Requirements for a successful buyer-supplier collaboration in new product development

- A case study at a large Swedish industrial manufacturer

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Krav för ett framgånsrikt samarbete mellan köpare och leverantörer i ny produktframtagning - En fallstudie på en stor svensk industriell tillverkare

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Abstract
The rapid rate of technological development, during the last decades, have shortened the product life cycles, and together with increasing competition, put higher pressure on companies to keep up with new product development (NPD) to keep a steady organic growth. New product development projects need to find new solutions to become more resource efficient as well as shorten time-to-market. Companies need to take advantage of knowledge and resources to keep up with the fast development of technologies. Organizations search for competitive advantage can no longer solely be found within the boundaries of their own capabilities. Instead, competitive advantage is found in relationship and collaboration between firms and external parts where suppliers could contribute with knowledge and capabilities and not only gods.

The purpose of this thesis is to investigate the process of NPD with focus on buyer-supplier collaboration, in order to better utilize resources to achieve time-to-market, cost and quality advantages. This study aims to understand “What” is needed for a buyer-supplier collaboration to succeed, depending on “Where” the supplier is involved, in order to give recommendations on “How” suppliers should be integrated.

Given the purpose of this study, a case study design was chosen as research approach. The case study was based on qualitative data from semi-structured interviews as well as observations and internal documents. The interviews were held with different stakeholders to obtain a holistic view regarding collaboration between buyers and suppliers. The empirical data consisted of 10 interviews in 4 different companies, with positions such as; R&D Managers, Purchasers, Key Account Manager, Supply Chain Manager and Project Leaders, all connected to the NPD process.

The result of the study confirms and identifies critical factors for a successful collaboration as for the requirements for point of involvement in different stages. Focusing on the right factors and excelling in these are shown to enable advantages seen to time-to-market, cost and quality.

Key-words: Buyer-supplier collaboration, supplier involvement, new product development, crucial factors
Sammanfattning

Syftet med denna studie är att undersöka processen för nyproduktsutveckling, där fokus ligger på leverantörssamverkan, för att på ett bättre sätt utnyttja tillgängliga resurser och i slutändan ge fördelar sätt till lanseringstid, kostnad och kvalité. Studiens avsikt är att få förståelse för "vad" som behövs för en framgångsrik leverantörssamverkan, beröende på "vara" leverantören involveras samt "hur" detta ska uppnås.


Studien resulterade i bekräftade vitala faktorer för framgång inom leverantörssamverkan, samt vad som krävs för involvering av en leverantör i rätt skede i processen. Med rätt fokus på faktorer och att uppfylla dessa krav har visat att det är möjligt att åstadkomma fördelar sett till lanseringstid, kostnad och kvalité.

Nyckelord: Buyer-supplier collaboration, supplier involvement, new product development, crucial factors
Foreword

This master thesis report is written at the department of Industrial Engineering and Management at the Royal Institute of Technology (KTH) in Stockholm, Sweden, and has been conducted from January 2017 until June 2017.

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1. Introduction

This chapter presents the underlying background of the studied area, followed by a problematization of our investigation with stated research questions. The contribution and delimitations of the study will also be assessed. Finally, a summary of the outline of the report will be presented.

1.1 Background

In a more globalized economy and low barriers to entry, firms need continuous development in order to become more resource efficient and to stay competitive. Technologies are developed in a fast pace and products are becoming more and more complex, which leads to new challenges. The rapid rate of technological development, during the last decades, have shortened the product life cycles, and together with increasing competition, put higher pressure on companies to keep up with new product development (NPD) in order to keep a steady organic growth (Ragatz et al., 1997). New product development projects need to find new solutions to become more resource efficient and in the same time shorten time-to-market. In other words, companies need to take advantage of knowledge and resources to keep up with the fast development of technologies (Melander, 2014). Organization’s search for competitive advantage can no longer solely be found within the boundaries of their own capabilities. Instead, competitive advantage is found in relationship and collaboration between firms and external parts.

One important external part in new product development are suppliers, both as a supplier of goods and knowledge. Parts and services that have been purchased from suppliers can amount for up to 70% of the company’s sales turnover (Van Weele, 2010). Derived from Transaction Cost Economics (TCE), it has been recommended that the relationship with suppliers should be strictly transactional, so that independence and cost benefits are ensured (Williamson, 1979). However, this view has been criticized and have been largely replaced by an emphasis on the positive outcomes that a closer supplier relationship can bring. In spite of this, organizations should remain careful when to engage suppliers and especially in closer relationship since it requires resources to establish a close relationship and they are not always appropriate for the specific situation. Previous research has shown how integration of suppliers in new product development can result in reduced cost and development time as well as improved quality and access to technology (Ragatz et. al, 1997). Practice has shown that it requires careful selection of suppliers as well as a well-established sourcing strategy to succeed in a close collaboration between buying firm and the supplier.
Though several advantages of a closer relationship are described in literature, companies struggle to benefit from the knowledge that the suppliers possess. The factor for success in a collaboration have mainly been studied on the whole new product development process. However, there is a lack of studies regarding the impact of crucial factors in NPD projects from a process perspective and how they can be prioritized to achieve benefits and minimize the risk with involving the suppliers in different stages of the process.

1.2 Problematization

The increasing popularity of electromechanical locking solutions has put pressure on innovation and investments in technology and knowledge. The product lifecycles become shorter, thus the lead times must follow (Melander, 2014). The vision at the case company is to reduce its time-to-market and at the same time use less resources whilst increasing the relationship with their suppliers. In order to manage this, the case company need to find ways to utilize resources in a more efficient way to be able to allocate more resources to innovation.

