

# Managing the power position of an automaker in the supply network of semiconductors;

A case study Master's thesis in Supply Chain Management

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### Abstract

The automotive industry is today facing a technological paradigm shift when electrifying, introducing autonomous driving and connected vehicles. This has led to new dynamics in the supply chain of the focal company. Historically, automakers have been accustomed to possessing buying power over its suppliers which is now changing due to great dependence on suppliers' technological developments. This, in combination with high competition on the semiconductor market has resulted in supply disruptions. This master thesis was initiated by an automaker with the intention to investigate how to manage the supply chain of semiconductors in order to secure supply and to stay competitive.

This case study aimed to investigate if it is possible to change the power position of the focal company by looking into present sources of power in the network and using purchasing strategies to address these sources of power and thus change power position. The case study took a qualitative approach where data was collected through interviews at the focal company and with other stakeholders in the network of semiconductors. Factors that influence the supply of semiconductors were identified as variables of customer attractiveness which was found to correlate with sources of power found in theory. It became clear that sources of power present in the different relationships were based on the suppliers' subjective view of an attractive customer. Thus, every individual relationship ought to be handled and adapted to these variables of customer attractiveness in order to improve the relationship and thereby be able to secure supply.

Conclusively, the report highlights the importance of changing from a dyadic supply chain perspective to a network perspective with regards to handling strategic relationships according to the subjective sources of power present in the relationship. This study proves that increasing the customer attractiveness towards suppliers contributes to a better power position, thus increasing the resilience of the supply chain i.e securing supply and the companies competitiveness on the market.

**Keywords:** Buyer dependence, sources of power, customer attractiveness, strategic purchasing, semiconductor management, automotive industry

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Anna Erkén

Moa Josefsson

## Abbreviations

BOM - Bill of material

- **CVC** Commercial Vehicle Company (pseudonym for the company)
- GAC General Agreement Contract
- ESI Early Supplier Involvement

NDA - Non-Disclosure Agreement

- NPD New product development
- **OEM** Original equipment manufacturer

#### **R&D** - Research & Development

- **RDT** Resource dependency theory
- **SRM** Supplier Relationship Management

VG - Vehicle Group (Pseudonym for the mother company)

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### 1. Introduction

This master thesis is focused on how to manage an automakers power position in the supply network of semiconductors. This chapter includes the background to the thesis which consists of a presentation of the case company, the automotive and semiconductor industry. Additionally, the aim and research questions are presented, followed by the thesis's delimitations. Lastly, the disposition of the thesis is presented.

#### 1.1 Background

This chapter covers the company presentation followed by an explanation of the characteristics of the automotive and semiconductor industry. While reading this chapter it will become clear that there are differences between the industries which makes it challenging for them to be compatible. The reason for presenting these characteristics is to enhance the understanding of the underlying aspects related to the problem. The aim and research questions will thereafter be presented.

Throughout the report, the company will be referred to as the focal company or the Commercial Vehicle Company (CVC). The corporation group that CVC belongs to will be referred to as the Vehicle Group (VG). These pseudonyms will be used throughout the report in order to keep the focal company anonymous.

#### 1.1.1 Company presentation

The focal company is an European commercial vehicle manufacturer. The company is part of a multinational automotive manufacturing corporation, called VG, which represents a large part of the global automotive industry. VG has, other than CVC, a number of other automotive brands. The range of brands within the group are wide, from low-consumption cars to heavy duty vehicles, with brands ranging from basic to premium and luxury. CVC together with two other premium vehicle brands in the group are the main profitable ones.

Semiconductors are not sourced directly by the focal company but sourced by their tier 1s who incorporate them into their products. For the product segment in focus of this study, the products (components) are mainly developed in a collaboration between the focal company and their tier 1s due to the products' technological nature. When a company does not have all resources and capabilities needed for product development in-house, they need to collaborate

with suppliers that possess the competence and technology (Melander, 2014). By doing this it is possible to improve quality, reduce development costs and time to market (Johnsen, 2009).

Today, within the product segment in focus, there is a difference in knowledge of the content of the sourced products. In products that are developed in collaboration with the supplier, CVC specifies exactly which semiconductors that should be used and are having total understanding of the content of the product. In black box products, CVC does not know which kind of semiconductors that are incorporated into the products they buy from their tier 1s. This results in a reactive approach towards shortages.

The purchasing organization works closely with the quality and the research and development (R&D) department. All purchasers work with one person from quality and at least one person from R&D. The purchasing organization is divided into project purchasing and commodity purchasing. The first is involved in the new product development (NPD) process and the latter takes over once the product enters production. The purchasing department sometimes questions the specification coming from R&D in order to increase the tolerance to broaden the supply base.

The supplier selection takes place three to four years before the part is introduced in production. After it is introduced, the contract with the supplier covers at least seven years of production, making the company locked-in with a supplier for at least 10 years. This length of contracts is required as the products have long product life cycles and to obtain return on investments. The more knowledge CVC has about a technology, the more detailed the specifications are and the more involved they are in the development of new products with suppliers. The parts and features that give the company competitive advantages are developed in-house.

#### 1.1.2 Automotive industry

The automotive industry is highly competitive and there are a few large original equipment manufacturers (OEMs) dominating the market. To be competitive, profitable and defend market share, one alternative is to lower cost. Historically, the solution has been to outsource manufacturing to low cost countries (Grodzicki & Skrzypek, 2020). The vehicles are today customized which demand high variety and small lot sizes which makes flexibility and adaptability important (Zapp et al., 2012). When outsourcing manufacturing functions it is possible to increase flexibility, improve quality, reduce development time and increase focus on core competencies. However, it also puts technological development in the hands of the suppliers. The trend of outsourcing is noticed at tier 1 and tier 2 level as well, which makes the

supply chain longer and more complex. Today's automotive industry is thereby characterized by global production networks and fragmented supply chains (Schwabe, 2020).

Generally, the majority of the buyer-supplier relationships are between small suppliers and the OEMs. The small suppliers deliver customized components which are defined by the OEM. These suppliers are often dependent on the OEM. The dependency is generally derived from high costs of switching since the supplier has invested in tools and technology to make specific customized components (Schwabe, 2020). The OEMs strive to maintain close relationships with a few suppliers for strategic items and have multiple suppliers for commodities to lower cost and reduce risk (Wie & Chen, 2008).

A vehicle is composed of approximately 15 000 components and the purchasing costs represent approximately 70% of the costs of goods sold which makes purchasing an important function (Zapp et al., 2012; Wie & Chen, 2008). Purchasing decisions in this industry are made mainly based on total cost and relevant risk factors, including transaction costs and costs for managing long value chains.

Historically the automotive industry has been characterized by incremental technological changes but it is now facing a technical paradigm change when going electric (Schwabe, 2020). The big shift to electrical vehicles is partly a result of new laws and regulation connected to the ongoing climate change. According to Skeete (2017), environmental regulations are one of the main drivers for innovation within the automotive industry. The focal company in this thesis is manufacturing commercial vehicles, and within this sector they are producing heavy duty vehicles, which is a segment that is responsible for 25% of all road transport emissions and 6% of the total emissions in the European Union (EU) (European Commission, n.d). In order to reach the Paris Agreement the EU has set up both regulations and incentives specifically for this sector to reduce pollution and CO2-emissions (Regulation of the European Parliament and of the Council (EU) 2019/1242).

Technology uncertainty, rapid changes of product specifications and process technologies gives rise to increased supplier involvement to cope with risks such as materials disruption and obsolescence (Xiao et. al., 2019). The ongoing technological paradigm shift from combustion to electric engines in the automotive industry proves this point. This type of high level of supplier involvement puts the buying firm, the OEM in this case, in a dependent position since the switching costs are high after making relationship-specific investments and commitment (Gelderman & van Weele, 2004). The dependent position could be seen as inevitable as the OEM needs its supplier to cope with new product development in technology uncertainty.

The transformation of conventional vehicles into electric and autonomous vehicles leads to a shift of the core business and strategic items for the automotive OEMs. As an implication, the share of electronics, especially semiconductors, are increasing in the bill of material. A change in industry structure, like this technology transformation, can boost or erode profits in an industry (Porter, 2008). One reason for this is that it can make the power between supplier and buyer shift. The fact that big semiconductor manufacturers are acquiring smaller players, is narrowing the supply base of semiconductors (Roland Berger, 2019). This increases the supplier power since the buyer has less freedom to choose a supplier (Caniëls & Gelderman, 2005; Kähkönen & Virolainen, 2011). Increased supplier power can affect profitability since the buying firm won't be able to push down prices and cut costs like before, which will result in reduced profit margin and deteriorating competitiveness (Porter, 2008).

The importance of managing semiconductors is therefore growing and the OEMs dependence is increasing in relation to the semiconductor manufacturers. Automotive OEMs are used to having buying power over their suppliers but are now facing a situation where they are dependent on their suppliers for electronics. Supplier relationship management is therefore of importance and can be used to make the most out of the power position a firm is situated in and minimize the supply vulnerability (Kraljic, 1983). Therefore, this study will explore how to cope with buyer dependence in order to secure supply of semiconductors and continue to be competitive in an technology uncertain environment.

#### 1.1.3 The semiconductor market

The evolution of technology has brought electrification, automation and connectivity to the market and these technologies are set to be drivers of the transformation of society and the automotive industry in particular. The technological evolution is predicted to considerably increase the share of electronics in vehicles' bill of material (BoM), especially semiconductors (Roland Berger, 2019). Since multiple industries will be affected by technological transformation towards electrification and automation, the increase of the overall electronics demand is substantial and different industries will compete for the same components. At the same time, the supply base has become consolidated since big companies have acquired smaller players during the past 10 years. Additionally, the semiconductor manufacturers are moving closer to the OEMs in the value chain as they are expanding their business from hardware to also include software and applications.

Semiconductor manufacturers are divided into different groups depending on which production steps they are performing. Integrated device manufacturers (IDMs) both design and

manufacture semiconductors. Fabless companies only design the semiconductor while they outsource the manufacturing to a foundry company who only manufactures the product.

The world leading semiconductor manufacturers today are Intel representing 15,6% of the global market followed by Samsung with 12,4% market share and SK Hynix with 5,5% (Statista, 2021). All these manufacturers are delivering to the automotive industry, however the largest share of their semiconductors are allocated to the computer, communication and consumer electronics industry. Instead the largest allocation of volume to the automotive industry is represented by NXP, Renesas and Infineon. NXP is the biggest supplier and together with Renesas the companies represent approximately half of the semiconductor volume towards the automotive industry (Purchaser, personal communication, April 2021). Common for all these actors is the trend of increasing lead times and pricing caused by the high market demand.

As presented in Figure 1, the automotive sector represents 12.2% of the semiconductor market and competes with communication (33%), PC/computer (28.5%), consumer electronics (13.3%) and industrial (13.0%) sector (Gartner, 2020). By comparison, one of the largest automotive companies' semiconductor expenditures is USD 4 billion, compared to the largest company in the consumer electronics industry with expenditures amounting to USD 56 billion (Herin, 2021). As a consequence, the automotive industry is not given priority. The focal company represents an almost negligible percentage of the semiconductor volume share which makes the company a small player with a volume that ought to be rather unattractive for semiconductor manufacturers. Even though it is a small player it demands approximately 650 000 000 semiconductors per year, roughly calculated, which as earlier mentioned is a number expected to increase.



Figure 1. Market share of semiconductors 2019 (Gartner, 2020)

The covid-19 pandemic has further increased the competition for semiconductors. When the production in the automotive industry slowed down, and to a certain degree stopped in the wake of the pandemic, the semiconductor manufacturers shifted their supply towards consumer electronics. As a result, it is even more difficult to allocate semiconductors for the automakers today, six months to a year later, when the production is up to full speed again. Being a small player, as our case company, makes it even harder.

Big OEMs in the automotive industry purchase semiconductors indirectly via tier 1 or distributors. In most cases, for components containing semiconductors, OEMs are dependent on tier 1. This is an unfamiliar situation for OEMs that, historically, are used to having power over suppliers due to the fact that tier 1s are relying on OEMs to access the market (Gandia & Gardet, 2019). This in combination with semiconductor shortages has resulted in big OEMs in the automotive industry expressing dissatisfaction towards their tier 1 and are now considering sourcing directly from semiconductor suppliers (Schwartz & Steitz, 2021).

This highlights the importance for the automotive industry to secure the supply of semiconductors as shortages can lead to loss of sales, loss of market share and lag in technology development (Zapp et al., 2012). Further, the total cost of semiconductors is projected to increase which puts pressure on cost efficiency to stay competitive (Roland Berger, 2019).

#### 1.1.4 Automotive vs semiconductor industry

Zapp et al. (2012) highlights the differences of the characteristics in the automotive and semiconductor industry where it is clear that asymmetry occurs in both product characteristics and manufacturing strategies. These differences complicate the alignment of processes as well as the accurate execution of capacity plans. The characteristics of the automotive and semiconductor industry identified from 1.1.2 and 1.1.3 are summarized in Table 1, which clearly shows discrepancy between the two industries.

Characteristics	Automotive Industry	Semiconductor Industry
Network position	OEM	Tier 2 or Tier 3
Product's life cycle	Long	Short
Lot sizes	Small	Large
Lead times	Short	Long
Flexibility in production	Flexible	Inflexible

Table 1. Characteristics of automotive and semiconductor industry (Zapp et. al, 2012).

Vertical Integration	Moderate	Low
Planning Horizons	Short	Long
Demand	Stable demand	Seasonal demand

The automotive industry is characterized by a large network contributing with a large share of the added value. The network consists of suppliers on a tier 1 and tier 2 level where the semiconductor industry, most often, acts on a tier 2 level contributing to a small but critical share of the added value.

Semiconductor manufacturers' most important allocation variable is volume due to the fact that they need high utilization in the production in order to generate profit. Semiconductor manufacturers are possessing an utilization ratio of 90-95% in their productions (Zapp et. al, 2012). The high investment costs in the semiconductor industry requires high production utilization at the chip manufacturer to stay profitable, therefore large lot sizes are of high importance. On the contrary, the automotive industry is characterized by small lot sizes with a great number of variance. This, along with that the lead times are very long (10-16 weeks) with a high number of process steps at the semiconductor manufacturing plants, urges the need for long planning horizons. After the covid-19 pandemic the lead times are now up to 36 weeks for some semiconductors and orders have to be placed nearly 6 months ahead (Senior Purchaser, personal communication, February 2021).

Longer planning horizons are also needed due to the seasonal production at the semiconductor manufacturer. The automotive industry has to consider that semiconductor production changes towards consumer goods during Q3 to secure supply for holidays (McKinsey, personal communication, February 2021). This means that no volume during this time will be directed towards the automotive industry. The automotive industry is characterized by stable demand which makes the seasonal production at the semiconductor manufacturer an alignment deviation.

The long product life cycles in the automotive industry also clashes with the short technology cycles occurring in the production of semiconductors (Zapp et. al, 2012). The high pace of technology changes makes it hard for semiconductor manufacturers to deal with products with long time spans, such as the product life cycles of 15 years in the commercial vehicle industry. At the same time, actors in the automotive industry settle for electronics that are located later in the life cycle. However, this means that when a vehicle is introduced at the market, the

semiconductors are already old which leads to the obsolescence of a component occurring earlier and earlier. The tier 1 of the OEM is then forced to do a "last-time-buy" or redesign the product as the volumes are too small for the semiconductors to continue to produce (Purchaser, personal communication, April 2021)

It is difficult for semiconductor manufacturers to optimize the production as there is a demand for fast technology changes from their biggest customer groups with the largest volume; the PC and communication industry. These customer groups drive the fast technology change and they are needed for the manufacturers to survive.

#### 1.2 Aim and Research questions

The new technical paradigm shift in the automotive industry has put the focal company in a new power position, unfamiliar to the firm. The aim of this study is to define their power position in the semiconductor network and create an understanding of how to manage supplier relationships when the company does not possess a dominant position towards suppliers. This study also aims to investigate if it is possible to change the power position of the focal company in order to secure supply of semiconductors, by looking into present sources of power in the network and using purchasing strategies to address these sources of power and thus change power position. In order to fulfill the aim of the thesis, two research questions have been constructed:

*RQ1:* How does CVC's power position towards their suppliers affect the supply of semiconductors?

*RQ2:* How can CVC secure their supply of semiconductors through purchasing strategies when being dependent on their suppliers?

#### **1.3 Delimitations**

This case study will focus on how CVC ought to act in the supply network in order to secure supply and cost efficiency. The study will focus on the automotive industry. However, the report will consider the effect other market segments have on the competition on the semiconductor market.

This project will consider all stakeholders up until the semiconductor manufacturers in the supply chain, i.e. tier 1 suppliers, tier 2 suppliers and manufacturers. The wafer, a critical component in the semiconductor, will thereby not be part of the supply chain included in this report. This decision was made due to time restrictions however also due to restrictions of possible interviews.

Since different types of semiconductors can be included in one component, this study will focus on components including semiconductors, rather than solitary semiconductors. The buyersupplier relationships studied in this report are between CVC and suppliers who supply components with active semiconductors, no other components will be considered.

Since there is no physical exchange between CVC and semiconductor manufacturers we will only look at the relationship between CVC and tier 1 suppliers and tier 1s and semiconductor manufacturers. The latter relationship will be studied on a general level and not between a specific tier 1 supplier and specific semiconductor manufacturer.

