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Purchaser's role in the early supplier involvement: a case study of an automotive tier 1 company

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Abstract

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Companies involve suppliers early in the new product development to gain competitive edge by shortening the industrialization time, creating better quality products and more innovative design. However, early supplier involvement is not without risks. When supplier is involved early, the costs can also increase and the development time be longer. In addition buying company will be more dependent on the supplier.

The purpose of this study is to identify the purchaser's role in the early supplier involvement process and to find out how purchasers can benefit the process and prevent the associated risks.

The thesis is commissioned by an automotive tier 1 company, which requested to remain anonymous for this thesis report. This company is also the case study company. The early supplier involvement has been studied widely over the past years, but the studies from purchasing point of view are still lacking.

Research methods for this thesis are a literature review and a case study. For the literature review five articles addressing purchaser's roles in product development are studied and analyzed. The case study company is an international automotive tier 1 –company, which supplies sub-systems for car manufacturers. The study is conducted in one of business unit's project purchasing department. The data for the case study is collected through interviews, observation and internal documents. The results of the case study are analyzed in a SWOT-matrix.

The results of the literature review and the case study support each other. Purchasing has a major role when the suppliers are involved early in the new product management. Purchasers have to initiate, coordinate and manage the process. In addition purchasers have a potential role in supporting innovation.

Keywords: Early supplier involvement, purchasing, sourcing, automotive industry

Laurea-ammattikorkeakoulu **Tiivistelmä**
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Ostajan rooli toimittajan osallistuessa tuotekehitykseen aikaisessa vaiheessa: case autoalan toimittaja

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Yritykset ottavat toimittajan mukaan tuotekehityksen alkuvaiheissa tarkoituksenaan lisätä omaa kilpailuetuaan saamalla tuotteen nopeammin markkinoille, parantamalla tuotteen laatua ja innovatiivista designia. Toimittajan osallistumiseen tuotekehitykseen liittyy kuitenkin riskejä ja hallinnollisia haasteita.

Tämän opinnäytetyön tarkoituksena on tunnistaa ostajan rooli, kun toimittaja osallistuu tuotekehitykseen aikaisessa vaiheessa. Lisäksi tarkoituksena on ymmärtää miten ostaja voi hyödyttää prosessia ja torjua siihen liittyviä riskejä.

Toimeksiantajana tähän opinnäytetyöhön oli autoalan tason 1 toimittaja, joka on myös yritys tapaustutkimuksen kohteena. Toimittajan osallistumista tuotekehitykseen on tutkittu laajasti viime vuosina, mutta laajempi tutkimus ostajan näkökulmasta puuttuu.

Opinnäytetyön tutkimusmenetelminä käytettiin kirjallisuuskatsausta ja tapaustutkimusta. Kirjallisuuskatsaukseen valittiin viisi tutkimusta, joissa käsiteltiin ostajan roolia toimittajan osallistuessa tuotekehitykseen. Tapaustutkimuksen kohteena oli autoteollisuuden tavarantoimittaja, joka valmistaa järjestelmiä autovalmistajille. Tutkimus suoritettiin yhdessä liiketoiminnan yksikössä, projektihankintaosastolla. Tiedonkeruumenetelminä käytettiin henkilöstön haastatteluja, havainnointia ja sisäisiä dokumentteja. Tapaustutkimuksen tuloksia analysoitiin SWOT-kaaviossa.

Kirjallisuuskatsauksen ja tapaustutkimuksen tulokset tukevat toisiaan. Ostajalla on merkittävä rooli toimittajan osallistuessa tuotekehitykseen aikaisessa vaiheessa. Ostajan tulee tehdä aloite toimittajan sisällyttämisesta tuotekehitykseen ja koordinoida sekä hallinnoida prosessia. Ostajalla on myös potentiaalia tukea innovaatioiden syntymistä.

Asiasanat: hankinta, osto, autoteollisuus, tuotekehitys

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Introduction

Companies have to develop innovative products to keep their competitive edge. As the product life cycles are shortening, companies are under a pressure to bring new products to the markets in a faster pace. Manufacturing companies are increasingly handing responsibilities to their suppliers with regard to their design and the engineering of components.

The purpose of this study is to identify purchaser's roles and to understand how purchasers can benefit the early supplier involvement process and prevent the risks included in this process.

The thesis was commissioned by an automotive tier 1 company, which requested to remain anonymous for this thesis report. This company is also the case study company.

This study is divided into two parts. The first part is a literature review, where the existing literature on the purchaser's role in the early supplier involvement is discussed and analyzed. Second part is a case study of an automotive tier 1 company, which is implementing a new early supplier involvement process.

1.1 Scope of the study

This study focuses on the purchaser's role and to the actions how purchaser can benefit the process and minimize the risks. As the case study company is from automotive industry, the results are mainly focused to this industry.

Early supplier involvement in the automotive industry between the original equipment manufacturers and their suppliers has been researched in detail in the past decades. This thesis concentrates on the relation between the tier 1 and the tier 2 suppliers, which seems to be less studied area.

1.2 Research questions

The early supplier involvement in the development of new products has been studied widely and the research on the topic has expanded greatly during last 30 years (Luzzini et al, 2015). The importance of the early supplier involvement has been acknowledged, but still there is a lack of studies from the purchasing point of view (Luzzini et al, 2015; Rosell et al, 2011; Schiele 2010). The goal of this study is to identify the purchaser's role in the early supplier involvement process. Further to discuss how a purchaser can benefit the new product devel-

opment and how the purchaser can minimize the various risks involved in the early supplier involvement. Research questions for this theses are following:

1) What is the purchaser's role in early supplier involvement?
2) How can the purchaser benefit the early supplier involvement process?
3) How can the purchaser minimize the risks involved in the early supplier involvement?

1.3 Framework of the thesis

This thesis consists of six chapters and the study itself is divided into two parts. The first chapter introduces the topic and defines the research questions. The second chapter covers the theoretical background starting by explaining the automotive industry, introducing purchasing in general and discussing the development of new products. The final topic in this chapter defines the term "early supplier involvement" and explains its risks and benefits. The third chapter is about the research methods and presents the used methodology: literature review and a case study. The fourth chapter is the first part of the study, the literature review about purchaser's role in the early supplier involvement. The fifth chapter introduces the empirical part of the study, a case study of an automotive tier 1 company. The sixth chapter summarizes the findings and offers recommendations to the case study company according to the results and suggestions for further research.

2 Theoretical background of the study

In this chapter the relevant theory needed to understand the study topic is presented. The chapter starts with the information about automotive industry and its typical tiered supplier network. The second topic is purchasing and its operational and strategical roles. Third theme is the new product development and the related typical processes. The final topic for this chapter is the early supplier involvement and the associated risks and benefits. Also the history of the early supplier involvement in the automotive industry is presented.

2.1 Automotive industry

The automotive industry, as any high technology global industry, has a complex supply chain network. The supply chain network is structured in tiers in automotive industry (Figure 1.). The original equipment manufacturers (OEM) are on top of this hierarchy. The OEMs are the car manufacturers, companies like Volkswagen or Toyota. Tier 1 suppliers are usually assemblers of subsystems, for example motors or interior parts. Tier 1 suppliers manage all the relationships with the tier 2 suppliers, who then manage their relationships with tier 3 suppliers. Tier 2 and tier 3 suppliers are usually small or medium-sized companies, but their im-

portance should not be underestimated. These smaller companies often carry the patents for their components and often have customized machinery (Iyer et al, 2009: 90-91; Gehr & Hellingrath, 2007: 5).

