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The challenges of supply market scanning

A comparative study of supply market scanning for mature- and innovative technology in the automotive industry

Master's Thesis in Supply Chain Management

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Abstract

The automotive industry is experiencing quick technological developments in areas such as automation, connectivity and electromobility. This pushes large automotive OEMs to innovate and at the same time provide their more mature technology to customers. This calls for scanning the market to fulfil two parallel needs; both to find technical innovation in the market and to find the best possible suppliers for mature segments. Literature on the area suggest that there might be different challenges associated with scanning for innovative technology compared to mature technology, but no studies have explicitly been done to compare the cases. This study therefore aim to investigate what the different challenges are in supply market scanning for mature technology, compared to the challenges associated with scanning for innovative technology.

The study follows a qualitative approach and is based on data collected through 19 interviews. The interviews was divided into two categories, one targeting people in the organisation conducting supply market scanning for mature technology and one targeting people conducting it for more innovative technology.

The study finds that the challenges of supply market scanning for mature technology have similarities to that of innovative technology, but that there are a few key differences. Supply market scanning for mature technology mostly faces challenges related to areas of *information gathering*, *knowledge and experience*, *cross-functionality and network* and *storing and sharing information.* Examples of challenges are: purchasers must have a big network, not having guidelines of how to do supply market scanning, making gathered information accessible to those of need it and not losing built up experience. Regarding supply market scanning for innovative technology they also face the challenge of making information accessible to those of need it, but more significantly they have different challenges related to the areas *mindset*, *legal aspects* and *specifications.* These areas include challenges about making the organisation open to scan for innovation despite the uncertainty it infer, adapting legal documents to fit new types of suppliers and being able to specify innovative technology.

The study discusses possible ways to address the identified challenges in order for large automotive OEMs to improve their supply market scanning. The study does for example conclude that such companies should reduce job rotation, introduce formal guidelines for how to conduct supply market scanning, introduce a functional central database for supply market intelligence and change mindset in regards to innovative technology.

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1. Introduction

1.1 Introduction to the Case Company

Volvo Group Truck Purchasing, hereinafter referred to as Volvo, sources a vast number of different components with a wide range of characteristics, such as differing level of maturity and innovation. A lot of the supply come from large suppliers which have been used for a long period of time. The majority of the sourced components are characterised as mature technology, but purchasers at Volvo now also are responsible of finding new types of suppliers in order to keep up with current developments in the industry.

Purchasers at Volvo express some difficulties in conducting supply market scanning. For example, to know all suppliers in the market. A purchasing manager at Volvo states: *"Recently we discussed the main areas where we lack competence. The first area that was mentioned by the managers was market knowledge".* Furthermore, Volvo contend that it is highly individual how different purchasers scan the supply market and how often. They express concerns of both risk of missing suppliers outside their current supplier base when sending RFIs and of missing new types of suppliers in the market that could increase their competitiveness and level of innovation. The need for supply market scanning at Volvo is twofold; they need to both be able to scan the market for new innovative suppliers and to find the most competitive suppliers for their traditional, mature components. These two parallel supply market scanning needs are assumed to pose different types of challenges for Volvo.

1.2.1 Supply Market Scanning

The State of Queensland (2018) contend that supply market scanning generally can give a deeper understanding regarding the available suppliers and the value they can provide to a purchasing organization. This is also emphasized by Jones and Barner (2015) who states that supply market scanning is crucial for identifying prospective suppliers. Bruel (2017) points out that not enough companies look for new suppliers on a regular basis, instead most companies only search for new suppliers when there is a particular need. He contends that companies, often wrongly, believe that they do not have the proper knowledge or that it will be too expensive to conduct supply market scanning, compared to what it will return. Jones and Barner (2015) does however in contrast to this statement contend that purchasers generally do not have the experience or formal training to conduct SMS.

Jones and Barner (2015) contend that large companies have dedicated full departments which search for the very best suppliers, but where the corporate commodity buyers also commit to doing market scanning themselves. The latter is much enabled by the internet which provides live information in a convenient and fast way. Jones and Barner (2015) contend that it is both time consuming and difficult to find suppliers. As an example, they acknowledge that performing general web-searches both yield unrelated results and too much data to efficiently process. Yet, this process of finding the right supplier-candidates through gathering information of the supply market, is one of the most important task in the sourcing process (Jones and Barner, 2015). Accordingly, a study by Babatunde and Adebisi (2012) showed that strategic scanning of the business environment in fact has a direct effect

on effective organizational performance. Zsidisin (2015) does however contend that there is a lack of research on scanning and processing the information from upstream supply markets.

1.2.2 Supply Market Scanning for Innovative Technology

Using supply market scanning can not only help an organization to increase their supplier base, it can also help them find innovative- technology and suppliers to address a company's challenges (Cousins et al., 2011). Many companies actually turn to its supplier base to find innovation due to decreasing in-house resources as well as a continuously change of demand from customers Zsidisin et.al (2015). Van Weele (2014) also claims that purchasers often turn to former known groups of suppliers instead of looking for new ones. However, innovation in the market also has the implication, according to Mikkelsen and Johnsen (2018), that companies may have to source from new suppliers in different supply markets in order to find innovative technology.

Many different industries are changing but the automotive industry might be one of the better examples of an industry that is continuously evolving and changing. Since the beginning of the automotive industry era both the product itself as well as how the product is manufactured has changed and evolved (Townsend and Calantone, 2014). Currently, the industry is undergoing a rapid technological change in three large areas. These could be summarized to connectivity, automation and electrification (Volvo Group, 2018; Scania Group, 2018; Daimler, 2018). This is a change that is said to be in the beginning of its development and therefore the uncertainty of technology is high.

Zsidisin (2015) emphasizes that supply market scanning is especially strategically important in an environment of globalization, outsourcing and amplified supply risk. Previously mentioned trends in the automotive industry, such as electrification, autonomous driving, connectivity and stricter emission legislation therefore force big OEMs to, more than ever, scan their supply market in order to both stay competitive and to capture innovation from the supply market. Especially since these trends create a higher degree of technological uncertainty in the supply market and according to Daft et al. (1988), the amount of information that needs to be scanned for, processed and analysed for an organization, increases when the uncertainty in the environment increases.

Despite shifting trends and threats outside the company call for innovation, Bessant et al (2005) contend that the internal environment of many companies is often relatively stable. He states that companies who are strong in a particular market of mature technology have a more difficult time to change path due to institutional- and psychological barriers, as well as commitment to existing technologies. The conclusion to be drawn from this, is that there are, or might be, specific challenges for conducting supply market scanning for innovative technology.

To conclude, research on the topic of supply market scanning agrees of the importance of supply market scanning (Van Weele, 2014; Zsidisin, 2015; Jones and Barner, 2015) and also that there are a lot of challenges associated with it (Jeeva, 2008; Daft and Weick 1984; Jones and Barner 2015). But research that investigates and compares challenges associated with supply market scanning for new innovative technology, with supply market scanning for traditional, mature technology, are missing.

1.3 Aim

Current market trends in the automotive industry, such as electrification, autonomous driving, connectivity and stricter emission legislation forces large OEMs to more than ever scan their supply

market in order to stay competitive and capture innovation in their supply base. Purchasing, being the interface between the company and the supply market, play an important role in scanning the supply market to find the right suppliers to source from. They need to both be able to effectively scan the supply market for suppliers of their traditional, mature components to ensure low price, quality etc., as well as scanning for new innovative suppliers to keep up with developments in the market. This means that supply market scanning in large automotive OEMs need to facilitate two parallel purposes, with possible different associated characteristics and challenges. This research therefore aims to investigate what the different challenges are in supply market scanning for mature technology, compared to the challenges associated with scanning for innovative technology.

1.4 Research Question

1. How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology in large automotive OEMs?

2. How can large automotive OEMs, address these challenges and improve their supply market scanning.

2 Literature Review

This section will present the existing theoretical research related to the study and will then be the foundation to the analysis and discussion. The subsections in this chapter will be structured as follows: 2.1 will focus on different aspects covering supply market scanning, 2.2 is about supply market intelligence and how it is stored in companies, 2.3 will handle absorptive capacity. Lastly, in 2.4 a literature framework will be presented, discussing how the different parts of the literature connect to each other. Furthermore, a comparative framework will be presented, containing the different challenges of supply market scanning for mature technology and supply market scanning for innovative technology.

2.1 Supply Market Scanning

Supply market scanning can according to Zsidisin (2015), be described as: *"...efforts to learn from benchmarking, suppliers, analysing market trends and experimenting with new technology".* Van Weele (2014) describe supply market scanning as "*the systematic gathering, classification and analysis of data considering all relevant factors that influence the procurement of goods and services for the purpose of meeting present and future company requirements"*. Supply market scanning in the context of a purchasing department shall foremost support decision-making and the continuous improvement of the purchasing department's performance (Van Weele, 2014). According to The State of Queensland (2018) supply market scanning have the power to improve an organization's understanding of how a market works, what the trends in the market look like and which will further evolve. Research on supply market scanning also agrees that one of the most important aspects of it is to find suitable supplier to source from (Jones and Barner, 2015; The State of Queensland, 2018; Zsidisin et al., 2015).

Bruel (2017) argues that finding suppliers should begin with gathering general, macro-economic and technical information gathering, which considers the respective countries that the company targets, to get a short list of which to continue the search within. After that, the process of gathering information about the supply market and supplier within each country can begin. Jones and Barner (2015) calls this approach top down; that is, starting with a broad scan of the supply market and then narrow it down to dig for more specific information. Another approach is also presented by Jones and Barner (2015), namely the bottom up approach. In this, the company starts with the existing supply base and explore who their competitors are in the supply market, to possibly expand the supply base.

2.1.1 Supply Market Scanning Model

Jones and Barner (2015) present a 4-step model of doing supply market scanning, valid for both top-down and bottom-up approach described in the previous section. Figure 1 shows this model as presented by Jones and Barner (2015):

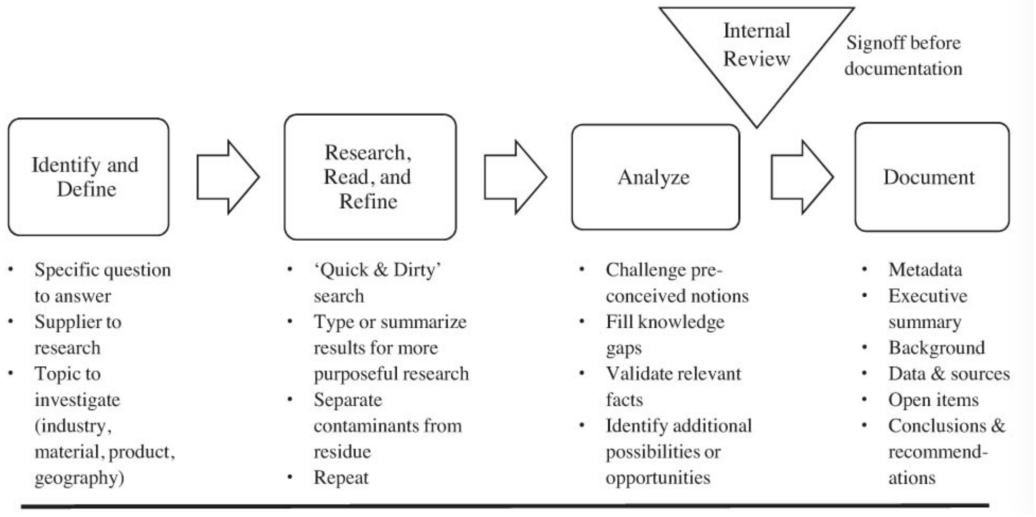

Figure 1: *Model by Jones and Barner (2015) that in 4 structured steps describes how to do supply market scanning*

1. Step one is what they describe as "Identify and Define". This step is about defining the requirements of supply market intelligence, i.e. what is the goal of the research. What information should be gathered in the research should be mapped so that the product of this step becomes a framework for the rest of the supply market scanning activities.

2. Step two, "Research, Read, and Refine" is meant to increase the purchaser's knowledge of the specific topic defined in step 1. Researching is about identifying the right terminology for the topic as well as finding relevant, trustworthy sources of information. After that, "reading" referred to actually getting down to reading through material and filtering away irrelevant or contextual information that has no place in the final documentation. Finally, step two is an iterative process, so "refining" the information gathered and perfecting the research approach for the next iteration is crucial.

3. Step three, "Analyse", has the goal of finding use for the information gathered and applying it to the organisation, according to Jones and Barner (2015). This takes time and experience to do and Jones and Barner (2015) suggest using some type of analytical framework to make it easier. Questions that should be asked and answered in this step is: What do we know? What does it mean? and What should we do? This will hopefully lead to identifying possibilities and opportunities.

4. Finally, step four is to document what has been done. What should be documented is metadata that gives context, executive summary giving the brief overview, background that expands the executive summary, conclusions that gives a recommendation, and finally what information sources was used.

Supply market scanning does however not always follow a structured model. Jones and Barner (2015) contend that the reason for conducting supply market scanning can both be due to a very specific predetermined need or goal as mentioned in the model above, but also due to a much more spontaneous reasons, discovered by purchasers in the day to day activities. This spontaneous pursuit of supply market intelligence, they call "opportunistic intelligence". This includes the spontaneous

communication such as asking questions to internal stakeholders and suppliers, according to Jones and Barner (2015). They present the example that opportunistic intelligence can come from a situation where an experienced purchaser is told by internal stakeholders that a product only can be sourced from one specific supplier, but purchaser know that this might not me the case, thus initiating supply market scanning activities.

2.1.2 Supply Market Scanning Intensity

As mentioned in the introduction, Bruel (2017) points out that not enough companies look for new suppliers on a regular basis. Therefore, it could be argued that it is of interest to look at what influences supply market scanning intensity. In this study this will be done by looking at two different explanations on what supply market intensity varies.

Early research by Daft and Weick (1984) present a theory on why supply market scanning intensity varies. They mean that there is a correlation between the maturity and size of a company and the degree of which they search new information about their external environment. They contend that new young organizations actively search for information about their environment, but as time passes and the organization grow, they tend to accept their environment and stop scanning the supply market for new partners. Contrary to this, the need for systematic supply market scanning has increased in recent years (Van Weele, 2014).

Later research by Handfield (2006) show that the degree of which a buyer must seek information varies in intensity, depend mainly on two variables. These two are the *"strategic importance/ technical complexity of purchase"* and the "*Capability of existing supply base to satisfy purchase requirements on cost, delivery, technology and service*". In Figure 2 these two variables form the X- and Y-axis in a 2x2 matrix.

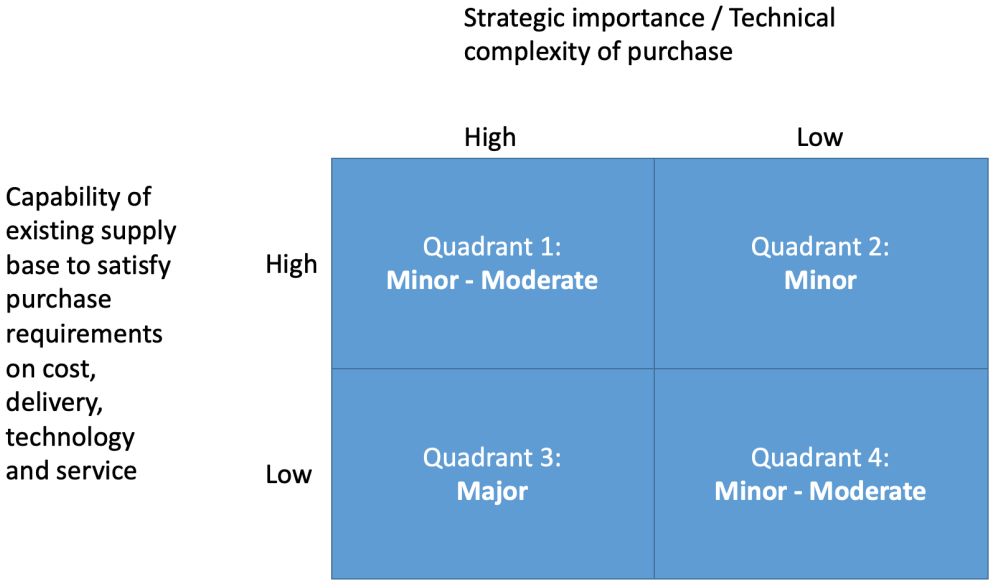

Figure 2: *A 2x2 matrix showing intensity of information search under various conditions, adaptation from Handfield (2006)*

Handfield (2006) contend that since the buyer has the required suppliers in quadrant 1 of Figure 2, the search for information will mostly be to verify that the supplier is still the best source and are therefore minor to moderate in intensity. In quadrant 3 however, the buyer does not have the

information needed since there are not suppliers in the supply base with the right capabilities, which means that the search intensity will be much higher. The lowest search intensity is found in quadrant 2, where the strategic importance is low, and the capability exists in the supply base. Relative to quadrant 2, quadrant 4 will have higher search intensity since the nature of the sourced products in this quadrant is less strategic or routine products.

2.1.3 Information Sources for Supply Market Scanning

So far in this study it has been elaborated on a model for conducting supply market scanning and how it can vary in intensity. The model by Jones and Barner (2015) did however not go into detail on how to perform the actual scanning activities, i.e. what sources of information to use. According to Branch (2002) there are multiple sources of information aiding in the search for potential suppliers, but many companies hesitate to scan the market for new suppliers because of a belief that it will be costly (Bruel, 2017). In this section, information sources are presented and elaborated on, as portrayed in the literature.

2.1.3.2 Internet Searches

Van Weele (2014) suggest utilising the internet to find suppliers. For the automotive industry he suggests sites such as Covisint.com and SupplyOn.com, which list suppliers. Handfield (2006) also state that internet search engines are a powerful tool to find suppliers. Jones and Barnes (2015) does however point out that purchasers often retrieve an overload, or the wrong information in these internet searches. To amend this, they suggest that purchasers learn to use both “Boolean operators” as well as other key operators, which are tools to control what is shown in the search result. Knowing these types of operators, ensures the purchaser can more easily sort through search results, or find more information when needed.

2.1.3.3 Colleagues

Bruel (2017) emphasizes the use of talking to colleagues as a source of information. Handfield (2006) point out that companies are often separated into different business units and sharing information across these provides opportunities to get information about potential suppliers. He contends that the information sharing can take the form of formal or informal meetings, purchasing newsletters or strategy development sessions.

Handfield (2006) also contend that experience gained from purchasers throughout the years are in of itself a huge source of information on potential suppliers. This experience is also a challenge to keep, since job rotation and career transfers means a risk losing this experience. Handfield conclude that earlier mentioned databases with stored supplier intelligence could mitigate such risks and ensure that relevant information stays within the company but contend that few companies use them.

2.1.3.4 Trade Exhibitions and Events

Branch (2002) and Handfield (2006) mention trade exhibitions as one effective way to scan for suppliers. At these, a buyer can generally get an overview of the competition, different prices and different levels of technology at the suppliers. Since many potential suppliers could be there, it also provides an opportunity for buyers to compare and benchmark them against each other. Furthermore, Branch (2002) says that more general seminars or sales conferences could also be a way to scan for suppliers and Bruel (2017) points out that there are clubs for procurement executives to exchange

information. These events are often good for both getting up to speed on general development in the market, but also networking (Bruel, 2017; Branch, 2002).