#### 1.4 Disposition

The remainder of this paper is organized as presented in Table 2.	Table
2. Disposition	

Chapter	Content
1 Introduction	
	Background including characteristics of the automotive and semiconductor industry and case company description. Further, the aim and research questions are presented in this chapter
2 Theoretical frame of reference	
	Highlights the theory that we use as a foundation for our research and we also account for the framework used in our study
3 Method	
	Describes the research process, approach, strategy and techniques applied.
4 Stakeholders' different perspective on securing supply	Analysis of different actors' perception of success factors to secure supply of semiconductors
5 Analysis of how to change power position	
	Analysis of CVC's current power position and how they could change their power position.

6 Discussion	The findings are compared to theory and discussed
7 Conclusion	Conclusions and recommendations

## 2. Theoretical frame of reference

This chapter highlights the theories that were used as a base for the research. Resource Dependency Theory was used to understand the dynamics of buyer-supplier relationships (Pfeffer & Salancik, 1978). In chapter 2.1, power and dependence is introduced as well as power positions, followed by an explanation of the sources of power and how they can be altered through various purchasing strategies. Power positions, sources of power and purchasing strategies are tied together in the framework applied in this thesis which is presented in chapter 2.1.3. The following chapter presents how to manage supplier relationships and how to, by the use of the extended kralic matrix, be able to change power position. Since the focal company is acting in a technology uncertain environment with a high degree of supplier involvement, chapter 2.4 presents the theory behind these topics. Chapter 2.4 is dedicated to explaining cooperative purchasing since the concept caught our interest during the study as a possible solution to alter some sources of power and thereby change the power position of the focal company. Chapter 2.5 and 2.6 explains the theory of take and pay and geographic stockpiling respectively, which are two strategies used by other market actors to secure supply of semiconductors. Finally, chapter 2.7 presents the sources of power affected by the presented purchasing strategies.

#### 2.1 Power and dependence

In research, power has been found to be a social construct and someone's ability to make someone else act differently from how they would have acted if they had not been influenced (Emerson, 1962; Wilkinson, 1996). When power in organizations and interorganizational relationships is studied, it is often based on the Resource Dependency Theory (RDT). The theory explains that power lies in the hands of the actor who obtains the resources needed for an activity to take place (Pfeffer & Salancik, 1978). Medcof (2001) argues that the relationships a firm has with other firms also affects its power.

Power is claimed to be rooted in dependency, and that the party that is less dependent in a relationship possesses power over the other party (Emerson, 1962; Pfeffer & Salancik, 1978). This power imbalance (Casciaro & Piskorski, 2005), or asymmetry of power, affects the buyersupplier relationship's characteristics and performance (Kähkkönen et. al, 2014). Actors in a supply network then have different power positions towards each other, which according to RDT can be changed by altering the actors level of dependence (Emerson, 1962). The RDT distinguishes between four power positions; independence, buyer power/dominance, supplier power/dominance and interdependence.

Independence is when neither party is dependent on the other. Caniëls & Gelderman (2005) defines buyer power as the difference between the supplier's dependence and the buyer's dependence. The authors also define supplier power as the difference between buyers's dependence and supplier's dependence. These asymmetric relationships are suggested to be less effective than mutual dependent relationships as the party possessing the power may be tempted to exploit it which gets the other actor dissatisfied with its position (Casciaro & Piskorski, 2005). Interdependence, also called mutual dependence, occurs when both parties have a similar level of dependence on each other and can be summed up to a total interdependence or total mutual dependence (Casciaro & Piskorski, 2005). Low level of mutual dependence (Casciaro & Piskorski, 2005). Low level of mutual dependence is thereby necessarily not a disadvantage and Caniëls et al. (2017) found that it can contribute to supplier satisfaction. Opposed to contemporary research, Caniëls et al. (2017) also found that power asymmetry can lead to high supplier satisfaction, regardless if it is supplier or buyer dominance.

#### 2.1.1 Sources of Power

Even though the topic of power and dependency is heavily discussed in academia, the sources of power and dependency and its effect on strategy is not (Gandia & Gardet, 2019). Gandia & Gardet (2019) distinguishes between two different sources of power, internal and external, where internal sources of power are further categorized into tangible and intangible resources. The authors further argue that the scarcity of resources and expertise is the main reason for internal dependency. External dependency is also further categorized into "nature of technology" and position within the network. By obtaining technical capabilities coveted or required by external companies, the latter become more dependent and the former increases its power. Further, in order to commercialize products, upstream manufacturers rely on

downstream actors which implies that manufacturers are dependent on actors closer to the market as they have access to the market (Gandia & Gardet, 2019).

According to Kähkönen & Virolainen (2011) power is a way to identify different functions each stakeholder possesses in a network. It is, as mentioned by Gandia & Gardet (2019), a common perception that OEMs possess a higher power position than upstream actors. By identifying variables that can increase or decrease power, it is possible to change the power position of an actor (Pazirandeh & Norrman, 2013). Pfeffer (1981) argues that by controlling resources and technology, tiers and manufacturers are able to shift their power position towards the OEMs. Therefore, a major source of power in relationships is the possession of tangible and intangible resources. Xiao et. al. (2019) further argues this point by claiming that buyer dependence, thus supplier power, occurs when suppliers possess a large complex network, high technological capabilities and expertise as well as non-substitutable resources and products. Some sources of power may affect the increase of other sources of power. For instance, market power and size affects the demand share according to Kähkönen (2011).

Shelby D. Hunt & John R. Nevin (1974) presents another perspective of power as a function of sources in a channel that are available to the stakeholder in the network. The authors claim that sources of power can be divided into coercive and non-coercive (Hunt & Nevin, 1974). Coercive sources of power exist when there is a negative incentive, i.e. punishment, while noncoercive is accepted by common ground or readiness to allow power to be used by a party. According to Kähkönen (2011), the aim of non-coercive sources is to have an impact on attitudes which is proved to be beneficial rather than focusing on negative incentives that are proved to have a negative impact on relationships.

According to Pfeffer (1981), one can analyse power sources in different levels; Network-, relationship- and organizational-level (Figure 2). The sources of power in a network is determined by the actors and structure of the network. By looking into power in relationships between actors in the network, one can determine the power an organization possesses within that relationship. The sources of power in this context is based on the characteristics of the relationship with regards to: control of information, negotiation skills, experience, type of product, switching costs, volume, length of relationship etc. On the organizational level Pfeffer (1981) argues that the power can be determined by looking at the organization individually rather than looking at the organization in relation to another actor. The sources of power in this context is based on the characteristics of the company and the offers of the company such as

uniqueness, brand, expertise, size, financial and economic resources. This correlates with the source of power called reputation by Pazirandeh and Norrman (2014).



Figure 2. Power sources can be found on different levels (Pfeffer, 1981)

Pazirandeh & Norrman (2014) presents sources of power accumulated from several articles, where the main sources of power identified are divided into six categories: substitutability, demand share, interconnection, information asymmetry and reputation. The categories touch upon all three levels of power mentioned in Pfeffers article; network, organization and relationship. The categories also align with the presented sources of power from the articles of (Xiao et. al, 2019), (Kähkönen et. al, 2011), (Gandia & Gardet, 2019) and (Hunt & Nevin, 1974). By identifying the current state of these categories it is possible to decrease or increase power by managing indicators (Pazirandeh & Norrman, 2014) which are presented in chapter 2.1.2.

#### 2.1.2 Indicators of sources of power

The category *substitutability* in Pazirandeh & Norrman (2014) refers to how easy it is to replace a supplier with a new one. Low substitutability means high market concentration while high substitutability can be compared to perfect competition. This takes into consideration how many suppliers that are available on the market as well as existing entry barriers for new suppliers to enter the market. If it is possible to use substitutional products to replace the existing product, i.e. if there is any substitutability of demand, is also an indicator in this category. Substitutability of supply can be altered through increasing the number of the suppliers, and a firm can use global sourcing to widen the supply base (Van Weele, 2010).

Substitutability of demand can be changed through increased standardization of parts as it makes it easier to change the supplier (Porter, 2008).

The second category is *demand share*. One indicator of this is how much a buyer accounts for the supplier's total sales. This explains how competitive a company is with regards to volume of the market. Kähkönen et al. (2014) found a significant and negative correlation between a company's spend of suppliers turnover and buyer dependence, which means that if the buying firm's demand share increases their buyer dependence decreases. One way to increase the demand share is to pool the demand with other actors through cooperative purchasing (thoroughly explained in 3.4) or pooling several demand types at the same supplier (Caniëls and Gelderman, 2005)

The category *interconnection* explains the history and characteristics of a relationship. One indicator is commitment which refers to how much information is shared and what type of contracts that are used to organize the relationship. Another indicator is based on how high importance that is attached to the exchange between the actors. Pazirandeh & Norrman (2013) explains it as follows; "...power asymmetry is derived from unequal importance given to exchange relationships". Vital questions to answer are how involved each actor is in decisionmaking and if the relationship is based on trust or if power is exploited. If a strategy for longterm partnership is applied and thereby joint investments are made, knowledge is shared and trust is developed (Jonsson, 2005), the interconnection is high. If a strategic decision is made to keep the supplier on an arm's length and competitive bidding is practiced then the interconnection will be lower.

*Information asymmetry* concerns the difference of shared information between actors. It shows how transparent a relationship is with information and how much and what type of information that is shared between the actors. Prajogo et al. (2020) argues that higher commitment, i.e longterm relationships, benefits the information and knowledge sharing. This shows interdependence between *information asymmetry* and *interconnection*. Information asymmetry determines how well aware an actor is about its surrounding network and its capacity and performance. Due to the interdependence, the purchasing strategies mentioned for interconnection, also affects information asymmetry. High Information asymmetry shows that the actor is *not* well aware of its surroundings.

The category *reputation* depends on a company's characteristics and resources as well as how other stakeholders perceive this actor to perform as promised. Indicators within this category aim to answer how a company competes with price, expertise, technological sophistication and size (Pazirandeh and Norman, 2014). The importance of branding is also highlighted which

pays regards to social as well as organizational aspects. High reputation proves a reliable customer with a good reputation.

Buyers in a dependent position also have to consider how *attractive* the supplier perceives them to be. Schiele and Vos (2015) argue that negative effects of being dependent on a supplier often occurs when the supplier does not perceive the buyer as attractive. This can lead to suppliers exploiting their position. A dependent buyer can suffer from amplified dependence if the knowledge of how to attract the supplier is limited (Pazirandeh and Norrman, 2014). Companies can decrease the power gap by finding ways of getting the suppliers attention, thus increasing attractiveness (Ellegaard, 2004). By doing that it is possible to access resources and expertise and as a result decrease dependency. Increasing the attractiveness and becoming a preferred customer can even give the company a competitive advantage and yield the buyer preferential resource allocation (Pellegrino et. al., 2020)

Patrucco et. al. (2018) further argues that being an attractive buyer both benefits technical developments and cost reductions. The attractiveness of a customer depends on the supplier's subjective view of attractiveness which has to be taken into consideration (Ellegard, 2004). The author emphasizes the importance of differentiating between suppliers since attractiveness is experienced differently for different suppliers. Hence, attractiveness is determined solely by the supplier. Therefore high attractiveness is achieved when the supplier perceives the buyer to be attractive.

#### 2.1.3 The conceptual framework

The conceptual framework by Pazirandeh & Norrman (2014), illustrated in Figure 3, suggests that external constraints to which a company is exposed, affect its power position. Here the actor can decide to adapt to the situation or attempt to change their power position. In order to change power position, purchasing strategies can be used to alter the sources of power, which in turn changes an organization's power position to a set of new constraints.



Figure 3. The conceptual framework of Pazirandeh & Norrman (2014)

#### 2.2 How to change power position

Supplier relationship management (SRM) is defined differently in academia. Kumar (2018) defines it as "..the process, practice and the methodologies followed for supplier's interaction." While Browne (2004) defines SRM as the "Focus on developing a mutually beneficial relationship with suppliers, especially those deemed as most strategic to promote quality, efficiency, innovation and other benefits". SRM aims to make the relationship between buyers and suppliers more effective thus making it possible to achieve effective output of deliveries, quality, services and planning (Oromo & Mwangangi, 2017). Closer and more collaborative relationships are perceived to generate benefits for both buyers and suppliers, making OEMs adapt to this notion. As a result, supplier bases have, for more than 10 year, been narrowed down to a few selected suppliers where establishment of partnership and collaboration has been central. These close collaborations are perceived to generate benefits that outbalance the costs (Teller, Kotzab, Grant, & Holweg, 2016). These additional benefits are presented as the company's ability to obtain agility, responsiveness and profitability.

Gadde & Snehota (2016) argues that partnership with suppliers ought to be developed when the characteristics of the supplier is of high importance economically, when the duration of the relationship is extended and according to the company's purchasing strategy. It is of importance not to adjust all relationships to the same purchasing strategy, instead differentiate according to their business nature. This in order to stay competitive since there has been a shift of how to stay competitive; from possessing capabilities to possessing relationships and connections, hard to copy, with an external network in order to access capabilities. Gadde & Snehota (2016) distinguishes between two reasons for entering a partnership with a supplier; (1) *"the volume of business the supplier represent"* and (2) *"the affect supplier have on the future of the* 

# company in that they are sources of technical development and important for product quality and performance".

When deciding to form a partnership, the companies have to focus mainly on the integration variables to succeed; coordinating activities, adapting resources and individual interaction (Gadde & Snehota, 2016). These variables will vary in focus depending on the characteristics of the relationship. Partnerships fulfilling a high degree of all these variables are considered to be of high involvement characteristics while vice versa are perceived to be characterized by low involvement. Conclusively, all partnerships are different and ought to be treated accordingly.

In 1983 Peter Kraljic presented a matrix for handling different supplier relationships and adjusting them according to the characteristics of the product or product group. The aim with the matrix was for companies to *"minimize supply vulnerability and make the most of potential buying power"* (Kraljic, 1983). Thus highlighting the importance of identifying power positions towards various suppliers and adjusting purchasing strategies accordingly. Gelderman & Van Weele (2003) presents, based on the Kraljic matrix, an extended matrix with regards to several purchasing strategies related to the four quadrants in the matrix (see Figure 4). The strategies within each quadrant can be distinguished between two different overall purchasing strategies; either *keeping the position in the quadrant* or *changing towards a different position*.



#### Figure 4. Extended Kraljic Matrix by Gelderman and Van Weele (2003).

By using the matrix, it is possible for companies and purchasers to identify their strategic products as well as products where large resources are unnecessary. Instead to focus the resources on the products most vital for the company. With this differentiation as a base, Caniëls & Gelderman (2005) argues that adjusted relationships and purchasing strategies can be implemented making an efficient way of handling the supplier base by utilizing the benefits from every relationship.

#### 2.3 Supplier involvement in new product development

Supplier involvement in NPD is needed when a company does not have all resources needed in-house (Melander, 2014). This relational exchange can create value by combining resources and capabilities in a way that gives at least one of the actors a competitive advantage (Borys and Jemison, 1989). Increased involvement of upstream actors in product development have shifted the management of buyer-supplier relationships from competitive relationships, where suppliers are played against each other for the buyer to achieve the optimum buy, to partnership (Bozdogan et al., 1998).

In response to a fast paced technology development and shorter product life cycles, manufacturers are involving their suppliers earlier in the product development phase. A supplier's involvement can range from minor design suggestions to being responsible for a part's entire design and engineering (Wynstra and ten Pierick, 2000). Early supplier involvement (ESI) refers to the timing when suppliers are involved which usually already is in the concept stage. ESI is crucial for value creation in supply networks, but in order to do this the parties involved need to set mutual objectives and goals in a long-term perspective (Kähkönen et al., 2014). Sharing goals and objectives and searching for new areas of collaboration with suppliers in order to create value does not increase buyer dependence (Kähkönen et al., 2014).

By collaborating with suppliers in NPD it is possible to improve quality, reduce development costs and time to market (Johnsen, 2009; Wynstra and ten Pierick, 2000). Other than positively affecting the performance of the buying firm, it can also have a positive influence on the supply chain performance by reducing operational lead time, combining scarce resources, sharing knowledge and sharing risks by joint investments. However, there are also risks with ESI that need to be considered. Risks of choosing an incapable supplier (Wynstra et al., 2001), knowledge leakage, increased transaction costs that could exceed the reduction of development costs and increased switching costs since supplier involvement increases embeddedness in buyer-supplier relationship (Xiao et al., 2019). Therefore, there is a need for balancing the pros and cons of supplier involvement. ESI increases the buyer's dependence partly as a result of enhanced commitment, but also because of the increased information sharing that ESI entails (Kähkönen et al., 2014). This should therefore be carefully considered when entering this type of relationship. However, the study of Kähkönen and colleagues (2014) found that if the standards and processes of supplier involvement is highly developed, the dependence is lower but so are also the aspirations towards innovation.

#### 2.3.1 Supplier involvement in technology uncertainty

Firms can manage uncertainties by seeking closer relationships, thereby increasing dependency, to improve transactions of information, commitment and exchange stability (Robert et al., 2006). ESI can be a solution to hedge for risks associated with technology uncertainty (Johnsen, 2009) but high technology uncertainty can lead to issues, like product development delays, even though ESI is applied. ESI is challenged by some authors (McGuinnes and Vallopra, 1999; Zirger and Hartly, 1996), with the electronics industry as an example, who argue that ESI does not shorten the buyer's overall product development time and that suppliers should rather be involved when needed, not always early.