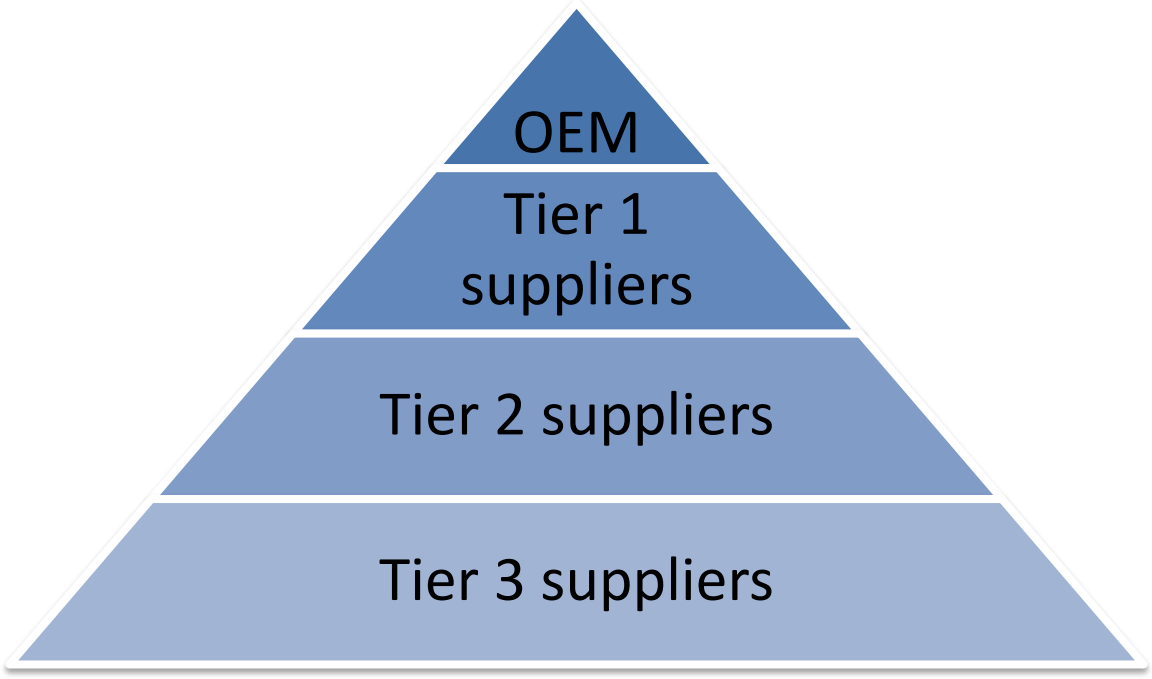

Figure 1. Structure of the automotive supply chain network

2.2 Purchasing

In the past three decades, the role of purchasing has transformed. Purchasing used to have more of an operational role. However, purchasing has become more and more a strategic activity. The main reason for this is the fact that nowadays sourcing volumes are often over 50% of a company's expenditure. Therefore purchasing has major contribution to the competitive advantages of a company (Mena et al, 2014: 9).

The main objectives of purchasing department are to procure raw material, components and other goods and services at a minimum possible price, maintain the continuous flow of goods, develop alternative sources of supply and maintain the good relationships with the suppliers. Depending on the company purchasing can also have additional functions. These can be expediting, inventory control, research, forecasting and value analysis (Monzcka et al, 2014: 175-176).

Purchasing is discussed to have three roles: a rationalization role, a structure role and a development role (Figure 2). The rationalization role focuses on minimizing total costs of production. Structure role concerns managing the supplier network and finally the development

role refers to the alignment of the technological development with the development of suppliers and supplier network (Wynstra et al, 2003).

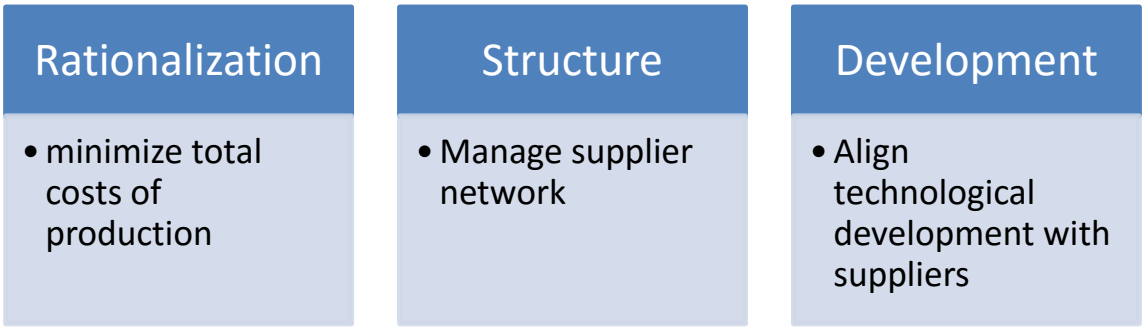

Figure 2. Roles of a purchaser according to Wynstra et al (2003)

Purchasing can be either centralized or decentralized in companies. Both practices have their own advantages. In a big corporation there can be multiple business units and locations. Every business unit or location can have their own purchasing department; this kind of practice is called decentralized purchasing. If the purchasing departments are combined and they operate only from one location serving all business units and locations, it is called centralized purchasing. The centralized purchasing brings the benefit of cumulated purchase volumes from various business units. Larger volumes bring leverage against suppliers and the purchasing department can negotiate lower prices or better terms for goods. Centralized purchasing also reduces the duplicate work of multiple business units doing similar purchasing processes. Other benefits are the better coordination of purchasing strategies and improved management of company-wide purchasing systems. By centralizing purchasing company will lose some of its flexibility and the local knowledge. Decentralized purchasing is used mainly because of the ability to respond quickly to the users' and customers' needs. Decentralized purchasing departments also gain greater understanding and knowledge of the local operative environment. Companies can benefit from both structures, by implementing a centrally steered purchasing group, which gets support of the decentralized operating units (Monzcka et al, 2014: 165-166).

2.2.1 Make or Buy

Components needed for manufacturing the main product are either made by manufacturer itself or purchased from an external source. In this situation a make or buy decision becomes necessary and purchasers have an important role in analyzing whether the component should be made or bought. It is usually the purchaser who has to identify whether there are qualified suppliers for outsourcing a project or not (Monzcka et al, 2014: 176).

The process for a make-or-buy analysis is complicated, because there are many factors considered in the decision. These decisions are also strategic as they define the business model of the company. Purchasing department should have the in-depth supplier knowledge to make the rational fact-based decision whether to outsource. This knowledge includes the information about supplier capabilities to manufacture and deliver goods, technology leadership, capacity, financial condition and overall risk analysis (Monzcka et al, 2014: 231).

The new product development is relying more and more on external sources. In 2000 85% of technology-intensive companies were relying on external sources of research and development, while in 1992 this number was only 20% (Roberts, 2001). This means that not just the manufacturing is being outsourced, but also the development.

2.3 New product development

Companies must bring new products to markets in order to survive in a competitive environment. According to the "Product Life Cycle "–model, the life time of a product is divided in multiple stages. A successful product's market share will slowly grow and in the end the product will generate steady profits. At some point however the sales start declining. There are different reasons for this, for instance the markets are saturated or new technology has been introduced. In the end product is not generating any more profit and has to be withdrawn from market. The life of a product varies between industries, but in general the life cycles are shortening nowadays (Chunawalla, 2009: 61-62).