2.1.3.5 Reverse Marketing

According to Van Weele (2014) finding new supply can be done in a completely different way than the usual way of a purchasing company contacting potential suppliers and asking for price, availability, quality etc (see Figure 3). It can namely be turned around completely and attracting relevant suppliers without conducting any extensive SMS. This is by Van Weele (2014) called reverse marketing, Blenkhorn and Banting (1991) contend that this approach gives the purchaser increased control where the supplier traditionally has taken the initiative (See fig 4).

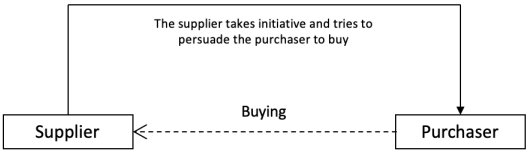

Figure 4: *Illustration of the traditional relationship between purchasers and suppliers, adapted from Blenkhorn and Banting*

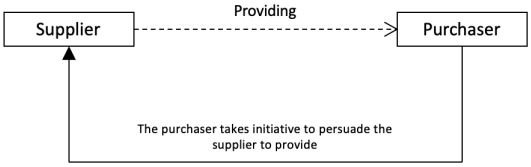

Figure 3: *Illustration of reverse marketing relationship between purchasers and suppliers, adapted from Blenkhorn and Banting (1991)*

Some companies find new suppliers by disclosing the company's supplier requirements publicly. At SONY this could for an example be the requirements that need to be met in order to qualify as supplier, required quality, jurisdiction and regulations to be fulfilled (Van Weele, 2014). This approach could according to Blenkhorn and Banting (1991) make the scanning process passive and let the suppliers make much of the purchasers' work. SONY also discloses information regarding its company policy, strategy, purchasing vision and list of contact information to purchasers that may be contacted. A company that uses this type of system can also according to Van Weele (2014) specify what type of components they are currently sourcing and its requirements on those. The suppliers that are interested then fill out a questionnaire in order to be included in the supplier screening, this is according to Van Weele (2014) done at both Sony and NASA. This website could as well be used when there is shortage of supply for a certain commodity and the buying company quickly needs more supply.

In order to make a reverse marketing strategy work, a prerequisite is that the buying company is attractive enough to get suppliers to contact them (Schiele and Vos, 2015). According to the same authors this attractiveness also helps mitigating conflicts and the risk of suppliers abusing a potential power position. In a case study conducted by Ellis et al. (2012) it is concluded that being the preferred customer, i.e. highly attractive, increase the chances of suppliers sharing their technologies and innovations. A buying company that is attractive enough can therefore effectively use reverse marketing.

2.1.3.7 Other Information Sources

Journals and magazines can provide information on suppliers as well as developments and trends in the market according to Branch (2002). Furthermore, trade directories can be effective for identifying suppliers (Jones and Barner, 2015, Branch, 2002). These can be issued by a number of different actors such as trade associations, different institutes, governments, international agencies, national chambers of commerce or other private companies.

2.1.4 Supply Market Scanning for Innovative Technology

As the aim of this study suggest, supply market scanning for innovative technology is will be investigated separately from that of mature technology. Therefore, this section will review what literature is available that explicitly focus on the innovative part of supply market scanning.

Schiele (2006) states that the word innovation refers to “something that did not exist before”, but that in a commercial setting it can both mean “new to the firm” or “new for the world”. Purchasing as a function has often been overlooked when it comes to their ability to contribute to companies' innovativeness (Schiele, 2006). Since innovation does not solely happen internally in the company, rather increasingly at the supplier (Schiele, 2006). Van Weele (2018) states that suppliers has been contributing with a wide range of innovation in the automotive industry, such as fuel injection, airbags, sun protection glass and tyre pressure sensors. Therefore, he argues that it is of critical importance to understand how to capture the innovation potential in the supply market. Meredith (2007) also contend that technological innovation at the suppliers will affect the buying firm. She urges companies to scan their suppliers offering to detect such changes, especially if the suppliers are geographically distant, as this can make detection more difficult.

2.1.4.1 How to do Supply Market Scanning for Innovation

Early research by Fahey et al. (1981) showed that there is no general agreement on how to structure an organization to scan for innovation in the market. They contend that consultants and governments often prefer a separate unit in the organisation that solely focus on scanning for innovation, while corporate respondents usually preferred these scanning practices to be part of daily activities at the different corporate functions. Later research by Van Weele (2018) contend that a prerequisite for successful technological exchange with suppliers, are a well-functioning collaborating within the buying company. Purchasing needs to have a close collaboration with R&D, production and product development, and furthermore have a professional project management leading the collaboration with the suppliers. Van Weele (2018) also argues that to enable technological exchange with suppliers, IT systems must be compatible and enable efficient information exchange.

Schiele (2006) point out that when supply market scanning for innovative suppliers, it is important to know what to look for. He states that one important characteristic of innovative suppliers is that they are specialized companies, not generic contractors and that the number of patents held can act as an indicator to help determine this. Other characteristic Schiele (2006) mention is that innovative suppliers generally are involved in multiple collaborations at the same time and that these relationships are based on trust and commitment. It is also important to know the requirements of what you are sourcing as well as knowing the terminology used in the supply market, especially when sourcing emerging markets and finding new market entrants (Jones and Barner, 2015). This is also emphasized by Cousins et al. (2011) who states that innovative technology requires thorough monitoring of technology interactions to ensure a good fit with existing technology.

Georghiou et.al. (2014) acknowledge that a good formulation of specifications can trigger innovation. Georghiou et.al. (2014) suggest formulating specifications in functional terms rather than what Van Weele (2018) describes as technical specifications. Functional specifications are outcome based and focus on the best solution and not, as in technical specifications where the focus is to ensure a certain route is taken to accomplish a certain solution. According to Georghiou et.al. (2014) a functional specification can increase the innovation on several levels since it gives the supplier room to make

improvements. The reason is according to the researcher that the solution is not specified in advance, instead a scope for the best innovation is created. Van Weele (2018) highlights that functional specifications gives suppliers the opportunities to showcase and apply their expertise. It also gives the suppliers an opportunity to provide a solution facilitated by new technologies that the buyer might not be familiar with, but that the supplier is expert at.

2.1.4.2 Challenges of Scanning the Supply Market for Innovation

Bessant et al. (2005) state that the main reason why existing mature companies have difficulties embracing innovation in the supply market, is because there is a mismatch between the characteristics of their dominant steady-state archetype and the requirement needed to capture innovation. He contends that companies under steady-state-conditions are generally good at working close with suppliers and have functioning processes for incremental innovation. Philips et al. (2006) calls this type of relationship with suppliers "strategic partnership", and in line with Bessant et al. (2005), contend that they have been successful in facilitating incremental innovation. However, these processes are also the barriers of scanning for, picking up and develop more radical innovation in the supply market because these established companies are mainly focused at scanning their existing supply base (Bessant et al., 2005). Philips et al. (2006) contends that it is crucial for companies to search for suppliers outside their existing supply base, in order to capture more radical innovation in the supply market.

There is a direct connection between the size and dominance of a supplier in the market and the ease of collecting information about them according to Jones and Barner (2015). Large and dominant suppliers are relatively easy to find, but small start-ups can go under the radar for years without being analysed or written about in the media, which makes them harder to detect. Information of such lesser known companies are often spread with the word of mouth, why Jones and Barner (2015) emphasise the importance of purchasers to reach beyond their network of contacts to retrieve information about these smaller companies using personal information sources.

Philips et al. (2006) suggest a solution for the challenge of being locked-in in a certain supply market. They suggest that is possible to retain the long-term strategic alliances with suppliers and at the same time experiment with new types of innovative suppliers in the supply market in a more non-committed fashion. These short-termed and non-committal relationships, which they call "dalliances", will enable companies to scan the supply market for innovation. Philips et al. (2006) define dalliances as: *"interest or involvement in an activity that only lasts for a very short period"* and suggest that these relationships will enable companies to be more flexible and agile in a rapidly changing market. The reason being that the company can go in and out of these relationships and get new knowledge with little to no resource commitments. In their study, Philips et al. (2006) contend that dalliance relationships facilitate that companies get a hold on new type of knowledge necessary for the company to keep up with developments in the supply market. If the company decides not to commit with a supplier or the dalliance ends for some other reason, it still gives them information about future opportunities and provide a potential supplier. However, Philips et al. (2006) emphasizes that purchasing does not have to, or should not, abandon their traditional long-term relationship with suppliers. Instead to add dalliances as a capability to ensure scanning outside their traditional boundaries, while their strategic long-term relationships still can ensure the core business.

Another key challenge Bessant et al. (2005) point out, is the problem of trying to predict the trajectory of a technology, such as what will emerge as a dominant design in the market. To meet this challenge, Powell et al. (1996) suggest exploring the periphery of the company, including subsidiaries, distributors and joint ventures, but also to build close ties and networks with new types of players, such as universities, research laboratories and customers. They contend that companies must learn how to position itself in these kinds of networks and how to tap into the knowledge that exist in them, in order to keep up with technological developments. Powell et al. (1996) further state that how well a company position itself in a network and are able to pick up information, increases if they have good abilities to collaborate with other actors in the network and conduct a diverse set of activities. Bessant et al. (2005) also suggest developing a curious culture within the firm, which will further encourage employees to scan both their internal- and external environments.

The next section of this literature review will focus on the information created by doing supply market scanning described in this section.

2.2 Supply Market Intelligence

Intelligence is according to Jones and Barner (2015) the combination of information and analysis. Supply Market Intelligence is according to them defined as: "*Supply market intelligence is created when external information is collected and analysed to form actionable conclusions that affect a company's ability to strategically locate, secure, and manage sources of supply"*. What is described in this definition, is that supply market intelligence is the thing created by conducting supply market scanning, why it is important to elaborate on in this study.
Jones and Barner (2015) also contend that supply market intelligence cannot be created by exclusively collecting large amounts of data, it is neither created fast nor considered obvious in advance. They contend: *"Information does not become intelligence until it has been read, qualified, and considered".* Supply market intelligence is usually also based on data collected over a period of time, i.e. creating trends and according to Jones and Barner (2015) this work of creating intelligence takes effort and requires skills to complete. It is also concluded by Jones and Barner (2015) that intelligence is analysed information that is being processed by people to fit a certain context. It is according to Jones and Barner (2015) therefore important to be aware of that intelligence is not fact and that the quality of the intelligence may differ.

2.2.1 Storing and Sharing Supply Market Intelligence

Jeeva, (2008) states that one challenge with supply market intelligence is that it is stored in an unstructured and inaccessible fashion in a majority of companies. Old and new intelligence is often mixed and much of it is often poorly written. To make use of the information there is a need for good information management systems. Zsidisin et al. (2015) also stresses the importance of sharing the gathered information internally in the organization. In fact, Zsidisin et al. (2015) states that there is a strong correlation between a company's internal integration of information and the firm's performance.

Van Weele (2014) states that some large companies today have specialized purchasing intranets with internal databases, where information on suppliers, market- and technical information are continuously gathered for later access. Cousins et al. (2011) point out that such database management systems, that codify and store supply market intelligence, improve the "sharing efficiency" within the company. Accordingly, Handfield (2006) states that such databases can be automated and store

thousands of suppliers listed as potentially qualified for the company. This will enable purchasers to search these databases when a need arises and get quick access to list of suitable suppliers. He points out the importance to update these databases, especially if there are rapid technological developments in the market.

Handfield (2006) suggest some guidelines when storing suppliers in an internal database. He states that one must consider what task and functionality the database is supposed to achieve and what types of data elements that should be in it to support that functionality. The data elements to be used in the database should be determined by the business requirements of the organisation and should be able to be filtered to generate different types of desired results. Handfield (2006) does for example suggest the data element "supplier classification", where the digits in a four-digit number can describe a supplier's different characteristics, such as what category they belong to and what product they provide. Handfield (2006) also warn against non-centralised supplier data that is not stored in a standardized manner. To avoid problems with different formats and other user specific input, he suggests the usage of standardised list-boxes to fill in certain parameters into the database.

2.3 Absorptive Capacity

Cousins et al. (2011) stresses the importance of a firm not only having the ability to scan the supply market, but also to be able to and *absorb* the supply market intelligence. According to Cohen and Levinthal (1990), absorptive capacity is *"the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends".* They also contend that absorptive capacity is one of the most important features for a firm's innovative capabilities. As Cohen and Levinthal (1990) definition, and the keyword *assimilate* show, absorptive capacity can be seen as the ability to create supply market intelligence after conducting scanning activities. Therefore, Absorptive Capacity is important for this study and will further be elaborated on in this chapter.

Tu et al. (2006) state that absorptive capacity is the aggregate of all individuals learning and their ability to share this knowledge within the organisation. Furthermore, they suggest that absorptive capacity consists of four distinct sub-dimensions. These are: Prior relevant knowledge, Communication network, Communication Climate and knowledge scanning, see Figure 5.

Figure 5: *Illustration of what parts Absorptive Capacity consists of according to Tu et al. (2006)*

The following sections further describes each of the four building blocks of absorptive capacity in Figure 5.

2.3.1 Prior Relevant Knowledge

Cohen and Levinthal (1990) suggest that an organization's absorptive capacity can be seen as a function of its prior knowledge. Prior relevant knowledge consists of knowledge in the organisation relating to job skills of the workers, the technology of the firm and management practises of the organisation, according to Tu et al. (2006). They contend that prior knowledge is both facts and ideas of individuals in the organisation that can have an impact on applying innovation.

"The prior possession of relevant knowledge and skill is what gives rise to creativity, permitting the sorts of associations and linkages that may have never been considered before" - Cohen and Levinthal (1990)

Moreover, Cohen and Levinthal (1990) state that the prior knowledge, such as knowledge about current trends and technologies developments on the market, influence how well an organisation can recognize and absorb new information and apply it to commercial contexts. Accordingly, Cousins et al. (2011) state that firms with well-developed technical capabilities are better situated to process external knowledge and capture innovation. They contend that new information might not be intelligible for an individual who does not possess the right contextual knowledge. Accordingly, Tu et al. (2006) suggest that prior knowledge improves an organisation ability to predict future technological developments. Furthermore, that the lack of relevant prior knowledge causes uncertainty and discourage deeper investigations into technological developments. In fact, without a proper understanding for the terminology connected to the market as well as the requirements of the sourced technology, purchasing is confined to their historical supply base, according to Jones and Barner (2015). Cohen and Levinthal (1990) does however contend that prior knowledge does not have to be as concrete as technical knowledge but can also take the form of knowledge about who knows what, who to turn to for guidance and identifying who needs certain information.

2.3.2 Communication Network

A broad external and internal communication network of an organisation will strengthen its absorptive capacity (Cohen and Levinthal, 1990). Tu et al. (2006) mention that cross-functionality and integration between different subunits in an organisation is key part of absorptive capacity and enabler of successfully implementing innovative technology. *"A communications network is the scope and strength of structural connections that brings flows of information and knowledge to different organizational units"* (Brown, 1997, as cited in Tu et al., 2006). Shared knowledge and expertise are important for communication (Cohen and Levinthal, 1990). At the most basic level, this consists of having a unified communicative language when communicating across subunits of an organisation, according to Cohen and Levinthal (1990). However, although they suggest that a specialized language might help communicating internally in an organisation, they also contend that it can inhibit the organisation to effectively tap into external knowledge, due to a "not-invented here"-mentality. Therefore, Cohen and Levinthal (1990), means that there is a trade-off between having an effective communications network internally and having an effective communications network externally.

Cohen and Levinthal (1990) does also point out that although some overlap of knowledge is necessary for communication, it is the diversity of different individuals in an organisation that makes innovation

possible. Absorptive capacity is in fact the sum of capabilities in a network of individual capabilities. Cousins et al. (2011) does for example suggest that functions like purchasing and engineering need to be aligned. They put forward Toyota and Honda as a good practice, who have co-located these functions in the same facilities in order to maximize interaction between them.

2.3.3 Communication Climate

Tu et al. (2006) state that an open and supportive climate within an organisation, greatly will increase the individual's ability to learn. Accordingly, Nevis et al. (1997) contend that learning is often informal and due to unplanned interactions, which speaks for open communication within organisations where information should be accessible, and lessons shared. In fact, Nevis et al. (1997) lists communication climate as one of ten facilitating factors that creates a learning organisation. *"Communications climate is the atmosphere within the organization that defines accepted communication behaviour, which may facilitate or hinder the communication processes"* (Brown, 1997 as cited in Tu et al., 2006). Cousins et al. (2011) contend that socialisation in organisations is of great importance, both internally and externally. Internally, close collaborating and relationships between engineering-, design- and purchasing departments are needed, especially to ensure a fit between innovative technology and existing products. Externally, Cousins et al. (2011) argues that: *"Sharing important information in a personal, timely, and frequent manner enables the supplier to act as supplementary information processing capacity for the buyer firm".*

2.3.4 Knowledge Scanning

The fourth part of absorptive capacity is according to Tu et al. (2006) knowledge scanning. Knowledge from outside the company's proximity is sometimes critical for the innovation process, according to Cohen and Levinthal (1990). Tu et al. (2006) defined knowledge scanning as: "*Knowledge scanning is an organizational mechanism that enables firms to identify and capture relevant external and internal knowledge and technology"*. In this study knowledge scanning focus on the upstream supply market and are termed "supply market scanning". This concept is further elaborated on in chapter 2.1.

2.4 Analysis of Literature Review

In this section the literature is analysed and explained to give understanding to how the different parts of chapter 2 are connected. This analysis leads to a literature framework presented in 2.4.1. In 2.4.2, a comparative framework of challenges is presented and explained, which is then used in the discussion of this study.

2.4.1 Literature Framework

In the literature, there is no sources that present a detailed process of how to conduct supply market scanning. The model presented by Jones and Barner (2015) in chapter 2.1.1, is a step by step model, but looking more closely at it reveals that it leaves out important parts. The most relevant deficiency is how it handles the actual information gathering, which it just briefly mentions in passing. Furthermore, it does not go into how to store or share information, or what capabilities an organisation must have to succeed with supply market scanning. Therefore, the literature review includes other relevant literature to give a more relevant picture of supply market scanning as a whole. From doing the study in an abductive, iterative, manner, it became clear that areas of absorptive capacity, as well as supply market intelligence was needed to interpret the empirical findings.

It could be argued that absorptive capacity and supply market intelligence can be seen as part of SMS, or at least that they elaborate certain parts of SMS. Van Weele's definition of SMS, mentioned in chapter 2.1, highlight the fact that information does not only have to be gathered, it has to be analysed and classified. Absorptive capacity and supply market intelligence illustrate what enables scanning activities to be absorbed in an organisation as well as what is created from doing supply market scanning i.e. supply market intelligence in a more detailed manner than what theory on only supply market scanning did. Figure 6 illustrates how these topics are considered to be connected in this study: an organisation conducting supply market scanning needs absorptive capacity to integrate and build supply market intelligence from gathered information. In turn, there must be some supply market intelligence to build on in order to do gather information effectively.