The rapid technical changes in the industry makes it hard for any company to possess knowledge and expertise in every new area. This fact increases the importance of suppliers as they possess valuable knowledge and expertise of how to manage different processes as well as finding new and innovative solutions in NPD projects. One step to fulfill the vision is to better collaborate with suppliers as much research pinpoints the benefits of such an action. What still isn’t clear is how a buyer-supplier collaboration in NPD, seen to critical factors and process, should be structured in order to make the most out of the involvement when it comes to resource efficiency.

1.3 Purpose and Research Questions

Based on the problematization, the purpose of this thesis is to investigate the process of NPD with focus on buyer-supplier collaboration, in order to better utilize resources and to achieve time-to-market, cost and quality advantages. This study aims to understand “What” is needed for a buyer-supplier collaboration to succeed, depending on “Where” the supplier is involved, in order to give recommendations on “How” suppliers should be integrated.

The following research questions were investigated in order to fulfil the purpose and aim of this research.
MRQ: How can supplier involvement in the NPD process provide time-to-market, cost and quality advantages?

The first research question identifies and confirms the critical factors seen to buyer-supplier collaboration in NPD, and which factors that needs to be addressed depending on where the suppliers are involved.

RQ1: What are the most crucial factors in order to implement a buyer-supplier collaboration in different stages of a NPD process?

The second research question is focusing on creating an understanding for what the requirements are for involving a supplier in different stages of the NPD process, in order to achieve time-to-market, cost and quality advantages for manufacturing companies.

RQ2: What are the requirements for an industrial manufacturer for involving a supplier in different stages of the NPD process?

1.4 Expected contribution

This study will contribute to the existing literature by investigating the impact of identified factors in different stages of a NPD process and how it in turn can be used to take advantage of the benefits and minimize the risk, seen to time-to-market, cost and quality. Researchers has primarily focused on only identifying challenges in the process of supplier integration in the NPD process. Other research has focused on the correlation between supplier integration and time-to-market in general, not focusing on the process of NPD in particular. Some literature suggests which factors that is important to overcome to succeed, however, it’s not specified which factors that needs the most focus and how they are connected, depending on where suppliers are involved. Therefore, this study complements the existing literature by investigating which critical factors that should have a higher priority, from a process perspective, in order to succeed in a buyer-supplier collaboration and how they ultimately can lead to time-to-market, cost and quality advantages. The study further contributes with insights and requirements from both buyer and supplier, something that previously has had a low focus. In order to enable the right circumstances for supplier involvement, it’s crucial to investigate all parties involved, both buyer and supplier, in order to maximize the outcome seen to time-to-market, cost and quality. In short, the study combines insight from buyer and supplier, process and critical factors and how they together effect time-to-market, cost and
quality.

1.5 Delimitation
Several different members of the supply chain can be involved in the NPD process, such as suppliers, R&D and customers. This study is limited to investigate the involvement of suppliers in the NPD process. Further, NPD has a wide scope including many aspects. This study is limited to where in the process suppliers can and should be involved and what factors a company need to focus on in order to succeed with the involvement of a supplier, more specifically, how the NPD process could become more efficient by involving a supplier. The aim with involving the suppliers can be different and the scope of this study is focusing on terms of time-to-market, cost and quality advantages.

1.6 Outline of the Thesis
This thesis contains six chapters and are shortly described below.

Chapter one, Introduction, presents the background of the study. Including, problematization, purpose of the research, research questions, contribution and delimitations of the study.

Chapter two, Literature Review, this chapter starts with an introduction to supply chain management and innovation. Then a framework for the NPD process is presented, followed by a framework of where in the process suppliers can be involved and its success factors. This is the core area of the study and are therefore presented in detail.

Chapter three, Method, presents how this study has been conducted and the methods used. Data collection, data analysis, reliability and validity will be discussed. Moreover, the four companies included in the case study are presented with brief explanations of their history and core values.

Chapter four, Empirical findings, presents the results related to supplier involvement in the NPD process as well as critical factors when involving suppliers from the case study.

Chapter five, Analysis and Discussion, contains the analysis of the data collected during the study. The findings from the case study are analyzed and compared to literature.
**Chapter six, Conclusion**, the research questions are answered with analysis as a basis, followed by managerial implications, discussion regarding sustainability aspects, as well as recommendations for future research.
2. Literature Review

In this chapter the literature review will be presented. The first section will introduce the concept of Supply Chain Management (SCM), New Product Development (NPD) and buyer-supplier relationship. This is followed by the main part which consist of buyer-supplier relationship in NPD and its factors for success.

2.1 Supply Chain Management

The term supply chain has during the last decades been progressed and described as the network between a buyer and its suppliers (Mentzer et al., 2001). A supply chain can further be explained as a set of entities (organizations or individuals) directly involved in the upstream and downstream flow of products, services, finances and/or information from source to customer. The chain starts with suppliers of the focal organization, also known as the assembler or Original Equipment Manufacturer (OEM), and ends with its customers. The widespread focus on the supply chain, due to the rapid rate of technological change, shortened product life cycles and globalization of markets, has led to the development of a management principle for how to manage the supply chain (Handfield et al., 1999). The management of multiple relationships in a supply chain is named supply chain management (SCM) (Cooper & Lampert, 2000). SCM has several different definitions, Mentzer et al. (2001), have through a literature review defined SCM as:

1. Managing the total flow of goods from supplier to the customer (System approach);
2. A cooperative effort to align intrafirm and interfirm operational and strategic capabilities into a unified whole (Strategic orientation); and
3. Creating unique and individualized sources of customer value, in the end leading to customer satisfaction (Customer focus).