This marketing focused model starts from the point when the product is introduced to the market. However, the product's life cycle starts already earlier, when the idea of the product is created and then continues with the development of the product.

The next two sub-chapters present two approaches for the new product development. Systems engineering offers a framework for a product development and the Stage-Gate process is one interpretation of this framework.

2.3.1 Systems engineering

Systems engineering is thought to be the best practice for the development process (Weiss, 2013: 13). There are multiple definitions for systems engineering. Peter Sydenham (2003) defines systems engineering in his book:

"A set of activities which control the overall design, implementation and integration of a complex set of interacting components or systems to meet the needs of all users."

Systems engineering provides a framework for a development process. It is not a set of rules, but a guideline for product development. Systems engineering covers the planning, designing, developing, validating and controlling products (Weiss, 2013: 13).

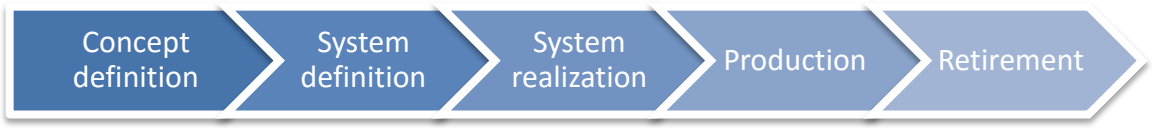

Figure 3. A generic system life cycle model by BKCASE Editorial Board (2015)

The life cycle models are one of the key concepts of systems engineering. These models consist of a series of stages regulated by predefined requirements, set by management. The goal is to confirm, that the system is mature enough to enter a new stage (BKCASE Editorial Board, 2015; Faulconbridge & Ryan, 2002: 5).

To understand the systems engineering life cycle process, a generic life cycle model is introduced (Figure 3.). This model has five stages and it starts with concept definition and ends to the retirement of the system. This model is created by the BKCASE Editorial Board (2015).

The life cycle starts from the concept definition, when organization decides to invest resources in a new or improved engineered system. This stage includes developing the concept of operations and the business case.

Next stage, the system definition, starts when the key stakeholders decide that the requirements for the project are sufficient and the resources can be committed for defining a solution options. Activities in this stage include developing system architectures and system life cycle plans and performing system analysis. During this stage prototypes are produced to assure the system's feasibility.

The system realization stage can begin, when the key stakeholders decide that the project is sufficiently low-risk to justify committing resources to develop and sustain the initial operational capability. To achieve this construction of the developmental elements, verification and validation of the elements and preparation of the production is needed.

The system production includes also the support and utilization. When the project is determined to be feasible and safe by the key stakeholders, the production starts. System produc-

tion is not just the production of the system, but it also includes quality monitoring and improvement and continuous production process improvement.

The system retirement stage is executed, when the system versions or elements become obsolete or are no longer economical to support.

2.3.2 The Stage-Gate process

The Stage-Gate is a commercial model and it was developed by Robert Cooper. He describes the model as both "a conceptual and an operational model for moving a new product from idea to launch". The Stage-Gate process is the result of a research on how successful companies managed and structured their new product development process. Various forms of the Stage-Gate process are widely used all around the world by companies (Grönlund et al, 2010).

There is a variety of other new product development models in the literature, but most of these models are linear and unidirectional, beginning with idea and ending with commercialization. In practice the development of a new product is not a simple, linear process. The process is complex and iterative (Tidd & Bessant, 2009).

The typical Stage-Gate model is divided in five stages. These are scoping, build a business case, development, testing and validation and eventually the product's launch. Before proceeding to the next stage, a project has to pass a decision point, which is called gate. The predefined targets and goals of the gates are to ensure the quality of execution, evaluate business rationale and approve the project plant and resources. At every gate there has to be a decision made whether to continue the project or not (Edgett, 2005).

The gates contain three elements: deliverables, criteria and output. Deliverables are the high level results of the activities, which are provided for the decision makers by the project leader and team. These results are measured against the clearly defined criteria. For example, criteria usually include technical feasibility and market attractiveness. Output is the decision on the continuation of the project (Edgett, 2005).

The Stage-Gate model is designed to speed up the project and improve the quality of execution of the product innovation process (Edgett, 2005). However, the model has been criticized being time-consuming, not having a provision for focus and restricting learning opportunities (Grönlund et al, 2010).

2.4 Early supplier involvement

Decisions made early on in the development process have significant effect on the product's quality, cycle time and especially on its cost. It is argued, that concept and design engineering decide as much as 80 % of the total cost of the product (Handfield et al, 1999).

Studies argue that there is a great potential in the early supplier involvement. When supplier is integrated early, buying company gets access to the supplier's technology, the quality and design of the product are better, time-to-market is shorter, costs are reduced and there is more innovative output (Handfield, 1999; Mikkola & Skjoett-Larsen, 2003; Schiele 2010). Even though early supplier involvement in new product development has many potential benefits, there are also many risks. These risks include leakage of information, increased dependency on suppliers, longer development time and increased costs (Handfield et al, 1999; Mikkola & Skjoett-Larsen, 2003).

The main problem for companies is how to realize the benefits associated with early supplier involvement. According to a study by Wynstra et al. (2001) there are three conditions, which have to be fulfilled, for a successful supplier involvement. First of all, company has to identify the processes and tasks related to supplier integration. Secondly, company has to be structured so that it supports the execution of these tasks. Finally the personnel need to have the right commercial, technical and social skills.

According to Monzcka et al. (2014) the key attributes for successful supplier involvement are supplier participation on the buying company's project team, direct cross-functional intercompany communication during the project, joint training efforts between buyer and supplier companies and sharing of technology between supplier and buyer companies.

2.4.1 Early supplier involvement in automotive industry

Early supplier involvement has been common in the automotive industry for years. In 1958 for example the Japanese car manufacturer Toyota has been involving engineers from their suppliers in its own product development (Nishiguchi, 1994). Another example is the North American company Ford. Between 1908 and 1911 Ford was working closely with their supplier H.R. Keim Mills to adapt the design of components and to use their suppliers pressed steel technology. These kinds of relationships diminished steadily in U.S. automotive industry while car manufacturers' wanted to maintain a low commitment to suppliers (Helper, 1996). In late 1980's western automotive industry was struggling while Japanese OEMs' were gaining market share. One of the reasons has been argued to be that at this time supplier involvement in new product development was more common in Japan than western markets. Studies show that by

relying on more their suppliers, Japanese OEMs were able to bring new cars to market at faster pace with more innovative features (Clark, 1989; Dyer, 1996). Another reason for Japanese manufacturers' success lies in "keiretsu" to this day. In Japan manufacturers and suppliers form a network of companies, who own each other's shares and trust and therefore companies work very closely together (Dyer, 1996; Iyer et al, 2009: 10).

3 Research approach and methods

This thesis consists of two parts, literature review and case study. These methods were chosen to get a whole picture on the topic. Literature review studies earlier findings and combines studies from around the world and from different industries. The goal of the case study is to get empirical evidence from the company who commissioned this thesis. This chapter describes the theory behind the chosen methodology.

3.1 Literature review

Literature reviews are comprehensive and systematic studies and they interpret the literature of a particular topic. The goal of a literature review is to answer research question by developing new insights, which is only possible when every piece of relevant information is seen in the context of other information. Literature review was chosen as research method as it gives an overview to the topic by studying the existing literature (Jesson et al, 2011: 9).