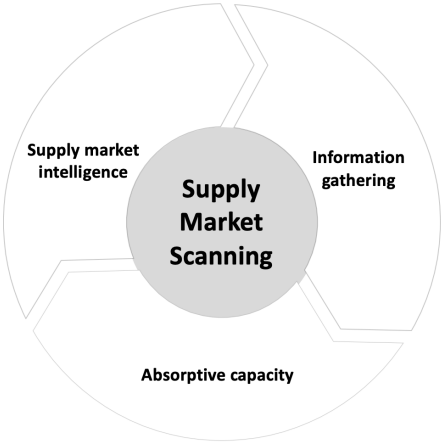

Figure 6: *Illustration of how information gathering, absorptive capacity and supply market intelligence connect to each other and together define supply market scanning*

2.4.2 Comparative Framework of Challenges

From the literature review, a number of challenges connected to supply market scanning were identified. These challenges were divided according to four different *themes* matching different parts of supply market scanning described in the previous section. *Knowledge and experience* are a part of literature concerning absorptive capacity according to Cohen and Levinthal (1990), *information gathering* is one of the most essential parts of supply market scanning according to Van Weele (2014). *Storing and sharing supply market intelligence* is according to Handfield (2006) and important part of supply market intelligence. *Mindset* is however not an explicitly mentioned theme in the literature review. However, *Mindset* is still a prominent theme across the literature chapters and have challenges connected it. Therefore, it is included as one of the four themes.

All the challenges identified in the literature review are summarized inTable 1. The identified challenges has furthermore been categorized with the distinction of *general challenges for supply market scanning* and *challenges specifically associated with scanning for innovative technology* in order to accommodate the comparison expressed in RQ 1: *How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology in large automotive OEMs*. The framework will be used in chapter 5.3.

Table 1: *Challenges related to supply market scanning in the literature review. A division has been made for general challenges and challenges that are specific for innovative technology. Yet another division is in 4 themes which the rest of this research will be built on*

General challenges for supply market scanning	**Specific challenges for supply market scanning for innovative technology**
Mindset	
Belief that it is expensive to conduct supply market scanning [F] supply market scanning only conducted when sourcing need arise [F]	• Commitment to existing technology [B] • Steady state conditions, inhibit companies to effectively conduct supply market scanning outside existing supplier base [B, C, H]
Knowledge and experience	
• Purchasers lack experience and training to do supply market scanning [F, E] • Keeping existing experience within the department [D] • Knowing relevant terminology and requirements of technology to be sourced [E]	• Predicting the dominant design for innovative technology [B]
Information gathering	
• Internet searches can yield too much data to process [E] • Internet searches tend to yield unrelated results [E] • Can be a time consuming and difficult task to conduct supply market scanning [E]	• Difficult to detect minor suppliers [E] • Supply market scanning are often done within the current supply base [B] • Recognising an innovative supplier [G]
Storing and sharing supply market intelligence	
• Supplier intelligence is stored in an unstructured fashion and are inaccessible to purchasers [A] • Old and new supply market intelligence are often mixed and poorly written [A]	• Update internal databases [D]
A. Jeeva (2008) B. Bessant et al. (2005) C. Philips et al. (2006) D. Handfield (2006) E. Jones and Barner (2015) F. Bruel (2017) G. Schiele (2006) H. Daft and Weick (1984)	

3 Method

This chapter describes what methods that have been used to create this thesis. The aim of the chapter is to give the reader a deeper understanding of what choices have been made and what measures that have been taken to ensure a good quality of this research.

3.1 Research Design

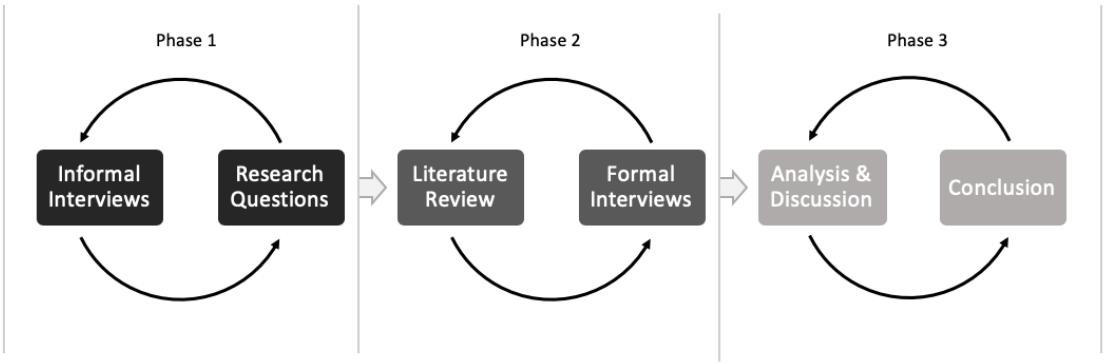

Figure 7: *Conceptual framework of the process of this research. Divided into 3 phases with recurring activities within each phase which were done in order to finetune the prior step before moving to the next phase*

According to Bryman (2012) qualitative research is concerned with words, which could be viewed as the opposite to quantitative research which is concerned with numbers. This study followed the outline of qualitative research that was suggested by Bryman (2012) where the first step is to construct general research questions. As Figure one shows, this study was conducted in three phases. In phase one, informal interviews or discussions at the case company was conducted to get a better understanding of the problem and context. This probing supported formulating the research questions for the study. However, as Figure 7 shows, the research questions were revised multiple times after discussing them with supervisors and employees at Volvo. At the end of phase one, research questions were set and phase two was initiated.

A critical part of understanding what the relevant questions on a certain topic are, is to do a thorough literature review according to Yin, (2017). With the RQ:s as starting point a literature review of the topic was conducted. He points out that the purpose of a literature review is not to find the answers to the topic, but rather to get a deeper understanding of what the relevant questions related to the topic are. This literature review served as template for constructing an interview guide and for conducting the formal interviews of the study. However, in the process of conducting interviews it became more and more clear that some parts of the previously made literature review were irrelevant, at the same time as new areas of the literature had to be explored. Therefore, also this phase, was made in an iterative manner. Spens and Kovács (2006) calls this type of research approach an “abductive process” and separates it from the more traditional inductive- and deductive processes. In the abductive process, the researcher observes some type of real-life phenomenon and tries to apply theoretical knowledge to it. The researcher conducts empirical gathering of data and theory building alternately, in a creative iterative process. This iterative process is according to Dubois and Gadde (2002) called “Systematic Combining” or “Theory Matching”.

In phase three, the empirical material was analysed and discussed. Comparison between the empirical findings and literature, as well as comparison between the innovative technology group and the mature technology group was made in the discussion part of the study. In the process of analysing and discussing conclusions answering the research question was successively made.

3.2 Case Study

The definition of a case study is that it *"investigates a contemporary phenomenon in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident"*, according to Yin (2017). Case studies are exploratory and suitable to answer "how-" and "why" type research questions, where the researcher has little or no control of the events. Yin, (2017) states that case studies can be used to explain, to describe, to illustrate and to enlighten. Defining such research question is considered the most important step in a case study according to Yin (2017).

3.2.1 Case design

Yin (2017) separates single-case designs from multiple-case designs. Multiple-case design is considered more thorough, since you are not relying on one specific case to be representative for a phenomenon. However, Yin (2017) also point out that multiple-case design takes much more time and resources to conduct compared to single-cases. Single-case can further separate into a number of different rationales: critical-, unusual-, common-, revelatory- and longitudinal cases (Yin, 2017). Similar to Yins common case, Bryman (2012) adds representative case as a type of case, which will be the type of this study. A representative case is meant to exemplify a common place situation according to Bryman (2012). He points out that a representative case is not chosen for its uniqueness, but rather because it provides a satisfactory context for the purpose of the study to be fulfilled and the research questions answered.

For this study, case study was first of all chosen with the motivation that the study aims to investigate a contemporary phenomenon (what happens in the automotive industry today). Furthermore the research questions asked are exploratory in nature: *"How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology* in large automotive OEMs*?* and *"How can large automotive OEMs, address these challenges and improve their supply market scanning?"* This suggest that the setting of a large automotive company like Volvo, which is a large automotive OEM, would act as suitable representative case. Furthermore, a single-case was chosen based on two criteria. Firstly, it was deemed that Volvo as a case would be representative as a large automotive OEM, and secondly due to time- and resource constraints for doing multiple cases.

3.3 Data collection

Yin (2017) contend that interviews serves as one of the sources of information in case studies and that they are particularly good at identifying the "Hows and Whys" of different phenomena. The characteristic of case study interviews is according to Yin (2017) more like a guided conversation than a rigid questionnaire. The strength with interviews is that they can directly focus on the studied topic and you will receive personal, insightful explanations from interviewees. Some of the weaknesses of interviews are that they can have bias because of poorly asked questions, it can be hard

to remember what was said and the interviewee might say what they believe the researchers want to hear.

Yin (2017) emphasizes the importance of being a good listener in an interview situation. An interviewees answer must be processed in many dimensions. The exact words and terminology must be heard, the mood of the interviewee must be felt, the context of the situation described must be understood, as well as the intended meaning of the answer. Furthermore, you as an interviewer should at the same time follow your line of inquiry as well as formulating unbiased question that serves that inquiry. The exact wording of a question can also has an effect on the answer from the interviewee. Yin (2017) states that asking "how" something happen is preferred over asking "why" something happens, since the latter might trigger defensiveness from the interviewee.

Three types of interviews are commonly used in case studies: prolonged interviews, shorter interviews and survey interviews (Yin, 2017). The interviews in this study will be what Yin (2017) describe as "shorter case study interviews". These are focused interviews, lasting for approximately one hour. The main reason for choosing this type of shorter interview, is due to time-constraints for the interviewees. The questions should be open-ended, but since time is shorter, the interviewer should follow the interview guide more closely than in prolonged interviews which lasts for hours. Bryman and Bell (2011) use the term "semi-structured interview" and state that the questions does not always follow in the order of the interview guide and that the interviewer should be alert, to pick up on things not stated in it. Notes from previous interviews can give light to emerging themes and help the interviewer to adapt or add questions to ask in later interviews (Bryman and Bell, 2011). In this study this process was used frequently. Topics that emerged during the early interviews was asked in a more direct way in the later ones, to determine if the interviewees had the same view. For some interviews unstructured interviews were used, this could according to Burgess (1984) be very similar to what a conversation may look like. According to Bryman (2012) such an interview may take its form from a topic or just a single question. For the unstructured interviews in this research we started with a short explanation of our thesis and what our aim was and what questions we hoped to cover in that interview were. Then the interviewee was let to speak freely.

3.3.1 Recording and transcribing

The interviews in this study will be the audio recorded to as large extent as possible. Recording the interviews has many advantages according to Bryman and Bell (2011). They contend that one of the main advantages is that the interviewer can concentrate on probing and being alert during the interview, instead of concentrating on writing down notes. Other advantages are that the interviewer's memory is limited, and it can be useful to listen to answers more than once. Permission to record will be asked for in the beginning of each interview, which is important to do according to Yin (2017). Yin also point out that recording interviews can make the interviewee uncomfortable and should only be done if the researchers intend to go through the recording in a structured way or transcribe it fully. Bryman and Bell (2011) point out that transcribing interviews are very time-consuming. For this study the recordings will not be transcribed in their totality, but they will be listened to after each interview in order to transcribe important parts or take notes in a structured way, this is what Yin (2017) calls structured listening. The reason for not transcribing the interviews word for word, is that the extra value that would induce in relation to the increased time it would take, is considered to be very little. Another logic for only transcribing important parts, is that transcription yield a lot of material to go through (Bryman and Bell, 2011). To ensure personal integrity, all recordings were deleted after the master thesis ended.

The transcribing was done with a program called oTranscribe, which enabled interactive timestamps to be implemented throughout the text. These timestamps were linked to a specific time in the recordings. This made re-listening to important part of the recordings in later stages easier. Each interview yielded one text-file. After transcribing, separate themes were distinguished from the interviews. Coding was done according to these themes, dividing and gathering similar empirical text from the transcript into uniform documents addressing a narrower topic. From these documents the empirical chapter was then written.

3.3.2 Sampling of Interviewees

Bryman (2012) contend that sampling done in qualitative research generally has two levels. The sampling of the context and the sampling of the participants. The sampling of the context is in this study discussed more in depth in chapter 3.2.1. For choosing interviewees in this study, sequential purposive sampling was used in combination with snowballing. Purposive sampling is when you strategically select your sample, so they are relevant for answering your research question.

In this study, purposive sampling was done for two separate interview groups. As the RQ for the study shows: *"How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology in large automotive OEMs?"*, two separate themes are distinguished; mature technology and innovative technology. To get relevant empirical material on these two themes, two different interview groups were targeted; one with people involved with supply market scanning for mature technology and one targeting people involved in supply market scanning for innovative technology. Since purchasing is the function within Volvo that mainly works with supply market scanning, this was the first distinction made. Figure 8 shows the Group Truck Purchasing (GTP) organisation, and furthermore, from which departments within GTP the interviewees belonging to the different groups were selected from. The innovative group is marked green and the mature group is marked blue. These two groups will be described more in detail in the following sections.

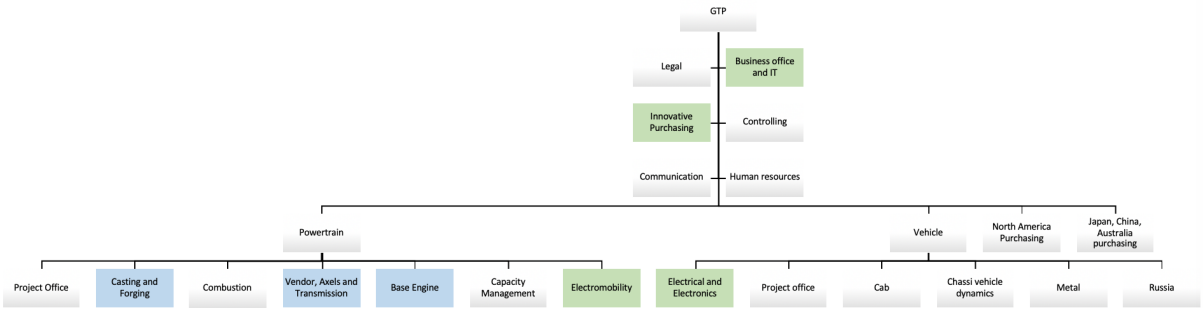

Figure 8: *Organisational chart of Volvo Group Trucks Purchasing (GTP). The groups in blue are identified as the mature technology group and the groups in green are identified as the innovative technology group*

The number of interviews conducted were 9 for the mature technology group and 11 for the innovative technology group. The aim was to conduct interviews until the study achieved "theoretical saturation"; which according to Bryman (2012) is when no new data emerge that stimulate new theoretical understandings.

3.3.2.1 The Mature Technology Group

The department within purchasing targeted was “powertrain purchasing”, who globally source components for truck engines. The groups marked blue in Figure 8, works with purchasing involving mature technology such as castings, engine components and axles. This made a good fit for the mature technology group, since these components is considered mature technology and has been around for a long time.

Being on site at the purchasing department and talking with various purchasers about the topic of the research enabled effective targeting of people involved in supply market scanning. This is what Bryman (2012) refer to as snowball sampling. Furthermore, snowball sampling was used at end of each interview when the interviewee was asked if he or she knew anyone else who had insights on the topic. This produced more interviewees as time progressed and is therefore distinguished as sequential sampling by Bryman (2012) who states that sequential sampling is a sampling method describing when the researcher starts with an initial sample and then adds to the sample as the research proceeds.

Many interviewees in this group were “segment leaders”, who is responsible for a segment globally across regions and across business units to find synergies for the purchasers within that segment. A segment is usually connected to a component group, for example such as air compressors. The segment leader coordinates purchasers within that segment and are responsible for scanning the supply market and sharing that information with the purchasers. This made them a good fit for this study. Some buyers who are not segment leaders, were also responsible for some level of supply market scanning; snowball sampling lead us to interview some of these. Purchasing managers were also selected with the help of snowballing. The reason for choosing them where because of their long experience within purchasing. All the interviews in this group followed a semi-structured approach, guided by the interview guide found in Appendix X.

Table 2: All interviewees for the mature technology group summarized

Interviewee	Role	Department	Media	Date	Time
M.1	Segment Leader	Casting & Forging	In person	2019-03-04	1 h
M.2	Buyer	Vendor, Axels & Transmission	In person	2019-03-05	1 h
M.3	Buyer	Base Engine	In person	2019-03-07	1 h
M.4	Segment Leader	Casting & Forging	In person	2019-03-07	1 h
M.5	Segment Leader	Base Engine	In person	2019-03-13	1 h
M.6	Purchasing Manager	Base Engine	In person	2019-03-15	1 h
M.7	Purchasing Manager	Base Engine	In person	2019-03-15	1 h
M.8	Segment Leader	Base Engine	In person	2019-03-22	0,75 h
M.9	Buyer	Vendor, Axels & Transmission	In Person	2019-04-11	0,75 h
Total: 9 interviews					

3.3.2.2 The Innovative technology group

The purposive sampling described by Bryman (2012), was done in this group as well. Innovative purchasing, electromobility purchasing and electrical purchasing were targeted as departments in which to conduct interviews in. The reasons for this are as follows: innovative purchasing is a department which was established to help secure and facilitate innovation within Volvo. They have an outspoken focus of working with early phase technology in the three areas: automation, electromobility and connectivity. These technologies are new and what innovative purchasing is investigating is not yet introduce to the company and therefore the technologies they are investigating are not yet in serial production. Electromobility- and electrical purchasing are also sourcing innovative technology, but they are not working with early phase technologies which innovative purchasing are. All three groups within the innovative technology group are scanning the market, but the focus of innovative purchasing is on scanning the market for early phase technologies. The focus of the electromobility- and electrical purchasing teams are more towards scanning the market for suppliers. However, overlap is occurring. All interviewees in this group were approached by the use of snowball sampling

In the process of conducting snowball sampling, some interviewees appeared that had interesting things to say either about some small part of supply market scanning or because the interviewee had been involved in supply market scanning activities although the person did not belong to purchasing. These people gave a specific perspective on a narrower aspect of supply market scanning. For example, the manager belonging to the department: legal, was snowballed by one interviewee in the innovative technology group, since the interviewee believed this manager could provide the legal perspective of supply market scanning.

For the people interviewed in the innovative technology group a semi structured approach in the interviews were used for those working with purchasing. For all the other interviews except from one interview with an engineer an unstructured approach was instead used. The reason for this was because we wanted the interviewee to talk freely about a specific topic.

Table 3: *All interviewees for the innovative technology group summarized*

Interviewee	Role	Description	Media	Date	Time	Type
I.1	Purchasing Manager	Innovative Purchasing	In person	2019-03-15	0,75 h	Semi structured
I.2	Purchasing Manager	Innovative Purchasing	In person	2019-03-19	1 h	Semi structured
I.3	Project Manager	Innovative Purchasing	In Person	2019-03-22	1 h	Semi structured
I.4	Commodity Buyer	Electrical purchasing under Vehicle Purchasing	In Person	2019-04-02	1 h	Semi structured
I.5	Segment Leader	Electrical Purchasing under Vehicle Purchasing	Skype	2019-04-08	1 h	Semi structured
I.6	Project Buyer					
I.7	Purchasing Manager	Electromobility Purchasing under Powertrain Purchasing	In Person	2019-04-15	1 h	Semi structured
I.8	Business Improvement	BO & IT under North	Skype	2019-03-12	0,5 h	Unstructured

	Leader	America Purchasing				
I.9	Project Manager	BO & IT	In Person	2019-03-27	0,5 h	Unstructured
I.10	Manager	Legal	In Person	2019-03-28	1 h	Unstructured
I.11	Manager	Vehicle Engineering	In Person	2019-03-26	0,75 h	Semi structured
I.12	Engineer		In Person			
I.13	Manager	Powertrain Engineering	Skype	2019-03-21	0,5 h	Unstructured
Total: 11 interviews and 13 interviewees						

3.4 Ensuring Quality

According to Bryman (2012) case study research has been widely discussed in terms of external validity. External validity is according to Bryman (2012) defined as *"whether the results of a case study can be generalised beyond the specific research context".* According to Yin (2017) has case study research been disdained by researchers because they think case study is not rigorous enough in terms of external validity. Accordingly, Bryman (2012) highlights this criticism, but further contends that generalisability simply is not the objective of a case study research. He contends that researchers that choose case study as their design of study are well aware of this. According to Bryman who refers to Guba and Lincoln (1994) instead suggest another way of assessing the quality of a qualitative study. Guba and Lincoln (1994) suggest using the criterion of trustworthiness and authenticity. Trustworthiness has been divided into four criterions; Credibility, Transferability, Dependability and Confirmability which will further be explored in the paragraphs to follow. Then, a paragraph on authenticity is elaborated on.