In order to achieve an efficient supply chain and reach its full potential there is a need to align all entities, buyer and supplier, towards the same goal. According to Cooper & Lampert (2000), companies need to be aware of the paradigm of competition and that a successful integration and management of members of the supply chain will determine the success of the company. This also requires firms to improve their innovativeness and become faster with equal or less resources. The NPD process has been characterized by complexity, difficulty and unpredictability. Moreover, today’s competitive environment entails that companies needs to rely on resources beyond their
own competences to innovate competitive products. NPD teams and processes must find the means for shortening time-to-market while also improving product quality and reducing costs. In the studies of Chesbrough (2003), the phrase “Open Innovation” was coined which is the use of inflow and outflow of knowledge that can improve internal innovation, and the expansion of the use of external innovation. Chesbrough (2003), stated that if a company sought innovation outside the company’s boundaries they can improve the value of their supply chain. One interesting factor that was identified as a source of innovation, was suppliers. Involving the suppliers in the NPD process is also a source to gain competitive advantage (Ragatz et al., 1997). Benefits when involving suppliers in the NPD process in a correct way can yield reduced cost and improved quality of purchased materials, reduced NPD time and improved access to technology (Ragatz et al., 1997). However, other studies indicate that when involving suppliers in the NPD process firms become slower at introducing products to the market (Knudsen & Mortensen, 2011). Hence, with the different conclusion from these different studies indicates that it is a challenge for firms when it comes to getting the most out of involving suppliers in NPD projects.

2.2 New Product Development

The next section describes and defines the stages in the NPD process.

2.2.1 Introduction

Before going into supplier involvement in the NPD process, the NPD process need to be defined. This definition will be used in the remainder of this research:

Handfield et al. (1999) refers NPD to all efforts that is focusing on creating a new product, process or service.

2.2.2 New Product Development process

Research within NPD emphasizes the need to focus on launching new products on the market to sustain a successful business. To achieve a successful business, companies need to have a competitive and well developed NPD process (Cooper, 1993, 2001; Ragatz, 1997, 2002; Ulrich and Eppinger, 2003). Many detailed NPD models have been developed during the years, and one of the first models was developed by Booz, Allen & Hamilton, also known as the BAH model. This model represents the foundation of other models, which often can be linked back to the BAH model. A pioneer of NPD research and important influence in the academic society is Robert G. Cooper. His first model was developed in the 1980s and was mainly used in the consumer goods industry (Cooper, 1993). Cooper has since then adjusted his model and included the philosophy of
stage-gate and agile thinking (Cooper, 2008). One of the most recognized stage-gate NPD process model, was developed in 1993 and is displayed below in Figure 1 (Cooper, 1993). However, in practice, every company have their own perspective in terms of what is included in the process. Regardless, the basic structure of the process, timeline and gates is usually the same. Companies with some kind of formal NPD process, that are going through the below activities are more likely to be successful when launching new products (Cooper, 2014).

![Figure 1. The stages of NPD process (Cooper, 1993).](image)

Each stage in the model consists of a set of information-gathering stages, an integrated analysis of the results of the activities and the result of integrated analysis, then followed by Go/Kill decision gates. Each gate is characterized by a set of deliverables or inputs, including a set of exit criteria, and an output. The inputs are the deliverables that the project leader need to deliver to the gate. The criteria are the objects and the steps the project must pass to be able to move on to the next stage. The gatekeepers should be senior managers and the role generally involves: review of the quality; assessment of project from an economic and business standpoint; approval of the action plan for the next stage (Cooper, 1993).

Each stage costs more than the preceding one and is therefore designed to gather information to reduce uncertainties and risk (Cooper, 1990). The activities within stages are undertaken in parallel and by a team of people from different functional area and is cross-functional (Cooper, 2008).

In 2014, Cooper added a feature called spirals. The spirals can be seen as an agile development process, meaning that projects teams can move more rapidly to a finalize product design through doing a series of “build-test-feedback-and-revise” iterations (Cooper, 2014). Spiral development fills the gap between the need of being sharp, early, and fact-based product definition before the development begins versus the need to be flexible and be agile when it comes to being able to adjust the design based on new information and market conditions. This is done by incorporate valuable customer feedback into the design during all stages. But also to get mock-ups to the
customers earlier in the process. The model serves as a skeleton from which a customized model can be developed (Cooper, 2008).

The first step is actually done before initiating a NPD project, which is to set a new product strategy. By linking the NPD process with the missions and objectives for the company, the stage will clarify the strategic requirements for idea generation and guidelines for idea scoping. (Cooper, 1993).

**Idea generation:** In the idea generation stage, the search for product ideas that meet the decided goals and objectives are initiated. The main purpose of this stage is to generate a number of different ideas from which the company can select the most appropriate one. The idea generation includes the birth, development and deployment of a concrete idea. After identifying the segments and product categories, the company need to identify the growth opportunities (Cooper, 1993).

**Idea Scoping:** In the idea scoping stage, initial analysis of the ideas gathered during the idea generation stage is conducted. Main activity is to determine the project’s technical and marketplace merits. A preliminary market assessment is conducted. This is done to determine which ideas that should be further investigated. The analysis is based on the resources within the company and the expected competition. The aim is to narrow down the number of ideas based on which ideas that offer the greatest potential. But also to assess the feasibility of development and manufacturing, costs and time-to-market of the idea (Cooper, 1990). Making a good selection is critical to the future health and success of the business since the development costs rise extensively with each stage in the NPD process (Cooper, 2014).