The technological paradigm shift from conventional to electric and autonomous vehicles, makes automakers move towards increased technological uncertainty, which according to Mikkelsen & Johnsen (2019) demands another way of organizing. Purchasing should be divided into advanced sourcing, which in interaction with R&D source future technology, and life cycle sourcing, which are responsible for sourcing during a product's life cycle. Purchasing competence is considered a catalyst for collaborative innovation. Mikkelsen and Johnsen (2019) suggests that in technology uncertainty, a mature purchasing organisation who possess technical knowledge can together with R&D perform technology sourcing and thereby contribute to innovation.

In order to access new technology a buying firm needs to seek for suppliers outside its known supply network and industry. NPD in a technological uncertain environment needs to go beyond exploitation or reliance of existing technologies and relationships, that is used for incremental technology development, and instead explore new ideas and relationships (Mikkelsen and Johnsen, 2019). Developing new buyer-supplier relationships like that requires trust and mutual willingness to take the risk to unify with a new actor from another industry (Mikkelsen and Johnsen, 2019). The authors also suggest that these new suppliers should bypass the standard supplier approval process in order to speed up the involvement.

In technology uncertainty, a manufacturer should, when selecting suppliers for involvement in NPD, choose suppliers who have strong technological capabilities over cost (Xiao et. al., 2019; Schiele, 2006). Involving suppliers that are dependent on the buyer may only entail limited value added on the buyer's activities, which makes buyers avoid this in technology uncertainty (Xiao et al., 2019).

#### 2.4 Cooperative purchasing

Cooperative purchasing is also referred to as horizontal purchasing, collaborative purchasing, joint purchasing, amongst many other terms. It is a form of consolidation of procurement activities such as supplier evaluation, negotiation, and contract management (Nollet & Beaulieu, 2005). Schotanus and Telgen (2007, p.53) defines cooperative purchasing as *"cooperation between two or more organisations in a purchasing group in one or more steps of the purchasing process by sharing and/or bundling their purchasing volumes, information, and/or resources"*. A purchasing group is an organization where cooperative purchasing takes place. Cooperating with multiple actors in a group calls for challenges. Multiple actors entails a number of dissimilarities between group members such as differences in size, organizational structure, market and preferences.

Cooperative purchasing has several advantages such as lower purchasing prices, lower transaction costs, reduced supply risk and increased learning between the members of the purchasing group. Tella and Virolainen (2005) found that cost savings, such as price reductions and lower management costs, as well as access to more supply market information, were the main drivers for industrial companies to be a part of a purchasing group. Cost savings is possible due to bigger volumes and thereby increased negotiation power towards suppliers (Nollet & Beaulieu, 2005; Tella & Virolainen, 2005) and lower management costs due to a decreased number of transactions.

However, being a part of a purchasing group also has some disadvantages such as costs of setting up and coordinating the purchasing group, supplier resistance, decreased flexibility and control (Schotanus and Telgen, 2007). Barriers for adopting and succeeding with cooperative purchasing can be lack of integration and communication infrastructure (Huber et al., 2004) and incompatible goals between group members (Nollet & Beaulieu, 2005). The coordination of the purchasing group is therefore important to succeed.

Purchasing groups are not only beneficial for the group members but also for the suppliers, as they can take advantage of lower transaction costs since they need to manage fewer customers. However, purchasing groups can be an entry barrier for new suppliers on the market with innovative products since they don't have sufficient volume to get economies of scale to be able to lower prices as much as big purchasing groups aim for (Nollet & Beaulieu, 2005). This gives existing suppliers an advantage and can also lead to supply market consolidation. Such consolidation can lead to a locked-in situation for the buyer. To prevent missing out on new

innovation, purchasing groups need to set up procedures to evaluate new suppliers and products.

#### 2.4.1 Purchasing groups

There exist different forms of purchasing groups. Schotanus and Telgen (2007) mention and describe the form of piggy-backing, third party, lead buying, project and programming groups.

*Piggy-backing groups* are informal purchasing groups. Here, one large actor in the group, in this context also called the host, individually sets up a contract with a supplier which smaller actors in the same group can take advantage of, often under the same conditions. However, the piggy-backing organization can usually not influence the specifications, neither the choice of supplier. The firm who piggy-backs on the larger actor, can benefit through lower purchasing prices and lower transaction costs. The host does not directly benefit from this collaboration other than the possibility of getting lower purchasing prices by the increased volume that the piggy-backing organizations contribute to. If this collaboration is planned to be long term, the host should be reimbursed to cover expenses related to the purchasing group as an incentive to continue. Piggy-backing groups are beneficial for the supplier as well as they can take advantage of lower transaction costs since they need to manage less number of customers. It is not always the case that suppliers allow smaller actors to piggy-back to get a lower price, but the smaller actor and supplier will still benefit from lower transaction costs.

A *third party group* is an external organization that is owned by the members of the purchasing group. The group functions as a large-scale long-term piggy-backing group. The third party organization carries out the purchasing processes by itself based on the accumulated purchasing volume. Like the piggy-backing groups, the members do not have any influence on the specifications nor the supplier choice, which makes customized products incompatible with third-party groups.

The third form of purchasing groups are *lead buying groups*, where purchasing activities are outsourced to specific members of the group based on their expertise, volume or resources. The members are then specialized at purchasing certain items. Lead buying groups are not compatible with a one-time-buy since the leading organization is at risk of not being compensated for their effort. The advantage with this form of purchasing group is that the collective efficiency increases as all parties do what they are best at. However, the disadvantage is that the members get dependent on other's knowledge and skills.

A *project group* is typically formed for a one time buy for a specific project, which is dissolved after completion. The members bundle their resources and learn from each other. In the beginning of the collaboration the members need to get to know each other which potentially slows down the purchasing process. This type of cooperative purchasing demands a lot of communication and coordination for the members to understand each other's requirements and agree on specifications and supplier choice. It is difficult to allocate costs and gains between members correctly. The more emphatic members will potentially do more of the work without gaining more from the collaboration than what a piggy-backing member does.

A programme group has a steering committee consisting of representatives from the members management who discuss cooperative purchasing projects and can learn from each other. The members of this group are collaborating repeatedly and play an active role in the purchasing process. Due to the latter matter, all members have an opportunity to influence specifications and supplier choice but it requires coordination.

#### 2.5 Take or Pay

Take or pay agreement is a purchasing strategy that generates risk sharing between suppliers and buyers. Take or pay is clauses used in purchasing contracts that can be organized in two different ways; take-or-pay or take-and-pay (Rogers & White, 2013). The former obligates the buyer to commit to a certain amount of items by either collecting and paying for the minimum volume in the contract (take), or paying for the items not collected i.e. the difference between minimum volume and effective collected volume (pay) (Schultz, 1997). This is the most common clause of the two. The latter obligates the buyer, at all times, to both collect and pay the contracted volume, regardless if the items are needed or not (Schultz, 1997).

Take-or-pay principals are most often annual contracts and are based on an annual TOP quantity i.e. the maximum quantity agreed between the buyer and supplier. The take-or-pay amount is, in most common cases, between 70-90% of the TOP quantity. If the buyer does not collect the goods according to the take-or-pay level, the company must pay a fee. The fee is based on the difference between the take-or-pay quantity and the amount of effective collected goods. However the TOP quantity is not fixed, it is modified if the buyer receives supplies that do not meet the quality requirements, if the supplier is not able to deliver or if the buyer is not able to collect goods due to unavoidable causes (Rogers & White, 2013). Thus, the fee in these types of clauses are solely based on items that can be delivered to the customer according to agreed specifications. In this way the risk is shared between the buying firm and the supplier (Schultz,

1997). The supplier commits production capacity to the buyer while the buyer commits to the volume.

#### 2.6 Geographic stockpiling

Yoon, Narasimhan, & Kim (2018) argues that globalization has exposed supply chains' to higher risks of disruptions due to fluctuations of external factors. Stockpiling is a strategy used to create resilience in the supply chain and for companies to continue their functions during disruptions (Liu, Song, & Tong, 2016). Even though stockpiling can contribute to great value when large disruptions occur, Liu et al. (2016) argues that in a normal state, this strategy is very costly.

There are two ways of stockpiling; dedicating and integrating. Dedicated stockpiling refers to having a separate warehouse where inventory is kept with a constant volume (Liu et al, 2016). Integrated stockpiling is a more cost efficient approach where already existing inventories in the supply chain are utilized to keep stock in case of disruptions. By using this method one can ensure that inventory is being rotated i.e. avoiding components becoming obsolete. Even though the inventory is being rotated, it has to be treated as it does not exist. This is argued by Liu et. al. (2016) that claims that stockpiling cannot be a solution for daily fluctuations.

By establishing inventory in different geographical locations one can obtain a sufficient and resilient supply chain (Hosseini, Ivanov & Dolgui, 2019). Supposing a force majeure ought to occur, companies having supplies on many different locations are less exposed to being affected negatively. This strategy further enables a substantial control over supplies and prices globally (Humphries, 2010). According to Hosseini et al. (2019) the dispersed distribution is a way for automakers to improve their supply chain; "Geographic separation of suppliers and holding excess backup and emergency inventory are considered as two resilience enhancement features for auto manufacturers".

#### 2.7 Sources of power affected by above purchasing strategies

In Figure 5, all theoretical pieces presented in this chapter are tied together with the central framework in this thesis. The chapters of theory regarding supplier involvement in technology uncertainty, cooperative purchasing, take and pay and geographic stockpiling are the strategies that later are analyzed by how they influence sources of power and thus how a power position of a firm can change. Supplier relationship management is about how a firm can make the most

out of the power position they have while minimizing supply vulnerability. Thereby the power position of a firm affects the choice of purchasing strategies.



Figure 5. Illustration over how the theoretical frame of reference is tied together

## 3. Method

This chapter aims to describe the method used in order to accomplish a high quality study. In the first two sections the structure and process of the study is presented in order for the reader to understand how the research questions are to be answered. In chapter 3.3 the approach is presented with the purpose of explaining the role of theory in this study. This section is followed by a presentation of the data collection method, research strategy and research techniques to understand where the data is coming from and the characteristics of the data. Lastly, data analysis, quality assurance and ethics are discussed.

#### 3.1 Research structure

The methodology describes how the study ought to be conducted where Saunders (2008) emphasizes the importance to take regards to research approach, research strategy and research techniques. The process ought to begin with deciding the research approach, then looking into research strategy and finally deciding research techniques (Saunders, 2008). The research techniques will include methods for data collection, data analysis, quality assurance and ethical considerations. The different elements are presented, explained and argued for in the following chapter.

#### 3.2 Research process

In order to perform the case study, a research plan was applied (Figure 6). The initial step was to try to understand the context around the issue, raised by the focal company, through conducting interviews internally at the company. Literature was reviewed iteratively during the research. During the process of understanding the context of the company it became clear that theory about supplier involvement in new product development and technology uncertainty had to be included in the report. When a comprehensive view of the issue was obtained, screening of theory about power and dependence started, where the framework of Pazirandeh & Norrman (2014) was found. This framework matched the issue identified; buyer dependence. This thesis will investigate if the framework is applicable in the automotive industry and will thereby contribute to research within buyer-supplier dependencies.

It became clear during the study that the focal company's tier 1 suppliers as well as the semiconductor manufacturers, prioritized their customers by how attractive they perceived their customers to be. As the attractiveness of a customer depends on the supplier's subjective view of attractiveness (Ellegard, 2004), the variable had to be adapted to the suppliers' opinion of customer attractiveness in a specific case. The indicator in our study is therefore defined by interviewing the suppliers to get a hold of their opinion of what an attractive customer is for them.



Figure 6. Schematic overview of the research process

To answer the first research question "*How does the power position of CVC towards its suppliers affect supply of semiconductors?*", it was necessary to understand CVC's current power position and what factors that influence the supply of semiconductors. Also, the success factors for other actors to secure their supply of semiconductors.

To understand the focal company's power position, the sources of power present in CVC's relationships with tier 1 suppliers were reviewed as well as the tier 1's relationships with semiconductor manufacturers. Data was collected through internal and external interviews as the primary source, which was analyzed based on the selected framework. To grasp what factors influence the supply of semiconductors, interviews were conducted with several actors in the supply chain and also other market actors, e.g. OEMs from other industries, to get an extended perspective. To ensure objectivity, secondary data was collected through annual reports and market scanning to supplement collected data from interviews.

Once the power position was determined, the factors that influence supply of semiconductors and success factors became known, it was possible to further build on that to answer the second research question: "*How can CVC secure their supply of semiconductors through purchasing strategies when being dependent on their suppliers?*".

By knowing which factors that influence the supply of semiconductors, what success factors that exist to secure supply and by reading theory, four different purchasing strategies were identified; take and pay, geographical stockpiling, collaborative purchasing and extending the supplier network. These four purchasing strategies' influence on sources of power were analyzed which made it possible to identify how CVC ought to alter the sources of power and thereby change power position to secure supply of semiconductors. The four purchasing strategies were analyzed through two perspectives. First it was analyzed how the four strategies were to affect the sources of power and thus change CVC's power position on the organizational level, relationship level and network level respectively. Additionally, the four strategies were analyzed through the perspective of the portfolio model by Caniëls and Gelderman (2005), who incorporate the power and dependence perspective, to see if the four purchasing strategies can be used to change the way semiconductors are treated at CVC today. Finally, recommendations of future actions, which purchasing strategies they should apply, were presented.

#### 3.3 Research approach

This case study will investigate if it is possible to apply an already developed framework for the interrelation between power and purchasing strategies with focus on buyer dependence, onto a supply chain in the automotive industry, acting in a fast paced and high technological environment. The selected theory framework remarks that by looking into the main sources of power and deploying the position of the actor regarding each separate source, it is possible to identify the actors purchasing power positions. Based on information declared from previous steps, one can make a choice of purchasing strategy; adapt, change or safeguard (Pazirandeh and Norrman, 2014). Therefore, this study will take on an abductive approach both testing and generating new theory (Bryman and Bell, 2015). The iterative process further argues the abductive approach where findings in interviews has been the foundation for theory research as well as theory research has contributed to additional interview questions and interviews. The approach presented correlates to Kovacs & Spens (2005) view of abduction as adding theory to an already developed framework.

The chosen framework will be tested by investigating if it is possible to shift the power position of the focal company by applying the presented course of action. In this way it is possible to extend the framework, from practiced in the vaccine market, to a framework also applicable to the automotive industry. Thus, new theory will be generated.

The case study is based on interviews with managers and staff from the purchasing and research and development department as well as suppliers involved in the supply network. In step 1, illustrated in Figure 7, an understanding for what type of purchasing strategies that are applied at CVC today and which sources of power that are present in their relationships with tier 1s and the tier 1s relationship with semiconductor manufacturers will be apprehended. This is done by interviewing purchasers from CVC, representatives at tier 1 suppliers and other network actors. With the information collected in step 1, it will be possible, in step 2, to define

CVC's power position towards tier 1 suppliers and their power position in the network. This is done by comparing the sources of power found in the interviews with the sources of power in Pazirandeh & Norrman (2014). In step 3 an analysis will be conducted on how the four purchasing strategies, found as successful in other industries, affects the sources of power.

Lastly, based on the analysis in step 3, step 4 will present the focal company's new power position.



Figure 7. Schematic overview of application of the conceptual framework

#### 3.4 Qualitative research

The focal company is situated in an unfamiliar situation with queries of the root cause and possible solutions of the semiconductor shortages. Therefore, collection of data in this study will be gathered from interviews with selected actors in the supply chain to be able to determine what causes these disruptions of semiconductor and get a holistic view of the problem. The study will take on a qualitative approach to understand underlying data of gathered words in order to identify and apprehend incentives and motives (Bryman and Bell, 2015). Qualitative data collection methods are interviews, reports and observations (Hammersley, 2013) however interviews will be the dominating input of data in this study. This will enable the holistic understanding of the phenomenon (Hammersley, 2013). Some quantitative data will be considered to amplify verbal data collected, for example annual reports to understand different actors' market share, cost breakdowns to understand impact of different semiconductors and quantified questions to provide insight of currently practiced purchasing strategies at CVC.

#### 3.5 Research strategy; case study

On the account of executing the study together with the focal company, within a limited part of the company, case study was the chosen research methodology. The openness to change throughout the study makes this methodology appropriate (Blomkvist and Hallin, 2015).

Research questions in a case study aims to answer the questions "how?", "what?" and "why?" (Saunders et al, 2008). By applying explanatory research questions in combination with that the study will be performed on a real time case reinforces the argument of using case study as a method since it benefits the input of data (Yin, 2012).

The focal company is a rather big actor on the commercial vehicle market that, most often, is situated in a powerful position towards its suppliers. Although, the increased demand of semiconductors in parallel with competition from a broader market, has put the focal company in an inferior position. Therefore, it was of interest, both scientifically and for the actors buying semiconductors, to investigate the focal company's power position and how they ought to move forward to secure supply and competitiveness. Scientifically this was necessary due to the scarcity of research within the field of buyers dependency on suppliers in the automotive industry. The phenomenon of that OEMs have been used to have power over suppliers in this industry may be the reason for this scarcity. This further increases the argument of performing this case study.

#### 3.6 Research Techniques; Data collection and Analysis

The intention of this chapter is to clarify the practice of the study and the methods it will contain with regards to data collection and analysis. The case study is based on interviews with managers and staff from the purchasing and research and development department as well as suppliers and other actors involved in the network.

#### 3.6.1 Primary Data

In order to gather data relevant for this study, interviews were conducted with the focal company, however also with external stakeholders within the same network. This enabled new points of views of the issue to be discovered (Blomkvist & Hallin, 2015). To align the interviews with the selected framework, interviews were performed at organizational, relationship and network level to identify the sources of power on each level. The interviewees' role on each level can be found in Figure 8.