Credibility is concerned with the researcher giving the interviewees an opportunity to review the empirical findings in order to receive a confirmation of the findings, this is often referred to as respondent validation. In this research this is achieved by simply sending the empirical findings to all interviewees, asking them to comment or confirm their statements.

Transferability, the second sub-criterion in qualitative research is according to Inger (1994) concerned with whether the results can be *"transferred to another similar context or situation"*. As seen in the beginning of this chapter section the goal of qualitative research is not to make the findings general, the goal is rather to create in-depth knowledge and understandings on a subject or phenomena. This is what Bryman (2012) describes as providing "*thick description"*. This criterion is highly subjective and Inger (1994) means that it is up to the other researchers to decide if this particular research relates to his or her research and if the criterion is fulfilled. However, to facilitate for coming researchers to establish if this research has met this criterion or not, this research has provided a thorough case description as well as an in-depth method section that will guide the next researcher assess this research.

The third criterion in trustworthiness is dependability, which is the correspondent variable to reliability in quantitative research. According to Bryman (2012) fulfilling this criterion is made by

keeping “complete records of all phases in the research”. In this research all transcript notes are kept, other documents such as the coding of the transcripts, iterations of the final report, meeting notes and internal motivations of who to interview etc. will also be stored. Recordings on the other hand will be stored until peer review is received, then the recordings will be deleted in order to ensure personal integrity (see section 3.3.1).

Confirmability, the last sub-criterion in *trustworthiness*, is about showing that the researchers have been acting in good faith and not manifested their own personal beliefs or values. Fulfilling objectivity in social research is according to Bryman (2012) impossible but the objective is to not have the text influenced by the researchers own opinions to as large extent as possible. In this study confirmability has been achieved by using open ended questions in the interviews and then code the interviews to ensure that nothing essential is excluded. Several sources of information have also been used in the literature review in order to get different viewpoints on the subject and increase the degree of confirmability.

Authenticity, which is the second primary criterion for assessing quality (Guba and Lincoln, 1994) suggests several sub-criterions which can facilitate the assessing of quality.
The authenticity criterion has according to Bryman (2012), been *“thought-provoking but have not been influential”.* It is mentioned that its real impact on research is controversial. Therefore, the focus on this criterion hasn’t been as extensive as *trustworthiness*. The first sub-criterion (fairness*)* can however be seen as important for this study. Fairness is concerned with if the research can represent different viewpoints of the interviewees in a fair way. This has the researchers tried to achieve to as large extent as possible in the empirical section of this study, when there has been opposing opinions this has been highlighted as clear as possible in the text.

4. Empirical Findings

This section consists of gathered information from interviews about how buyers and segment leaders at Volvo Group Truck Purchasing conduct supply market scanning and what the challenges they face are. The empirical data is gathered from two separate interview groups as stated in chapter 3.3.2. In 4.1 empirical findings from the "mature technology group" will be presented, followed by 4.2 where empirical findings from the "innovative technology group" will be presented.Table 4 explains terminology used by the interviewees in this chapter.

Table 4: *Terms explained that is related to the theme storing and sharing supply market intelligence*

Term	Explanation
Product system roadmap (PSR)	A cross functional document where information is stored on one specific product system of the truck from multiple departments perspective within Volvo.
Teamplace	An online platform and online storage of documents, functionality include giving and restricting access to a designated set of people.
Segment business plan	A document where the segment leaders gather supply market intelligence on their specific segment. The segment business plan is stored in Teamplace and the information is gathered in a PDF-file together with an associated excel-file which is also shared through Teamplace.
Volvo Supplier Information Base (VSIB)	An information base where Volvo stores information about their suppliers.

4.1 Supply Market Scanning for Mature Technology

Empirical findings in 4.1 is divided according to five separate themes, which can be seen in Table 5 below. The first three themes are the same as the themes presented in the comparative framework (see Table 1), while the last two themes, marked light grey in Table 5, emerged from the interviews as being areas with challenges related to them.

Table 5: *Showing the five themes of chapter 4.1. Themes derived from the literature are marked dark grey and themes derived from the interviews are marked light grey*

Knowledge and Experience	Information gathering	Storing and sharing supply market intelligence	Legal aspects	Cross-functionality and network

4.1.1 deal with the *knowledge and experience*, 4.1.2 address *information gathering*, 4.1.3 address *storing and sharing supply market intelligence*, 4.1.4 address *legal aspects* and 4.1.5 deal with c*ross-functionality and network*. These following sections goes into the challenges of the respective themes, providing context, examples and quotes from the interviews. At the beginning of each subsection the empirical data will be presented in a Table showing the challenges and which interviewees acknowledged them.

4.1.1 Knowledge and Experience

Having experience and the right knowledge is very important according to the interviewees. One of the purchasing managers acknowledge that it is not until you spent a few years at a position that you

have the right understanding of the market to effectively scan the supply market. Table 6 shows challenges related to the experience and knowledge from a supply market scanning perspective.

Table 6: *Challenges related to knowledge and experience*

Challenge	Reference
Purchasers sometimes lack the right technical knowledge to conduct supply market scanning	M1, M2, M3, M6, M9
There is no training on how to do supply market scanning	M2, M4, M5, M6, M8
Job rotation rate of purchasers causes experience to be lost	M2, M5, M6, M7, M8, M9
It is easier to give business to an existing, experienced supplier than finding new ones	M1, M2, M3

As seen inTable 6, interviewees consider that lack of technical knowledge sometimes is a challenge for doing supply market scanning. For example, one of the segment leaders contend that buyers often are lacking knowledge in terms of the technical requirements of what they are buying, stating: *"when you scan the market you must know what and who you are looking for"*. A few suppliers have done parts for Volvo for so long that the buyer doesn't have to learn the technical details, according to the segment leader. Another buyer state: *"It is difficult when I get detailed, technical questions from the supplier. It had facilitated if I had a fairly detailed description of what we want, which I can send to the supplier"* [Translated]. However, one of the purchasing managers contend that although experience and knowledge is important, having curiosity is more so. The purchasing manager state that it can be: *"Huge value of not knowing what's going on"* and elaborates with *"if you know too much you put yourself in a box"*. According to the interviewee, if you know too much and ask very specific questions, you also frame what answers you are going to get from the suppliers. For example, if you describe a component down to the last detail, that is what you are going to get. Furthermore, this might not always be the best solution, the purchasing manager contend.

As seen in Table 6, many interviewees state that there is no training on how to conduct supply market scanning. One of the segment leaders conclude: *"...you have to be creative yourself"* [Translated]. When asked if there is any such training done, one of the buyers contend that there is not, but that acknowledged that it would be good. However, one of the segment leaders state that: *"It would be good to have training on how to find suppliers, but it will very much depend on what type of market you operate in. It might be a bit too general"*. In line with this, one of the purchasing managers also point out that it would be difficult to form such a training because it would be to general, but that some kind of tools should be set in place to guide buyers in their scanning activities.

Related to the importance of experience, there is a challenge related to job rotation within the purchasing departments, as can be seen in Table 6. One buyers state: "*There are some functions within a company that are extremely important to have a form of continuity in, purchasing is one of them, and we have not had it in twenty years I would say"* [Translated]. One of the segment leaders exemplifies that job rotation can lead to much lost information which is only stored in the buyer's heads. The interviewee contend that Volvo has lots of suppliers showing up, giving presentations and providing information, which is mostly stored as experience with the buyer. *"The moment he leaves, the information is gone"* the segment leader states. Another segment leader states: *"You cannot run business intelligence without knowing what you are searching for"* and elaborates that buyers must be in a position for some time to just learn the basics and cope with the day-to-day activities. One buyer

suggest that the high job rotation is due to the selection of people for the purchasing jobs. The interviewee means that people with high educations are chosen in the recruitment process and therefore has purchasing become a springboard for further advancement within the company.

Regarding the handover process between new and old buyer, one of the segment leaders state: *"We are supposed to have a nice, formal handover, with a nice template and stuff. But not many follow it"*. Contracts and contact information to suppliers are handed over, but the story of what has happened with the supplier over time and the experience is lost. There is too much information to be able to hand it all over, the interviewee concludes. Another buyer acknowledge that it is not prioritized in a handover to disclose things like all potential supplier that has been found in the market. To mitigate these kinds of problems one of the purchasing managers state that they try to make sure that the new employees can work parallel with the old for a while, to ensure knowledge transfer, but that this seldom happens in reality.

The knowledge and experience of the existing supplier is also something that interfere with supply market scanning. According to two interviewees, it is often easier for Volvo to continue working with an existing supplier than introducing a new one, see Table 6. *"It is easy for us to keep giving business to the same supplier who is used to do these parts"*, one of the segment leader states. These are often big suppliers, who are both competitive and used to working with Volvo. Another segment leader states that new suppliers require testing to ensure thing like quality and safety, which has also been emphasized by a buyer. This has the effect that supply market scanning does not have to be done to the same extent, that buyer contended.

4.1.2 Information Gathering

The interviewees mention many sources of information they use when scanning the supply market. Everything from doing Google searches, to attending trade fairs, to using trade associations lists and to utilising contacts in their network, are used to find information about the supply market and identifying new suppliers. In the last part of this section Table 8 summarize what Information sources are used by the mature interview group. Table 7 shows the challenges related to information sources.

Table 7: *Challenges related to information gathering*

Challenge	Reference
No formal process exists for doing supply market scanning	M1, M2, M6, M8
Google searches yield to much data to sort through	M1, M2, M3, M5, M9
Trade shows take a lot of preparation	M1, M2, M5

Many of the interviewees state that there is no formal way of conducting supply market scanning, as can be seen in Table 7. One buyer state: "*There is nothing outspoken about scanning the market - it is self-preservation"*. Accordingly, a segment leader contends: *"It is up to you how to do it"*. Another segment leader states, *"Each and every one has their own way of doing it"* and also point out that when a good practice surface, they have a hard time capitalizing on the practice and making it a standard way of working. One of the purchasing managers accordingly state that supply market scanning is done in an ad hoc manner and acknowledge that there is a gap between what they do, and what they should do in regard to supply market scanning. However, the interviewee state that there should not be an exact process for supply market scanning, but that it could be done in a more

structured way than it is today. One of the buyers suggest that the responsibility for conducting supply market scanning should lie on innovative purchasing, since there generally is a lack of time in a normal purchasing environment.

All of the buyers of mature technology states that they use google in one way or another when searching for suppliers. One of the buyers use it as the main tool for finding suppliers, often using keywords such as "automotive industry" together with the sought-after component. As Table 7 shows, many interviewees do however point out that a challenge with Google searches is that they yield too much data to sort through. One of the buyer's state that one cannot look into most of the results due to time constraints. The interviewee states: *"Right now we cannot really go through all the possible suppliers, it is easy to choose some at random and then you go on with one rather early"* [Translated]. Many of the buyers for mature technology state that the process of looking through google results is vastly time consuming. However, one of the buyers contend that google is a good initial sorting tool when you already have a list of supplier names, for example to determine if they have the right certificates.

Interviewees of the mature technology acknowledge trade fairs as one of the best sources to find names of new suppliers. One of the segment leaders' states: *"I really encourage the buyers to also participate in fairs. It is very very important".* The reason being that, at fairs one can get a good overview of what suppliers exists, what they are able to produce and get a contact person at the supplier company. Specialized fairs, dedicated to certain market segments exists, but Volvo has not always been a part of them one segment leader contend. One segment leader states: *"We have never been a part of it in the past, but now we have started working on it"*, when asked if they often go to fairs. One of the buyers contend that fairs still are pretty broad in terms of the diversity of suppliers there, but that they are narrower in terms of potential suppliers for Volvo than what internet searches normally yield.

As can be seen in Table 7, the interviewees state that before going to trade fairs, a lot of preparatory work has to be done. One of the buyers contend that without proper preparation, you will drown in the sheer number of suppliers. The preparatory work consists of going through the participant directory for the fair, looking up each supplier to see what they do and if they can suit Volvo's requirements. One of the buyers give an example of a case where the preparatory work got too extensive and complex. It was a specialized fair aimed towards the interviewees segment, which Volvo had not attended before. When the segment leader at Volvo reached out to the organizers, they were thrilled and offered to dedicate half a day for Volvo to present to all the attending suppliers there. However, taking the idea of such a presentation back to Volvo, yielded a lot of extra work and complexity. In order for the segment leader to have such a presentation, a lot of stakeholders and departments within Volvo would have to scrutinise and approve it. This caused the buyer to not do the presentation, stating that the bureaucratic complexity would have taken 2 month. Another buyer has a similar case where a trade fair was not attended because of too extensive preparatory work. The interviewee states that doing the necessary pre-study of all the attendees of the trade fair, checking that they have the right certificates etc, simply took too much time. However, two interviewees stated that preparatory work for fairs is not a problem. One segment leader contend that it will take approximately two hours, but that the fair visit then will be more efficient. The other, a buyer, stat that no preparation at all is needed.

Table 8: *Identified information sources for the mature technology group, presented in descending order depending on the number of interviewees that has identified the source as useful*

Information source	Interviewees that acknowledge usage of the source
Personal network	M.1, M.2, M.3, M.4, M.5, M.6, M.7, M.8, M.9
Trade fairs	M.1, M.2, M.4, M.5, M.6, M.7, M.8, M.9
Google	M.1, M.2, M.3, M.4, M.5, M.7, M.9
Existing suppliers	M.1, M.8, M.2, M.3
Upstream suppliers	M.1, M.9, M.2, M.3
Trade Associations	M.1, M.4
Using patents	M.7

As seen in Table 8, the most common information source mentioned in the interviews was related to personal network, that is people internally in the organisation or externally who provided information. More on this in section 4.1.5 “Cross-Functionality and Network”. As mentioned previously, trade fairs and searching Google is two sources of information the mature technology group use. However, from the interviews a few different information sources has been mentioned, see Table 8. For example, one of the segment leaders proclaimed that the best way to initially find suppliers is to contact trade associations and receive member list from them to go through. The associations are active in many countries collect lists of companies in some specific segment, which is companies that could be potential suppliers for Volvo according to the segment leader. Another segment leader meet with upstream supply chain actors on a regular basis and simply ask them who their key clients are, which provides names of potential suppliers to further look into. This scanning activity is also used by a buyer who states that these actors often possess useful information.

As Table 8 shows, another source of getting information of new suppliers, are asking existing suppliers who their competitors are. It was disclosed by one segment leader that in conversation with suppliers, the interviewee sometimes steers the conversation to be about the competing firms of the supplier. If and when the supplier names any competitors that is not previously known by the segment leader, these names are then further investigated as potential suppliers.

One of the purchasing managers state that Volvo has recently used patents to find suppliers. They take the basic function of the component they want to source and then look up who has registered all the patents in that area. The purchasing manager contend that this does not only yield information about company names and contact information, but also how much these suppliers are investing in your targeted area. Looking at how many patents they registered gives more accurate and objective information than if the supplier comes to you with their own words describing what they are doing, the interviewee elaborates: *“They can tell you ‘...we are the number one, we are investing millions in that technology, we are the best of the best…’ and then these patents says something else”.*

4.1.3 Storing and Sharing Supply Market Intelligence

One of the themes from the interviews was about storing and sharing information gathered about the supply market. Table 9 shows the challenges related to this area and are further explained in the following section.

Table 9: *Challenges related to storing and sharing supply market intelligence*

Challenge	Reference
No obvious place to store and share information	M.1, M.2, M.3, M.4, M.6, M.8, M.9
Information gathered by others is inaccessible	M.1, M.2, M.3, M.6, M.8
Can't search Central database (VSIB) without knowing supplier name or supplier code	M.1, M.2, M.3, M.5, M.8
There is no way of categorising or filtering to find suppliers in VSIB	M.1, M.2, M.3, M.4, M.8
VSIB is not updated sufficiently	M.3, M6, M.8, M.9, M.2

A seen in Table 9, interviewees find it difficult to know where to store and how to share information within Volvo. One of the segment leaders reflects: *"Except the segment business plan and the PSR, I don't know where to put the data for optimal use - it is a very valid challenge I have… How can I make sure that the work I've done, which has provided me some insights, can be useful to others and that would be understandable to all?".* One of the purchasing managers gives the example of a big mapping project Volvo committed to some years ago. In it, trucks were mapped together with engineers and suppliers. The purchasing manager state: *"it was not very structured when we gathered everything, instead it happened in the teams, and it may have disappeared a lot when someone left. There was no common place where we collected it"* [Translated]. In line with this, one segment leader state: *"It would have been good to collect Volvo information in a more structured way"* [Translated].

As Table 9 shows, accessing other people's information is another challenges interviewees brought up. One of the purchasing managers states: *"We work a lot in excel and then it tends to get stuck on a hard drive somewhere and disappear when that computer disappears - so it's a super challenge"* [Translated]. The interviewee adds that there is a lot of value in storing information, especially because it means that you do not have to redo the work to get it. Databases in excel that stores existing as well as potential suppliers, are done on own initiative, according to one segment leader. The buyers' store gathered information in an excel file on their computer or upload it to the teams Teamplace. It is hard to get the all buyers to fill in information in the database, due to lack of time and other priorities according to the segment leader. The Teamplace where the files are stored is often restricted to the team, so no one else in the organization can access it, according to a segment leader. However, one of the buyers acknowledge that it would be useful to get access to all the databases people have, stating *"It is too primitive that everything is individual and is based on personal databases"* [Translated]. This need is also brought up by one of the purchasing managers who contend that sometimes there is information synergies between different teams, and then information sharing is very important. A segment leader gives the example that a buyer in another team keeps asking the interviewee, in emails, about suppliers they can send RFQs to. This happens because the buyer and the segment leader are not in the same team and cannot access the same Teamplace where the excel-files about potential suppliers are stored, according to interviewee.

One official supplier database exists within Volvo. It is called Volvo supplier information base (VSIB) which is a database available to buyers within Volvo. It is a database where high level information about current suppliers are stored. The database is only searchable with either entering a supplier name or with the unique code attributed to each supplier, *"without knowing any of these two, you can't search for anything"*, one of the segment leaders contend. As Table 9 shows, many interviewees consider this a challenge. One buyer states that using VSIB is usually used when the

supply market scanning activities are already done, to see if the suppliers in questions are already in the database. The interviewee adds that it would be much more useful if it would be possible to search for a type of component instead of just a specific supplier name. In accordance, a segment leader states that what type of part a supplier supply, is not even stated in VSIB. Another segment leader contend that finding potential suppliers stored there, will be difficult due to lack of filtering options in the database, stating: *"..if we add a few filter buttons, categorizing the supplier by region, by type of business, then it would be a good sorting tool"*. Accordingly, one of the buyer's state that they should be able to put in what suppliers are able to do and then search for it, but that it is not possible today.