**Build Business case:** During this stage the most promising product ideas are evaluated using quantitative performance criteria, based on external requirements. This is a critical stage since successful product ideas that meet the requirements will be included in the development stage (Cooper, 1993). Market research are used to determine the customer’s need and preferences to define the best product, but it also includes competitive analysis. The customers’ needs should be translated into technically and economically feasible solutions and it might involve some preliminary design and development of a prototype (Cooper, 1990). Inadequate market analysis and a bad market research is common causes contributing to failure in new product development and to the product’s financial performance (Cooper, 1980). Finally, detailed financial analysis, including discounted cash flow and sensitivity analysis, is conducted (Cooper, 1990).
**Development:** In this stage successful products from the business analysis will be turned into either prototypes or volume ramp up. During this stage, products might go through several alterations which also is the reason why the development stage is the most time consuming. The main purpose of this stage is to bring the product to the market on time, within budget and with the required specifications (Cooper, 1993). But it also includes an updated financial analysis and the resolution of legal/patent issues (Cooper, 1990).

**Testing & Validation:** The purpose of this stage is to validate the entire project. This stage is important since it might dramatically decrease any risk of failure when launching the product (Cooper, 1993). This include: the product itself, the production process, customer acceptance towards the product and the potential financial benefits of the project. Cooper (1999) argues that how well tested the project is, has a direct correlated with the new products success on the market. However, testing should not solely be done in this stage, it needs to be conducted during the whole NPD process.

**Launch:** This stage involves the full-scale market launch of the product. In this stage it is important to get ongoing customer feedback to ensure that the products meet the expectations and to be able to identify and fix any problems (Cooper 1993).

In the post launch review, the new product project is terminated, the team is disbanded and the product gets included the firm’s product line. This is a good stage to evaluate the project's outcome. Revenues, costs, expenditures, profits, and timing are compared to the projections during the projects. Product innovation will always be a high-risk undertaking, but the stage-gate process helps minimizing these risks in the NPD process (Cooper, 1990). However, some authors have criticized the stage-gate model due to its inflexibility (Sethi & Iqbal, 2008). According to Sethi & Iqbal (2008), it is often hard to incorporate new information into projects, or to make changes in plans after a project have been reviewed at a gate. Because if the parameters are fixed, which they usually are after a gate, new information cannot be incorporated in an efficient and easy way into the project, which can result in that that the product development team loses motivation to learn new technologies in the area. Furthermore, Mankin (2004) argues that the stage-gate model is suitable for products targeted at specific, well-defined markets. According to Mankin (2004), some product, usually if the product or market are undefined in the beginning, need a more iterative process and would not be able to pass gate 2 and would therefore be killed following the stage-gate process.
2.3 Buyer-supplier collaboration in the NPD process

While above section described and defined the stages in the NPD process, the following chapter will describe where a supplier can be involved in the NPD process of a buyer.

2.3.1 Introduction

The literature is using various definitions of supplier involvement in new product development. Handfield et al., (1999) define it as the information suppliers provide and their participation in decision making. On the other hand, Van Echtelt et al. (2008) argues that a supplier can provide more than just information when being involved in NPD. The definitions are similar but since Van Echtelt et al. (2008) is more extensive it will be used in the research. The definition is as follows:

The resources (capabilities, investments, information, knowledge, ideas) that a company’s supplier can provide, the tasks performed and the responsibilities they have towards the development of a part/subassembly, process or service in a NPD or an existing project.

2.3.2 Supplier involvement in the NPD process

Supplier involvement in the NPD process has been examined by looking at where in the NPD process supplier can be involved and to what extent (Kampstra & Gattorna, 2006; Spekman & Carraway, 2006).

Supplier’s involvement in the NPD process can range from small design suggestions to full responsibility of developing, designing and engineering of a specific part or sub-assembly (Wynstra & ten Pierick, 2000). But suppliers can also be helpful in later stages, when the suppliers may help commercialize the product and manage after-sales product quality. In many sectors, especially technology heavy sectors, suppliers understand the technology challenges and the manufacturability of their parts of the end product much better than the OEMs do and their knowledge is often essential for the success of the product (Bughin, Chui & Johnson, 2008).

While Cooper's model is possibly the most recognized framework for NPD projects, the possibilities of integrating a supplier was first covered in the framework developed by Handfield et al. in 1999. This model is similar to Cooper’s model but it better describes where in the NPD process suppliers can be involved. Handfield et al. (1999) argue that there are five stages where the supplier can be involved in accordance to Figure 2.
The stages in the model created by Handfield et al. (1999) are:

1. Idea generation: The search for product ideas that meet the decided goals and objectives are initiated, what is needed to make the product and how much it might cost. Voice-of-the-customer is usually used to involve customer with the aim to answer fundamental questions.

2. Business/Technical assessment: The company assesses its internal capabilities and resources to design and produce the products that have gone through the idea generation stage.

3. Concept development: The creation of the concept is defined which might involve the creation of a first prototype.

4. Engineering and design: The development of the process, which includes blueprints and design specifications of the product.

5. Pilot/Ramp-Up for Operations: In this stage the final prototype is built and tested. The production facilities and processes are prepared for full production of the new product.

Handfield et al. (1999) defines early supplier involvement (ESI) as the two first stages of the model, Idea Generation and Business/Technical Assessment. In the third stage, it is not unusual that suppliers are integrated at the beginning or at the end of the NPD process. This entails that a supplier can be involved in the design of the creation or in creating and delivering the prototype. The ESI concept leverages the advantages of involving supplier in cross-functional teams at early stages of product development (Johnsen, 2009). The aim is also to formalize the process for working with suppliers to ensure alignment and accountability throughout the product launch innovation process.

The relationship between project team effectiveness and design quality is stronger when the supplier is involved early in the process (Petersen et al, 2003). Involving the supplier early is also regarded as strategically critical issue to take advantage of reduced cycle times, improve quality,
and reduce cost as well as to generate new ideas and apply new technologies (Ragatz et al., 1997; Petersen, 2003; Perols et al., 2012). Moreover, it becomes increasingly difficult and costly to make design changes as the development process continues. It is therefore crucial to bring as much product, process and technical expertise as possible early in the NPD process to have as much impact as possible over quality, cycle time and cost (Handfield et al., 1999).