To find all the relevant sources for literature review, researcher has to perform a literature search. The purpose of the literature search is to get in-depth knowledge about the topic and find out what others have studied to avoid duplicate work. The literature search should always be performed systematically. To have systematic search strategy, researcher has to identify which type of literature they are looking for and develop search terms that are logical and relevant to the research questions (Booth et al, 2012: 70-72 ; Jesson et al, 2011: 26).

3.2 Case study

The research method for this study is a case study with qualitative data. Case study was chosen, because it is useful when the phenomenon under research is difficult to study outside its natural setting and when the concepts and variables under investigation are difficult to quantify (Ghauri & Gronhaug, 2010: 109). Qualitative data was chosen over quantitative data, because qualitative research is suited well for studies about social relations and when studying the reality as experienced by the respondents (Adams et al, 2014: 6).

A case study usually involves data collection through different sources like verbal reports, personal interviews and observation. In addition financial reports, archives and internal reports such as budget and operating statements can be used (Ghauri & Gronhaug, 2010: 109).

Case study is mentioned to be the preferred method, when research questions need answer to „how“ or „why“, when researcher has little control over events and the focus is on a current phenomenon in a real-life context (Yin, 2009: 8).

A case study can include one or more cases. There is no lower or upper limit to the number of cases to be included in a study. Single case design is appropriate when the case is critical and researcher wants to use the case for test an established theory. Multiple cases are more appropriate for studies not including rare, critical or revelatory case. It should be still clear what particular purpose every case serves in the study (Ghauri & Gronhaug, 2010:114).

Data for this study has been collected from personal interviews and by observation in project related meetings and from internal documents. A SWOT-analysis is used to get the understanding of the early supplier involvement in the case study company.

3.2.1 Interviews

Personal interviews are often considered to be the best data collection method. One of the main advantages is the opportunity for feedback and clarification. In personal interviews the chance for the interviewee to misunderstand questions is lower. There are also disadvantages. In personal interviews respondents are not anonymous and because of this might not answer truthfully to sensitive questions. Personal interviews also take more time than surveys. Personal interviews can be done via telephone or face-to-face (Ghauri & Gronhaug, 2010: 125, Zikmund et al, 2013: 207-208).

In research, there are two types of interviews, structured and unstructured. Structured interviews have a standard format and emphasize on fixed response categories, systematic sampling and loading procedures combined with quantitative measures. The advantage of structured interviews is the uniformity in the behavior of the interviewers, as then the situation is possible to be replicated later. On the other hand, respondents are given the full liberty to discuss opinions and reactions on a particular question in unstructured interviews. The interviewer only asks lead questions and records the answers in order later to analyze the responses. Unstructured interviews are good in context of discovery, but they do require skilled and cautious interviewer. Unstructured interviews are also often more time-consuming (Ghauri & Gronhaug, 2010: 125-126).

To get applicable data from an interview, it has to be planned accordingly. “The purpose of data collection through interviews is to obtain valid information from the most appropriate person.” The first step is to analyze the research problem and understand what kind of information is really needed. Also the interviewees have to be chosen accordingly (Ghauri & Gronhaug, 2010: 127).

For this study the questions for the interview were planned accordingly to the research questions. The goal was to get to know the opinions and experiences of the interviewees and details of their projects. The persons chosen to be interviewed were people who had first-hand experience on early supplier involvement, which in this case were purchasers.

3.2.2 SWOT-analysis

SWOT analysis, also known as SWOT-matrix (Figure 4.), is a decision tool for organizations and a method to develop their understanding of certain situation. The acronym stands for strengths, weaknesses, opportunities and threats (Speth, 2015; Turner, 2011: 74).

Figure 4. SWOT-matrix

Strengths
Strengths are internal originating positive factors, which need to be maintained.

Weaknesses
Weaknesses are internal originating negative factors, which need to be changed or stopped.

Opportunities
Opportunities are external originating positive factors, which need to prioritized or captured.

Threats
Threats are external originating negative factors, which need to be countered or minimized and managed.

The SWOT-analysis is commonly used by marketers (Speth, 2015), but it is an excellent tool also in purchasing, especially on the divisional or business unit level (Turner, 2011: 77). Turner (2011) recommends purchasing department to use SWOT-analysis when doing business with new suppliers, analyzing new purchasing processes or studying the linkage of different goods with a known supplier.

Further, the SWOT-analysis was chosen for this study, because it is meant to study certain situation in a forward-looking manner (Speth, 2015). Also SWOT-analysis supports the research questions about how purchasers can benefit the early supplier involvement process and how they can prevent the risks included, while the threats and opportunities are analyzed.

3.3 Validity and reliability of the study

Validity measures if the accuracy of the data collection method and if the data collection method collects that kind of data which the study intends to measure (Riege, 2003; Yin, 2009: 43). To increase the validity of this study following methods were used as recommended by Riege (2003) and Yin (2009): multiple sources of evidence, comparison of the evidence with existing literature and addressing the rival explanations by researching the literature and finding different explanations for the phenomenon.

The goal of reliability is to minimize the errors and biases in research. This means, that the study could be repeated using the same procedure as described by the author and the later researcher should gather the same findings and come to the same conclusions (Yin, 2009: 45).

This report includes detailed description of how the study was conducted, so the research is hypothetically possible to be replicated. However, every company and every project is unique so it is possible that the later researcher would not come to same conclusions. To increase the reliability, all interviews were recorded and observations were written down for later analysis.

4 Literature review

Early supplier involvement has been studied extensively, but the research from the purchasing point of view is still lacking (Luzzini et al, 2015; Rosell et al, 2011; Schiele 2010). However, there are some studies about the purchaser's role in early supplier involvement and these studies are analyzed in this literature review.

The goal of this literature review is to identify the purchaser's role in early supplier involvement according to the existing studies. The articles for this topic were searched from online e-article search engines Laurea Finna, EBSCOhost and ProQuest Central. The prerequisites for the articles were that they were up to 20 years old and covered both purchasing and early supplier involvement in their subject. Five articles were chosen for this literature review (Table 1).

Authors	Year	Title
Luzzini, D., Amann, M., Caniato, F., Essig, M., Ronchi, S.	2015	The Path of Innovation: purchasing and supplier involvement into new product development
Rosell, D., Lakemond, N., Dabhilkar, M., Bengtsson, L.	2011	Purchasing Capabilities for Supplier Innovation in New Product Development
Schiele, H.	2010	Early supplier integration: the dual role of purchasing in new product development
Wynstra, F., van Weele, A., Axelsson, B.	1999	Purchasing involvement in product development: a framework
Wynstra, F., Weggeman, M., van Weele, A.	2003	Exploring purchasing integration in product development

Table 1. Articles used in the literature review

4.1 Purchasing involvement in new product development

Several studies argue that including purchasing in new product development has positive effects (McGinnis & Vallopra, 1999; Nijssen et al, 2002; Tracey, 2004). Also the probability to involve suppliers early is likely to increase, if purchasing is involved early on in the new product development (Tracey, 2004). These studies show that purchasing can have a significant role in the early supplier involvement and the potential to affect positive ways to the development of new products. The following chapter studies the articles on purchasers' role (Table 1.) in detail.

4.2 The Purchaser's role in new product development and early supplier involvement

The chosen articles had two distinct focuses: general framework for the purchasing involvement in new product development (Wynstra et al, 1999; Wynstra et al, 2003) and how purchasing can benefit the innovation results when supplier is involved early (Luzzini et al, 2015; Rosell et al, 2011; Schiele 2010).