As Table 9 also shows, three of the interviewees contend that the information in VSIB is not updated sufficiently. One segment leader gives the example of when searching for a supplier name, the results show many duplicates of that supplier and it is difficult to know which one to use. Similarly, a, buyer contend that is it an administrative disaster and that the database has not been cleaned up for years. The interviewee means that the problem has come from the fact that there is no one responsible for such activities.

4.1.4 Legal Aspects

One challenge of supply market scanning is connected to *legal aspects*, as Table 10 shows. As described the introduction to this chapter, *legal aspects* is an additional theme to those derived from the literature. The theme was added due to the fact that challenges with touchpoints to this area was found in both the mature group and the innovative group (see chapter 4.2.5).

Table 10: *Challenges related to Legal Aspects*

Challenge	Reference
Design ownership and confidentiality agreements sometimes make supply market scanning more difficult	M.2, M.6, M.7, M.8

One of the purchasing managers elaborates on the challenge presented in Table 10, stating that it is common that the supplier owns the design and technical solutions for components. This creates problems the day Volvo want to find new suppliers since they are unable to go to a new supplier and share blueprints and technical requirements with them. One buyer state: *"we can't do anything really, it's their design",* and contend that supply market scanning is done anyway, but that it is much more time consuming. In line with this, a segment leader draws the conclusion that if you do not own the design you are pretty much locked in or have to create a very generic technical requirements to approach new suppliers with. However, on the contrary, where Volvo owns the design, the segment leader points out: *"If you own the design you can send out RFQs on a very regular basis"*.

4.1.5 Cross-Functionality and Network

Working cross-functional between different departments and different business units are important in order to effectively do supply market scanning. *"I am convinced that purchasing and engineering need to work hand-in-hand. This is how we are the most powerful towards our suppliers",* one of the engineers contend. An example of cross functional work related to supply market scanning, is told by one of the segment leaders who means that the best department to gather supply market intelligence for that segment, is the aftermarket team, who is constantly out to scan for pirate companies that could

compete with original Volvo parts. However, the interviews show that working cross-functional and accessing the right people, does have its challenges. Table 11 shows the challenges related to this area and are further explained in the following section.

Table 11: *Challenges related to Cross Functionality and Network*

Challenge	**Reference**
Formal processes for working cross-functionally is lacking	M1, M3, M4, M5, M7, M8
Finding the right people within the organisation is difficult	M1, M3, M4, M9
Information from other departments can be too complex	M3

There are sometimes synergies between components that belong to different segments or different business units within Volvo, according to one of the purchasing managers. The interviewee states that working cross-functional is especially important in such areas. Furthermore, one of the segment leader contends that a component in their segment is basically the same as in another segment, which are sourced by another business unit within Volvo. *"We have similar segments within the company that have not collaborated so much recently ... We do not share the same supplier base, though that would be possible"* [Translated], the segment leader state. Another segment leader similarly contend that it would make sense to have more formal collaboration with other business units within Volvo and share the supply base, but that it has simply not been prioritized.

As Table 11 shows, formal processes for such collaboration is lacking, and cross-functional initiatives are often up to each individual. On this topic, a segment leader exemplifies: *"It depends on the individual if it will happen or not, which is according to me a weakness - we should have a very frequent and automated feedback between sales and purchasing".* One of the buyer's state that there is no formal structure, but that the interviewee tries to meet with buyers from other business units within Volvo Group once or twice per year. A segment leader contends that there is no formal process of exchanging information throughout the organisation, which has led to people constantly has to search for other who has the right information. *"It is a weakness and we lose efficiency... If you don't have a good network then you can be in the dark for a long time"*, the segment leader states.

Finding the right people within the organisation and having the network to do so, is a challenge for Volvo as can be seen in Table 11. According to one buyers, the challenge of finding the right people is tightly connected to the size of the company: *"It is a huge problem that we are so many involved. Because if you want to do something, then you must have everyone involved... But you cannot involve everyone today because you do not even know who everybody is".* Accordingly, one of the segment leaders state: *"It is a problem in all major big companies, that it is hard to find the right people - The network is the most important thing".* An example, given by a segment leader, is getting certain documents from the engineering department, stating: *"You need to be well connected to your engineering counterpart to get access to those".* Another segment leader contends: *"It is not at all easy to find people, you will at least be redirected 10-15 times before you find the right guy".*

Many of the interviewees within purchasing acknowledge that they often talk to their counterparts in the engineering department and the quality department; *"They have often been here longer than us and are a good source of information"* [Translated], one of the buyer's states. However, one of the

buyer's state that when they need non-confidential information about the component that could be sent to suppliers in an RFQ, the technical information they sometimes receive from their counterpart at the engineering department are too technically complex.

4.2 Supply market scanning for innovative technology

This section consists of the empirical findings from the interviews classified as Innovative Technology. The empirical findings in 4.2 is divided according to six separate themes, which can be seen in Table 12 below. The first four themes are the same as the themes presented in the comparative framework (see Table 1), while the last two themes, marked light grey in Table 12, emerged from the interviews as being areas with challenges related to them.

Table 12: *Showing the five themes of chapter 4.2. Themes derived from the literature are marked dark grey and themes derived from the interviews are marked light grey*

Mindset	Knowledge and Experience	Information gathering	Storing and sharing supply market intelligence	Legal aspects	Specifications

4.2.1 deal with *Mindset*, 4.2.2 address *knowledge and experience, 4.2.3 information gathering*, 4.2.4 address *storing and sharing supply market intelligence*, 4.2.4 address *legal aspects* and 4.2.5 deal with *specifications*. As in 4.1, these following sections goes into the challenges of the respective themes, providing context, examples and quotes from the interviews. At the beginning of each subsection the empirical data will be presented in a Table showing the challenges and which interviewees acknowledged them.

4.2.1 Mindset

An engineer contends that Volvo Group as an organisation today is outsourcing more today than before when it comes to technology and innovation. A lot has changed the last hundred year, an engineer contends, stating: *"We are buying a lot of stuff now. A hundred years ago at Renault, they were making their own bolts".* According to a buyer the market will change a lot in the future as well, and this will probably force the organisation to change ways of working and thinking. An example of a change that has already occurred at Volvo Group is the creation of Camp X, which is their "*global arena for technology and business transformation"* (Volvo Group, 2019). Here, external parties are invited to collaborate with Volvo Group in order to, among other, solve common challenges such as automation, electromobility and connectivity.

Table 13: *Challenges related to Mindset*

Challenge	Reference
Early phase technology projects are difficult to measure in terms of risk and money	I.2, I.3
Difficult to convince internal stakeholders to start early phase projects	I.2, I.3, I.5
High technical and commercial uncertainty	I.4, I.5
High uncertainty regarding what role Volvo Group will have in the future market	I.4

As seen in Table 13, early phase technology is not easily measured in terms of risk and money. A purchasing manager contend: *“People are not used to thinking in this early phase, people want to immediately see what it will result in at bottom-line ... and you don’t know that, you are not there, it’s so early” [Translated]*. The interviewee gives an example of a blockchain project that they are working on and contend that the project will probably not succeed the first time since it will get stuck somewhere on the way. According to the purchasing manager such a project will internally be considered a failure since it will only incur costs, no profit. However, at the department where the interviewee works, the important part of this type of projects is about showing technical progress which you later can build on. *"If you start to prove that the technology works then you can make the next project even bigger" [Translated]*. This way of thinking about projects is according to the purchasing manager considered to be different compared to the traditional mindset of a purchasing department, which traditionally is much more cost focused. Accordingly, a project manager concludes: *"In big companies we don't have innovation in mind, we don't take risk, we don't spend money".* The project manager believes that in order to become a leader in the technological change Volvo can’t keep working as they have been before; new ways of thinking needs to be implemented in the organisation.

According to Table 13 a purchasing manager says that it is difficult to convince internal stakeholders to start early phase projects. A segment leader agrees with this and says that the main obstacle is the internal project organisation which can sometimes be resistant towards starting innovative projects. A project manager states that convincing stakeholders and top management can sometimes be difficult since the traditional way of arguing for starting a project is to show estimations of costs and profit. The interviewee means that this is difficult to show for innovative technology because these parameters are highly uncertain in advance since there is no, or very few, other projects to compare to.

As seen in Table 13, a buyer contends that there is high technical and commercial uncertainty in the market. In order to adapt to the coming changes in the market the interviewee highlights the importance of being all ears to the current changes and contends: *“It’s not necessarily Volvo who is at the centre of what is going to happen or that Volvo are the one to decide" [Translated]*. Accordingly, a segment leader highlights the importance of being observant of the market and the shifts in technology. The interviewee concludes that it is important to keep the scanning generic and speaking with several suppliers and start-ups concurrently. Limiting the scanning means that the buyer has to be certain that the right technology is chosen and that the best suppliers are included, this is according to the segment leader impossible to know in advance.

As seen in Table 13, a buyer elaborated on the uncertainty regarding what the role of Volvo will be in the future market. The interviewee is reflecting upon Volvo’s role and that it might change in the future. The buyer imagines two different potential cases that in the future will change Volvo’s role. Either, Volvo will engage in deep collaboration with other actors, offering a common product to an end customer. Or, Volvo Group will become a supplier to other actors, supplying the final assembled truck. The buyer concludes after describing these scenarios: *"There is nothing given from the beginning… there’s a chance or a risk, depending on how you see it, that everything is changing”*. According to the interviewee it is important to be humble and realize that Volvo’s position as an OEM might change in the future.

4.2.2 Knowledge and Experience

In this section challenges from the interviews related to knowledge and experience is presented. This theme also found in the literature on supply market scanning. In the interviews with the innovative technology group, one interviewee expressed clear challenges on this theme, which can be seen in Table 14.

Table 14: *Challenges related to Knowledge and Experience*

Challenges	Reference
Limited experience about new technology	I.2
Transform early phase projects into potential value in the future	I.2

As seen in Table 14 a purchasing manager acknowledge that the biggest challenge is limited experience of new technology and contend *"We haven't had any buyers who have worked with it for 10-15 years, we hardly know what it is" [Translated].* Where the interviewee refers to disruptive technology such as blockchain and machine learning. The interviewee continues and says that another challenge related to this is *"To have the skills to transform these early phases into a potential value in the future" [Translated].*

4.2.3 Information Gathering

Gathering information can be done in several different ways, one purchasing manager describes an early phase technology project they are currently doing. He states that more or less everyone within the department were aware of the technology but had no deeper knowledge of it. Therefore, they initiated a project and investigated the technology further. When they saw that competitors had initiated similar projects, they realized that this project was worth even more investigation and resources. Therefore, students were brought in to see what a potential usage area of this technology could be for Volvo Group. This is one way of gathering information that were encountered during the interviews

Table 15: *Challenges related to Information Gathering*

Challenges	Reference
Filter and absorb all available information	I.1, I.2
The scope of the market research is too general which generates results on a too high abstraction level	I.2
Supply market scanning is time consuming and not prioritized	I.5, I.7
Internet searches doesn’t yield relevant supplier results	I.13

As seen in Table 15 two interviewees, both directors, acknowledge that there is a problem to filter and absorb available information. One purchasing manager states that they do not scan the supply market for new potential suppliers that much, since they don't have to, the suppliers come to Volvo. The same interviewee describes the market as a floodgate: *"The scanning is zero challenge. It is a floodgate of information!".* The other purchasing manager adds that having a large network have helped the team a lot when scanning the market.

As can be seen in Table 15 a purchasing manager identified that the scope of market research tends to become too general, which generate results on a too high abstraction level. The interviewee contends that a learning from prior market researches is to limit the scope early on in terms of what should be investigated. If limiting the scope is not done properly, the scanning tends to not provide any foundation for further research, according to the interviewee.

A segment leader contends that one of the bigger challenges is time and that scanning the market often is less urgent than other activities *"In the end of the day, you have to have time, because you're also responsible for delivering cost reductions and securing that the line is running, that the strategies are being followed and the quality is good. So, I'd say this often is a less urgent topic"*.

A challenge that is expressed by an engineer is that when doing internet searches the relevance of the search is quite poor. *"It's not that often that you find relevant results, you find a lot of things about consumer areas or industry areas but when it comes to products that are adapted to the truck industry you don't find that many relevant results from internet searches".*

4.2.3.1 Information Sources

The interviewees use various sources of information for doing supply market scanning, some are recurring and used by many, while some of the information sources are only used by one or two interviewees. The identified information sources are presented in Table 16. As can be seen in the Table, the most widely used sources of information is using google and going to trade fairs.

Table 16: *Identified information sources for the innovative technology group, presented in descending order depending on the number of interviewees that has identified the source as useful*

Information source	**Interviewees that acknowledge usage of the source**
Google	I.2,I.13, I.11, I.7
Trade fairs	I.11, I.4, I.5, I.7
Existing suppliers	I.13, I.11, I.4
"Technology days"	I.1, I.5, I.7
Personal network	I.3, I.5, I.7
Incubators	I.1, I.2
Business intelligence	I.2, I.5
Media (podcasts, technology websites, technology news)	I.2, I.4
"Supplier Innovation Dialogues"	I.1, I.7
External actors (Consultants, Universities, Associations)	I.2

As seen in Table 16, using google as tool for finding information about the supply market or new suppliers is used by three interviewees. One interviewed engineer contends that using Google is very good for getting names and contact information. However, the relevance of the search results is sometimes poor which also is identified as a challenge earlier in this section. A segment leader contends that using google isn't as useful when finding innovative suppliers as it was when the interviewee worked with mature technology. However, the interviewee says it is still used.

As can be seen in Table 16, trade fairs is a source of information used by several interviewees. One manager says that a lot of suppliers want to present and talk about electrification and that if Volvo wanted, they could sit in supplier meetings all day long during these type of fairs. A segment leader contends that attending key trade fairs is a good information source and acknowledge that this is one of few structured processes of gathering information that the interviewee does. An engineer contends that fairs is good to attend in order to get new names of suppliers and a buyer says that fairs will probably be even more important in the future.

According to Table 16 three interviewees is using the existing supplier network in order to Figure out its suppliers' main competitors. This is done by simply talking to the different suppliers in the network. According to a buyer this is something that can be quite useful, and the interviewee has had few problems with getting suppliers to disclose their well-known competitors.

According to a director, the department Innovative Purchasing has recently started to implement something called "Technology Days" which the interviewee describes as *"We give the buyers the opportunity to invite their suppliers and showcase their newest, greatest stuff"*. This is according to the interviewee a way for letting the supplier come to Volvo and get more exposure. A manager acknowledges this as a good opportunity to learn more about a technology or a supplier and it does not require as much time as Supplier Innovation Dialogues.

As seen in Table 16, using your personal network and communicating cross-functionally with people in the company to identify suppliers is yet another source of information. A project manager contends

that asking the colleagues is a time efficient way to map the supply market. It is also a good way according to the interviewee to make sure that the scanning is covering all relevant suppliers globally and that as few suppliers as possible are missed. A segment leader agrees that it is important to work cross functionally and contends that the engineering department can have a lot of good input since they might have heard of suppliers that the interviewee might not have heard of. The interviewee believes that colleagues in the engineering department might have heard about suppliers before the buyers have, because they have a genuine interest in the technology and reads technology news etc.

As can be seen in Table 16, both the directors contend that being part of incubators and being engaged with these imply good input for further research and projects. It can also bring new people into the company. A purchasing said during the interview *"We become members of mobility lab and we get like a sneak-peak on all those companies. As soon as a new start-up goes and sits there, they call Volvo and all the others and say: 'Hey guys, come over and check out this cool new company' ".* By doing this, the purchasing manager states that they can collaborate with start-ups for a limited period of time in order for both parties to get to know each other. These time-limited project are often around 2-month long collaborations, i.e. a clear start and stop process. The interviewee means that these type of relationships are positive for both parties since neither one of the parties could know in advance if they would like to work with each other in the future. The prerequisite for these type of collaborations is that an NDA is signed, which according to the same purchasing manager seldom is a problem.

As seen in Table 16 can business intelligence be used as an information source. A purchasing manager says that buying business intelligence reports from consultants can be quite useful if you enter a brand-new area of technology that few within Volvo Group have knowledge about. The interviewee further states that, if the segment and technology has been around for a while the information should already exist within the company and there should not be a need to buy business intelligence. A segment leader also contends that receiving business intelligence can be of great importance, which the interviewee is said to be receiving from an internal department. The newsletter provides information about what the competitors are have published.

As seen in Table 16 is media identified as a source of information. A buyer says that different sort of media can be very important for getting to know the market and the companies *"Much is about getting acquainted with the technology, reading news, reading technology sites, getting down in different podcasts where it's talked about these companies" [Translated].* The interviewee says that start-ups and young companies possess a lot of technical expertise the interviewee therefore states *"So what will be even more important is to stay out and be at the forefront at all fairs and keep us up to date of technology developments and what is said in trade magazines" [Translated].*

Another source of information is Supplier Innovation Dialogues which can be seen in Table 16. A purchasing manager describes these events, stating that Innovative Purchasing invites between 5 and 10 suppliers for a three-hour meeting. Every supplier meets Volvo Group's CPO, her executive board, relevant buyers within that area and engineers at Volvo. This meeting is arranged with the single objective, which is to discuss innovation and according to a manager the meetings are arranged every month. The logic behind the meetings is according to one of the directors that innovation is not only found among small start-ups but also among traditional suppliers. These companies are usually already suppliers, which makes it, according to a manager, even more easy for them to collaborate together. The purchasing manager acknowledge that these events requires a lot of preparation and that full teams are involved to plan topics and ideas. A manager describes these events as a good

information source but not a great one, however, this type of events would be beneficial to conduct in markets where the manager's team has less information about the supply market.

Collaborating and engaging with external actors is an information source brought up by a purchasing manager that contends that collaborating with external actors can sometimes bring new fresh eyes on an area or a project. External actors can according to the interviewee for an example be universities or associations.

4.2.4 Storing and Sharing Supply Market Intelligence

A buyer contends that a difficulty with market intelligence is to adapt it and package it so that, among others, the engineering organization can use the intelligence and: "*make sure that you get something out of it" [Translated]*. This is also highlighted by a purchasing manager that says that people in general want new technologies or ideas to perfectly match into their daily work procedures and processes, without any adaptations. The purchasing manager contends: *"If you get something that you have not done yourself, you want it to match directly, and to match directly in your scope". [Translated].*

Table 17: *Challenges related to Storing and Sharing Supply Market Intelligence*

Challenge	Reference
Stored material isn't by default visible for anyone else in the organisation	I.2, I.13, I.3, I.11
Making information useful for others in the organisation	I.2, I.4

As can be seen in Table 17 a purchasing manager concludes that stored material is not by default visible for anyone else in the organisation. However, the purchasing manager says in the interview *"It's nothing that prevents people at Volvo from calling and asking if we have done something interesting in a particular area" [Translated].* The reasons for not sharing the intelligence can vary, one reason that the purchasing manager share is that the material can be of confidential character. An engineer says that they only share information within the project i.e. only people connected to that specific project has access to that information. However, another engineer contends that the information can be accessed by other people in the organisation but then you need to find the person that is responsible for that project. Another engineer acknowledge that information is not shared to everyone and contends: *"We share information by email",* the engineer then contend that this is probably enough, it doesn't have to be more complicated than this. The interviewee also contend that the engineering department has a common place where some information is stored, but not all. A segment leader says that the storing of information is done in an excel file; *"It's as simple as excel, actually"*. The same interviewee contends that uploading presentations from the suppliers that you meet would be a good idea in order to share information in a better way. According to the segment leader this isn't done in a structured way as of today: *"Often, we lose this kind of information".*

A buyer acknowledges that processing information and making the information useful for others in the organisation is a big challenge, which can be seen in Table 17. The buyer contends that the challenge is to take care of the gathered information as an organisation and to make use of it. The interviewee continues and says that translating general information into something concrete is a real challenge. Accordingly, a purchasing manager states *"The important thing is that the information you produce not only dies but creates value later in the future" [Translated].* The purchasing manager also

highlights the importance of sending the gathered information to the right people in the organisation and not to everyone.