According to Handfield et al. (1999), there are two major reasons that decides when to integrate a supplier in a specific stage of the NPD process: the rate of change of the technology and the level of supplier expertise in the given technology. In general, if a supplier possesses a high design expertise and their technology experts can help with key insights in creating new product, then the supplier should be included early in the process. Second, if the technology is undergoing a significant amount of technological change, that the supplier can’t master, then it should be delayed in the product development cycle.

![Figure 3. Where to involve suppliers in the NPD process (Handfield et al., 1999).](image)

Figure 3, displays what type of suppliers a manufacturer should involve and at what time of the NPD process. Based on the study from Handfield et al. (1999) it can be summarized that it is the buyer’s choice to decide if they want to share their knowledge and processes and if the designed product needs early or late integration. While supplier input can benefit the NPD process at any stage, earlier involvement appears to offer greater advantages. However, it is not a question of involving all suppliers earlier, but the right suppliers (Johnsen, 2009). A research, showing performance improvements when suppliers are involved in the NPD process, was tested for 134 buying companies, shown in Figure 4. The result shows that there are several aspects that are improved when involving a supplier in different stages (Monczka, 2000).
Figure 4. Overall performance improvements when suppliers are involved in the NPD process (Monczka, 2000).

Johnsen (2009) have through an extensive literature review been able to synthesize the research findings into a model of factors affecting the success of supplier involvement, Figure 5. The model consists of success factors that are organized into three main groups: (1) supplier selection; (2) supplier relationship development and adaption; and (3) internal customer capabilities and is fed by literature research from the last 30 years. Together, these three groups constitute the factors that is impacting time-to-market, product quality and development and product cost, which are considered to be the most important overall positive effects of involving a supplier in NPD.

The first factor concerns the supplier selection process. ESI is one point that have been discussed as important, which implies the involvement in the two first stages. However, not all suppliers should be involved early, only the right suppliers. As stated earlier suppliers of high value parts and complexity should be involved early, meaning it is important to understand the suppliers. Suppliers need to be chosen according to capabilities, commitment and innovativeness (Johnsen, 2009).

The second factor is the need for supplier relationship development and adaption. This is main group includes success factors concerning the integration of the supplier. However, these factors are often overseen and underestimated by managers, but are critical for the success of the NPD (Johnsen, 2009).

The third factor includes the factors for the internal organization, and is divided into top management commitment and internal cross functional coordination. Internal factors within the company for how to manage internal cross-functional relationship is key to be able to manage supplier relationships. Internal processes need to be developed to ensure that suppliers are selected and evaluated on the right basis and that supplier relationships are allowed to evolve (Johnsen, 2009).
Although most studies have stated that supplier involvement in a NPD process has positive outcomes, some studies opposes this fact. Birou (1994) state the involvement not always lead to improvement in terms of efficiency and effectiveness. Hartley et al. (1997) further states that a supplier does not affect the overall project success when being involved in the NPD process. According to Wynstra & ten Pierick (2000), supplier involvement is a good strategy, as long as it is managed carefully. Johnsen (2009) further discusses the challenges that management faces when suppliers are involved. Also Petersen et al. (2003) finds that the majority of engineers are feeling uncomfortable when technical information is shared and discussed in the presence of an external supplier. These challenges and success factors to succeed when supplier are involved in the NPD process is further discussed in the next chapter.

2.4 Critical factors within buyer-supplier collaboration

Today, the manufacturing industry has experienced an increase in competition which in turn has increased the need for a shorter lead time, cost savings as well as quality in the process of NPD (Bonnacorsi & Lipparini, 1994; van Echtel et al, 2008). Supplier collaboration has shown to have a positive effect in NPD and some research point out that collaboration and early supplier involvement in fact are the foundation of a successful NPD process (Ragatz et al, 2002; Bidault et al, 1998; Johnsen, 2009). The success factors can all be analyzed from different perspectives seen too long and short term outcomes where both are important to consider (van Echtel et al, 2008).
2.4.1 Trust

To integrate suppliers into NPD, a company must overcome such barriers as resistance to sharing proprietary information, and the not-invented-here syndrome (Ragatz et al, 1997).

Trust is one of the most frequently studied elements in any type of collaborative relationship (Fynes et al, 2005) and is also, according to Monczka et al. (1998), the most crucial action needed to collaborate successfully. There are however many dimensions of trust but Dyer (2000) defines trust as “one party’s confidence that the other party in the exchange relationship will fulfill its promises, commitments and will not exploit its vulnerabilities”.

Operation in an industry with unexpected changes, both in environment and technology, the existence of trust can help sustain the relationship as it makes it more flexible and able to endure potential challenges (Spekman & Carraway, 2006). Higher levels of trust will lower the perception of risk that is believed to be associated with opportunistic behavior and reinforces the belief that the relationship can fulfill the needs of the future (Moore, 1998). A certain level of trust will also help in accepting a higher risk if a company is convinced that it will help in obtaining a sustainable competitive advantage (Hoyt & Huq, 2000).

According to Wynstra et al. (2001), an increased trust will lower the potential risk in NPD. A collaboration with a new supplier will, due to this fact, be seen as riskier as a higher level of trust hasn’t yet been built. Due to the large amount of information that is shared in these collaborations, a high level of trust is necessary to sustain the relationship (Bonnacorsi & Lipparini, 1994).

This trust is developed over time and builds on understanding the expectations both buyer and supplier has. By being able to evaluate these in NPD based on the actual performance, trust can be built by succeeding in meeting the expectations. (Ragatz et al, 1997).

As the buyer often has a position of power they might be tempted to implement high levels of competitions to push prices and performance. This move will most often decrease the level of trust from the supplier side. To show the intent of a long term business has a positive effect on trust and will thus lead to an improved outcome of the collaboration in NPD (Walter, 2003).