The tasks of purchaser could be divided into two groups; tasks related to projects and affecting short term (Table 2.) and tasks, which will benefit the company in long term (Table 3.). The long term tasks are not directly related to the early supplier involvement, but they are crucial to ensure that the future activities with suppliers are successful (Wynstra et al, 2003).

Tasks of a purchaser in a new product development project	Reference
Decide between make or buy	Wynstra et al, 1999 and 2003
Involve supplier early in the development of new products	Luzzini et al, 2015
Choose the right supplier for the project	Luzzini et al, 2015; Wynstra et al, 2003
Formulate policies for the involvement of suppliers	Wynstra et al, 1999
Manage development costs	Rosell et al, 2011; Wynstra et al, 2003
Manage serial costs	Rosell et al, 2011; Schiele, 2010
Coordinate development activities	Wynstra et al, 1999 and 2003
Organize and take part in meetings with the suppliers	Schiele, 2010; Wynstra et al, 2003
Support the innovation process	Luzzini et al, 2015; Rosell et al, 2011; Schiele, 2010

Table 2. Tasks of purchaser in a new product development product

The both articles by Wynstra and his research group (1999 and 2003) provided the most tasks for purchaser in early supplier involvement process (Table 2). The other three articles by Luzzini et al (2015), Rosell et al (2011) and Schiele (2010) focused more on the task of managing the costs and the role as supporter of the innovation. Schiele (2010) argues that purchasers have a dual role in new product development, including the previously mentioned cost management and supporting the innovation process.

The focus on innovation is understandable, as new innovations are important for companies. Without innovations the technology intensive companies cannot survive in competitive environment. The problem with these studies was that they did not explain how purchasers can actively contribute to the innovations. Luzzini et al (2001) describes purchasing department as “the catalyst of collaborative innovation” and they demonstrate that purchasing involvement in new product development actually lead improved innovation performance. The only task which directly supports the innovation was mentioned by Schiele (2010) and this was the organization of meetings with the suppliers. These meetings have to aim for innovation and need to be prepared accordingly to produce any results.

Even though the studies do not mention that many actions by purchasers, they do mention indirect ways to affect innovation. These indirect ways come from the strategy or the skills of purchaser. To be able support the innovation process, purchaser has to have appropriate knowledge on purchasing and technology and the strategy of company have to include innovative goals (Luzzini et al, 2015; Rosell et al, 2011; Schiele 2010).

Tasks of a purchaser in long term	Reference
Keep good relations with the suppliers	Wynstra et al, 2003
Detect the potential innovative suppliers	Luzzini et al, 2015; Wynstra et al, 1999 and 2003

Table 3. Tasks of a purchaser in long term

To ensure the successful involvement of supplier purchasers need to maintain good relations with suppliers (Table 3.). The goal is to establish a long term relationship with supplier, which will increase trust between the companies, encourage suppliers to engage more in collaboration projects and encourage suppliers share more their ideas. This kind of relationship management should not only happen during the projects, but also between the projects. Outside the project related work, purchasers should also actively follow the supplier market and detect the potential innovative suppliers. These tasks outside projects could be seen as waste of time, as they do not bring any immediate results. Literature however highlights the importance of these activities, as they create the base for supplier involvement (Luzzini et al, 2015; Wynstra et al, 2003).

4.3 Summary

The purchasers have an active role in the early supplier involvement. The tasks could be divided into two groups: short term and long term. The short term tasks are project specific and long term tasks aim to ensure the successful collaboration with suppliers in the future.

In short term the main roles of purchaser are to initiate and coordinate the early involvement of supplier, maintain the costs on reasonable level and support the innovation process. In long term purchaser manages the relationships with suppliers and follows the supplier market to find innovative suppliers.

5 Case study

This chapter starts by introducing the company and its purchasing departments and the standard purchasing process in new product development. As a new process is being implemented, the new early supplier involvement process is presented next.

The interviews and the projects of interviewees are presented and the last part of this chapter consists of the SWOT-analysis on early supplier involvement in the case study company.

This thesis was commissioned by an automotive tier 1 company, which is therefore also the company under study.

5.1 Company profile

The case study company is a tier 1 automotive supplier, meaning they assemble systems and sub-systems for original equipment manufacturers. The tiered supplier network and the relationship between supplier and original equipment manufacturers in the automotive industry are discussed in detail in chapter 1.1.

The case study company is Europe based, but operating globally in over 50 countries and has over 100 000 employees. The company operates research and development facilities as well as manufacturing plants around the world. Company is divided into divisions and these divisions further into business units. This research studies the purchasing department in one of these business units. The business unit itself operates globally as well, and purchasers are located in Europe, Asia and NAFTA region.

The purchasing department in the case study company is divided into centralized and decentralized purchasing. Parts in serial production are purchased by the centralized purchasing department and new parts for development projects are purchased by decentralized purchasing. Every business unit has their own decentralized purchasing department, while the centralized purchasing is not part of the business units (Figure 5). These departments have also other significant difference. The centralized purchasers are specialized in certain component categories while decentralized purchasers are always working on new product projects. In this thesis decentralized purchasing is called project purchasing, as it describes the function best.

This study is conducted in a project purchasing department and concentrates on the role of project purchasing. However, both purchasing departments are involved in new product development. The centralized purchasing supports project purchasing when needed, as they do have detailed knowledge of component groups and their suppliers.

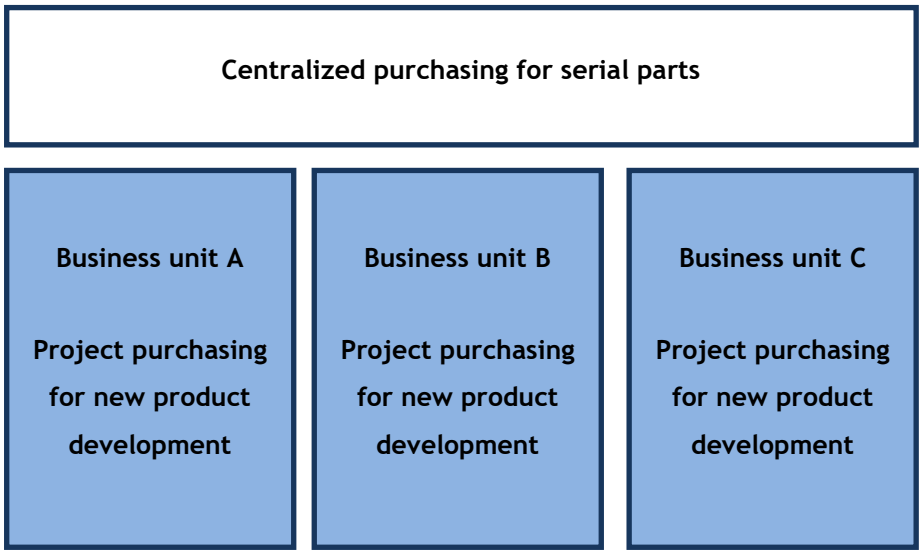

Figure 5. Structure of purchasing departments in the case study company

5.2 The purchasing process in the new product development

The case study company is using modified stage-gate process for managing the product life cycle. The Stage-Gate process is explained in detail in chapter 2.3.2. Product life cycle in the case study company is divided to 12 gates (Figure 6). For this study only the gates and phases before serial production are considered, while this study concentrates on the early supplier involvement and new product development ends when the production has been approved. The project purchasing is involved in the first eight gates, ninth being the gate when production is approved.