Figure 8. Interviews conducted on different levels in the focal company's network.

Internal interviews were performed at the purchasing department with purchasers responsible for suppliers providing components including semiconductors. These interviews were performed to understand CVC's view of the relationship with tier 1s. Further, interviews were conducted with R&D and project purchasers to understand internal collaborations and future outlook for electrical components and company strategy.

External interviews were performed in order to avoid biased results that may occur if only the focal company's view of the relationship would be taken into account. These interviews were also performed in order to understand the supply chain and identify power dependencies upstream that affect stakeholders downstream. The intention of the external interviews conducted with tier 1 suppliers and semiconductor manufacturers were to investigate if the interpretation of the relationships within the supply chain aligns. Also, interviews with distributors and other market segment actors were conducted to get an extended understanding of the supply network. All interviews are declared in Table 3.

The template of the interviews with purchasers were based on indicators of power as well as the importance of purchase of the components. The interview template for the purchasers can be found in Appendix A. In order to secure that all relevant data regarding the subject would be touched upon, the interviews were taking on a semi-structured approach with qualitative data. This interview method allowed new inputs during the interview as well as that it was possible to adapt the structure of questions to the interviewee (Bryman & Bell, 2015). Beliefs and opinions were possible to identify thus a holistic view could be attained.

Table 3. Interviewees included in this study

Actor	Role	Type (time)	No. of Interviews
Organizational level			9
сvс	Purchaser (commodity purchasing)	MS Teams (57 min)	1
СVС	Senior Purchaser (project purchasing)	MS Teams (58 min)	1
СVС	Senior Purchaser (project purchasing)	MS Teams (48 min)	1
сvс	Purchaser (commodity purchasing)	MS Teams (68 min)	1
сvс	Purchaser (commodity purchasing)	MS Teams (58 min)	1
СVС	Purchaser (commodity purchasing)	MS Teams (62 min)	1
СVС	Purchaser (commodity purchasing)	MS Teams (65 min)	1
сvс	Senior Business Development Advisor	MS Teams (62 min)	1
CVC	Manager R&D	MS Teams	1
Relationship level			6
VG member	Strategic Purchaser	MS Teams (46 min)	1

VG member	Strategic Purchaser	MS Teams (60 min)	1
Tier 1	Sales Director	MS Teams (48 min)	1
Tier 1	Sales Director	MS Teams (30 min)	1
Tier 1	Sales Manager	MS Teams (60 min)	1
Tier 1	Business Development Manager	MS Teams (58 min)	1
Network level			3
Distributor 1	Purchasing Manager and Key Account Manager	MS Teams (60 min)	1
Distributor 2	Key Account Manager	MS Teams (63 min)	1
Telecommunicati ons company	Sourcing Category Manager	MS Teams (52 min)	1
TOTAL			18

By conducting interviews on a network, relationship and organizational level it was possible to identify the sources of power and different requirements for each stakeholder. The ongoing crisis and the limitations of relationships in the supply network affected interviews conducted. Interviews within the focal company as well as with stakeholders with an existing relationship were easier to establish. However, further up in the supply chain, no long term relationships exist with the focal company, making it harder to find stakeholders willing to participate in the study. This is illustrated in Figure 9 where there is a clear distinction between the number of interviews performed at every level. The parentheses in the figure represents how many interviews that have been conducted with different persons with the same titles as well as

different stakeholders. The outward numbers represent how many interviews that have been conducted at each level.



*Figure 9. Illustration of the number of interviews conducted at every level in the focal company's network.* 

#### 3.6.2 Secondary data

Hard data has been collected to understand market share of different actors. However also to examine the focal company's share of their tier 1's sales and thereby understand one source of buying power, demand share. This data was calculated manually by collecting turnover per supplier directly from the focal company and comparing it with the tier 1's total annual sales. This information was collected through annual reports.

Secondary data was also collected through a deviation excel file provided by the focal company. This file provides data regarding which semiconductors that contribute to the biggest impact if shortages arise as well as which components that these semiconductors are included in. By looking into this file, one can establish which components that are critical for the company.

Furthermore, a cost breakdown on different components has been done together with a cost engineer in order to further be able to emphasize critical components that are contributing to the most cost. This type of data is used to categorize the components into the Kraljic matrix to understand how to treat components based on their strategic characteristics.

Finally, quantified questions were attached at the end of the interview templates in order to be able to identify sources of power on a scale between 1-5. In this way it was possible to apprehend how individuals interpreted the situation and how much knowledge each possessed regarding what the questions intended.

#### 3.6.3 Data Analysis

In order to analyze data in a qualitative study it is common to use the method coding. Using theoretical coding of qualitative data allows building a hypothesis based on what interviewees say (Carl. F Auerbach & Louise B. Silverstein, 2003) Coding is a method to find patterns in different transcripts and to determine which data that is important and data that is irrelevant. By applying codes to sayings simplifies the comparison between different transcripts and relevant information is easier to identify (Bryman & Bell, 2015). Therefore, this method has been implemented using sources of power, power position and purchasing strategies as codes to be able to identify data relevant for the study, however also to be able to understand the data collected.

Due to the huge spread of information and data that appears in semi-structured interviews makes it vital to structure the data to be able to understand it (Easterby-Smith et al., 2015). Interviews were conducted with questions designed from the chosen framework to be able to analyze sources of power, power position and purchasing strategies. The data gathered from interviews were later analyzed and the significant parts applicable to the case study were withdrawn and inserted into spreadsheets and charts. By structuring the data it was possible to secure that the data gathered from different stakeholders were of the same character and analyzed in the same way.

Quantitative data were collected to analyze the market share of CVC, however also to identify CVC's share of volume of each tier 1. This due to that volume was identified as key to secure supply in the supply chain of semiconductor. Data of cost breakdown was analyzed to identify the cost drivers in an electrical control unit (ECU) and which strategy semiconductors ought to be treated with to be able to present the correct purchasing strategy.

#### **3.6.4 Quality Assurance**

(Bryman & Bell, 2015) urges the importance of evaluating a study with regards to three aspects; validity, reliability and replicability. Validity refers to studying the right thing while reliability is studying the thing in the right way (Patel & Davidsson, 2011; Blomkvist & Hallin 2015). There is a relationship between the variables urging the importance of considering both parts. In order to reach high validity it is needed to reach high reliability however, reliability is not a guarantee for validity. An interpretation can be performed in the right way however interpretation of the wrong thing results in low validity. Throughout the study, this will be secured by the use of a framework. Interview templates will be adapted to match the data

needed for the framework as well as coding will help identify the same data in every transcript to apply to the framework. The interviewees will be carefully selected together with the supervisor from the focal company in order to secure valid data and that the data is provided from people with the greatest knowledge within the area. Interviews will be recorded and noted and later compiled in order for the interviewees to confirm that the data is interpreted correctly. In this way, the authors secure validity and reliability.

Replicability means that the course of action ought to be described clearly and precise in order for others to replicate the study (Bryman & Bell, 2015). The methodology chapter presents the course of action and ensures replicability by presenting every step in the process and decisions made on the way.

# **3.6.5 Ethical Considerations**

Since this case study will be of anonymous characters it is of high importance to have a clear strategy of how to perform the case study without anyone being hurt in the process. In order to ensure ethics and morals, four main claims have been applied to this study (Vetenskapsrådet, 2002).

- 1. <u>The requirement of information</u>; information about the study has been communicated to the persons involved and interviewed.
- 2. <u>The requirement of consent</u>; persons interviewed have given consent to be a part of the study and to interviews being recorded.
- 3. <u>The requirement of confidentiality</u>; interviewees, company data and companies are anonymous by using pseudonyms.
- 4. <u>The requirement of utilization</u>; data collected will only be used for the purpose of this study.

As mentioned in the previous chapter, all conducted interviews have been sent back to the interviewees' to ensure that words have been interpreted correctly. This has been done with the intention of validity however also for the interviewee to have a second chance to exclude data if not feeling comfortable. The authors have also signed an NDA for the company for the security of both parties.

# 4. Stakeholders' different perspective on securing supply of semiconductors

In this chapter the actors present in CVC's network are introduced and explained, both on a relationship level and network level. The core of this chapter consists of these stakeholders' perspective of solutions to secure supply of semiconductors. The solutions are already implemented or identified as solutions that are yet to be implemented. Information and facts in this chapter originate from interviews with network actors such as distributors, tier 1s, automotive OEMs and OEMs from other industries. Desktop research has been applied in cases where interviews have not been possible to perform. The last section presents an accumulated view of the situation according to different semiconductor experts interviewed.

# 4.1 Overview of stakeholders

The shift towards an electrified society has put pressure on all industries, not only the automotive industry. Despite that end products at these markets are different, components in the different products are, in some cases, the same. This implies a possibility of CVC using the same semiconductor supplier as OEMs in the automotive industry as well as OEMs on other markets (OM) (see Figure 10). In the situation of semiconductors being different for different industries, the components still share the same limited production capacity. The increased demand for semiconductors, not only originating from the automotive sector but from all markets, increases the competition of these components.



Figure 10. Illustration of the supply chain and information flow of semiconductors

Figure 11 is an illustration of the business group CVC belongs to where VG is the mother company, and SC1 is the sister company included in this study. Projects have been initiated by solitary companies within the group but also by the mother company to find solutions for the

increased competition of semiconductors on the market. Today, there are no existing contracts established between semiconductor manufacturers and stakeholders in the group, but direct communications streams exist.



Figure 11. Illustration of the supply chain and information flow within VG

The stakeholders' perception of successful solutions to secure supply of semiconductors, that have been implemented or only identified, are summarized in Table 4a and Table 4b. The former summarizes the solutions that are connected to customer attractiveness i.e. the subjective view of an attractive customer according to individual suppliers. The latter presents either already implemented or identified strategies used to change power position in order to ensure supply. These actors have individual subchapters in chapter 4, where their perspective on how to secure supply is further explained.

					Actors					
Solutions to securing supply	Tier 1s	VG	Sister Company 1	OEM AM 1	OEM AM 2	OEM TEL	OEM TEL 2	Consumer Electronics	DB	Market experts
Customer attrac	tiveness	5					[	Actors		
Large volumes	x	x			x			x		x
Volume commitment	x	x	х		х	x				х

 Table 4a. Implemented or identified solutions connected to customer attractiveness to secure supply

Supply chain transparency	х	x	x		x		х		х
Long term relationships	х				x	x	x		х
Management communication	x	x							
Technical knowledge inhouse	x		x	х		x	x		x
High supplier involvement					x				
Sharing road maps	х								
Cultural and language similarities	x							х	
Driving semiconductor innovation					x	х	х		

# Table 4b. Solutions connected to strategies to change power position in order to secure supply

		Actors										
Solutions to secure supply	Tier 1s	VG	Sister Company 1	OEM AM 1	OEM AM 2	OEM TEL 1	OEM TEL 2	Consumer Electronics Actors	DB	Market experts		
Strategies to cha	ange pow	er positi	on		'	'	1	'				
Paying premium price										x		
Sharing risk			x	х	×	×						
Strategic partnership with SM		x				x	х					
Direct contact with SM	X	x	x			x	x					
Long term relationships	x					x	x	x		Х		

Management communication	x	х								
High supplier involvement						Х				
Contract management				х	Х	Х				
Geographical stockpiling			х	х		Х	Х			
Take and pay					Х					
Multiple supplier paths									х	
Committed facilities									х	
In-house production							х	Х		
Collaborative planning	Х							х		
Acquire shares in strategically important companies							x			

# 4.2 Stakeholders in relationship with CVC

This section presents the stakeholders' characteristics and view of the semiconductor situation, at the relationship level presented in Figure 8. All data in these sections are information provided from interviewee representatives from the stakeholders.

# 4.2.1 Tier 1 suppliers

Common for CVC's tier 1 suppliers included in this case study, are that they are all traditional suppliers to the major automotive OEMs in Europe. A description of each supplier can be found in Table 5. Some are pure automotive suppliers while others supply other market segments as well. At the same time, some suppliers supply all automotive manufacturers while some are more focused on commercial vehicles.

Common across cases is that CVC is perceived to be an attractive customer due to its technical sophistication and drive of innovation. Even though they do not have the most attractive volume, the margins within the commercial vehicle segment are higher than passenger cars and which strengthens CVC's attractiveness. This implies higher prioritization when allocating semiconductors according to several tier 1s.

It is expressed by some tier 1 suppliers that the technical knowledge and understanding at the purchasing department at CVC has lately decreased. This is obstructing the collaboration and allocation according to one supplier that claims that purchasers do not always understand the complexity of the components. Tier 1 suppliers express the need for increased information sharing and commitment to volume in order to be able to in turn get allocation from semiconductor manufacturers. Sharing of roadmaps are, to solve this, central for the tier 1s to work proactively and continue to keep up with technical developments as well as fulfilling volume demand.

Even though CVC possesses a good reputation, this has been saturated historically by solitary events where CVC has not kept what they have promised. However, in comparison to other automakers, tier 1s experience CVC as helpful but demanding. Other automakers have had a tendency to only demand and pressure suppliers, which during the semiconductor crisis has resulted in these customers being down prioritized. The down prioritization has led to loss of allocation (Phillips, 2021). Thus, by not exploiting the previous position of power and instead being helpful has benefitted CVC during the semiconductor crisis. Finally, cultural and language similarities are mentioned as an enabler for a successful partnership where other companies have been prioritized due to a more simple and familiar way of communicating.

Tier 1s	Size (turnover)	Customer segment
Supplier A	Big supplier (<10 B €)	Automotive
Supplier B	Small supplier (<1 B €)	Automotive
Supplier C		Automotive
	Small (< 500 M €) but market leader in	
	its segment	
Supplier D	Big supplier (<10 B €)	Automotive
Supplier E & H	Big supplier (<80 B €)	Automotive, industrial, consumer goods

Table 5. Characteristics of tier 1 suppliers

Supplier F	Medium sized supplier (~5 B €)	Automotive
Supplier G	Medium sized supplier (~1 B €)	Automotive, industrial, medical
		technology
Supplier I	Small player in the industry but monopolist for the product included in this study (~5 B €)	Automotive
Supplier J	Small supplier (<500 M €)	Commercial vehicles
Supplier K		Automotive
	Medium sized supplier (~5 B €), but market leader within the product segment	

#### 4.2.2 VG - Parent Company

VG is the parent company of several automotive brands with significant volume in the automotive industry, however in comparison to other actors in other industries the volume is rather small. This, in combination with that VG views semiconductors to be enablers of innovation and future competitiveness, has driven the company to look into different solutions to solve the issue of semiconductor shortages. Thus two projects have been initiated; Project 1 and Project 2.

Project 1 aims to gather information and knowledge regarding semiconductors incorporated into the components they buy from their tier 1s and register them into an IT system. Project 1 is a system where hardware can be managed in real time and where tier 1s' fills in information regarding semiconductors in their components. This information is expected to increase knowledge of components incorporated in their products, enable volume alignment between actors in the group as well as simplify traceability of components in the supply chain.

Project 2 is a program with the aim of establishing strategic relationships directly with semiconductor manufacturers. The project covers components sourced from different tier 1s, who are to be affected by these new partnerships. It is therefore relevant to find a supplier that can deliver according to the tier 1's preferences as well. By entering these strategic relationships with semiconductor manufacturers, VG argues that they will be able to ensure capacity, drive innovation and optimise costs related to semiconductors. The semiconductor manufacturers nominated for these partnerships have been evaluated by market share, technical sophistication, motivation, capacity and potential for cost optimization.

Even though it is expressed by a strategic semiconductor manager that committing to volume is the most important variable in order to be able to secure supply, these strategic relationships do not include committed volumes. There are no contracts established, instead the relationship ought to include one table communication once a year and that semiconductor manufacturers are provided insight of VG's production plans. Forecasts will be shared 18 months ahead, although no frozen planning horizons are included. Meanwhile semiconductor manufacturers are asking for three year forecasts with a fee if fluctuations occur (Strategic Purchaser, personal communication, April 2021).

When reaching out to the semiconductor manufacturers for Project 2 there was a great interest from many actors, thus it became clear that semiconductor manufacturers are very eager to collaborate with OEMs. The strategic semiconductor manager claims that the interest originates from the increasing electrification in vehicles making the automotive market grow in demand for semiconductors.

CVC has been able to join one of the collaborations in Project 2 where a communication stream has been set out between CVC and the semiconductor manufacturer to share technical knowledge and roadmaps. One of the responsible for the collaboration at CVC says that the aim of the collaboration is not to develop chips or purchase chips directly from the semiconductor manufacturer but to get to know the market and utilize what is state of the art. The reason for not attempting to source directly is CVC's unfavorable size, this collaboration is therefore only including sharing intangible resources. Thus, semiconductors purchased from this supplier will still have to go through the tier 1s.

#### 4.2.3 Sister Company 1

Sister company 1 is one of the premium brand car manufacturers within VG. The interviewee is working with strategic purchasing of semiconductors and is the only one at the car manufacturer responsible for the semiconductor management topic since 2018. This role was implemented due to large issues in the supply chain of semiconductors which, according to the interviewee, was a result of lack of knowledge within the topic internally. There was a lack of information regarding the content of semiconductors in sourced products which was highlighted as a central issue. The information system (Project 1) implemented by VG and adopted by the sister company, has been developed for the purpose of making product content visible. In cooperation with VG, the car manufacturer has started to request tier 1s to share information regarding this. However, the semiconductor manager intends that the tier 1s' are reluctant to transparency and collaboration in the matter. *"Tier 1s' fear that if OEMs' are* 

having too much information, they will use the information against them for price negotiation". Instead the interviewee argues that semiconductor manufacturers are more willing to collaborate. These companies want to secure supply since they possess large investments but no committed volume.