4.2.5 Legal Aspects

The majority of risk in Volvo Group is coming in through the relationships with its suppliers, according to a lawyer. Therefore, contracts are a crucial part in the work to minimize risks. As of today, one-size-fits-all template contracts are mainly used, related this has several challenges come to light, see Table 18. These are further elaborated on in this chapter.

Table 18: *Challenges related to Legal Aspects*

Challenge	Reference
Contracts are a one-size-fits-all template document that is supposed to apply to all suppliers	I.2, I.1, I.3, I.10
Contracts can scare newly started suppliers	I.3
Small suppliers don't always have the capacity to review the contracts	I.11

A purchasing manager contend: *"When Volvo engages traditionally with a company it is a one size fits all document"*. According to a buyer the traditional contract is covering basically every possible risk; therefore, buyers tend to overuse this document since this will hedge them against unknown risks. This is especially true when sourcing innovative technology since the technical expertise with the buyer might be limited. A lawyer said that it's not reasonable to put in all type of different scenarios in a contract; for small suppliers it has to be more streamlined. This is also acknowledged by a purchasing manager who states that one-size-fits-all template contracts used by mature technology can't easily be adapted to small innovative suppliers. A small supplier that is only selling software shouldn't have to sign a clause about for example environmental impact since it doesn't impact their business, according to the lawyer. Accordingly, the purchasing manager contends that the contracts has to be tailored to fit each specific situation, which is also acknowledged by a buyer working with innovative technology. Customising every contract is according to the lawyer a very time-consuming activity for the lawyers of the company.

As can be seen in Table 18, a project manager states that contracts can scare newly started suppliers because if the supplier fail to fulfil its contractual part it's liable for all costs. The project manager believes that this fear is mainly present among newly started companies. An engineer says that small suppliers without enough financial power tend to read the contracts very thorough since they can't afford to miss any contractual part.

As seen in Table 18, small suppliers don't always have the capacity to review all contracts. An engineer describes that beside the standard contract there is also a contract from the engineering department called technical requirement. This can according to the same interviewee be up to 100 pages, and for a small supplier this imply a lot of additional work. The engineer states: *"If you come with a technical requirement of 100 pages to a small innovative supplier, they say 'I need to hire 20 people to read that, I'm only one', so basically they do not answer."* This means, according to the engineer, that small suppliers tend not to respond to the RFI or RFQ. If the contracts and requirements are too extensive Volvo therefore risk that small suppliers are missed, according to the engineer.

4.2.6 Specifications

According to a manager, RFI's and RFQ's has to be more outcome-oriented when sourcing for innovative technology, meaning that the specifications needs to be fewer and the requirements on a more general level. A segment leader gives an example in a prior sourcing case, where they had to send out a low detailed RFI in order to understand their own needs and to receive feedback on what the market was capable of supplying.

Table 19: *Challenges related to Specifications*

Challenge	Reference
Don't know what specifications are necessary when sourcing	I.1, I.2, I.11, I.4, I.7
Sending non-specified RFI's is a time-consuming activity	I.7
Tendency to over specify the RFI which requires a lot of time	I.5
Forced to source from suppliers that aren't used to the requirements of the automotive industry	I.11, I.13, I.7

As seen in Table 19, a challenge brought up was that buyers don't exactly know what specifications are necessary when sourcing or what to look for. A buyer says: *"We don't really know what we are looking for when buying" [Translated]*. Accordingly, an engineer stated, *"It was difficult to scan the market because we did not know what we were looking for and few technologies were available".* The engineer also contends that when they were writing the technical requirements they did not know if the requirements were too high or too low since they had no previous RFI to compare with. Both the directors also acknowledge that this is a challenge, one of them contends that with new technology, such as blockchain, you do not yet know the future use-case of the technology. The purchasing manager means that this uncertainty of the future makes it even more complicated.

As seen in Table 19, sending non-specified RFI's is a time-consuming activity since the scope becomes wider and the RFI is sent to more suppliers. This is highlighted by a manager which says that you are required to send non-specified RFI's when you are working with innovative technology, which is elaborated on in the section above. The interviewee highlights that the time that the team spends on sending those RFI's would decrease if they in advance knew what they were looking for. Sending RFI's to 30 different suppliers takes time says the manager. Another challenge that comes with sending non specified RFI's is that the answers you get from suppliers also becomes less specified.

As seen in Table 19 there is according to a segment leader sometimes a tendency to over specify the RFI which also requires a lot of time. A segment leader acknowledges that there's an issue with over specifying. *"The issue is that it can take too much time to send it out, because people want to specify everything, so they will take too much time trying to Figure out some number or specification".*

According to Table 19 two of the interviewed engineers said that when sourcing for more innovative suppliers you are sometimes forced to scan for suppliers that has no, or very little, prior experience of delivering to the automotive industry. The interviewee says that suppliers outside the automotive industry are not used to all the development phases that are standard in the automotive industry. A segment leader agrees with this view and says; when engaging with start-ups: *"The challenging part in the early discussion is to get them aware of our truck requirements"*. The interviewee says that this

takes a lot of time from Volvo Group both in communicating the requirements but also to make sure that the supplier understands them.

5. Discussion

In chapter 5 the empirical findings will be analysed and discussed in order to fulfil the aim of the study: "*investigate what the different challenges are in supply market scanning for mature technology, compared to the challenges associated with scanning for innovative technology*." In 5.1 the challenges of mature technology are analysed and discussed with support of the literature in chapter 2 and in 5.2 the challenges of innovative will be discussed in the same way. These two parts will serve to answer research question 2: *"How can large automotive OEMs, address these challenges and improve their supply market scanning".* It will also serve as a foundation for the comparison between the two technology groups that will be done in section 5.3. The developed comparative framework from chapter 2.4.2., will be used to compare the challenges and answer research question 1: *"How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology in large automotive OEMs?"*

5.1 Challenges of Mature Technology

In 5.1, the challenges from the mature interview group will be discussed. Each "theme" (see Table 20) will in turn be discussed in different sub-sections. Table 20 shows the summary of challenges of the mature group identified in the empirical findings. The challenges were, to as large extent as possible, grouped according to the themes identified in the literature review which were the foundation for the comparative framework in chapter 2.4.2. These themes, that was found are marked dark grey in Table 20. The themes marked light grey, are those not found in the literature, but identified through the empirical findings. Furthermore, the bold text mark those challenges which is also acknowledged by the literature and those in normal format are challenges only found in the empiric findings. This Table will serve as a reference throughout 5.1.

Table 20: *All challenges of supply market scanning for mature technology identified from the interviews, divided in 5 themes. Themes marked dark grey are the same as the themes in the comparative framework of chapter 2.4. Themes marked light grey are additional themes from the empirical findings. Challenges in bold corresponded to what was also said in the literature review.*

Knowledge and experience	Information gathering	Storing and sharing supply market intelligence	Legal Aspects	Cross-functionality and network
Purchasers sometimes lack the right technical knowledge to conduct supply market scanning **There is no training on how to do supply market scanning** **Job rotation rate of purchasers causes experience to be lost** **It is easier to give business to a known, experienced supplier than finding new ones**	**Google searches yield to much data to sort through** Trade shows take a lot of preparation No formal process exists for doing supply market scanning	**No obvious place to store and share information** **Information gathered by others is inaccessible** Can't search Central database (VSIB) without knowing supplier name or supplier code There is no way of categorising or filtering to find suppliers in VSIB **VSIB is not updated sufficiently**	Design ownership and confidentiality agreements sometimes make supply market scanning more difficult	Formal processes for working cross-functionally are lacking Finding the right people within the organisation is difficult Information from other departments can be too complex

5.1.1 Knowledge and Experience

Knowledge and experience is a theme reoccurring in both the interviews and the literature. As seen in Table 20 above, all the challenges identified during the interviews, are more or less also mentioned in the literature (marked bold). This implies that the challenges experienced in the case company are not

unique to that context, but rather that these problems are more general. The different challenges in this theme does however have pretty separate characteristics.

Previous research by Jones and Barner (2015) show, purchasers generally do not have the experience or formal training to conduct SMS. The empirical findings of our study show the same challenge, confirming Jones and Barner's (2015) statement. However, knowledge is a wide topic which Tu et al. (2006) also point out, stating that "*prior relevant knowledge*" both take the form of job skills of the worker, knowledge on the technology and management practices of the organisation. The first of the challenges in Table 20, showing that purchasers sometimes lack the right technical knowledge, are in line with what Cohen and Levinthal (1990) define as knowledge about the technology. Both Cohen and Levinthal (1990) and Cousins (2011) suggest that kind of technical knowledge to be of importance in order to process and absorb gathered information and apply it to commercial ends. However, as the challenge in Table 20 show, keeping knowledge and experience is related to problems such as job rotation, which was also pointed out by Handfield (2006). Therefore, these challenges could be seen as having a connection to each other, i.e. job rotation hinders purchasers from building up technical knowledge.

One could argue that training of new purchasers could serve as a mitigation of the job rotation-consequences mentioned above. However, the interviews revealed that it might be easier said than done to introduce training on how to do supply market scanning. Two arguments were made in line with this. One interviewee stated that a SMS-training would be too general since the segments are so different from each other. Another viewpoint came from a purchasing manager, who meant that knowing too much will cause you to ask for something too specific, putting you in a box and giving you exactly what you asked for and nothing else, thus hindering innovation. These arguments against training, would have to be considered if supply market scanning training would to be formed.

Even if training could be argued to one mitigation against job rotation, the empirical findings shows two other potential improvement areas for solving this challenge. The first coming from an interviewee in chapter 4.1.1, who contended that handovers practises between new and old staff, isn't followed correctly. Furthermore, a purchasing manager stated that new and old personnel should work in parallel for some time to ensure knowledge transfer, but that it seldom happens. Therefore, it could be argued that although job rotation is a challenge as stated in Table 20, empirical findings shows that it could be mitigated by properly following existing handover procedures. The other potential improvement area the empirical findings revealed, came from a buyer who pointed out that the hiring process is connected to the challenge of job rotation. The buyer meant that the purchasing organisation was prone to hire people with degrees, wanting to take quick career steps, thus not staying too long within their position. Based on these statements, it could then also be argued that the hiring process could need to be revised.

As seen in Table 20, the last challenge of this theme was "it is easier to give business to an existing supplier than finding new ones". The interviewees point out in chapter 4.1.1 that when known supplier are used to work with Volvo and has gained experience together with them, it is easier continue giving business to them rather than conducting supply market scanning to find new ones. This challenges are somewhat similar to what Bessant et al. (2005) mention, namely that supply market scanning is often mainly done within the current supply base. So, one could argue that the challenge acts as a barrier to conduct supply market scanning since using the same suppliers over time, implies that you do not have to conduct supply market scanning to the same degree.

5.1.2 Information Gathering

Gathering information is a central part of supply market scanning (Van Weele, 2014). Yet, the interviewees were pretty unanimous that there does not exist any outspoken, formal process of how to do it. Even in Jones and Barner's (2015) formal model for how to conduct supply market scanning, there is no real description on how the actual information gathering should be done. They only mention it in passing as part of one of the more abstract steps in the model; a model, suggesting that supply market scanning is done in a very structured fashion. However, the empirical findings suggest something else, namely that the practices are highly ad hoc, up to each and every purchaser and done in different ways and to different degrees. As one interviewee put it: "*It is up to you how to do it".* This unstructured approaches used at Volvo, is more in line to what Jones and Barner (2015) call opportunistic intelligence, where purchaser themselves take initiative and scan the market as they see fit. This being said, it is hard to know if an unstructured or structured approach is the most effective alternative. Maybe it is somewhere in between, as one purchasing manager imply by contending that supply market scanning should not be a structured process, but it should at least be more structured than what it is today.

However, there might be reasons, from both the literature and the empirical finding, that suggest why formalizing information gathering is complex, or irrelevant. Cohen and Levinthal (1990) point out that relevant prior knowledge is gathered over time, suggesting a successive approach to gathering information based on experience. This seems to be more in line with how the interviewees describe the information gathering practices, compared to Jones and Barner's (2015) start to finish model in chapter 2.1.1. Furthermore, the characteristics of the information needed is different between purchasers, but also the information sources used to find the information. This also becomes evident looking at Table 21 below, showing what information sources the different purchasers use. Some are widely used, such as Google and Trade fairs, but some are almost unique to one or a few interviewees. Moreover, it became clear in the interviews that different purchasers had different main sources of information and did not really know about other purchasers' tactics when asked. One almost solely used lists from trade association, one only used Google and another almost exclusively used the network of contacts. Since the practises are so different, they would be hard to fit into a formal, one-size-fit-all process. However, since many purchasers does not seem to know each other's tactics, some sort of workshop or formal guidelines of different approaches to gather information, could be beneficial.

The information sources the interviewees use in large, match those found in the literature review quite well, with some exceptions. In Table 21 below, the information sources used by the interviewees is listed and those mentioned in the literature are marked in bold text. As seen in the Table, buyers use creative ways not described in the literature, such as using patents to find suppliers and scanning the upstream supply market. However, some tactics, such as reverse marketing, was mentioned as an information source in the literature but not used by the interviewees which leads us to believe that there is some untapped potential that could be utilized if used. Reversed marketing could for example make scanning process passive and let the suppliers make much of the purchasers work according to Blenkhorn and Banting (1991).

Table 21: *The identified information sources for the mature technology group, presented in descending order depending on the number of interviewees that has identified the source as useful. Sources of information marked bold correspond to what the literature identify as useful sources*

Information source	Interviewees that acknowledge usage of the source

Personal network/Colleagues	M.1, M.2, M.3, M.4, M.5, M.6, M.7, M.8, M.9
Trade fairs	M.1, M.2, M.4, M.5, M.6, M.7, M.8, M.9
Google	M.1, M.2, M.3, M.4, M.5, M.7, M.9
Existing suppliers	M.1, M.8, M.2, M.3
Upstream suppliers	M.1, M.9, M.2, M.3
Trade Associations	M.1, M.4
Using patents	M.7

Some practices related to information gathering revealed other interesting traits of the organisation connected to supply market scanning. One interesting example that was given by a segment leader, was about how the bureaucratic complexity made it too complex to get a presentation approved for a trade fair. This can be equated to what Daft and Weick (1984) mean is a challenge for large firms in general, namely that there exists a correlation between the size and maturity of a company, and the degree of which they search for new information. In the case of Volvo, the interviewee means that too many departments had to be involved and approve the presentation for a trade fair, causing it not to happen. The example could stand as proof of Daft and Weick (1984) claim that the big sizes of companies is less active in regard to searching their environment. Furthermore, it suggests a need do decrease the bureaucratic complexity of the organisation, as this is a hinder of conducting supply market scanning.

Regarding chapter 4.1.2 and the empirical findings regarding information gathering, one can read that many of the interviewees mention that it is time consuming to gather information and that it is no outspoken policy about conducting it. Both the challenge "*Google searches yield to much data to sort through*" and "*Trade shows take a lot of preparation*" are suggesting that the big factor is *time*, and that supply market scanning is *time consuming*. This indicate that there might be a question of prioritising supply market scanning over other tasks. This implied low intensity of supply market scanning might be explained by looking at Handfield's (2006) model of supply market intensity, described in chapter 2.1.2. If we assume that the case company, a large and mature organisation, as a collective know a sufficient number of suppliers to satisfy their requirements, then we can feel confident that they can be placed in quadrants 1 or 2. Regardless if the strategic importance of purchase is high (1), or low (2), the model shows that the supply market scanning intensity will be "minor" or at the most "moderate". According to the model, the intensity is only "major" if there does not exist the right capabilities in the existing supply base, which for example should be more the case in the innovative area.

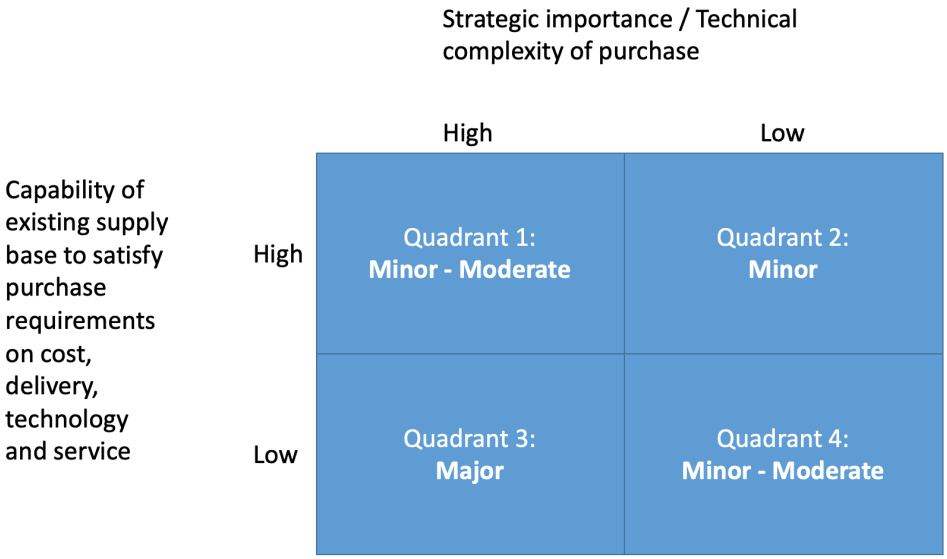

Figure 9: *2X2 matrix showing intensity of information search under various conditions, adaptation from Handfield (2006)*

5.1.3 Storing and sharing supply market intelligence

Regarding storing supply market intelligence, the buyers pretty much all gave the same picture in the interviews. Storing information is done in a structured way, but the challenge lies in the fact that most of it is done on individual's computers and not in a central database. This is however not surprising, since Jeeva (2008) state that it is common that supply market intelligence is stored in an unstructured fashion and are inaccessible to purchasers. The reasons for this at Volvo, could be manifold. One explanation of the challenge could be that the existing central database are not optimal for real life usage, as the empirical findings suggest *"Can't search Central database (VSIB) without knowing supplier name or supplier code", "There is no way of categorising or filtering to find suppliers in VSIB"* and *"VSIB is not updated sufficiently".* These challenges clearly show the problems regarding the existing database that could explain why many build their own databases in the teams or on their computers. This has had the effect that, as one segment leader put it in chapter 4.1.3: "...*I don't know where to put the data for optimal use - it is a very valid challenge I have… How can I make sure that the work I've done, which has provided me some insights, can be useful to others and that would be understandable to all?".*

Handfield (2006) do point out that a central database, storing supplier market intelligence, should have the functionality of being searchable and indexed, but that it also should be able to filter according to some relevant data elements. The challenges in Table 20, suggest that the database existing today is the total opposite: "*Can't search Central database (VSIB) without knowing supplier name or supplier code*" and "*There is no way of categorising or filtering to find suppliers in VSIB*". Judging by these challenges, one can say there is a mismatch of the current database used, and what is needed to ensure proper storing and accessibility to supply market intelligence.