The new product development starts with new idea or innovation (Figure 6.). The first two gates happen already before the case study company has received an order from the customer. The third gate is a mark for a won project. The responsibility of project purchasing ends, when the production starts at the gate nine.

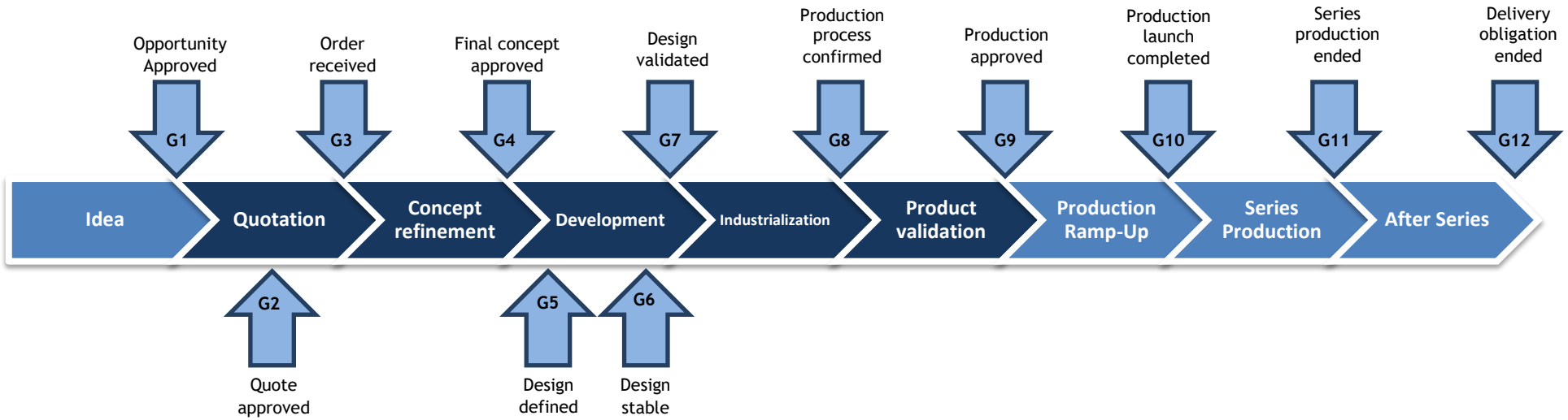

Figure 6. Production life cycle in the case study company according to the internal documents by the case study company. Project purchasing is involved in phases marked as dark blue.

In this thesis the following process is referred as “standard process”, as this process is being in use and the norm of how to do the sourcing. Project purchasing’s responsibility is to identify potential suppliers and involve suppliers early, before the second gate. Involving suppliers early is defined in this case as sending the first request for quotation to have a price indication and initiate first technical meetings with suppliers. However, this is the only mention about early supplier involvement in the process description and it is not mandatory. Normally project purchasing is involved around gate four, when the concept is approved. Project purchasing receives information of the suppliers from the centralized purchasing and using this information project purchasing chooses the potential suppliers. Project purchasing is also responsible for cost calculation for bill of materials. A bill of materials features an overview of the components used for a system and is an important tool for purchasing and management to get a general idea of the costs.

According to the current process description, the nomination of serial suppliers happens between gates five and six as after the gate six the design of the product has to be stable. If the supplier is involved at this point, there is not much time for collaborative development.

Samples, or also known as prototypes, are an important part of the development process. The case study company has to build samples of their products for their customer, so also the suppliers of components have to provide samples of their products to the case study company. There are four different samples, A-, B-, C- and D-samples. A-sample is the first one, and it is just a demonstrator. The A-samples do not have any main functionality; it just looks like the component or it only has the main function and looks nothing like it will look in serial production. The B-samples are for the design validation, but it still has restricted functionality. The C-samples are for the product validation and the design for the component is frozen. Finally, the D-sample, also known as PPAP-sample (Production Part Approval Process) is done by the serial process and serial tooling. D-sample is as the serial part will be and a proof that the tool works as they are supposed to.

In the standard sourcing process, the first samples, A-samples and sometimes B-samples, are purchased from “sample manufacturers”. These companies are usually smaller and will only provide samples of the components, according to the design and specifications of the buying company. When project is proceeding and the design of component has been accepted by the case study company, purchasing has to find a serial supplier, who will then manufacture the part for serial production. In this kind of business model the development is done in house and the tooling costs are paid by the case study company. For all samples also tooling costs have to be paid, because tools to manufacture the samples have to be built.

5.3 Current and future early supplier involvement processes

As the early supplier involvement is mentioned very briefly in the process descriptions, it has not really been common practice and there have not been clear instructions. In general early supplier involvement has been considered being co-operation with the potential serial supplier before the B-sample.

In 2016 the case study company is going to introduce a new official process for early supplier involvement. There was a need for a new, sophisticated process as the product life cycles are getting shorter and the case study company needs to adapt this change. The new process has been in development for two years and as pilot projects have been successful, the process is soon available for the business units. This new process includes guidelines for the early supplier involvement and also features new ways to manage the co-operation with the suppliers. These new models are called collaborative supplier involvement -models. These models have been developed internally in the case study company, using scientific research as the basis. The details of these models are confidential, but in the next paragraph they are presented on a general level.

Collaborative supplier involvement models have different kind of approaches, but they all emphasize the usage of multiple suppliers. Having multiple suppliers bidding for a component during early phases can significantly drop the price and encourage better and more innovative design. In other models, suppliers can also work together. In this situation they would be suppliers from different technical fields and would develop a system together with the case study company instead of competing with each other. Multiple suppliers mean more overhead management of the process and consequently more resources. The new models will take more time, but also more money, when multiple samples are produced. Even though the new models will take more resources in the beginning, the goal is to get cost and time reductions before and during the serial phase.

The project purchasing has the most responsibility in the new process. Project purchasing has also described to have a coordinating role. The decision about early supplier involvement is done by project purchasing, research and development, quality management and project management together, however, project purchasing has to initiate and document the early supplier involvement application. The decision about which model is used is done by project purchasing and project management. Supplier selection is done by project purchasing, research & development and quality management. At this point the responsibility shifts from project purchasing to research and development, which will conduct technical meetings with supplier. This does not mean that the work of project purchaser would end. They will continue supporting the project team until the gate nine.

5.4 Interviews

Unstructured personal interviews were chosen as the research method as they offer the chance to ask more in-depth questions and clarification (Zikmund et al, 2013: 207).

Six employees from the purchasing department were interviewed. Five of the interviewees belong to the business unit, which was being studied. Four of these people are purchasers in projects with early supplier involvement and were interviewed about their projects. The head of strategic purchasing was interviewed about early supplier involvement practices in the business unit. The sixth person who has been interviewed was Head of negotiation and concept also from a purchasing department, but from a different business unit.

Interviews were conducted between 18.1. – 5.2.2016 (Table 4). Interviews were conducted in person, when possible. Only the interview with the Head of Negotiation and concept was done via phone. The interviewees received the questions beforehand (Appendix 1). The interviews were unstructured interviews and questions were used just as a base for the interview.

Interview date	Interviewee
18.01.2016	Project purchaser
22.01.2016	Project purchaser
27.01.2016	Project purchaser
28.01.2016	Head of project purchasing
05.02.2016	Head of negotiation and concept
05.02.2016	Project purchaser

Table 4. Interview dates and the interviewees.