Today the company has direct contact with semiconductor manufacturers, both to support tier 1s in need of prioritization, but also to share volume figures to secure demand and make sure that volumes are aligned with tier 1's volume figures. Even though the company has a close collaboration with the semiconductor manufacturers, forecasts are not being committed to. This is, according to the purchaser, a big issue in the supply chain. While the car manufacturer has binding orders of 8 weeks, tier 1s' in turn has 4 weeks of binding forecasts towards semiconductor manufacturers. This does not align with the semiconductor lead times of 24 weeks. Therefore, actors have to increase transparency to work towards a supply network instead of a supply chain, the purchaser says. This in combination with one table communication between stakeholders and sharing risk, are key for semiconductor management the purchaser argues.

The close collaboration with VG, however also other subsidiaries in the group, has enabled and benefited volume alignment and closer contact with semiconductor manufacturers going further. By breaking up responsibilities towards different semiconductor manufacturers, it has been possible to share workload and knowledge across companies. Beyond this, strategies for semiconductor management are discussed within the group where stockpiling has been one solution touched upon. Semiconductor manufacturers and tier 1s are keeping stock in order to minimize risk if a disaster would occur. However none of these stocks are directed towards the actors within VG but to customers in general. According to the interviewee, stockpiling has been discussed to solve the problem of semiconductor shortages. Stockpiling *further down the supply chain is more expensive than earlier in the supply chain*" says the interviewee.

# 4.3 Stakeholders in the network of CVC

This section presents the stakeholders', at the network level presented in Figure 8, characteristics and view of the semiconductor situation. The data presented originates from interviews with the stakeholders and desktop research in cases where interviews were not possible.

#### 4.3.1 OEM Automotive 1

The automotive actor 1 is today viewed as the number one automaker of dealing with shortages according to Reuters (2021). The company is the only company in the automaker business that, during the shortages crisis, has increased its vehicle output. The strategy that contributed to this success has been in place for a decade. The realization of lead time being too long for semiconductors, the automotive actor 1 detected when the nuclear disaster in Fukushima occurred in 2011. It took the company six months to recover from the disaster and go back to business as usual. This forced the company to rethink its strategy. Since semiconductors, already then, were a crucial component, the company implemented a new strategy called BCP (Business Continuity Plan). This plan included suppliers stockpiling for the company with an annual payment for the arrangement at the suppliers site. The contracts include, up to this point, stock piles for 2-6 months of supply to avoid shortages. Due to the fact that the company also possesses inhouse knowledge of semiconductors since they owned a semiconductor manufacturing plant for almost three decades makes the company successful. An interviewee in the article of Reuters (2021) claims that: "...a deep understanding of semiconductor design and manufacturing processes was a major reason why it has managed to avoid being hit by the shortages, in addition to its continuity contracts."

#### 4.3.2 OEM Automotive 2

According to the senior business developer advisor at CVC and a consultancy firm, the automotive actor 2 has implemented a successful strategy of take or pay to manage the semiconductor shortages. By committing to two years of volume they have secured supply and will pay for the amount ordered, no less or more. Even though there is residual material the automotive actor 2 would have to pay for the components. In this way they have managed to secure sales revenue (McKinsey, personal communication, February 2021). The automotive actor 2 claims volumes that make this strategy sufficient, however CVC would have to accomplish cooperative purchasing with VG in order to reach volumes of this character (McKinsey, personal communication, February 2021).

#### 4.3.3 OEM Telecom 1

The interviewee is a global category manager within a telecom company. The company builds technological infrastructure required for the technological evolution to continue. However, the market share of the business itself is not big with its semiconductor volume of eight billion. Still the company is attractive to the semiconductor manufacturers since the telecom actors are

driving the technology development. Other market segments rely on their infrastructure developments in order for their own products to continue to develop i.e. the manufacturers would lose business opportunities from their biggest customers if the telecom company could not perform. Even though there is a high technological turnover in the production of chip manufacturers, the category manager argues that smaller customers and industries are needed. This in order for the semiconductor manufacturers to keep their utilization rate to 90%.

The telecom company has managed to not get affected by the global crisis of semiconductor shortages. According to the global category manager, this has been a result of long and close relationships as well as a new strategy of building inventories. Due to the geopolitical situation that started a few years ago, the company began to build inventories in different geographical places to always have access to semiconductors. This in combination with 20 years of relationship with semiconductor manufacturers, including high supplier involvement and information sharing, has made the company a prioritized customer. Contract management also contributes to the successful strategy of sourcing semiconductors for the telecom actor. The contracts include planning horizons and forecasts of 11 months with committed volume including compensation to the supplier when demand fluctuates over a certain level. This contributes to a more trustful relationship according to the global category manager.

#### 4.3.4 OEM Telecom 2/Consumer electronic actor

This OEM is one of the biggest within the telecommunications industry. Due to the geopolitical constraints between the US and China, the biggest semiconductor manufacturer was prohibited to continue its business with this company. Therefore, the actor has stockpiled two years of inventories to secure supply. This is expected to continue since the restrictions between China and the US may stand (McKinsey, personal communication, February 2021). While relying on stockpiled inventories, the actor has now begun to invest in semiconductor manufacturers in order to have access to supply however also knowledge and tangible assets (Senior Business Advisor, personal communication, February 2021). The company has started producing and designing their own chipsets to decrease the dependence on US manufacturers, however also of semiconductor manufacturers in general. Through an investment company, the telecom actor has invested in 20 different semiconductor related companies. One of them is a chip design tool

company, where the company bought 15% of stakes. This company is one of few companies in the world possessing this expertise of these designing tools required to design their own chipsets.

#### 4.3.5 Consumer Electronics Actors; CEA 1 & CEA 2

CEA 1, the biggest consumer electronics actor in the world, has been building its own semiconductors since 2010 to three of their product segments but will, as from 2020, use its own chips in computers as well. This shift has resulted in CEA 1 terminating a 15 year long relationship with the biggest semiconductor manufacturer in the world. There are several reasons for this, however the CEO at CEA 1, stated that it is a "*long-term strategy of owning and controlling the primary technologies behind the products we make*" (CNBC, 2020). Additionally, CEA 1 believes that the company will be able to innovate faster than the bigger semiconductor manufacturers with the possibility to increase the integration of their products even more. CEA 1 has further started to develop an additional chip that would make the company even less dependent on another big semiconductor manufacturer where there have been some conflicts regarding patent infringement(The Verge, 2020). Even though the companies settled, CEA 1 is moving towards producing the chips in-house with the same intention as when terminating the former contract.

Up to this point, neither CEA 1 nor CEA 2 has been affected by the semiconductor shortages (Nikkieasia, 2021). This is discussed to originate from the huge leverage these companies have towards the semiconductor manufacturers claiming 16% of the total market (VW pp; Nikkieasia, 2021). Additionally, both companies work proactively together with the semiconductor manufacturers to handle shortages through collaborative planning where transparency has been key to succeed.

#### 4.3.6 Distributors; Distributor 1, Distributor 2

The distributors included in this case study are both authorized and unauthorized and are mainly performing broker services during occurring shortages for CVC. Even though, according to the distributors, big OEMs express willingness to buy directly from semiconductor manufacturers, manufacturers do not share the same enthusiasm. Semiconductor suppliers, according to distributor 1, do not want to do business with companies close to the consumers since they want to avoid managing customer service. There are also barriers for inexperienced buyers to claim business with semiconductor manufacturers. The distributors argue that cultural and language barriers play a big role in doing business with these kinds of companies, especially outside of Europe. A purchasing manager at distributor 1 claimed "*Producers in China do not want to communicate with European customers*". Distributor 2 further confirms this point by stating that one benefit of using a distributor is that they can use suppliers from all different geographical markets with internal people speaking the language.

The distributors claim to have access to an extended supplier base in comparison with traditional tier 1 suppliers. Usually, tier 1s are solution providers, which most often buy semiconductors from franchises that only can supply the continent the franchise acts within. This due to pricing differences and regulations in different continents. Distributors do not have this limitation. By having an office in each continent, they are able to do business in one continent and then ship between its nodes. The distributors also corporates with other distributors, buys back abundant components from customers and secures stock by adding volume on an already existing order, purchased from other actors, in manufacturers production. This enables distributors to secure supply while semiconductor manufacturers increase utilization in production. Through this strategy the distributor has managed to increase feasible sourcing paths.

The distributors act within the open market and compare it to the stock market. Actions and decisions have to be made fast in order to be able to confirm purchase of supply before it is being allocated to other actors. This is the biggest problem at the open market, the rapid move of materials between stakeholders. Distributor 2 has been able to manage this through committed facilities. By having access to cash, they are able to pay suppliers in advance and thereby secure supply faster than others.

#### 4.3.7 Semiconductor Market Experts

A senior business advisor at CVC further emphasizes the insufficient volume of CVC and that VG, as a group, possesses larger buying power in regards to volume. Since the knowledge of semiconductors within components bought from tier 1 is limited, an alignment with VG is under investigation. This alignment would permit CVC to access project 1 to apprehend information regarding semiconductors included in their systems. Although, this alignment would have to be carefully reviewed since it can contribute to overwhelming administration the senior business advisor argues.

A consultancy firm has been involved in the process of CVC finding ways to avoid semiconductor shortages. The firm recommends either getting the attention of the manufacturer by paying a premium price or committing to volume on a long-term basis. Committing to volume as a main key variable is further emphasized and confirmed by experts in the industry and semiconductor manufacturer representatives (Senior Purchaser at CVC, personal communication, February 12; Purchasing manager at Distributor, personal communication, February 17). This requires high volume transparency throughout the supply chain to avoid bullwhip effects the consultancy firm argues. The senior business advisor claims that long

planning horizons are important in this matter; "Automotive sector was the only sector that dropped in Q2-2020, everything else grew. Other industries placed orders 6-12 months ahead". According to the semiconductor market expert the prioritization of allocation from semiconductor manufacturers depends on three different aspects in the following order:

- 1. Capacity commitment; committing to volume with risk sharing
- 2. Confirmed order; Orders that cannot be changed
- 3. Floating demand; forecasts that can be changed

# 5. Analysis of how to change power position

In this chapter the collected data will be analyzed based on the framework presented in figure 3. In order to change the power position of a company, it is vital to know the current position. Therefore chapter 5.1 covers an analysis of the current power dynamics in CVC's supply chain of semiconductors. In chapter 5.2 the four purchasing strategies, collaborative purchasing, extending the supply network, take and pay and geographical stockpiling, are analyzed through two different perspectives on how they can change CVC's power position.

# 5.1 Current power dynamics in CVC's supply chain

Chapter 5.1.1 covers the purchasing strategies that CVC applies today, their motivations and perceived impact. In the next chapter, 5.1.2, an analysis is conducted of which sources of power that are generally present in the relationship between CVC and its tier 1 suppliers and where they originate from. In chapter 5.1.3 each tier 1-relationship is analyzed to decide which power position CVC has towards each supplier. The analyses in chapter 5.1.1-5.1.3 are based on the data collected in the interviews with purchasers at CVC and sales representatives at tier 1s. In chapter 5.1.4 the relationship between tier 1 suppliers and semiconductor manufacturers is analyzed on a general level based on interviews with tier 1s, other market actors, experts and desktop research. Their perception of the behavior and demands of semiconductor manufacturers was used to define the latter actor's position as scheduling first hand interviews with this stakeholder was unsuccessful.

#### 5.1.1 Current purchasing strategies

The focal company practices different purchasing strategies to manage the relationships with their tier 1s. In order to challenge current suppliers on price and thereby diversify the supplier base and adjust limited substitutability, CVC applies *global purchasing*. However the company, in most cases, does not use suppliers outside of Europe due to quality reasons and language barriers according to Purchasers at CVC. These suppliers have a hard time explaining their solution to CVC, which results in them not being nominated for the contract at stake.

Once a supplier has been nominated, *single sourcing* is the only alternative due to the high supplier involvement in product development. This involvement is placing the company in a locked-in position with regards to substitutability of supply. The reason for applying ESI (Early supplier involvement) is that they have insufficient resources in-house as a result of the products in focus are not part of the core business. Also, it reduces the development costs and time to market. The parts in question have 3-4 years of development time, detailed specifications and high level of customization which makes the nominated and then contracted supplier, the only one capable of supplying the product. This increases the buyer-dependence.

Even though the specifications are detailed and profound, similar specifications for some components allow *pooling of demand* and *joint negotiations* with other brands within VG, which increases their demand share towards the supplier in question. According to some of the suppliers, the similarities of the specifications are not always satisfactory enough and could be further improved to optimize the cooperative purchasing and thus become more attractive to the suppliers.

Additionally, the company applies the strategy of *purchasing several demand types from the same supplier* in order to lower the price on already purchased products but also for the potentially new products. If they already have a contract and product purchased with a supplier, this is an aspect taken into account when negotiating new contracts for new products. However, in other cases when two suppliers are competing for the same contract where one is an already existing supplier, CVC is willing to diversify its supplier base to reduce their dependency.

The company applies a *real time bidding* tool to perform *competitive bidding* between suppliers. The suppliers can, through this tool, get real time information about their placing in comparison to the other attendees in the competition of the contracts. This is done to increase transparency as the suppliers previously have doubted CVC when they have communicated the other attendees counter offers separately to each supplier. Once a supplier has qualified for all requirements and been nominated, a *general agreement contract* is signed that states the responsibilities for each party. In this way CVC can influence commitment and information sharing. Additionally, CVC *renegotiates prices and contracts* on a continuous basis to match the contracts according to the market developments. Due to the fact that technology changes, prices of electronic components generally are declining every year and prices must therefore be updated.

The general contract contains a *long-term relationship* including a development phase and a supply phase. The contract is renegotiated when it has passed the development phase. The long term contracts are mainly based on securing return on investment for the money spent in the development phase. General contracts are established for each supplier however more *detailed contracts* are applied to each component sourced.

The supplier has the right to receive information about CVC's demand 12 months ahead without commitment to volume. The suppliers ought to inform CVC about capacity and disruptions in time. Some of the purchasers experience that suppliers tend to accommodate full transparency before nomination but decrease the information sharing once nominated. As a result of CVC's purchasing strategy of sourcing from one supplier, it is possible for the supplier to exploit the situation when entering the contract.

One observation was that no *soft contracts* were applied, where knowledge transfer or similar was included. CVC and its suppliers are perceived to work closely between the R&D departments during the development phase. However, once the parts go into production and the relationship continues between the purchasing department at CVC and sales at the supplier, the relationship seems to be more distant.

#### 5.1.2 Sources of power in the relationship between CVC and tier 1s

All buyer-supplier relationships included in this case are characterized by supplier involvement in new product development which leads to a severe lock-in effect. The degree of supplier involvement will therefore be treated relative to each other and the substitutability of supply will be analyzed based on the availability of suppliers *before* choosing and entering a contract with a supplier.

The supply market in our study of tier 1s, are mainly characterized by low *supply substitutability* due to high market concentration with some exceptions. The high market concentration can be explained by the high entry barriers which originate in the high quality requirements set by automakers. These high quality requirements are necessary as the vehicles

have a long life time and are exposed to a severe environment during this time. The automotive industry is characterized by a high degree of customization which leads to high development costs for suppliers which also contributes to high entry barriers and therefore low substitutability. The high degree of customization and supplier involvement in product development makes the *substitutability of demand* low across all cases but two. In these two cases the components are less customized which makes the substitutability of demand moderate with a greater range of suppliers to select from. Further down in the supply chain, there is even higher concentration of suppliers producing semiconductors which decreases possibilities of *substitutability*.

The level of *interconnection* towards the supply base is different across cases. Though, a common aspect among cases is that the exchange is of high importance. This is mainly due to the close collaboration CVC has with their suppliers for some of the products during the development phase. The closer the collaboration, the higher importance is attached to the exchange. From the perspective of R&D, the R&D and purchasing department acts as "good cop-bad cop" respectively. Good will and trust is built between the R&D departments while purchasing at CVC handles the commercial issues and maintains control thus acting as the bad cop. This statement is not entirely agreed upon by the purchasing side which indicates misalignment between the departments. The trust in the relationship differs, and in two of the cases CVC experience that the supplier exploits its power and in a third case they perceive that the supplier has a tendency to take advantage of the lock-in effect.

One supplier argued that culture and common language facilitates *interconnection* where the actor has decided to establish a higher degree of interconnection with an actor closer to their culture than with CVC. The duration of the relationship further contributed to the willingness of continued interconnection. One supplier argued that they had higher commitment to those customers where they had a long relationship and who they had future business opportunities with.

It is clear in our study that historical events impacting the relationship can negatively affect future collaborations. One supplier argues that separate events of conflicts in the past and how suppliers have been treated, affects the present and future relationship. One incident where CVC did not stick to the contract is still recalled by the supplier and could possibly affect the suppliers decisions in the future. On the opposite side, events where CVC supported suppliers in tough situations are also remembered by suppliers, thus CVC are perceived to be a helpful customer. During the covid-19 crisis, there are some signs originating from desktop research,

that CVC has been prioritized before other customers, who have treated the same supplier harshly.