Looking at what benefits trust can generate, Dyer (2000) argues that it can substantially lower the transactions costs as it reduces cost to search for new suppliers and costs related to negotiating, monitoring as well as administration of contracts. It will also lead to a superior knowledge sharing.
2.4.2 Commitment

Commitment from both parties in NPD is of importance to enable a responsive and active cooperation (Wynstra et al, 2001). Ragatz et al. (1997), lists commitment from both buyer’s top management and supplier’s top management as crucial parts in the success in NPD. In many projects there are often high level of costs, seen to investments, and the stakes might not be evenly balanced which entails the need of commitment for both parts to give incentives as well as increase the probability of success in the project (Bonnacorsi & Lipparini, 1994; Swink & Mabert, 2000).

Morgan and Hunt (1994) defines commitment as a belief that a relationship will last indefinitely and therefore requires the highest potential effort to achieve it. It’s therefore of importance that there is a balance between resource commitment from both parties, since there seem to have a correlation to the continuity of the collaboration (Yoshino & Rangan, 1995). The commitment can be demonstrated by allocation resources in form of investments, manpower and facilities to operate in (Mohr & Spekman, 1994). These resources create the basis of how to reach the set goals and promotes a behavior that should lead to change. According to Angle & Peery (1981), success in a collaboration is highly dependent in the commitment and that there exists a balance between short and long term goals. Monczka et al (1998), also states that successful collaboration occurs when both buyers and suppliers show commitment and allocate a variety of assets for future activities. Such activities could be training and improvement in needed skills, specialized facilities for developing needed technologies or demonstrating that one can perform joint activities for future projects (Anderson & Weitz, 1992).

2.4.3 Communication

Anderson & Narus (1990), defines communication as “the formal as well as informal sharing of meaningful and timely information between firms”. This will keep both parts updated on issues like financials, quality and production aspects as well as new ideas. Communication will thus help the common understanding and each other’s outlooks and boundaries (Beach et al, 2005). Lack of communication is found to be one of the main reasons for collaborations to fail (Mohr & Spekman, 1994; Ellram & Edis, 1996). Effective communication is required both on regular day-to-day activities and non-routine activities and connections between the two companies should encompass all levels of both organizations (Lambert et al, 1996).
As mentioned earlier, the expectations from both buyer and supplier are crucial to be aware of. This is where communication, with regards to development responsibility in NPD comes to play a big part. Clear communication will lead to fewer misunderstandings in the supplier’s development work, since less assumptions has to be made. Clear communication is also important for technical specifications so that they are formulated in a way that is agreed upon and performed in a standardized way. (Wynstra et al, 2001)

When it comes to communication and the success of a buyer-supplier collaboration, three attributes, crucial to success, has been identified to be strengthen according to Mohr & Spekman (1994); information participating, information quality and information sharing.

Information participating relates to the degree of mutual planning and goal setting (Mohr & Spekman, 1994). Both parties should be incorporated and willing to share information that could help with the efficiency of a project. Information quality relates to the many aspects of accuracy, timing, completeness and trustworthiness of the information shared (Daft & Lengel, 1986). Information sharing is all about to what extent crucial and proprietary information is communicated throughout the collaboration (Mohr & Spekman, 1994). When signing contracts, both parties usually agree on sharing confidential information to some degree, but to truly succeed with a collaboration, information sharing must extend beyond what is minimally seen as relevant to the other party in order for it to possible lead to more innovative product development (Dyer, 1994).

Much of a successful collaboration is being prepared to understand and working with other cultures, systems and behavior (Archer & Cameron, 2005). This fact is why communication has an important role to play. Lemke et al (2003) explains that a more personal business relationship is an important factor in successful buyer-supplier collaboration and the right communication will help in achieving this. Sjoerdsma & Van Weele (2015), further address the importance that individuals should be able to connect and collaborate on a personal basis for effective knowledge exchange.

Intra- and inter-organizational communication in all hierarchical levels is needed for a more effective process. This will in turn lead to a shortened NPD process overall but also a more agile one. (Bonaccorsi & Lipparini, 1994). Ragatz et al. (1997) also lifts the benefits of a good inter-organizational communication as they ensure a quick identification and possible solutions of problems.
The sharing of customer information is important in the early stages of collaboration within NPD. This information helps in creating an alignment between buyer and supplier in order to co-create something of value to the end customer to fulfill their requirements (Ragatz et al, 2002).

Furthermore, active communication and sharing of information on technical development and creative solutions enhances the NPD and the successful goal achievement. Information concerning cost and technology should also be shared in an early stage to ensure the engineering teams from buyer and supplier to quickly begin cooperating. (Petersen et al, 2003)

Another aspect of communication are its channels. According to Takeishi (2001), having frequent face-to-face meetings increases the chances for success where a strategy to co-locate engineers for specific periods of the project could be suitable.

2.4.4 Common vision
Being able to achieve a common vision will increase or generate many of the other success factors in NPD projects. It is therefore crucial for both buyer and supplier to establish common goals and agree on a vision that both parties support (Wynstra et al, 2001). With a common view on long term strategy and product development, the companies can reach a higher degree of trust which is one factor that is crucial for success (Swink & Mabert, 2000). In setting up common goals you also provide a roadmap for the collaboration which in turn will enhance the commitment to the project and thus increase the chances of success (Brinkerhoff, 2002). By combining both individually strategic goals with a common vision, a win-win situation can be achieved that further increases the commitment and incentives to deliver and succeed (Lambert et al, 1996; Cullen et al, 2000). Lambert et al. (1996), states the importance of understanding each other’s perspectives when creating a common vision.