5.5 Projects

For this thesis four projects in different phases were chosen and studied more closely (Table 5). These projects were chosen, as the supplier was involved earlier than in the standard process. In this case the definition for early supplier involvement was before the B-samples were ordered. The data was collected by interviewing the responsible project purchasers and in case of project 1, attending in the meetings with the suppliers.

It should be noted, that these projects are for complete systems and the mentioned component in Table 5 is only one part of the system. Systems are built up from multiple parts and even though most of the parts are existing parts, there are most likely more new sourcings in these projects than just the ones used in the case study. In this thesis these components are under closer study, because the early supplier involvement was needed for these parts.

	Project 1	Project 2	Project 3	Project 4
Component	Connector	Lead frame	Lead frame	Cable assembly
Reason for early supplier involvement	Case study company was missing the needed knowledge and experience to develop this kind of part.	Case study company was missing the needed technology to manufacture this part.	Case study company was missing the needed technology and no suppliers available with existing technology.	Case study company did not have experience with this kind of part and long development time was acknowledged beforehand.
Tasks of the purchaser	Handle contracts regarding the supplier involvement, manage pricing, coordination between project team and supplier, lead the conversation in meetings	Coordination between the project team and the supplier, manage pricing	Search for potential suppliers, manage pricing, lead the conversations in the meetings	Handle contracts regarding supplier involvement, manage pricing, coordination between the project team and the supplier
Status February 2016	Discussions with potential suppliers	Supplier nominated	Supplier nominated soon	Supplier nominated

Table 5. Project descriptions

Two of the sourcings (project 2 and 4) were already finished and the supplier was nominated for the serial production. The sourcing for project 3 is still going on, but it looks very likely that the supplier will be nominated. The sourcing for project 1 has just started and the first technical meeting with one of the potential suppliers has been held.

Reasons for early supplier involvement varied, but they all had common theme: the case study company was missing critical technology or knowledge. This is of course understandable. The case study company is an assembler of systems and is focusing on its core competencies. It would be impossible to be expert on every field and with every technology. The suppliers instead are focused on certain components and have experience and knowledge from long time period. In addition they have specialized machines for the production.

5.5.1 Purchasers' role in early supplier involvement projects

In the interviews purchasers were asked about their tasks in the project with early supplier involvement. These tasks are listed in the Table 5. The answers were similar by all purchasers. According to these answers the main tasks for a purchaser are taking care of the pricing and coordinating the project team and the supplier.

The tasks listed by the purchasers from the case study company match mostly to the tasks listed in the literature review (Table 2.). None of the purchasers mentioned supporting innovation as a task, even though taking part and organizing the meetings with suppliers and lead-

ing the conversation most likely involve this. Purchasers also seem to see their role narrower than it actually is, as for example not everyone mentioned handling the contracts or searching for the potential suppliers. The explanation might be in the fact that every project is different and in the organizational structure. For example project purchasers do not need to usually search for potential suppliers, as they will get the information of potential suppliers from the centralized purchasing.

5.6 SWOT – analysis

The SWOT-analysis is studying the early supplier involvement in the case study company. The data for the SWOT-analysis was collected from the interviews with the employees and observation in the meetings with the suppliers. Also literature on early supplier involvement was used.

In this analysis the results of co-operating with the supplier are seen as external factor, even though the case study company is the other side of the co-operation. The main contributions come from the supplier and this is the reason why it is an external factor.

Strengths:	**Weaknesses:**
Organizational structure Motivated personnel New process	Lack of experience in the early supplier involvement Lack of contracts for the early supplier involvement Implementation of the new process
Opportunities:	**Threats:**
Access to supplier's knowledge Access to supplier's technology Better quality of product Shorter industrialization time Innovation Reduced costs	Being dependent on the supplier Supplier has more leverage in pricing Supplier declining to collaborate Increased costs

Table 6. SWOT-matrix about early supplier involvement in the case study company.

Strengths

The purchasing department structure is similar, as to what Schiele (2010) recommends in his study. According to Schiele, companies should divide their purchasing in two departments: purchasing department which will take part only in new product development and purchasing department which will take over after the product goes into serial production. This organiza-

tional structure is used by the best-practice firms and has been proven successful. Having already this kind of organizational structure is a strength for the case study company.

The interviews pointed out, that all purchasers were aware of the potential benefits of early supplier involvement and ready to work to achieve these benefits. The positive attitude of purchasers is going to be important especially when the new process is going to be implemented.

The new early supplier involvement process, introduced in chapter 5.3, has been in development for two years. This means it is not a rushed decision. The new process is very detailed and should give excellent guidelines for purchasers how to involve suppliers early. In addition the models for collaborative supplier involvement bring in new ways to work with multiple suppliers and get more competitive pricing. The new models have been proved to be successful in pilot projects and this is a good indication for future success as well. The models have their basis in the scientific research and the models were modified to suit the case study company's needs. The development was done internally consulting different departments in different business units, so the case study company's competencies were considered during the development.

Weaknesses

According to the interviews, most of the purchasers had not had any previous experience with early supplier involvement, except for the project they were interviewed for. This lack of experience with early supplier involvement is something management should take into account when implementing the new process and offer training for the employees. Training is important, because as literature points out, the early supplier involvement brings managerial challenges, which are often underestimated (Wynstra et al, 2001).

In addition, the new process is being implemented with collaborative supplier involvement models, which bring completely new ways of thinking and acting with supplier involvement. The implementation phase is the weakest and riskiest phase of the new process. People do not like change in general and the new process will change the daily work of purchasers (Anderson & Anderson, 2010: 30). The new process will also increase the workload in the early phase of the project and it is more complicated than the standard process. Resistance to change might not only come from the purchasing department, but as well from other departments.

The lack of contracts for early supplier involvement between the case study company and supplier was also a topic commonly mentioned in the interviews. These kinds of contracts are in development, but it will take time as the legal department is also involved. For the current

projects contracts will be signed after the involvement of supplier, which is not ideal situation. The contracts should be signed before the supplier is involved in projects. Contracts are important tool to minimize the impact of risks in early supplier involvement and the case study company should speed up the process of creating these kinds of contracts.

Opportunities

There are many opportunities in early supplier involvement. One of the main opportunities is the access to the supplier's knowledge and technology. As the tier 2 suppliers are focused on certain components, they have in-depth knowledge and expertise of these components. To get the access to this knowledge, suppliers need to be involved earlier and take part in the design and development process. Normally the case study company designs the part they need and sends the drawing to supplier. Supplier can of course give feedback of the drawing, but in general they cannot change the design and there is no room for innovation.

Having the access to supplier's knowledge can lead to many benefits. Overall the product quality will be better, because the supplier can provide their expertise in the development. Also the total costs could be reduced, while supplier knows what kind of work and parts asre really needed for that kind of components.

According to the literature, involving supplier early can reduce the development time (Handfield, 1999; Mikkola & Skjoett-Larsen, 2003). This is something that some of the interviewees agreed. Also the shorter industrialization time was mentioned many times. Shorter industrialization time means, that the product will be faster on the market. Involving suppliers early can lead into shorter development time, but not necessary. Early supplier involvement can shorten the industrialization time by better planning and the possibility to order tooling for components earlier. Toolings have normally very long lead times, and if the toolings can be ordered already in development phase, the industrialization time will be shorter. The shorter industrialization time will give a competitive edge to the case study company. This has already been proven to be true in one of the previous projects not included in this study. According to the interviewee, the supplier was involved earlier than normally and the product was in the markets faster than normally in similar projects. At that time this product had no competitors, but now there are multiple. The case study company needs this kind of results to be repetitive.