CVC is using an escalation process of three steps, when supply disruptions occur, where the third step involves including VG on the matter. This occurs when production is to be affected. Escalations to VG are placed in order to get the attention of the supplier however also to emphasise the importance of CVC within VG. CVC wants to benefit from the high level communication that VG has with tier 1s and semiconductors manufacturers. However, expressed by suppliers, this can do more harm than good to collaborations since these escalations are perceived as punishment i.e. negative incentive, even though that is not the intention of CVC. Although, high level communication directly with CVC is communicated by suppliers to be coveted.

The *information asymmetry* between suppliers and CVC was quite similar across cases in this study. Prevalent for all cases was that the focal company experienced that they shared slightly more information with their suppliers than the suppliers shared with the company. The suppliers live by another reality where they experience that they share at least as much information as CVC. Information demanded by CVC regarding volume allocation would, according to one tier 1 supplier, hurt the tier 1 since it would result in their customers questioning other customers' demand. "*Customers do not share the view of what is a fair allocation of semiconductors*" the key account manager says. At the same time CVC has not been obliging to share actual demand i.e. committing to forecasts which has hindered the information flow in the supply chain.

Multiple suppliers expressed that CVC would increase their customer attractiveness if they increased their transparency and information exchange. The suppliers suggest that if CVC were to increase the sharing of future roadmaps, they would improve their attractiveness since the suppliers then can adapt their product offerings and optimize allocation of resources internally. In order to achieve this, one supplier requests communication on management level. It is also suggested by multiple suppliers that if CVC committed to their forecasts they would increase their customer attractiveness since the tier 1s are prioritized in the same way towards their suppliers. If CVC commits to a certain volume, the tier 1s can commit the same volume towards the semiconductor manufacturer. A summary of the factors that the tier 1s expressed as customer attractiveness is illustrated in Figure 12. Multiple factors were indicated as attractive by several tier 1s but not all factors were expressed by every tier 1.



Figure 12. Variables of an attractive customer expressed by tier 1's

In this study, the indicator demand share is dependent on the focal company's share of tier 1s total sales. CVC's demand share is mainly low due to the fact that they have small volumes compared to other OEMs in the automotive industry and that the majority of CVC's suppliers are big suppliers who supply a large number of other players in the industry with higher demand share. Their annual demand is then often less than the other players on the market who are not necessarily direct competitors. For one of the cases CVC pooled their demand with another brand in VG and thereby increased their demand share. Even though CVC has had ambition of pooling demand with other subsidiaries in the group to increase volume, one supplier argues that this has contributed to confusion where CVC communicates this ambition but different requirements still remain from the different companies. According to multiple suppliers included in this study, volume is a factor that affects the customers attractiveness and thus the prioritization amongst them. Supplier D expressed that "they [CVC] could increase their attractiveness if they would source together with its sister company". This due to decreased development costs and costs relating to handling customers for the supplier. CVC could then increase their volume purchased and demand share which entail increased buying power. Even though volume is of high importance, one supplier argues that other aspects also have to be taken into consideration, such as profit margins and the level of innovation in the project. Multiple suppliers agree that a project together with a technological sophisticated customer including a high level of innovation is attractive.

Common for the majority of the suppliers in this study are that they are well known brands within the automotive industry with good *reputation* and technological sophistication. From the suppliers' point of view CVC is an attractive customer to work with due to their reliability, premium brand, technological sophistication and being ahead on innovation. Even though commercial vehicles entails lower volumes than passenger cars, the former results in longer contracts with more stable and/or increasing volumes which is one factor that makes commercial vehicle manufacturers attractive as customers. The fact that products sold to the commercial vehicle segment have larger profit margins than the products sold to the passenger car segment is one additional incentive for prioritization according to one supplier. A summary of the characteristics of the source of power of every supplier, included in this case, can be found in Table 6.

		Suppliers											
Indicators	Α	В	с	D	E	F	G	н	I	J	к		
Substitutability													
Substitutability of supply	Low: High market concent- ration	Moderate	Low: High market concent- ration	Low: Monopoly High entry barriers	High market concentr- ation High entry barriers	Dynamic market with a large number of players	Dynamic market with a large number of players	High market concent- ration High entry barriers	Low. Monopoly	ModerateHigh	Low		
Substitutability of demand	Not possible to change	Not possible to change	Not possible to change	Extremely expensive and time consuming to switch	Extremely expensive and time consuming to switch	Moderate	Moderate	Not possible to change	Not possible to change	Extremely expensive but will change if needed	Low		
Interconnection													
Importance of the relation	High	Moderate	High	High	High	Moderate - Low	ModerateLow	High	High	Moderate	High		
Trust	Moderate	Moderate- Low due to phase out	High	High	High	Moderate - High	Moderate	Low	Low	Low	High		
Commitment	Tendency to take advantage of lock-in effect	Moderate	High	Tendency to take advantage of their power	Supplier exploits its power	High	High	Supplier exploits power	Supplier have tendency to exploit its power	Moderate	Moderate		
Information asymmetry	Moderate	Moderate, slow when disruptions	Moderate	Moderate	Moderate	Low, quick to respond to disruptions	Moderate	Moderate	Low	Low	Low		
Demand share	Low	High	Low		Low	Moderate- High		Moderate	ModerateHigh	Moderate	Low		
Supplier's reputation	Moderate- High	Low- Moderate	ModerateHigh	High	High	High	Moderate	High	Moderate	Moderate	High		
Summary													
Researchers estimation of CVC's power position	Slightly supplier dominance	Slightly buyer dominance	Slightly supplier dominance	Supplier dominance	Supplier dominance	Equal	Equal dependency	fominanceSupplier	Supplier dominance	Equal dependency	iqual dependency		

Table 0. Characteristics of sources of power across the case	Table	6.	Characteristics	of s	sources	of	power	across	the	case
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#### 5.1.3 Current power position

Supplier A has a good reputation within VG. They are technologically sophisticated and they are quick to inform their customers about changes or disruptions. Though, they do not reach all requirements and are also expensive. Despite this, the supplier is still nominated which proves limited options of supply. There are high entry barriers on the supply market due to high quality requirements and last time the product was up for negotiation only 4 out of 24 suppliers met the requirements set. This results in a relationship characterized by slight supplier dominance.

For a local tier 1 in this case, CVC has a high share of demand, compared to demand share of other suppliers in this case study. The responsible purchaser at CVC for this supplier estimated that if they were to change supplier, the supplier would have to reduce their production and manpower. The trust and reputation for this supplier has been harmed as a result of repeated quality issues and dissatisfactory communication. Also due to that the supplier appears to have a reactive approach to disturbances, instead of having a more proactive approach as their competitors seem to have. The supplier is also lagging behind in technology development which further lowers the supplier power relative to the buyer. CVC are going to phase out this supplier in some segments and they are concerned that they will be less prioritized for the components that they will continue to buy for other segments. Although, as of today, the relationship is characterized by slightly buyer dominance.

The reason for choosing supplier C is their technological expertise and the product contributes to end customer satisfaction. They are the primary supplier in Europe and to quote the purchasing manager ".. *you should have them as a supplier for this product*". The substitutability of demand is low since it is not possible to change the product or supplier during the contract. As with supplier A, few suppliers managed to meet the requirements for final negotiation. Supplier C are transparent before nomination however after being nominated they have a tendency to exploit the situation. They are perceived as legitimate, without any issues or disruptions, and CVC trusts that they will perform as promised. Supplier C has won a contract for another product segment thus they will continue to be an important supplier to CVC with slight supplier dominance.

For the products bought from supplier D, the supplier is the main responsible for decisions regarding the product development and CVC trusts and listens a lot to what the supplier suggests. CVC perceives supplier D as a very high technological competent supplier who is competitive on price compared to other giants on the market. At the same time, the responsible purchaser states that commitment between the actors is based on supplier power since the

supplier is aware that there does not exist any other supplier for this product. Resulting in that the relationship is characterized by supplier dominance. The wide portfolio of VG and the premium product of CVC makes the supplier view the brands of the companies as very legitimate and attractive. This cohere with one of the three main variables of an attractive customer presented by the supplier; *volume, technical sophistication* and *transparency*.

As the experience of exploited power in the relationship with supplier D, the same applies to supplier E but the purchaser experiences that they exploit their power even more. For instance, this supplier has demanded CVC to pay for activities not included in the agreement as well as that no contract exists between the supplier and CVC. This is something suppliers, aware of their power position, can do and something that would not happen in a balanced situation (Donada & Nogatchewsky, 2005). Thus the supplier possesses dominance in this relationship. The relationship with supplier E was also examined through another purchaser for another segment. For this product, they have a higher demand share due to the fact that it is an expensive component and that not many competitors would pay that price for such a component. The responsible purchaser cannot see that any other supplier would be able to compete with supplier E's quality. *"If the word came out that we wanted to challenge this supplier, and we weren't successful finding anyone else, the supplier would raise the price"*.

Supplier F together with supplier G, acts in markets with a rather wide supply base compared to the previously mentioned cases in this study. Also, prevalent for the two cases is that the products bought are less customized than in the other cases which in turn leads to lower switching costs. CVC perceives supplier F as a reputable supplier with a solid brand and technological capability. Additionally, supplier F is further viewed as organized, proactive towards disturbances and easy to communicate with. On the other hand, supplier G is perceived to have taken on more projects than they can manage which have hurt their reputation. CVC apprehends that the communication with supplier G from time to time is inadequate. Postcontractual dependence on the supplier arises by investing time and resources into setting up and managing the relationship. CVC shares a lot of information and includes the suppliers in decision making, therefore, one can argue that the relationships are of equal dependency characteristics.

Supplier I is a small company with a weak position in the automotive industry, but monopolist at the market for the specific product included in this study and thereby situated in a strong position. They are aware of their monopolistic position which has been exploited by raising prices. It would be very difficult to change the supplier due to the high development costs. The supplier possesses the expertise regarding this product, resulting in CVC not being involved in the product development. Historically, there have been some issues and disagreements which makes it essential to set up contracts to manage the relationship. The responsible purchaser states that the root cause for the lack of trust can be a result of the fact that they experience that the supplier does not share sufficient information. This proves that the supplier is aware of its dominance. There is no long-term communication between the buying and supplying firm, only short-term.

Supplier J is a relatively big company but small in comparison to competitors. They act on a supply market with high competition and high number of suppliers to choose from. There are seldom any new entries on the market, it is rather consolidation of the market which also applies to supplier H's market. The reason for this is that these components have been around for a long time with big stable market players, which makes it unattractive for new actors. CVC has an active collaborative relationship with supplier J since CVC is more involved in product development as the product is more customized. This proves that the relationship is of equal dependency character. The supplier acts professional even though CVC is about to phase out this supplier for this product. For now, before the phase out, CVC is one of their biggest customers, if not the biggest with 30% of the supplier's turnover. Even with the high switching cost of supplier J, the supplier will be replaced. The reason for the phase out is that the supplier is not able to meet the technological requirements for the future.

CVC perceives Supplier H to be the best supplier, technologically and price wise, available in the market for this specific product. For the moment, there is no business case that makes it worthwhile changing the supplier. CVC has put the responsibility for the product development on the supplier as they are the party who possesses the technological knowledge. The supplier is easy to work with as they are transparent, react fast towards disturbances and no conflicts have arisen, thus the relationship is of equal dependency character. Regarding demand share for both supplier I and H, CVC is a rather small customer since the suppliers are delivering to the whole automotive industry.

# 5.1.4 Sources of power in the relationship between tier 1 and semiconductor manufacturers

The *substitutability of supply* on the semiconductor market is low as it suffers from high market concentration after multiple mergers and acquisitions the last 10 years. The *substitutability of demand* for tier 1s is sometimes limited as their customers sometimes specify exactly which semiconductors that should be used in a product. This results in a lock-in effect between the

tier 1 and the semiconductor manufacturers when the tier 1s are not able to choose the supplier of semiconductors on their own.

When tier 1s are bound to use a specific supplier the relationship becomes important to them since absence of the exchange of goods with the specific supplier will result in lost business with its customer. Therefore, there is a tendency that tier 1s attach higher importance to exchange than semiconductor manufacturers do, since the latter party already has the business secured with CVC in this case. For instance, CVC develops some components around a specific semiconductor from a specific manufacturer forcing the tier 1's to adjust their component solution accordingly.

Due to the fact that semiconductor manufacturers prioritize their customers in regards to capacity commitment, confirmed orders and floating demand, they put emphasis on the buyers' information sharing. The tier 1s experiences that they share more information than they are given back from the semiconductor manufacturer. Therefore there is *information asymmetry* between the actors. Although, the trend has recently shifted to semiconductor manufacturers collaborating and exchanging information to a larger extent with tier 1's, however also directly with OEMs.

Due to the high competition from multiple industries the automotive tier 1s *demand share* is lower than corresponding actors on other markets. This can partly be derived from the fact that it is a substantial difference between the largest automotive OEM and one of the largest players in the consumer electronics market, where the former demands 4 billion semiconductors per year and the latter demands 56 billion per year. Therefore, other markets such as the communication or consumer electronics industry, are more attractive in the eyes of semiconductor manufacturers since the volumes are bigger and the technology is more fast paced where the product life cycles are much shorter.

It is understood from all stakeholders, including tier 1s, that semiconductors will be a key component in their products from now on. For tier 1s to be able to offer their customers autonomous, electrified and connected solutions they rely on the technology sophistication of the semiconductor manufacturers which boosts the latter actor's *reputation* as a supplier. Further, semiconductors as a key component also influences the *importance of the relationship* from the buyers' point of view, as lack of supply of these components will badly weaken their position on the market.

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Generally, the automotive tier 1s, the buyers in this situation, are not the ones who drive innovation in this buyer-supplier relationship dyad. At least when compared to the situation in the communications industry where the actors in the same position in the network drive the innovation of semiconductors and the chip manufacturers depend on their technology sophistication and expertise. This is not the case in the automotive industry, as tier 1s ask for already developed technology for semiconductors. Still, the *reputation* of automotive tier 1s (buyers) in this case can be seen as moderate (see Table 7), as they are generally financially stable, legitimate and have solid brands as many of them have been around in the industry for decades.

Some of the factors for customer attractiveness (see Figure 13), from tier 1's point of view, originates from the relationship they have with their suppliers; semiconductor manufacturers in particular. As semiconductor manufacturers prioritize their customers based on volume commitment, confirmed orders and floating forecasts, this is something that CVC's tier 1s have to follow to ensure supply. One supplier expresses that "*If we cannot give the right information [about our demand], we cannot get supply from our suppliers*" which in turn affects the importance they give to customers who can supply them with the right information i.e reliable forecasts.



*Figure 13. Customer attractiveness variables in the relationship between tier 1 and semiconductor suppliers.* 

One of CVC's dominant suppliers, says that *"we have no dominant role towards semiconductor manufacturers"*, which implies that tier 1 suppliers are in a dependent situation towards their suppliers. The tier 1s, in several cases, need to commit to volumes and pay for the volume even though they may end up not needing the products. This results in the tier 1 suppliers' view that

an attractive customer for them commits to volumes. Tier 1s are low to moderately attractive as customers to the semiconductor manufacturers due to their low volumes, that they demand old technology and that they do not commit to volumes to the extent that other customers do. Though, they are increasing in attractiveness due to increasing electrification and autonomous driving in the automotive industry.

Table 7. Sources of power in the relationship between tier 1s and semiconductor manufacturers through the buyer's perspective

Indicator	Value
Substitutability of supply	Low, due to high market concentration
Substitutability of demand	
	Low - moderate, depending on the buyers´ customers´ specifications
Importance of relationship	
	High, since absence of the exchange with semiconductor manufacturers will result in lost business with its customers
Trust	
Commitment	Low - moderate
Information asymmetry	<b>Moderate - High</b> , due clear differences in the amount of shared information between the actors
Demand share	
	Low, due to automotive industry's low volume compared to other markets
Supplier's reputation	
	<b>High</b> , as the suppliers' technology sophistication are key to the tier 1s
Buyer's reputation	
	<b>Moderate</b> , one reason is for why they do not
	ones who drive innovation
Summary	
Researchers estimation of tier 1s power position	Overall characterized by supplier dominance

# 5.2 The potential change of power position through purchasing strategies

The four strategies; cooperative purchasing, extending supply network, take and pay and geographical stockpiling, will in this chapter be analyzed by how they affect the sources of power and thereby how CVC's power position will be altered if they are implemented. Each strategy is analyzed on the organizational level, relationship level and network level. This analysis is summarized in table 8. The focus of the analysis is continuously on sourcing products including semiconductors. Additionally, the four strategies are analyzed through the perspective of the portfolio model by Caniëls and Gelderman (2005), who incorporate the power and dependence perspective, to see if the four purchasing strategies can be used to change the way products including semiconductors are treated at CVC today.

Purchasing strategy	Stakeholders with current practice	Impa	ct on the netwo	ork	Potential impact on power dynamics			
		CVC - Tier 1s	Tier 1s - SM	CVC - SM	Organizational	Relationship	Network	
Cooperative purchasing	VG, SC1	Improved buying power	Improved buying power	Improved power position	Decreased flexibility in choosing suppliers	Sharing knowledge and workload	Increased buying power, allocation prioritizatio n	
Extending the supply network	Desktop research	Improved buying power due to improved supply substitutabilit y	Depending on the size of tier 1 the power position changes; smaller→ larger power	No substantial change	Increased substitutability of supply, innovation opportunities	Risk of losing existing relationships, increased interconnect- ion with new suppliers	Increase competitiv e- ness and flexibility	

Table 8. Impacts on the network related to the four purchasing strategies

Take and pay	Telecom actor 1, OEM AM 1 & 2,	Improved buying power	Improved buying power	Improved power position	Increased supply chain costs, decreased loss of sales revenue	Higher inter- connection	Increased customer attractiven ess, reputation
Geographica l stockpiling	Telecom actor 1 & 2, OEM automotive 1	Improved buying power	Slightly improved buying power	Slightly improved buying power	Increased supply chain costs, decreased loss of sales revenue, reduced risk	Increased interconnecti on and commitment, sharing risk	Increased competitiv eness and reputation.