A database like the one Handfield (2006) describes, could not only serve to address the challenges directly tied to the database, but also the previously discussed challenges of supply market scanning in large. Take for example the challenge of *"Job rotation rate of purchasers causes experience to be lost*", discussed in chapter 5.2.1. Interviewees has stated that much information is stored as knowledge with the buyers and on their personal computers. If there were a central database that did not have the current challenges connected to it, much of this information could be accessed from filtration and advanced searches in a central database. This would mitigate the fact that staff come and go over

some time period. Moreover, if information was centrally stored, the problem of who to share information with, would also be mitigated. The segment leader who mentioned the problem of knowing who to share information with, would not to the same degree have to find the exact persons to send material to - they could search for it themselves in line with Handfield (2006) describes functionality of a database.

It could also be argued that a better functioning database could address the challenges connected to supply market scanning being time consuming. The empirical findings showed that, the process of going through lists from trade associations or researching companies prior a trade fair is very time consuming. As of now, if such document is stored on buyers' computers as the empirical findings suggest, it indicates a risk that such work has to be re-done the next time over. A well-functioning central database could be incrementally "filled" with information and see to it that unnecessary extra work is minimised.

5.1.4 Legal Aspects

Legal aspects was a reoccurring theme in the interviews for mature technology, although what was said in relation to the theme was quite similar between the interviewees. The challenge expressed was as Table 20 shows: *"Design ownership and confidentiality agreements sometimes make supply market scanning more difficult"*. However, the literature did not address this topic in relation to supply market scanning and the expressed challenge did not fit with the existing themes presented in the comparative framework in chapter 2.4.2. This is why *legal aspects* was added as a theme based on findings in the empirical findings (marked light grey for distinction in Table 20).

The challenge highlights a special trait that one can distinguish some of the challenges, namely that they take the form of "barriers" to conduct supply market scanning rather than present a challenge in the actual execution. In this case of legal aspects, the empirical findings show that state in the relationship with existing suppliers could pose as a hinder for the buyers to go out and scan the market in the first place. It could be argued that this actually help explain the statement made by Bessant et al. (2005). As mentioned earlier, Bessant et al. (2005) state that supply market scanning is often done in the current supply base. It could be that barriers like design ownership mentioned above are part of the reason for that kind of lock-in.

5.1.5 Cross-functionality and Network

Cross-functionality and network is the second theme that had no clear challenges connected to it in the literature, although literature such as on absorptive capacity acknowledge its importance for supply market scanning (Tu et al., 2006). Since no challenges was identified for this theme in the literature, this was not part of the comparative framework in chapter 2.4.2. From the empirical findings however, challenges on this theme became evident, hence it was added as a new theme in Table 20, marked light grey to distinguish it from the themes with challenges from the literature.

The empirical evidence also clearly points to the importance of having, and using, your network when doing supply market scanning. The quote from a segment leader exemplifies this: *"If you don't have a good network then you can be in the dark for a long time"*. This is in line with Tu et al. (2006) who contend that two of the cornerstones of absorptive capacity are *communication network* and *communication climate*. Like many other themes discussed in this chapter, the challenges belonging to this *cross-functionality and network* could be connected to the size and complexity of the company, in

line with claims by Daft and Weick (1984). As mentioned, they point out the connection between a company searching their environment less as they grow bigger and more complex. Signs of this being true can be found in the empirical findings. Interviewees states that it is hard to reach and find the right people in the organisation, and that you can be redirected 10-15 times before you find the right person. One buyer said straight out that the organisation is too large and too many people are involved: *"It is a huge problem that we are so many involved. Because if you want to do something, then you must have everyone involved... But you cannot involve everyone today because you do not even know who everybody is"*.

Cross-functionality is important for supply market scanning to work efficiently according to Cousins et al. (2011) who point out that functions like purchasing and engineering need to be aligned. Cohen and Levinthal (1990) explain that having connection between engineers and purchasers is important and exemplifies with that there must be a "*common language*" between different departments, meaning that they understand each other and can communicate effectively. One challenge in this theme, seen in Table 20, interviewees state that "*information from other departments can be too complex*", which shows a clear contrast to what Cohen and Levinthal (1990) mean are so important.

However, although the empirical findings suggest that this is a theme with many challenges, it could be because it is such a relevant and utilised capability of doing supply market scanning. The reasoning being, that the more something is utilised, the higher probability there is that challenges surface connected to it. As we saw in Table 8 in chapter 4.1.2, personal network is the most widely used source of information amongst the purchasers and could therefore be seen as one of the most important parts of supply market scanning. Despite it being one of the most important parts of supply market scanning, some interviewees suggested that "*formal processes for working cross-functionally are lacking*". From examples in the empirical finding, it is understood that they see more opportunities of working together to achieve better supply market scanning, but that it is up to them to make it happen because formal practices do not support it. As one segment leader puts it: *"We have similar segments within the company that have not collaborated so much recently ... We do not share the same supplier base, though that would be possible"*. This fact relates back to the discussion about *knowledge and experience*. As Cohen and Levinthal (1990) point out: prior knowledge as part of absorptive capacity also include knowledge about "*who knows what*" and the ability to identify who needs certain information. Network could therefore be seen as part of prior knowledge that is built up over time. Therefore, it could be argued that purchasers would become more effective at supply market scanning the longer they stay in their position.

5.2 Challenges of Innovative Technology

In 5.2, the challenges from the innovative interview group will be discussed. To facilitate the comparison between the literature review and the empirical findings, Table 22 will be used as reference point throughout this section. For this comparison, both categories of challenges in the comparative framework (see Table 1) are considered since all challenges identified in the literature as "General challenges" also may apply to innovative technology.

Table 22: *All challenges of supply market scanning for mature technology identified from the interviews, divided in 6 themes. Themes marked dark grey are the same as the themes in the comparative framework of chapter 2.4. Themes marked light grey are additional themes from the empirical findings. Challenges in bold corresponded to what was also said in the literature review.*

(F) Mindset	(G) Knowledge and Experience	(H) Information gathering	(I) Storing and sharing supply market intelligence	(J) Legal aspects	(K) Specifications
F1. Early phase technology projects are difficult to measure in terms of risk and money F.2 Difficult to convince internal stakeholders to start early phase projects **F.3 High technical and commercial uncertainty** F.4 High uncertainty regarding what role Volvo Group will have in the future	**G.1 Limited experience about new technology** G.2 Transform early phase projects into potential value in the future	H.1 Filter and absorb all available information H.2 The scope of the market research is too general which generates results on a too high abstraction level **H.3 Supply market scanning is time consuming and not prioritized** **H.4 Internet searches doesn't yield relevant supplier results**	I.1 Stored material isn't by default visible for anyone else in the organisation I.2 Making gathered information useful for others in the organisation	J.1 Contracts are a one-size-fits-all template document that is supposed to apply to all suppliers J.2 Contracts can scare newly started suppliers J.3 Small suppliers don't always have the capacity to review the contracts	K.1 Don't know what specifications are necessary when sourcing K.2 Sending non-specified RFI's is a time-consuming activity K.3 Tendency to over specify the RFI K.4 Forced to source from suppliers that aren't used to the requirements of the automotive industry

5.2.1 Mindset

From the empirical section of "mindset", two major traits can be identified. The first is the large uncertainty that innovative technology inherently has, the second is the difficulties that surround innovative technology in terms of willingness to take on risk and to measure it in terms of risk and cost. If looking at this from a high-level perspective those two themes seems quite natural for an area where there is little or no prior experience to rely on, which can be argued to be the case for innovative technology.

In the literature it is suggested that Volvo is not alone among large companies that have challenges connected to embracing innovation. For an example Philips et al. (2006) and Bessant et al. (2005) contend that large and mature companies are quite good at incremental innovation but has not yet mastered how to implement more radical innovation. Therefore, one can believe that literature such as Cohen and Levinthal (1990) who suggest that steady state conditions inhibit companies to effectively conduct supply market scanning are true. However, this does not seem to fully correspond to the picture given from the interviews, but. In this case it is found that Volvo has created a new innovation arena called Camp X where they have gathered business functions to work with innovation. It is not outspoken, but from what Cohen and Levinthal (1990) write about steady state archetype, the creation of Camp X can be seen as a step away from this. Bessant et al. (2005) contend that companies that are strong in a particular market may have strong commitments to a certain technology. Bessant et al. (2005) therefore argue that there may be a mismatch between capturing new innovation and obtaining the company's current strong position in a certain field. Therefore, it can be argued that it is difficult to change a company's orientation and path towards a new technology or strategy. This is also exemplified by one interviewee who elaborated on the difficulties to change e.g. a component in a truck that is already working fine. The interviewee then says that a clear driver to innovate that particular component has to be present, otherwise it may be complicated to innovate.

The first identified trait, uncertainty, was materialized as high technical and commercial uncertainty when scanning for innovative technology. In theory the solution to this challenge is to explore the

periphery of the company (Powell et al., 1996). They also suggest expanding the collaboration to new actors such as universities. This is also brought up in the empirical section where the importance of creating new types of relationships but also strengthen the existing ones is mentioned. This is identified among several interviewees who indicate that the solution to this perceived uncertainty is to be all ears to the market and be curious about collaborating with new suppliers and start-ups.

It also seems that there is an uncertainty regarding what market role Volvo Group will have in the future. One interviewee says it is not obvious that the rapid changes currently prevailing in several technical areas will leave Volvo in the same market role in the future. This challenge has similarities with what is stated by Bessant et al. (2005) which describes the difficulties of in advance knowing the future dominant design. Therefore, as suggested in the prior paragraph, collaborating with new actors may be important to mitigate all types of uncertainties.

From the interviews it is highlighted that early phase technology is difficult to measure in terms of risk and money. This seems to be true because of what has been elaborated on in previous paragraphs about uncertainty. Innovative technology is to its nature uncertain, which in turn equals a higher degree of risk that in turn can make it harder to measure and evaluate these risks and costs. Also, there is according to some interviewees usually no prior projects to benchmark against when sourcing innovative technology, which increases the uncertainty. In order to not let this uncertainty, get in the way of starting projects or sourcing innovative technology a change of mindset may be required in regard to what variable to evaluate and measure. According to the interviews there may be better and more effective variables to evaluate than cost.

5.2.2 Knowledge and Experience

It is mentioned in the interviews with innovative purchasing that experience is limited when it comes to new technologies. A purchasing manager says that everything they do is new and that there are no employees that has been working with these technologies for 10-15 years, as is true about mature technologies. This challenge is especially prominent among the interviewees working at *innovative purchasing*, the interviewees working with other areas such as electromobility- or electrical purchasing does not see this as similarly challenging. The explanation can be found in the fact that these departments have been sourcing for a longer time. Schiele (2006) contends that when scanning for innovative suppliers it is important to know what to look for. However, this creates a vicious circle since the challenge seen in the interviews is that the interviewees believe they have limited experience about new technologies. This leaves the department in a bad place. However, in the literature two distinct ways of acquiring knowledge is mentioned. The first is attending trade exhibitions and the second is talking to colleagues. Also, which is already mentioned in the previous section *mindset,* Powell et al. (1996) suggest exploring the periphery of the company to gain new knowledge, but also to engage with completely new actors such as universities or research laboratories. The latter is done at *innovative purchasing* and it seems like this is a good way for them to acquire knowledge about technologies. This is one way of getting out of the vicious cycle of lacking knowledge and experience.

5.2.3 Information Gathering

It is highlighted by Jones and Barner (2015) that finding new suppliers is both time consuming activity and difficult. This is also highlighted by two interviewees who say that as a buyer you have a lot of other important tasks to complete as well and this task often becomes less urgent. Jones and

Barner (2015) also highlight that internet searches usually yield unrelated results, which seems to correspond well to what is found in the empirical chapter. The easy access to people and companies that internet has resulted in, is described by a purchasing manager as "a *floodgate of information*", making it hard to review all information. Interestingly, the fact that a purchasing manager describes information gathering as a "*floodgate of information*" stands directly in contrast to the challenge from Jones and Barner (2015) who states that it is hard to detect small suppliers. In this case it can be seen that finding small suppliers is not a big concern. The real challenge, when examining the empirical findings, instead seems to be about filter and absorb available information, not gathering information. In the literature, Cousins et al. (2011) highlight the importance of what Cohen et al. (2011) calls absorptive capacity and says that it is the most important feature for a firm's ability to capture innovation.

In the prior paragraph it is emphasized that gathering information is not the difficult part, instead the difficulties can be found in absorbing and filter the information. This seems to be correct when speaking to people working with early phase technology that has never been around before. However, everyone working with innovative technology does not solely work with early phase technology. Therefore, when looking at the empirical findings, and examining the amount of different information sources it is obvious that it can still be difficult to find all type of suppliers in the market and gather information about them. If supply market scanning would have been easy, then a single tool for the activity would have been enough to use.

From the interviews, see Table 23, it is seen that Google and trade fairs is the most recurring sources of information, these also match those mentioned in the literature review. It can also be seen in Table 23 that use of colleagues, media, and trade associations also matches the literature. Apart from those 5 sources of information there is 6 other sources that have come up during the interviews and that does not match the literature. Some of the sources such as Technology Days or Supplier Innovation Dialogues are Volvo specific activities. What is clear, is that Volvo utilises the concepts of "dalliances", which Philips et al. (2006) mean are short-termed and non-committal relationship enabling companies to scan the supply market for innovation without committing to much resources and time. A purchasing manager describe this and says that they try to work with start-ups for a predefined short period of time, in order to see if they can learn from each other and if there are potential for further commitment. This is according to the interviewee beneficial for both parties since neither of them in advance know if the collaboration will be valuable. Furthermore, Volvo conduct other creative activities with little resource or time commitment to scan the supply market, such as using "technology days". It seems like they are achieving what Philips et al. (2006) mean are one of the goal with dalliances, to have these loose ties which enable the company to stay up to date with current developments, at the same time as their traditional long-term relationships are in place.

Table 23: *The identified information sources for the innovative technology group, presented in descending order depending on the number of interviewees that has identified the source as useful. Sources of information marked bold correspond to what the literature identify as useful sources*

Information source	**Interviewees that acknowledge usage of the source**
Google	I.2, I.13, I.11, I.7
Trade fairs	I.11, I.4, I.5, I.7
Figure out suppliers' main competitors	I.13, I.11, I.4

“Technology days”	I.1, I.5, I.7
Personal network	I.3, I.5, I.7
Incubators	I.1, I.2
Business intelligence	I.2, I.5
Media (podcasts, technology websites, technology news)	I.2, I.4
Supplier Innovation Dialogues	I.1, I.7
Consultants	I.2
Trade associations	I.2

5.2.4 Storing and Sharing Supply Market Intelligence

From the interviews it is learned that information is stored with internal projects and not in any structured way. It is neither, by default, stored in a way where everyone in the organisation can access it. Information is often stored in excel files and not in common information management systems which Jeeva (2008) and Handfield (2006) advocate, this is also what. Jeeva (2008) identify as a big challenge with supply market intelligence. Since the interviewees commit that they are storing information in excel files, inaccessible for others, it strengthens the relevance of this challenge. Some interviewees highlight that information should not be sent and shared with everyone in the company, but to the right people. Interestingly, an engineer contends that sharing information by email is enough and that the current system of sharing information overall works quite fine. However, with a well-functioning centralized information system, as suggested by Jeeva (2008) and Handfield (2006), there will be much less issues related to who the information should be shared with.

5.2.5 Legal Aspects

In relation to supply market scanning the literature did not address any challenges related to contracts or any other legal aspects. In the interviews this was however so important that it was decided to have a section elaborating and discussing the legal aspects in terms of how it can both be a barrier but also a facilitator to supply market scanning.

A concern among the interviewees is that contracts are a one-size-fits-all template document, i.e. difficult to adapt the contract to a specific context. This setup may work for the majority of the suppliers that Volvo buys from, but, when sourcing innovative technology, it is different. Innovation, of course, exists among big suppliers, but innovation also exists among smaller companies and among start-ups. In order to engage and collaborate with these, it is important to make sure that the contracts do not act as a barrier for the relationship. Innovative suppliers are according to an interviewee in a sense vital for the future success of Volvo. However, with this said, today it does not seem like those one-size-fits-all template contracts are hindering Volvo from engaging with small suppliers, but it is a barrier. In the interviews it is obvious that a change towards less standardised contracts is something that is highly desired by the buyers since large contracts requires a lot of time from them. But it also requires a lot of time from Volvo’s lawyers as well as from the supplier. The contracts have to become more understandable and adapted to the very specific situation. Other risks, not yet mentioned but still very important, are according to the interviewees that some smaller suppliers might not even have the resources to go through the long contracts and make sure they are covered in every aspect.

This might result in Volvo losing innovative suppliers that would like to benefit to Volvo's innovation. If it is well known among suppliers that Volvo's contractual steps are this extensive and complex, there is according to an engineer a risk that they will not even respond when Volvo sends an RFI. This could imply that Volvo will never gain the knowledge about some smaller, but capable, suppliers. An interviewed lawyer contends that this issue is prioritized and that a solution with modular contracts will most likely be the solution to the problem. Contracts that are tailored to each specific situation would benefit not only the buyers at Volvo but also the suppliers who will have less paperwork to go through. According to the lawyer modular contracts will only consider the necessary parts of the contract i.e. only focusing on relevant requirements and risks.

5.2.6 Specifications

In relation to supply market scanning, the literature did not address any particular challenges related to specifications. However, Van Weele (2018) suggests using functional specifications in order to capture innovation in the supply market. In accordance with Van Weele (2018), several of the interviewees felt a big uncertainty regarding specifications and were thinking that they might be too tough when formulating the specifications or if the requirements were even rightly formulated. One interviewee even acknowledged that scanning the market was difficult since they didn't know what they were looking for and what specifications the product needed to fulfil. From what Van Weele (2008) and Georghiou et.al. (2014) writes about functional requirements it could be argued that functional specifications should be utilized more. They further highlight that functional requirements may even drive and increase innovation if used correctly. It is suggested that when responsibility is given to the suppliers to come up with a solution this can unleash inherent expertise, which in turn may drive innovation.

Looking at the challenges regarding specifications in Table 22, one can see that they indirectly relate to each other. As the first challenge in the theme suggest, buyers do not know what specifications are necessary. This may be explained due to that innovative technology to its nature is unknown and uncertain, which has been elaborated by Schiele (2006) but also in the empirical chapter. Therefore, it is difficult to know what specifications are necessary. The other challenges, namely, setting specifications being a time-consuming activity and that RFI's easily gets over-specified, can be derived to the uncertainty that innovative technology poses. Therefore, how specifications are set may require a different way of thinking i.e. another mindset. Also, to relate to the prior paragraph, knowledge and experience of how to formulate functional requirements may be as important as a change of mindset. Therefore, there may not only be a connection between the challenges of this theme and mindset, but also to the themes of *knowledge and experience.*

5.3 Comparing the Challenges

In this section, the challenges discussed in the previous subsections 5.1 and 5.2, are placed in the comparative framework from 2.4, with the addition of the new themes from the empirical findings. This forms Table 24 below, where the bold challenges as before mark that the they are also mentioned in the literature. This comparative framework will serve as point of discussion and reference throughout section 5.3.