Literature mentions innovation as one of the main benefits of early supplier involvement (Rosell et al 2011; Schiele, 2010; Un et al 2010), but innovation was not mentioned as a benefit by the purchasers. Reason for this might be that innovation is not as concrete outcome as for example the shorter industrialization time. Even if innovation is harder to measure, it should not be overlooked. Innovation is thought to be a product of network, rather than just of a

single person or company (Luzzini et al, 2015). Involving supplier early and working with them closely during the development phase offers great opportunity for innovation. Especially the new collaborative supplier involvement models emphasize on creative thinking and innovative problem solving.

Threats

Involving supplier early in product development can also lead up to a situation, where the case study company is tied to supplier, but for reason or other would not want to work together anymore. Reasons could be bad quality from supplier or supplier does not meet agreed deadlines. There is always, also in normal sourcing, a risk, that supplier will deliver products worse quality than was originally accepted. If the supplier was involved early, this means that even more resources were wasted. This also means increased costs, as the part might need to be sourced again.

When supplier is involved early, it can soon become an unique supplier for the component. Being unique supplier will remove competition and supplier will gain more leverage in pricing against the case study company. Purchasers mentioned open book pricing and contracts as a tool to prevent this kind of situation.

Finding a supplier for early involvement is not self-obvious. Even if the case study company is willing to involve a certain supplier into their new product development, the supplier might say no. There are multiple possible reasons for this from the supplier side; lack of trust, lack of experience, unsuitable organizational structure or the supplier simply has no time for early supplier involvement. Supplier declining the co-operation is not necessary a threat, but it certainly is a limitation and could harm the development process.

6 Conclusions

The results of the case study are very similar to the findings from the literature review. Purchasers have multiple roles in the early supplier involvement process. The main difference between the case study and the literature review findings were the purchasers' contribution to innovation. Innovation was heavily emphasized in the articles included in the literature review, but did not come up in the case study.

1) What are the purchaser's roles in early supplier involvement?

   Purchasers have a major role in the early supplier involvement. Studies prove that suppliers are involved early more likely, if the purchasing is involved in the new product development (Schiele, 2010).

According to both the literature review and the case study, purchasers *initiate* the involvement of suppliers, *coordinate* the process and *manage the costs*. In addition according to the literature review, purchasers *support the innovation process* and *manage the relationships* with the suppliers.

2) How can a purchaser benefit the early supplier involvement process?

According to the literature the purchasers' capabilities to benefit the early supplier involvement rely heavily on the organizational structure and purchasers' skills (Wynstra et al, 2001; Schiele, 2010). Purchasers cannot directly to affect these attributes. It is the management's task to find the optimal organizational structure for purchasing and to hire people with right skills and train their employees.

According to the case study purchasers tasks in benefiting the process and preventing the risks are similar. Purchaser has to take a proactive role to benefit the early supplier involvement process. Even though in the studied case company decisions were made by the cross functional team, the purchaser was responsible for most of the early supplier involvement process. This means purchaser has to have enough knowledge of early supplier involvement to make it successful. Choosing the right supplier for the development is always important, but the importance is emphasized in early supplier involvement. Interviews pointed out that purchasers' found the most important to deal with known reliable suppliers, who already have existing contracts with the case study company.

3) How can a purchaser minimize the risks involved in early supplier involvement?

Interestingly, none of the articles chosen for the literature review (Table 1.) studied how purchasers could prevent the risks associated with early supplier involvement. After all the articles were chosen to identify the role of purchaser, but none of these roles were mentioned to relate to the risk management.

Multiple threats associated with early supplier involvement were introduced in the SWOT-analysis (Table 9). By choosing known reliable suppliers and by building trustworthy relationships with the suppliers purchasers can minimize many of these risks. Open-book calculations and contracts are also a tool to minimize the commercial risks and purchasers should have enough knowledge of these methods to use them correctly.

6.1 Recommendations

The purchasers of the case study company already acknowledge the importance of their role in the early supplier involvement; though seem to see their role narrower than it actually is. To implement the new process successfully and gain as much benefit as possible, the management has to take care of proper training of purchasers. As the new process is complex, the training should last at least a day and could be executed as a workshop. Management has to take into account, that the new process will take more resources in the beginning of a project and ensure that purchasers have these resources.

In the case study company the decisions regarding the early supplier management are done together with the whole project team, but purchasers are the ones who initiate the process. The new process describes purchasers to have a supporter role, but this is only the half-truth. Purchasers should not just support, but initiate, manage and coordinate the early supplier involvement process.

There will most likely to be resistance against the new process. In general, people do not like change. But change is something that happens naturally all the time. Companies have to keep changing to keep themselves as competitive. The case study company has to anticipate and understand the resistance and work their way around it. Everyone who is concerned by the new process, have to understand the reasons behind it and why the change is necessary (Anderson & Anderson 2010: 30).

To follow up the implementation of the new process, the case study company should organize workshop after one year of implementation to discuss about the projects and lessons learned.

As already mentioned, the innovation potential associated with early supplier involvement was not acknowledged by the purchasers from the case study company. The case study company should find a way to pursue the innovation also through early supplier involvement, while studies by Luzzini et al (2015) and Rosell et al (2011) argue that especially the purchasers can have a positive impact on innovation.

Even though the organizational structure is similar at the case study company as what Schiele (2010) recommends, the case study company could try supplier focused view instead of project focused view. At the moment the new product development is focused on the single projects or components. Schiele (2010) recommends broadening the view to supplier-wide. The case study company should identify the innovative suppliers and plan how to ensure the continuous collaboration with these suppliers from project to project in long term.

6.2 Suggestions for further research

Early supplier involvement is a very wide topic. Many questions came up while writing this thesis, but because of the scope of the study everything could not be included in this study. The following topics are suggestions for further research, and they could be implemented from the purchasing or even from the whole cross-functional team point of view.

As this research was conducted right before new early supplier involvement process was implemented, there would be a good chance to conduct a research after the implementation. It would be very interesting to study if the roles of purchaser's have changed after the implementation of new process and how successful the new process is. Particularly the effectiveness of the different collaboration models would be very advantageous information for the case study company.

Supplier selection for the early supplier involvement has been discussed in the literature (literature review by Ho et al, 2010). But as every company is different and has different strategic goals, the case study company should also study their own factors for choosing the supplier for the early supplier involvement.

Studies regarding early supplier involvement include usually only one level of buying companies and suppliers. In some industries, especially in automotive industry, the supplier network is tiered. As early supplier involvement is used widely within the different levels, a study of how the early supplier involvement between original equipment manufacturer and tier 1-supplier affects to the early supplier involvement between tier 1 and tier 2-suppliers would bring new information to the topic.

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Figures

Tables

Appendix

Appendix 1: Interview questions for purchasers

Early supplier involvement

1. What kinds of benefits you think early supplier involvement has?
2. What kind of challenges and risks you think early supplier involvement has?
3. Do you have any previous experience in early supplier involvement?

Project specific questions

1. Describe the project shortly.
2. Why was the supplier involved early in this project?
3. Why was this supplier chosen?
4. When was the supplier involved in this project?
5. Where is the supplier located?
6. Who has made the decisions regarding the early supplier involvement?
7. What have been your tasks as purchaser in project regarding the early supplier involvement?
8. Has the early supplier involvement been beneficial for the project?