Semiconductors are not treated as strategic items at CVC today, as they in most cases are not specified in the requirements and the supplier of the product including a semiconductor choses the semiconductor. However, at the component level, i.e. the relationships with tier 1 suppliers, are handled as strategic or leverage relationships due to its high supply risk and profit impact. The awareness of the supply risk and profit impact for the specific component were at the beginning of the thesis insubstantial for the company.

Components that include semiconductors at CVC should be treated as strategic items due to their concentrated supplier base. In parallel, semiconductors are incorporated in their core products and the components are perceived to be an enabler of future innovation which implicates high *supply risk*. In addition to this, the short and shortened life cycle of these components results in them becoming obsolete faster which leads to that the time for lasttimebuy is earlier which increases the supply risk. The microcontroller, an active semiconductor, represents 50% of the cost of an ECU making the component of high importance. Additionally, the share of semiconductors will increase in the BoM and thereby further affect the *profit impact*.

#### 5.2.1 Cooperative purchasing

If CVC would be a part of a cooperative purchasing group it could either be a part of a *piggyback group* together with VG or its sister companies. Alternatively, they form a *project group* for specific new development projects together with VG or its sister companies, which can be different for every project. A third alternative is that a *third party group* is formed for the sister companies within the commercial vehicle sector to organize the purchasing on a more large scale and long term perspective. The third alternative could have been a possibility but as the components included in this study have a high level of customization and the attributes of

vehicles from the other brands differs, it is not the optimal solution. This leads to a piggyback group or a project group being the solutions under consideration.

On an *organizational level*, participation in a purchasing group leads to reduced transaction costs and lower purchasing prices for CVC as a result of increased demand share. However, being a member of a purchasing group requires costs of coordination for CVC as lack of it can be a barrier to the purchasing group's success. Being a member of a piggybacking group can also lead to decreased flexibility as CVC possibly will not be able to choose the supplier. This will be done by the host, presumably one of the bigger brands in VG. To piggyback a contract with VG will lead to CVC missing out on some suppliers that would have fulfilled their requirements. For example, VG will not choose a supplier that only focuses on the commercial vehicle market as it will not fulfill their requirements. However, being a part of a purchasing group can get CVC access to new suppliers that it would not have been able to get business with by themselves. Collaborative purchasing will enable CVC to access expertise from the other members of the purchasing group which positively affect the source of power reputation.

Schotanus and Telgen (2007) argues that purchasing groups possibly can meet supplier resistance, but multiple suppliers interviewed in this study welcome such initiatives. The reason for this is that it would lower their costs since they need to manage fewer customers with different specifications. The need for coordination on the *relationship level* can be emphasized regardless of which form of purchasing group that is applied, as the members need to align their goals and requirements for the cooperative purchasing to be successful. Additionally, integration and communication infrastructure need to be implemented between the members. When using a project group, this step will have to be implemented repeatedly for every new project group which slows down the purchasing process. Although, by repeating the set-up of purchasing groups, some economies of learning can be achieved.

As a result of the purchasing groups' increased volume and demand share, and provided that the selected supplier will increase its volume of the same components compared to before, the tier 1 will increase its demand share at their suppliers, e.g. semiconductor manufacturers. Demand share as a source of power increases which results in an improved power position for the tier 1 towards their supplier, i.e. at the *network level*.

If CVC were to apply cooperative purchasing, they would improve their power on an organizational level due to improved access to expertise. Due to increased demand share, CVC would increase their buying power towards the tier 1s and thereby improve their power position on the relationship level. As a result, the tier 1 increases their demand share at their suppliers

the tier 1's increases their buying power towards their suppliers, e.g. the semiconductor manufacturers. This results in a change of power positions at the network level as well.

#### **5.2.2 Extending the supply network**

Mikkelsen and Johnsen (2019) argue that in order to access new technology a firm needs to seek outside its known supply network. A barrier for CVC to do this is their high quality requirements. As mentioned in the article by Mikkelsen and Johansen (2019), who studied a company in a market that demands high quality requirements and has extensive regulations, these new suppliers should bypass the standard supplier approval process to speed up the involvement. Another way to extend the supply network is to use brokers. These strategies affect the sources of power; *substitutability of supply, demand share* and *interconnection*.

Extending the supply network beyond existing actors within the automotive industry will lead to improved access to new technology in technology uncertainty (Mikkelsen and Johnsen, 2019). As a result, this will improve CVC's *reputation* which leads to an improved power position on an *organizational level*.

On the *relationship level*, extending the supply network will increase the *supply substitutability* as CVC will have more suppliers to choose from. An actor outside the existing supply network will be a supplier new to the automotive industry and possibly of a smaller size than some of

CVC's known suppliers. This results in increased *demand share* at the tier 1 supplier, compared to using big established automotive suppliers. Creating a new relationship with an unknown supplier and bypassing the standard supplier approval process requires trust and commitment from both parties which affects the source of power; *interconnection*.

Depending on the size of the tier 1, the power position towards the semiconductor manufacturers changes. If the tier 1 is smaller than the suppliers that CVC have used earlier, then the tier 1's *demand share* at the semiconductor manufacturers are less than tier 1s that CVC has used before, which deteriorates the power position at the *network level*. The use of brokers increases the *substitutability of supply* as they have more supply paths than a typical automotive supplier.

If CVC would find a new supplier outside the known supply network they would improve their power position on the organizational and relationship level. However, they would not improve their power position on the network level. Though, if they were to combine that option with the use of brokers where the latter actor supports in sourcing semiconductors, the power position would improve on the network level as well.

#### 5.2.3 Take and Pay - Maintain partnership/accept locked in situation

If CVC ought to implement Take and Pay it would be an agreement with both tier 1s and semiconductor manufacturers since the components would be provided by the semiconductor manufacturers but received by the tier 1s. The reason for implementing take and pay further up in the supply chain is related to costs since introducing take and pay for further developed components, i.e at the tier 1 level, would contribute with larger costs. Take and pay enables CVC to change the power indicators of *trust, commitment, demand share, customer attractiveness* and *reputation*. Schultz (1997) defines the take and pay strategy as the commitment of production capacity from supplier to buyer while the buyer commits to volume. This will affect the *trust* and *commitment* in a positive way where volume is committed to however the risk is shared making the trust increase between stakeholders. However, contract management is necessary to realize this strategy since take and pay are clauses used in purchasing contracts (King and Spalding, 2013).

Commitment to volume has also been expressed by all tier 1s to be an attractive variable, making CVC increase its *customer attractiveness*. This originates from the high need of committed volumes already from the semiconductor manufacturers. They claim high utilization ratio in their production making them prioritize committed volume. This causes a chain reaction making tier 1s prioritize in the same way. By using take and pay, suppliers are ensured payment for a certain amount of volume regardless of if the customer collects the components or not, which will increase prioritization. In turn the tier 1's can commit to volume towards semiconductor manufacturers.

Take and pay also increases the demand share since bigger volumes are committed to, for a longer time with the assurance of payment to the supplier regardless of fluctuations of demand from buyers side. This has been proved to be a successful strategy, also presented in chapter 4, by another automotive actor that has managed to not be affected by the semiconductor crisis due to the two year take and pay contracts. Even though the actor argued that sufficient volume share is necessary for this type of strategy, CVC's favorable business case with higher margins ought to be a way to reimburse these high sufficient volumes.

Applying this strategy will contribute to increased costs since CVC will, most likely, pay for components not necessary. However, by establishing collaborations with brokers as mentioned
in 5.5.2 abundant components can be resold making these costs to decrease. Even though CVC would have to account for higher costs, sales revenue will be ensured which is crucial.

Take and pay as a strategy will affect the power position at the *relationship level* due to that CVC would increase its customer attractiveness and commitment increasing the prioritization from the supplier. This will also generate an improved reputation of being a reliable customer committing to relationships, influencing other suppliers to be more willing to cooperate. Thus, CVC will improve its power position at the *organizational level*. Additionally, by ensuring allocation, the power position in the *network level* will also be changed since other customers will be affected in terms of lower prioritization as a consequence of the increased prioritization and allocation towards CVC.

#### 5.2.4 Geographic stockpiling - Maintain partnership/accept locked in situation

Applying geographical stockpiling as a purchasing strategy will affect CVC's power indicators of *trust, commitment, customer attractiveness* and *importance of relationship*. As mentioned in section 2.7 stockpiling is a way to create resilience in the supply chain and for companies to continue its activities during disruptions (Liu et al., 2016) i.e. it is a way to reduce risks. Liu et al. (2016) argues that this strategy ought to not be used in a normal state since it is very costly,

instead to handle large disruptions. Therefore, during this semiconductor crisis this type of strategy is an approach to help secure supply. However, when the market stabilizes it is not the best solution. Therefore, this type of solution ought to be perceived as a short-term solution for securing semiconductor supply.

The indicators of *trust*, *commitment* and *importance of relationship* will increase if implementing integrated stockpiling at suppliers site. This, since the partnership and contracts with the supplier will extend when applying stock to the contract. This is also a solution that has to be controlled by using contracts where both parties have to share the risks of fluctuations. This can be compared to the take and pay contract where stocks have to be compensated for by the buyer in order for the supplier to be able to hold it. The commitment will thereby also affect the indicator of *customer attractiveness* where the buyer will commit to volumes and pay a fee for inventory handling.

The integrated stockpiling strategy would be more beneficial for CVC to implement than dedicated stockpiling since it is more cost efficient using inventories that already exist. However, this method can also benefit the issue of obsolete components since this strategy makes sure that components are being rotated. The benefits of applying stockpiles in different

geographical areas can also be highlighted due to the occurring trade wars restraining the market availability. By implementing stocks in different continents, CVC will have access to more suppliers, better prices and will reduce risk if disruptions would occur in one area.

Since this strategy also comes with a lot of costs it has been reflected by an automaker in relation to CVC that stockpiling ought to be performed as far up in the chain as possible to reduce costs; the more refined the more costs. Thus there will be higher costs in the supply chain, but it will enable sales revenue which ought to be prioritized.

This strategy has been successfully applied by other stakeholders both in the automotive industry however also actors in the telecom market. These stakeholders amplify the need of contract management, for both parties to commit to the partnership and share the risk of possessing and handling the stock. This will affect the *trust* in the relationship i.e. contribute to a favorable power position in the *relationship level*. Similar to take and pay, this will cause a chain reaction towards the stakeholders in the network when prioritization and allocation is directed towards CVC instead of other actors i.e. the power position in the *network level* will also be slightly affected.

# 6. Discussion

This chapter contains a comparison of sources of power in literature and sources of power found in the case study. Further a discussion regarding power position in the entire supply chain is conducted due to its high interconnection in this case. The purchasing strategies are further discussed with the aim to clarify its effect on CVC's power position and pros and cons attached to each strategy. Finally, the purchasing strategies are discussed by taking the perspective of the extended Kraljic matrix.

# 6.1 Sources of power present in the semiconductor supply network

As CVC to a certain extent is exposed to inevitable supplier dependence due to high supplier involvement and low supply and demand substitutability, which is fixed in this study, we started to look elsewhere. Being dependent on a supplier does not always have negative effects but those negative effects often occur when the supplier does not see the buyer as attractive (Schiele and Vos, 2015). If the buyer's attractiveness is increased the power gap can be decreased (Ellegaard, 2004). Therefore, CVC's tier 1 suppliers' and the semiconductor manufacturers' perception of customer attractiveness became central in the thesis.

Revisiting the theory of sources of power and the indicators identified by Pazirandeh and Norrman (2014), it became clear that the variables for customer attractiveness found in our case study are connected with sources of power in theory. In Table 9 the attractive attributes, i.e. the informal ways that the tier 1 suppliers prioritize their customers, are summarized. The same phenomena is found for the semiconductor manufacturers and are summarized in Table 10. Beyond these factors there are other sources of power that are present in the relationship between CVC and tier 1s, and tier 1s and semiconductor manufacturers such as substitutability of both supply and demand.

Variables for customer attractiveness from tier 1s' point of view	Sources of power in theory
Large volumes	High demand share
Committing to volume	Increased interconnection (commitment)

Table 9. Tier 1 suppliers' perception of customer attractiveness is connected to sources of power found in theory

Sharing of roadmaps	Increased interconnection and decreased information asymmetry
Long term relationship	High interconnection (trust, commitment, importance of relationship)
High level management communication	Increases interconnection (commitment, importance of relationship)
Transparency of volumes in the supply chain	Low information asymmetry and increased trust
Technology sophistication	High reputation
Cultural similarities	-

Tier 1 suppliers prioritize customers with large volumes, i.e. high *demand share*. Multiple indicators of *interconnection* can be connected to the variables requested from the tier 1s side, such as sharing of roadmaps, long term relationships, high level management communication and transparency in the supply chain. The latter variable is also connected to *information asymmetry* and indicated as low when transparency is implemented, i.e. when transparency from both parties is present the information asymmetry decreases. Further, tier 1 suppliers value customers who commit to volumes which is a commitment to sharing risks in the supply chain and thereby the source of power; *interconnection*.

Tier 1 suppliers' customers' innovativeness and technology sophistication was found as an important attribute, which in theory is connected to the indicator *reputation*. This can also be connected to the success factors to secure supply of semiconductors where "technological knowledge in-house" was the factor expressed by most actors. This emphasizes the importance of reputation as a source of power in this case study. Lastly, for the variable cultural similarities a direct connection could not be found to a source of power in theory. However, this variable is not of as high importance as the other attractiveness variables since it is not a factor that decides if a business deal is done or not but rather eases the relationship while ongoing.

A connection between variables of customer attractiveness and sources of power in theory was also found when analyzing semiconductor manufacturers' perspective. For semiconductor manufacturers, customers with large volumes, i.e. high *demand share*, are more prioritized and get better allocation of volume than customers with lower volumes. Secondly, customers who commit to volume are prioritized over customers who do not commit to volume, even though they have large volumes. Thereby *interconnection* as a source of power is present as the supplier values the customer's commitment to the exchange and relationship. Transparency and increased information was shown to be a variable for customer attractiveness from the semiconductor manufacturers point of view which is connected to low *information asymmetry*. Lastly, the telecom actors with low volume but who are the ones who drive innovation, are adequate evidence that technical sophistication, i.e high reputation, is a source of power as these actors get prioritized even though they do not have large volumes.

Table 10. Semiconductor manufacturers' perception of customer attractiveness connected to the sources of power found in theory

Variables for customer attractiveness from semiconductor manufacturers' point of view	Sources of power
Large volumes	High demand share
Committing to volume	Increased interconnection (commitment)
Transparency / information sharing	Low information asymmetry
Technical sophistication	High reputation

### 6.2 The subjective sources of power contradicting the rest of the case study.

In this case study some indicators are more salient than others. Several indicators have been mentioned in deliberative cases however, four indicators of customer attractiveness have been mentioned by every stakeholder in the supply network of semiconductors; *Large volumes, committed volumes, transparency/information sharing* and *technical sophistication*. Even though large volumes are highly prioritized, tier 1 suppliers and semiconductor manufacturers sometimes prioritize committed volumes higher. When comparing allocation of volume between actors similar to CVC this distinction is applicable, while in other cases it would not be. For instance, committed volumes from an automaker would most likely not be prioritized higher than volume from a consumer electronics actor, as the volume is radically much higher for the consumer electronics actor. Expressed by several stakeholders, low volume can be accepted if the business case is favorable, e.g. high margins or opportunity to access new technology, which proves that sources of power present are dependent on external situational factors. This can also be proved by the previously mentioned case in 6.1, where Telecom

companies, despite unfavorable demand share, are prioritized due to other markets' dependence on their technical developments of infrastructure. Thus, customer attractiveness is subjective, as it varies in every relationship and is also affected by other network actors present. The power position of an actor is also based on several sources of power which proves that solely considering one source of power such as volume would not represent the full picture nor ought it to be viewed as key in every case.

Today, the automotive industry is having a hard time competing on volume, i.e. demand share, with the other industries. This volume barrier could slightly decrease due to the fact that some big consumer electronics and telecom actors are moving towards making their own semiconductors. This might open up possibilities for other markets to seize a bigger demand share of the semiconductor manufacturers. The latter actors will have to find other industries and actors to extend the collaboration with.

The automotive industry's attractiveness in the eyes of the semiconductor manufacturers might increase partly due to the need for semiconductor manufacturers to find new customers. An additional reason is that semiconductors are perceived to drastically increase in the BoM of all types of vehicles, increasing the overall volume demand, which makes the industry more attractive to semiconductor manufacturers. Also, the new cutting edge technology used for electrification and autonomous driving is drawing the semiconductor manufacturers attention to the automotive industry. This supports that, even though large volumes are heavily discussed to be the main key to secure supply, it is not the entire truth as we can see the importance of technology sophistication as well.