Table 24: *Comparing framework of the identified challenges for the two interview groups. Divided into the 7 identified themes*

Challenges of supply market scanning for mature technology	Challenges of supply market scanning for innovative technology
Mindset	
	Early phase technology projects are difficult to measure in terms of risk and money Difficult to convince internal stakeholders to start early phase projects **High technical and commercial uncertainty** High uncertainty regarding what role Volvo Group will have in the future
Knowledge and Experience	
Purchasers sometimes lack the right technical knowledge to conduct supply market scanning **There is no training on how to do supply market scanning** **Job rotation rate of purchasers causes experience to be lost** **It is easier to give business to a known, experienced supplier than finding new ones**	**Limited experience about new technology** Transform early phase projects into potential value in the future
Information Gathering	
Google searches yield to much data to sort through Trade shows take a lot of preparation No formal process exists for doing supply market scanning	Filter and absorb all available information The scope of the market research is too general which generates results on a too high abstraction level **Supply market scanning is time consuming and not prioritised** **Internet searches doesn't yield relevant supplier results**
Storing and sharing supply market intelligence	
No obvious place to store and share information **Information gathered by others is inaccessible** Can't search Central database (VSIB) without knowing supplier name or supplier code There is no way of categorising or filtering to find suppliers in VSIB **VSIB is not updated sufficiently**	Stored material isn't by default visible for anyone else in the organisation Making gathered information useful for others in the organisation
Legal Aspects	
Design ownership and confidentiality agreements sometimes make supply market scanning more difficult	Contracts are a one-size-fits-all template document that is supposed to apply to all suppliers Contracts can scare newly started suppliers Small suppliers don't always have the capacity to review the contracts
Cross functionality and network	
Formal processes for working cross-functionally are lacking Finding the right people within the organisation is difficult	

Information from other departments can be too complex	
Specifications	
	Don't know what specifications are necessary when sourcing Sending non-specified RFI's is a time-consuming activity Tendency to over specify the RFI Forced to source from suppliers that aren't used to the requirements of the automotive industry

In the following sections of 5.3, the discussion from 5.1 and 5.2 are synthesized to reveal the most predominant traits of each theme and technology group. The aim is to use what has been previously discussed to compare the technology groups to each other, in accordance with research question 1: *"How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology?"*.

5.3.1 Mindset

From Table 24, it is evident that there is a big difference in regard to mindset between supply market scanning for mature technology and innovative technology. No challenges were specifically derived to this theme in the mature group. This is however not totally unexpected, since innovative technology has the element of searching for the unknown. Which is different from the case of mature technology where purchasing often look for something very specified, as one purchasing manager pointed out. The mindset of an organisation that goes from knowing what to source, to scanning for innovative technology imply a need to change their mindset. The challenges show that implication quite clearly in Table 24, by having a lot of challenges for the innovative group, and none for the mature. The empirical findings suggest a lot of uncertainty in regard to innovative technology, both in terms of technical and commercial value, but also in regard to the bigger picture, such as what role Volvo will play in the future. So, the difference between the two groups can lie in the fact that the organisation is built up around the mature technology with existing procedures of measuring things like risk and value. Therefore, it will require a new mindset for the organisation to be able to handle the uncertainty involved with innovative technology.

5.3.2 Knowledge and Experience

A clear similarity between the innovative and the mature group, is that there sometimes is a lack of knowledge about the technology to be sourced. The reasons for this lack of knowledge does however differ, according to the empirical findings. Lack of knowledge about innovative technology is lower in general due to its novelty, which means that it has to be built from scratch. In the mature technology group however, knowledge could be argued to already exist to a greater extent, due to the technology being mature. But the challenge of knowledge sometimes lacking could instead be derived from things like job rotation. The other challenges of the mature group indicate this, since they are more about organisational issues like training and job rotation, which could be argued to be more about keeping experience and knowledge. What strengthen this argument even more is that, *Innovative purchasing*, where most of the interviews for the innovative group was made, are in of itself a young department. That could be an explanation why issues like job rotation might not have appeared yet.

5.3.3 Information Gathering

It can be seen in Table 24 that the challenges between the two groups are quite similar. For example, both interview groups acknowledge that internet searches yield both too much-, and irrelevant data. It can also be seen in the empirical chapter that supply market scanning indeed is a time-consuming activity, for both groups. Interestingly, two interviewees at innovative technology contend that supply market scanning being a time-consuming activity may not be the same as it being a challenge. They suggest that the activity maybe instead has to receive a larger priority among buyers and management. This may imply that the mindset regarding the importance of supply market scanning may need to change.

A big difference between the two groups are instead to be found in the use of information sources, both in terms of the number of sources used, but also in terms of what type of sources. This can be seen in Table 25 below. Some information sources are used to a wide extent in both interview groups, such as personal network, trade fairs, Google and existing suppliers. However, this is only 5 out of 13 identified sources that are common between the two groups. It could therefore be argued to be a lot of room to exchange best-practices. However, many of the information sources that the innovative group uses may not be applicable for the mature group, such as using incubators.

Bessant et al. (2005) points out that a challenge is that supply market scanning often is done within the existing supplier base. This is however not perceived as a challenge among the people working with innovative technology and the reason for this can be probably be found in the fact that their supplier base is not as extensive as the supplier base that the mature technology group has.

Another distinct difference that can be noted is the fact that the innovative group uses more information sources than the mature group. The explanation can probably be found in the very nature of the two groups, where the mature group already in many cases have an existing supplier base to source from. The opposite can be said to apply to the innovative group who does not have an established suppliers base. Therefore, they are naturally forced to scan the market for suppliers. The technology that the innovative group is sourcing is also changing in a quicker pace and therefore they have to pay closer attention to the technology changes in the market.

A clear distinction of information sources between the two groups are that the innovative group utilizes what Philips et al. (2006) calls dalliances (see also 5.2.3). That is, having an interest or an involvement with suppliers for a short period of time. This may be an activity that the mature group could to some extent utilize.

Table 25: *Comparing the information sources used by the two interview groups. The number within parenthesis is the number of interviewees who is identified to use the source*

Information Source	Used by the Mature Technology Group	Used by the Innovative Technology Group
Personal Network	YES (9)	YES (3)
Trade Fairs	YES (8)	YES (4)
Google	YES (7)	YES (4)
Existing suppliers	YES (4)	YES (3)
Trade Associations	YES (2)	YES (1)
Upstream suppliers	YES (4)	NO
"Technology Days"	NO	YES (3)
Incubators	NO	YES (2)
Business intelligence	NO	YES (2)
Media (podcasts, technology websites, technology news)	NO	YES (2)
"Supplier Innovation Dialogues"	NO	YES (2)
Consultants	NO	YES (1)
Using patents	YES (1)	NO

5.3.4 Storing and sharing Supply Market Intelligence

Regarding, *storing and sharing supply market intelligence*, the challenges posed by the interviewees show that the underlying issue is basically the same for the two groups. The challenges are about being able to find stored information from others and to make gathered information accessible for those who need it. The challenges of the mature group expose that much of the challenge with accessibility could be derived to the practices of how they currently store information and the lack of functionality in the central database. Why the mature group seems to be more concerned with storing information could, as discussed in section 5.1.3, be due to reasons like job rotation. A rotation of people can be argued to increase the need for effective storage and sharing of information, as Handfield (2006) point out. However, since the symptoms are the same for the innovative group, namely challenges related to concerns of making information accessible to those who need it, it could be assumed that they also need database with new functionality.

5.3.5 Legal Aspects

In both the mature- and the innovative technology group, *legal aspects* are by some interviewees considered to be a barrier for conducting supply market scanning. There are however differences in how the challenges materialise. In the mature group, not owning the design of components can make it harder to scan for new suppliers, since the designs cannot be shared. Looking at the challenges for the innovative group however, it seems that most of the challenges can be derived from the fact that legal practises are adapted for working with traditional suppliers that are well established. As discussed in 5.2, contracts are often big multi-page contracts which takes time to go through. For the innovative group, which frequently work with smaller companies and start-ups, such contracts bring

other types of challenges. As Table 24 show, these big contracts scare newly started supplier, they do not fit every supplier's business and small companies do not have the capacity to review them. One could argue that they are simply not adapted for smaller companies acting in the innovative arena.

In section 5.3.1 it was argued that a different *mindset* was needed to overcome the *uncertainty* involved in doing supply market scanning for innovative technology. Here it could be argued that new *practices*, also are needed for the innovative group; practices that allow supply market scanning to be different according to context and supplier. As discussed in 5.2.5, an example of this could be contracts adapted to different types of suppliers.

5.3.6 Cross Functionality and Network

For this theme no identified challenges were brought up for the innovative group, see Table 24. From examining the challenges of the mature group, it is evident that buying mature technology is heavily interlinked with different parts of the company and therefore having an extensive network has become increasingly important. For example, does a sourcing decision give rise to a plethora of new complex decisions and new stakeholders needs to be involved. This complex environment seems to result in a feeling among the interviewees that *cross functionality and network* pose a big challenge.

Camp X, where the innovative group is working, is a newly started facility where both engineers and buyers are gathered. Since they are in the same proximity collaborations and interactions may become more effective. This is in accordance with Cousins et al. (2011) who put forward Toyota and Honda as good examples where this has been done. They have with success co-located their buyers and engineers in the same facility to increase the interaction between the two groups. Therefore, Camp X could be supposed to maximize the interactions between engineers and buyers similar to the example that Cousin et al. (2011) gave.

5.3.7 Specifications

For this theme the difference between the two groups is very distinct. For the mature group, specifications are not identified as a challenge when scanning the market. This could be because the technology the mature group is sourcing usually has been around for quite some time and a lot of knowledge exist about what specifications are needed. This may not be the case for the innovative group which often has little to no knowledge about how to specify when sourcing. Therefore, they might benefit from using less detailed, functional specifications.

One purchasing manager in the mature group says that if asking suppliers for a specific product, that is exactly what you will get, no more no less. This statement by the purchasing manager suggests that a change to functional specifications and thereby a change of mindset is required among buyers and engineers. This connects back to the theme *Mindset* which discusses the importance of mindset and the many difficulties that comes with changing old ways of thinking.

6. Conclusion

The case company Volvo expressed difficulties in conducting supply market scanning. The company felt that supply market scanning needed to be improved in two separate areas. Supply market scanning needed to accommodate finding potential suppliers for the mature technologies, but also for more innovative technologies. The aim of this study therefore became to investigate what the different challenges are in supply market scanning for mature technology, compared to the challenges associated with scanning for innovative technology. The research questions were formulated to find these challenges and also to suggest how a large automotive OEM like Volvo could address them to improve their supply market scanning. This chapter will serve to answer the research questions of the study. Furthermore, it will include how the study will contribute to research and the to the industry, it will also provide the potential limitations of the study.

RQ1 *How does challenges of supply market scanning for mature technology, compare to supply market scanning for innovative technology in large automotive OEMs?*

There are many challenges of doing supply market scanning in large automotive OEMs. That the company is large, is in itself a challenges when it comes to supply market scanning. A lot of people in the organisation need to be involved to get things like external presentations approved which show that this bureaucratic complexity is a barrier for supply market scanning to take place. Furthermore, this study shows that the network of purchasers, both internally and externally to the company, is crucial for conducting supply market scanning.

The study also shows that purchasers feels a bit lost when it comes to conducting supply market scanning, since there are limited formal guidelines and practises on how to do it. Supply market scanning is more done in an ad hoc manner and are often up to each purchasers. It was for example shown that many types of information sources were unique to one or a few of the interviewees and that purchasers often had their own databases with supply market intelligence stored on their own computers. The latter, also having the effect that purchasers experienced that accessibility of stored information is a challenge; it is difficult to know who to share the information with and how to get hold of relevant information from others. Furthermore, expressed challenges with the currently used central database explain why purchasers has made their own, decentralized databases. The decentralized storage of information does not only show that accessibility of information is a challenge, but also that there are challenges regarding the functionality of the existing central database. Furthermore, that information is stored decentralised, together with the fact that is evident is that succeeding with supply market scanning is highly dependent upon one's network and accumulated experience, makes job rotation a big challenge. Job rotation hinders purchasers from building up that crucial network which sometimes causes information and experience to be lost, because of the decentralised stored information may disappear with the rotating personnel.

This research shows that there are some similar challenges between supply market scanning for innovative technology and mature technology. The three themes with the most similar challenges are *knowledge and experience, information gathering* and *storing and sharing supply market intelligence.* In regard to the first one, both groups believe they sometimes lack knowledge and experience about each respective technology when scanning the market. Another theme which has a lot of similar challenges is information gathering. Both groups contend that internet searches give irrelevant results and that filter and absorb information is a key challenge. Another similar challenge between the two

groups is storing and sharing information, where accessibility to information in the organisation is perceived as a challenge, .

The three themes where challenges of supply market scanning differ between mature- and innovative technology (see Table 24) are *mindset, specifications* and *legal aspects.* Regarding legal aspects, practices used in supply market scanning for mature technology are not adapted to innovative technology, which often involve smaller companies like start-ups. An example of such practices is the one-size-fits-all template contracts which is a challenge when collaborating with smaller companies. Regarding specifications, the study shows that specifications is a big challenge when sourcing innovative technology. The reason for this is found in the fact that there is a lot of technological uncertainty and lacking knowledge, in regard to innovative technology. Lastly, this study shows that a big challenge for the innovative technology group is *mindset*, which it is not for the mature group. That is, to develop the right mindset of the organisation in order to be as receptive as possible to innovation in the market.

RQ2 *How can large automotive OEMs, address these challenges and improve their supply market scanning?*

This study has shown multiple different possibilities on how to address the challenges found regarding supply market scanning. Furthermore, it has shown how important factors like network and sharing experience is for supply market scanning. To answer research question 2, Table 26 below was constructed. In Table 26, the potential measures discussed in chapter 5 are listed, together with their expected effect and the challenges they address from the empirical findings.

Table 26: *The key suggested measures to take and each expected effect of these measures.*

Suggested measures for large automotive OEMs	**Expected effect**	**Addressed challenge**
Reduce job rotation	Purchasers' knowledge, experience and network will increase over time, improving supply market scanning Decreases the impact of having decentralised supply market intelligence lost when purchasers change job	*Job rotation rate of purchasers causes experience to be lost* *There is no training on how to do supply market scanning*
Make sure handover templates are followed	Ensure good knowledge transfers between purchasers Decreases the impact of job rotation	*Job rotation rate of purchasers causes experience to be lost* *There is no training on how to do supply market scanning*

Introduce effective centralised storage of supply market intelligence	Reduces the impact of job rotation, since the information is not stored locally on personal computers that may disappear Increases accessibility of supply market intelligence between purchasers Reduces the importance of an extensive network providing purchasers with information Allows for quicker access to the right information Reduces the risk of the same work being done twice in different parts of the organisation	*No obvious place to store and share information* *Information gathered by others is inaccessible* *Making gathered information useful for others in the organisation* *Job rotation rate of purchasers causes experience to be lost* *Supply market scanning is time consuming*
Create formal guidelines or workshops of how to conduct supply market scanning	Increases purchaser's knowledge of each other's practices and information sources Increases awareness and prioritisation of supply market scanning Supply market scanning becomes more effective	*No formal process exists for doing supply market scanning* *There is no training on how to do supply market scanning* *Job rotation rate of purchasers causes experience to be lost* *Supply market scanning is time consuming* *Supply market scanning is not prioritised*
Adapt contracts according to size and type of supplier	Reduces time spent on adapting standardised contracts Includes more suppliers in supply market scanning activities	*Contracts are a one-size-fits-all template document that is supposed to apply to all suppliers* *Contracts can scare newly started suppliers* *Small suppliers don't always have the capacity to review the contracts*
Use functional specifications	Accommodate innovation at the supplier Reduce the need for detailed technical knowledge	*Limited experience about new technology* *Don't know what specifications are necessary when sourcing* *Sending non-specified RFI's is a time-consuming activity* *Tendency to over specify the RFI*
Allow other measurements when evaluating suppliers and projects	More suppliers can be included in the scope The risk of missing innovative suppliers and start-ups decreases	*Early phase technology projects are difficult to measure in terms of risk and money*
Allow more uncertainty	Innovative suppliers that were not before considered, due to not fulfilling certain requirements, can now be included	*Difficult to convince internal stakeholders to start early phase projects* *High technical and commercial uncertainty*

6.1 Contribution

The literature on supply market scanning for innovative technology is not as extensive as the literature on general supply market scanning. Therefore, this study can be said to have added a deeper understanding of what challenges are faced when scanning the supply market for innovative technology. This research has also highlighted two themes of challenges that were not brought up at all in the literature, namely *legal aspects* and *mindset.*

Furthermore, this research contributed both to the literature as well as to the automotive industry by creating a comparative framework (Table 24) which highlights seven themes of challenges when conducting supply market scanning. Also, suggested measures in relation to each theme were brought up in the conclusion. These are suggested to help the automotive industry to better address the challenges they face when conducting supply market scanning.

6.2 Limitations and Future Research

Throughout this research it is seen that the mature technology group, as it is identified in this research, contains a vast amount of different technologies. However, in this research was the mature technology group treated as one homogenous group. This has in many aspects been an effective division since the challenges of supply market scanning is perceived quite similar in the mature technology group and therefore saturation has quite easily been accomplished. However, it is at the same time a limiting factor to treat the group as homogenous since the interviewees in this group work with technology that have different market characteristics, different suppliers and sometimes even different challenges. Therefore, different or more detailed divisions within the group of mature technology, might have altered the results of this study. However, dividing the study into more detailed sub-groups could not have been done due to time constraints. In future research it could therefore be of interest to make another division and investigate if that research will yield similar results. Divisions that would be of interest to investigate would be to further divide the mature group according to complexity of sources components or the strategic importance of them, as these characteristics could have an impact on supply market scanning.

For the innovative group, snowballing resulted in interviewees with different roles that was working with different technologies. Therefore, the interviewees experienced different challenges with supply market scanning depending on what technology they were working with and what role they had. The most distinct difference was seen between the group working at innovative purchasing and the two other groups working at electromobility- and electrical purchasing. Because of these vast differences, saturation was not fully accomplished for all challenges. However, conclusions could still be made for those themes and challenges that had greater saturation. In this aspect time was another limiting factor, a longer period of time may have allowed the researchers to extend data collection. Future research could therefore benefit from making another selection of interviewees or dividing the innovative technology group in two interview groups.

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Appendix

Interview Guide

General information

- What product/commodity do you buy?
- What are your experience within purchasing?
- What are the characteristics of the supply market for your product?

Information Gathering

- How does the process of gathering information about the supply market and suppliers look?
- Is searching for new suppliers inside your current supplier base done more often compared to searching for completely new suppliers?
- How often do you scan the supply market for information?
- What kind of information sources do you use to gather information about supply market and to find suppliers?
- How do you use internal IT systems or databases to search for information internally in Volvo?
- What knowledge do you think is needed to find relevant information about suppliers?
- How would you say training help you in conducting supply market scanning?
- How does experience help you in conducting supply market scanning?
- How does collaboration with other departments in Volvo look like in regards to scanning the supply market?
- What are the challenges when gathering information about suppliers?

Information processing

- How is gathered information about suppliers stored?
- How do you process and analyse gathered information?
- What is the routine of spreading gathered information with your colleagues or within Volvo?
- How do you access and use information gathered by others within Volvo?
- What are the challenges of processing, storing and retrieving gathered information about suppliers?