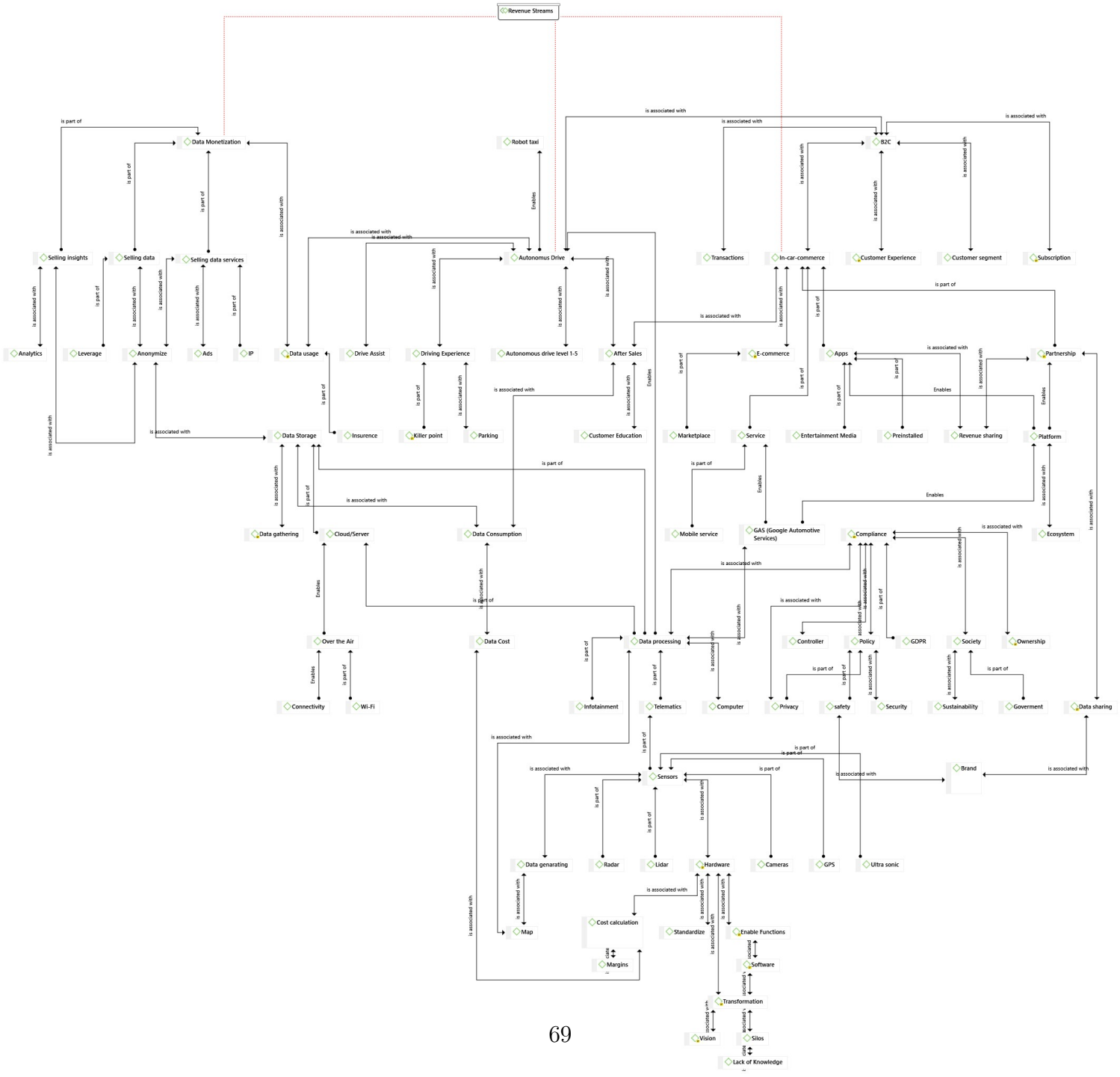
Table B.1: Areas Identified in Literature

	Mikusz, Schäfer, Taraba, & Jud (2017)	Guptha & Sandu (2018)	Viereckl, Ahlemann, Koster & Jursch (2015)	Frost& Sullivan(2019)	Varshney, Vetter & Kalakota (2000)	Hartmann, Zaki, Feldmann & Neely (2014)	Seiberth & Gründinger (2018)
Complementary solution	x						
Efficient Customization	x						
Open Commerce	x			x			
Digital Lock-In	x						
Data Orchestrator	x						
Autonomous Vehicles		x	x				
Security and privacy Requirements		x					
High Mobility		x	x				x
Dynamic Paring		x					
Location Centric		x					
Cloud		x					
Time sensitivity		x					
Aggregator of data and audiences			x				
Digital service provider			x		x		x
Digital augmented product provider			x				
Digital enabler			x				x
Minimizing costs			x				
Home integration			x				
On-the-go retail				x			
Inventory Management					x		
Digital revenue streams uses data as a key resource						x	x
safe guarding							x
Customer experience							x
Digital Life							x

Table B.2: Aggregated Areas Identified

In-Car Commerce	Increasing Quality of Hardware	Retention of Customers
Autonomous Drive	Technical requirement	Data Monetization
Other		

C | Appendix - Thematic Analysis



Revenue Stream Themes

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