Petersen et al. (2003) mentions the importance of sharing information on the strategic and technical direction of each company. This will give the supplier the opportunity to adapt solutions based on the shared information, so that it matches the imaginary direction the buyer intends to go. Clearly stating the individual goals can help in creating an alignment in the collaboration and will increase business performance (Lambert et al, 2004). Sharing this information will further lead to, or increase, trust between both parties and enable the relationship to become more flexible and adaptive to potential changes during the projects (Cullen et al, 2000).
When sharing both strategic and technical information, agreements are often a demand. There is always a risk in sharing material which causes the need to keep it safe. According to Ragatz et al. (1997), a risk and reward agreement is rarely used in NPD projects but Van Echtel et al. (2008) begs to differ, as they find that a mutual agreement concerning risk and reward is often a requested incentive due to the nature of NPD.

2.4.5 Management support

Change management is critical in order to implement something as complex as a collaboration plan. The organizational structure, culture and way of working most often need to be changed and are thus dependent on the support from management (Mohr & Spekman, 1994; Maheshwari et al, 2006; Wong, 2001). Conversation must shift from “What’s in it for me?” to “What’s in it for us?”, and this can only be done through accountable leaders and an engaged organization with clear governance structure (Tevelson et al, 2013). According to Fawcett et al. (2008), there are no technological shortcuts to succeed in this change and it’s a long and difficult transformation that require the supervision of top management. It is important that top management is committed to collaborate and that support is given from the start and establishment to the continuous improvement work once implemented (Ellram & Edis, 1996).

The support from management is crucial in many aspects of collaboration both on the buyer side as well as supplier side (Ragatz et al, 1997). Management support from the supplier side has been identified as being equally important for the success of a collaboration where short term cost benefits needs to be set aside for long term business development (Hendrick & Ellram, 1991). Supporting the collaboration will lead to a higher degree of trust and commitment as the support itself will be incentive to do so (Johnsen, 2009). In order to really succeed in cross functional work, both internally and externally, the management support is vital (Takeishi, 2001).

Management has an important role when it comes to creating internal consensus with regard to long and short term goals as well as strategic and technological direction (Wynstra et al, 2001; Johnsen, 2009). Petersen et al. (2003), states that the management need to link goals and directions to see to that the internal alignment between purchasing and R&D is functioning efficiently. Management must take part in creating and leading cross-functional teams consisting of key individuals from different divisions for them to generate the effect needed.

Managers need to find and work towards mutually beneficial long term objectives as well as point individuals in the right direction (Archer & Cameron, 2005). Top management from both buyer
and supplier has to decide on expectations, drivers and costs early in the implementation of the collaboration (Lambert et al, 2004). One key to success lies in the achievement of a collaborative leadership approach where top management from buyer and supplier works progressively to maintain and strengthen the relationship (Archer & Cameron, 2005).

To be able to maintain or develop a close collaboration between buyer and supplier during NPD, management need to see to it that it is supported throughout the ranks. This can be made possible by appointing relationship promoters or partnership champions, whose role is to coordinate activities, such as exchange of information and technology, between both firms as well as solve potential conflicts and promote the relationship both internally and externally. (Spekman et al, 1998; Brinkerhoff, 2002; Walter, 2003)

2.4.6 Internal alignment
Something that might occur when dealing with suppliers are conflicts within the internal divisions in a company. Purchasing and R&D might have different views on a potential collaboration as they might have different objectives seen to innovation, cost and other factors. It’s therefore important to align the divisions and to do so there are different organizational approaches to reach this in NPD projects. One alternative is to create cross-functional teams, including engineers or buyers to coordinate work and information flow between internal divisions. A common vision isn’t only important externally but are also crucial for efficiency when working internally. (Wynstra et al, 2001)

It’s therefore important to build credibility for the collaboration at senior level and within the organization. This requires discussing the opportunities generated by the relationship with all parties involved since this is critical to be able to mobilize the internal team and persuading suppliers to develop a shared vision (Tevelson et al, 2013).

2.4.7 Partner capability
Partner capability can be described as the organization's capability to achieve the set goals of the partnership based on its resources (Kim et al, 2010). Evaluating partner capability is important when establishing a buyer and supplier collaboration (Beach et al, 2005).

Innovation abilities of the supplier as well as its technical adaptation to market changes should be evaluated to determine feasibility of long term success as the end goal with the collaboration is to
achieve a sustainable competitive advantage (Maheshwari et al, 2006). However, both technical competence and knowledge should be evaluated together with the ability to work as a team, ability to share information as well as common problem solving skills (Maheshwari et al, 2006). Since all projects are different, Spekman et al. (1998) states that the capabilities should be evaluated based on the value that it could create.

The partner capabilities need to be evaluated on a continuously basis in order for the NPD to be successful (van Echtel et al, 2008). Takeishi (2001) argues that the architectural knowledge is of specific importance in NPD seen to supplier’s partner capability. Furthermore, Walter (2003) states that partner adaptations, such as the common alignment of organizational structure, behavior as well as planning, shows commitment and enhances new product development projects.

2.4.8 Incentive
Generating incentive will increase the probability of success but will also increase the willingness to cooperate. For the sake of a good collaboration, it’s important for the buyer to offer advantages, give incentives, to the supplier in order to motivate and to be able to begin a NPD collaboration at all. (Wynstra et al, 2001; Swink & Mabert, 2000, Tevelson et al, 2013)

In order for both parties to commit to the collaboration, incentives are a must where both feel that there is something to gain, a win-win situation (Lambert et al, 2004; Tan, et al., 2002). Brinkerhoff (2002) further implies that a win-win situation is of importance to maintain since it can be seen as a base for the value creation in a collaboration. To be able to create an equal win-win situation could turn out to be a big challenge. The incentives within the collaboration must be analyzed to be able to tell if there exist any other constellation, apart from collaboration, to reach a particular goal, or the incentives to collaborate will decrease (Lambert et al, 2004). The benefits of collaborating, seen to the whole supply chain, must exceed those gained if working completely separated (Mohr & Spekman, 1994; Lambert et al, 1996; Maloni & Benton, 1997).