## 6.3 Power positions in the supply chain

It is of importance to emphasize that it is not enough for OEMs to only secure their own power position towards tier 1 suppliers, but to facilitate possibilities for tier 1s to improve their position towards semiconductor manufacturers. If not, there is a risk that tier 1 suppliers will become a huge bottleneck and the result of shortages will continue to be a problem for OEMs. By providing accurate forecasts, roadmaps and committed volumes and thereby sharing risks, it is possible for tier 1s to provide the same information and commitment to the semiconductor manufacturers. Thereby, tier 1 suppliers can improve their prioritization and in turn be able to supply its customers. This supports the shift from the previous trends of exploiting suppliers towards a supply network where collaboration is a key success factor.

#### 6.4 The purchasing strategies' pros and cons

The purchasing strategy included in extending the supplier network of the usage of distributors has also been discussed to be a strategy to increase the substitutability and find new suppliers in the network. However, CVC is highly dependent on tier 1s as solution providers instead of solitary component providers, making distributors not an optimal supplier for the components at the department included in this case study. Instead, distributors have been used when shortages have occurred, as a broker, and when production is to be affected by the shortage. Although, the components have not been bought directly from CVC instead via tier 1s with the help from CVC. This brings the discussion if this kind of collaboration is only beneficial during shortages and this semiconductor crisis instead of as a long-term solution. However, in the future if CVC would collaborate closer with semiconductor manufacturers, distributors would be a supply path to consider.

Take and pay as well as geographical stockpiling ought to also be viewed as short term solutions for securing supply of semiconductors until the market has been balanced. Since the outlook of the semiconductors is viewed to be unbalanced for some more years, it would be beneficial for CVC to implement purchasing strategies to reduce the negative effects of this situation. Although cooperative purchasing and extending the supplier network are viewed as long term solutions for securing supply where cooperative purchasing will bundle CVC closer to the semiconductor manufacturers where collaborations are easier to establish. By extending the supplier network it is also possible to find new supplier paths to join in longer relationships with to secure supply.

Due to that CVC lack sufficient volume as well as in-house knowledge about semiconductors, sourcing semiconductors directly from semiconductors manufacturers would not be a beneficial option. Instead, in order to manage to secure supply of semiconductors in the long run, CVC has to improve its relationship with tier 1 suppliers. Closer collaborations are necessary with focus on sharing road maps, increasing transparency and committing to volume i.e sharing risk with the tier 1 suppliers. One of the main attractive resources possessed by CVC is its technical sophistication which is of high importance to continue to be foremost in innovation to attract suppliers and claim allocation. Also, CVC should increase their knowledge sharing with its sister companies as the latter actors possess more knowledge about semiconductors. The sister companies also possess know-how on how to increase knowledge in-house which CVC should take advantage of.

## 6.5 Purchasing strategies in the perspective of the Extended Kraljic matrix

In order to handle the challenges of a strategic product it is of importance to treat the product accordingly. The four purchasing strategies that have been taken into consideration correspond with the strategies presented in Figure 4 by Gelderman and Van Weele (2003); *Maintain strategic partnership, accept lock-in partnership, find new suppliers and pooling of requirements.* These strategies have also been discovered as successful strategies implemented by other actors in the market. This is presented in chapter 4.

When analyzing the purchasing strategies in the perspective of Caniëls and Gelderman (2005), two approaches have been applied. Firstly, the already established relationships with tier 1's, with a component perspective, are taken into consideration and how to further develop these relationships to utilize benefits attached to strategic relationships as much as possible. Secondly, the non-existing relationship with semiconductor manufacturers will be analyzed since today, solely semiconductors, are not handled at all. Therefore, one approach will also consider a new relationship with semiconductor manufacturers where solitary semiconductors today are treated as non-critical products. The analysis will include how to move from a noncritical approach to establishing a strategic relationship with semiconductor manufacturers via VG and how to increase volume share towards tier 1s by applying cooperative purchasing i.e pooling of requirements.



#### Figure 14. Chosen purchasing strategies to move towards strategic purchasing

Taking the perspective of the extended Kraljic matrix, *cooperative purchasing* will result in members pooling their requirements which increase the profit impact and the leverage towards suppliers due to the increased demand share. As semiconductors today are treated as noncritical items it is the starting point, and when applying cooperative purchasing CVC will move from treating semiconductors as non-critical items to leverage items. Further, if a strategic

partnership would be applied between the purchasing group and a supplier, semiconductors would be treated as strategic items. This is illustrated in figure 14.

Semiconductors should be treated as strategic items due to the high supply risk and medium to high profit impact. *Extending the supply network* and thereby finding new suppliers outside the already existing supplier base lowers the supply risk, regardless if CVC decides to find a new tier 1 supplier or a broker. Brokers will in this case be a way to increase the substitutability of supply further up in the supply chain, acting as a supplier to tier 1 suppliers. If CVC would enter a strategic partnership with this new supplier the item would be treated as strategic.

Take and pay as a strategy corresponds with the strategy presented by Gelderman and Van Weele (2003) of accepting lock-in partnership and maintaining strategic partnership. By sharing risks and committing resources to each other contributes to maintaining a partnership favorable for both parties. The power position will not change in an extended way, instead CVC will adapt their position according to the situation with the possibility to utilize new benefits with an extended partnership.

By applying geographical stockpiling CVC will address the maintaining strategic relationship and accepting lock-in situation strategies and will by this strategy handle the components as strategic according to Gelderman and Van Weele (2003). Although prioritization would increase due to the risks and costs that are being shared between both parties. Therefore, CVC will adapt i.e. improve its position by extending the partnership and adjusting activities in line to the situation.

# 7. Conclusion

This chapter concludes the case study by answering the two research questions presented in chapter 1.2. The conclusions are both taking empirical findings and theory into consideration and can be read as a conclusion and recommendations for the focal company.

The new technical paradigm shift in the automotive industry has put the focal company in a new power position, unfamiliar to the firm. The aim of this study was to define the focal company's power position in the semiconductor network and create an understanding of how to manage supplier relationships when the company does not possess a dominant position towards suppliers. This study also aimed to investigate if it is possible to change the power position of the focal company in order to secure supply of semiconductors, by looking into

present sources of power in the network and using purchasing strategies to address these sources of power and thus change power position. In order to fulfill the aim of the thesis, two research questions was constructed:

#### RQ1: How does CVC's power position in the network affect supply of semiconductors?

CVC is in a position of slight buyer dependency towards its tier 1 suppliers. However, tier 1 suppliers in turn are situated in a similar position towards the semiconductor manufacturers. The sources of power that puts them in this position is mainly *demand share* and *information* asymmetry. Tier 1 suppliers and semiconductor manufacturers both prioritize, i.e. distribute their volume allocation, according to the customers' attractiveness. Therefore, one can say that the variables for customer attractiveness also are success factors to secure supply of semiconductors. CVC's supply of semiconductors is dependent on their power position towards tier 1 suppliers as well as the tier 1s' supply of semiconductors from semiconductor manufacturers. If CVC has buying power over their supplier (tier 1) but the tier 1 in turn does not have any power over their supplier, CVC's supply of semiconductors will be affected and tier 1s can be seen as a bottleneck. This emphasizes the importance of moving towards a network approach instead of dyadic supply chains. This concept is illustrated in Figure 15 where the width of the arrow represents the volume of supply of semiconductors. To the right is the case when tier 1 suppliers have higher buying power towards its supplier of semiconductors than the left case, all other things being equal, which yields bigger volumes for tier 1s and thereby also CVC.



Figure 15. Visualization of volume allocation in the supply chain

The other layer of the point in question is when CVC has higher buying power toward the tier 1 supplier, compared to the tier 1's other customers, all other things being equal (illustrated to

the left in Figure 16). This yields a higher volume than if CVC would have lower buying power or customer attractiveness toward the tier 1, than other customers.



Figure 16. CVC's power position towards tier 1 suppliers in relation to how other customers affect its supply of semiconductors.

Conclusively, CVC needs to have an increased focus on the sources of power present in their relationships with the tier 1s; commitment, transparency, demand share and technical sophistication and focus to improve them to improve their power position. Further, they should adapt each individual supplier relationship in line with the customer attractiveness variables present in each relationship. This since it has become clear that variables attractive in some cases, will in other cases be surpassed by other variables as stated in 6.2. By focusing on this CVC will improve its power position, not drastically change power position but adapt to the situation and utilize the existing benefits in the relationship.

We conclude that when situated in an environment of high technology uncertainty with low substitutability, it is of importance to extend the view of the supply chain from a dyadic supply chain towards a network perspective. Companies have to accept the fact that collaborations and interactions are of high importance and that relationships have to be adapted to individual cases and their external circumstances, and not have one general approach to manage their supplier relationships. This study proves that increasing the customer attractiveness towards suppliers contributes to a better power position, thus increasing the resilience of the supply chain i.e. securing supply and the companies competitiveness on the market. CVC will have to, in the relationship with tier 1s, increase their transparency, commit to volumes, continue to be in the forefront of innovation and start looking for possibilities to increase their demand share.

# RQ2: How can CVC secure their supply of semiconductors through purchasing strategies when being dependent on their suppliers?

In all markets where semiconductors are present there have been disruptions in the supply chain in the aftermath of the covid-19 pandemic in 2020. However, some actors have been more successful to secure supply than others. Some purchasing strategies that were repeatedly mentioned when scanning the market and interviewing different stakeholders, showed four main strategies affecting the supply chain in a beneficial way, which was "take and pay", geographical stockpiling, cooperative purchasing and extending the supplier network. These purchasing strategies can be implemented either separately or in combination and are presented in figure 17.

Although, one imperative for even beginning to implement purchasing strategies of this kind is increasing the knowledge of semiconductors in-house. As earlier mentioned both by other stakeholders and by CVC themselves, it is not possible to manage parts you know nothing about. By taking part of Project 1 within VG and thus increasing the knowledge of semiconductors incorporated in the components they buy, they would enable further categorization of semiconductors. This is important as some semiconductors are more critical than others and should not be treated as equal. When possessing this kind of knowledge, the realization of the discussed and analyzed purchasing strategies are possible to implement for critical semiconductors.

Through implementing the purchasing strategies discussed and analyzed in this report, CVC would address the sources of power present in their supply network and thus improve their power position in the network both on a short term and long term basis. Thus, by improving the power position, CVC will become a more attractive customer and in turn increase its prioritization at the tier 1 suppliers. In this way, CVC would secure supply, through the use of purchasing strategies, since tier 1 s would be less reluctant to direct allocation in CVC's direction.



Figure 17. Possible purchasing strategies that lead to securing semiconductor supply.

## 7.1 Limitations & recommendations for future research

The duration of the thesis was limited to four months which restricted the available time to collect data. If we would have had more time, more stakeholders would have been possible to interview and thereby additional perspectives on the semiconductor market. The thesis was performed during a crisis situation in the semiconductor market with shortages of components worldwide as a result of covid-19 as well as fires and snowstorms which impaired multiple production facilities. The crisis situation limited our ability to get interviews with more candidates, stakeholders and specifically semiconductor manufacturers. The ambition to define the relationship between CVC and every tier 1 supplier that supplies components containing active semiconductors was thereby limited to just a few tier 1 suppliers. The tier 1 suppliers included are the ones that have answered to our interview requests and participated in interviews. Further down the supply chain it was even harder finding possible interviewees which limited the input of data on that level.

Our study focused on the supply chain of semiconductors and it did not include wafers, which is an element that semiconductors are based on, which have a long production lead time as a result of enormous amount of process steps which extends the complex supply chain that we have studied. We can see a trend of that competition might be pushed further up in the supply chain towards wafers manufacturers. Wafers are a natural sequel that ought to be further investigated, as the more actors there are between an OEM and critical components, the higher the risk of diverging volumes and bottleneck situations.

The study was performed in the beginning of the technology transformation of electrification, connectivity and autonomous driving in the automotive industry and a lot of changes of the power dynamics in the network can change in the coming years. Therefore, we recommend conducting a similar study on the power dynamics in the supply network of semiconductors in the automotive industry in a couple of years to see what has changed.

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# Appendices

# **Appendix A - Interview Template for Commodity Purchasers**

### Introduction:

- 1. Tell us about yourself and your role at CVC.
- 2. How many components are you responsible for?
- How many of them contain at least one semiconductor? (Active/passive) (Microcontroller?)
- 4. For the components that you are responsible for, which suppliers are you in contact with? (mainly)
- 5. Who else is involved from CVC in this relationship?

#### **Reputation:**

1. What comes to mind when you hear: (name their supplier/suppliers)

- 2. How do you perceive this supplier regarding; size, brand, price, expertise, technology sophistication?
- 3. Do you perceive this supplier to be legitimate?
  - 1. Do they perform as promised?

#### Substitutability supply:

- 1. What products does the supplier offer?
- 2. Do you have substitutionally options for this/these products?
- 3. Do the products have any market regulations?
- 4. How often are new suppliers entering this market?
- 5. How extensive is the switching cost?

#### Interconnection:

- 1. How important is the supplier in exchange decisions?
- 2. How is the history of the supplier? Long-term, short-term? Conflicts?
- 3. If you would be forced to change supplier, how much impact would it have?
- 4. How is the commitment between CVC and the supplier? Based on trust or power?

#### Information asymmetry (per supplier):

- 1. How much do you know about the suppliers capacity and output?
  - 1. Their lead time?
  - 2. If deviations occur, how long before you are informed?
- 2. How much does the supplier know about CVC demand?
- 3. Do you control the information that is shared? *Which position do you have in the communication flow?*
- 4. How much do you know of the supplier market within this segment and the exchange between other actors?
- 5. How transparent are CVC towards suppliers regarding information?

#### **Importance of purchase (per part):**

- 1. How much do the components cost?
- 2. Do you know the annual demand of the components?
  - a. Volume value per supplier
- 3. Could you explain the value adding profile of these components? What kind of value does it bring to the end product?
- 4. What is the consequence if there are shortages of the components?
  - a. Production stoppers?
- 5. What's your outlook for this/these component(s) in the future? How will they develop?

#### R&D

- 1. How is your collaboration with R&D?
- 2. Is the decision of the semiconductor made by R&D or together with the purchaser? Why, why not?
- 3. If the specifications were different, would the supply base be bigger?
  - a. Is there room for changes in the specification to increase the supply base?

1. How do you interpret the relationship you have to your suppliers?: (mark with a X, and explain)

	Supplier 1	Supplier 2	upplier 3
Supplier dominance			
Scania has dominance in the purchasing decisions/relationship			
Equal dependency			
ndependence of each other.			

### 2. How substitutable is the component/components?

There is only one supplier	1	2	3	4	5	Perfect competition
Component 1						
Component 2						
Component 3						

# 3. How many suppliers are usually available for each component type? (max, min, and average)?

	Component 1	Component 2	Component 3
Maximum number available			
Minimum number available			
Average number available			

# 4. Compared to each supplier, how much control does CVC have over purchase decisions?

No control	1	2	3	4	5	Total control
Supplier 1						
Supplier 2						
Supplier 3						

# 5. How costly is it to switch suppliers?

Minimum cost	1	2	3	4	5	Extremely expensive
Component(s) 1						
Component(s) 2						
Component(s) 3						

# 6. How often do you experience shortages from this supplier?

Never	1	2	3	4	5	All the time
Supplier 1						
Supplier 2						
Supplier 3						

## 7. How much information do you share with this supplier?

Nothing	1	2	3	4	5	Full transparency
Supplier 1						
Supplier 2						
Supplier 3						

# 8. How much information do you get from the supplier?

Nothing	1	2	3	4	5	Full transparency
Supplier 1						
Supplier 2						
Supplier 3						

# 9. What common purchasing strategies do you carry out within your segment? (mark with "X" for strategies you carry out, one or more)

Detailed contract agreements	
Competitive bidding	
Extending current agreements	
Supplier development	
Spot purchase/Direct purchase	
Differentiated pricing for different suppliers.	
Purchasing several demand types from same supplier	
Global Purchasing	

Local Purchasing	
Multiple Sourcing	
Standard information sharing	
Increased information sharing	
Short-term supplier relationship	
Long-term supplier relationship	
Detailed contracts	
Soft contracts	
Other	

10. Explain why:

# **Appendix B - Interview template for tier 1 suppliers**

- 1. Tell us about yourself and your role at XXX
- 2. What are your responsibilities towards CVC?
- 1. What is your view of an attractive customer?
- 2. What variables are important for you as a company when going into a relationship with a customer?
- 3. How do you prioritize your customers?
- 4. How can a customer increase attractiveness towards your company when already in a relationship?
- 5. What comes to mind when you hear the brand VG?
- 6. How do you perceive VG regarding; size, brand, price, expertise, technology sophistication?
- 7. What comes to mind when you hear the brand CVC?
- 8. How do you perceive CVC regarding; size, brand, price, expertise, technology sophistication?

- 9. Do you perceive CVC to be legitimate?
- a. Do they act according to your agreement?
- 10. How many customers do you have for products you sell to CVC?
- 11. CVC share of total volume sold of this/these product(s)?
- 12. Do the products you sell to CVC differ in comparison to products you sell to other customers?
- 13. How much information do you experience that CVC shares with you? What kind of information?
- 14. How much information do you share with CVC? What kind of information?
- 1. How is your collaboration with the purchasing department?
- 2. Who takes the decision of which semiconductors that are going to be purchased?
- 3. Do you have multiple choices of suppliers for these components?
- 4. What are the main reasons for shortages?

# **Appendix C - Interview template other actors**

- 1. What does your company's relationship to tier 1 and semiconductor manufacturers look like?
- 2. In what ways is your company an attractive customer to Tier 1s and semiconductor manufacturers?
- 3. What, in your point of view, is important to secure supply in a longer perspective?
- 4. What is your strategy to deal with semiconductors in the future?
- 5. In what ways is your company an attractive customer?