Identified incentives should be measurable in order to continuously evaluate them to be able to modify and make changes to maintain the win-win situation (Lambert et al, 2004). Buyers should demand a lot of their suppliers and at the same time treat them fairly to set a tone of mutual interest that makes the collaboration far more productive (Tevelson et al, 2013).
3. Method

This section will provide a description of the method used in this study. The first part consists of an overall presentation of the research approach and is followed by in-depth presentation of the research design. The research design describes how the literature was reviewed as well as how the case study was conducted. Lastly, a discussion regarding validity, reliability and generalizability is presented in order to ensure the quality of the research.

3.1 Research Approach

The purpose of the research is to identify success factors with buyer-supplier collaboration in NPD processes, identify where suppliers are involved and which success factors that are most important in each process to achieve a time-to-market, cost and quality advantage. Thus, by gaining an understanding of why and how suppliers are involved in the NPD process, the aim of the study is to contribute with knowledge regarding implications. Mainly of what’s essential regarding critical factors when involving a supplier in the different stages of the NPD process through studying the advantages and disadvantages of involving a supplier in the NPD process. This study extends and confirms findings within the field, however, they should be seen as foundation for future research.

Given the purpose of this study, a case study design was chosen as research approach in order to answer the research questions. A case study was suitable as research methodology since the aim is to gain in-depth understanding of a delimited area (Collis and Hussey, 2014). Additionally, Yin (2013) states that a case study method is relevant and applicable to use since it provides answers to “how” and “why” some phenomena occur. The case study was conducted at four different manufacturing companies in Sweden and the focus was to identify ways to involve suppliers in the NPD process as well as what is required to succeed with the collaboration. Throughout the report the company names are not mentioned by name, instead it is referred to as Company A, Company B, Supplier C and Company D. Company A and B are both part of the case company group, but works as separate entities within. Supplier C is a supplier to the case company.

The case study was based on qualitative data from semi-structured interviews as well as observations and internal documents. The interviews were held with different stakeholders to obtain a holistic view regarding collaboration between buyers and suppliers. The different stakeholders consisted of R&D Managers, Purchasers, Key Account Manager, Supply Chain Manager and Project Leader, all connected to the NPD process. The observations were mainly from meetings between and within the supply chain management department as well as from the
innovation department. The internal documents concerned the NPD process at Company A and Company B. All qualitative methods were used to triangulate the data (Collis & Hussey, 2014). In the following chapter the research design is discussed in more in-depth.

3.2 Research Design

The aim of the chosen research design is to secure that the gathered empirical material is able to fulfil the purpose of the study and enable an answer to the problematization. The empirical material can either be gathered or investigated during the research, also known as *explanans*. This is done to create an understanding of the problematization, called *explanandum* (Blomkvist and Hallin, 2015). In this research the explanandum is to use the knowledge from the suppliers more efficient to achieve a better NPD process. The explanans of this study has been gathered over time and knowledge regarding the explanans has expanded during the study, resulting in a research that has been designed as an iterative process. According to this research design the problematization, purpose and research questions has been updated when new explanans and knowledge has come to light. This is aligned with an abductive approach and the technique enables the researchers to continuously update their knowledge with factors from empirics and understanding of literature and adapt the research to this.

The first step of the research was to gain an understanding for the problem and the field, also called step 1 in the process displayed in Figure 6. By reviewing internal documents and through unstructured interviews/discussions with R&D Managers and Supply Chain Managers at the case company, an initial understanding of the case and scope was achieved. These insights together with discussions with supervisors from the case company, gave us important understanding of the problem and forthcoming challenges.

In parallel with the unstructured interviews, the existing literature was reviewed and categorized. The combined data that was collected from the unstructured interviews and existing literature together with the discussion with our supervisors gave us a solid foundation to be able to formulate a preliminary problematization. The next step was to formulate a preliminary purpose and main research question. The main research question consists of two sub-questions: RQ1 and RQ2. RQ1 was conducted to understand the crucial factors when involving a supplier, while RQ2 were conducted in regard to how this relationship can excel in NPD projects.
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Aligned with the abductive approach, the literature was reviewed further during the research process to gain a deeper understanding. Furthermore, the in-depth semi-structured interviews were mainly aimed at a point of gathered data, but they were also used to gain specific knowledge and to clarify uncertainties in different areas, step 2. Moreover, the third step consisted of analyzing the gathered material to be able to answer the research questions. Finally, the last step consists of a conclusion of the research and a discussion regarding further research. The whole process is displayed in Figure 6.

![Figure 6. The research process for this study.](image)

3.2.1 Literature review

The Literature review is the foundation of the study and has contributed to in-depth knowledge about buyer-supplier collaboration and its success factors in NPD. According to Blomkvist and Hallin (2015), the literature review is important in order to understand what has already been done within this field of research and where the research can contribute with additional knowledge. The literature review has also been used to identify potential gaps in the literature. Moreover, it contains a summary and a critical analysis of existing findings within the area. In order for the research to stay on point, only relevant literature is presented.

The first phase in this stage was to collect and read literature of the phenomenon to gain a broad understanding. This was mainly done by reading frequently cited authors and to review influential researchers in the field. As the research proceeded, the scope of the literature could be narrowed down. Existing knowledge and theories was collected from different sources. The main keywords used in this study were: “Buyer-supplier collaboration”, “Supplier Integration”, “Supplier involvement”, “NPD”, “New Product Development”, “time-to-market”. A combination of the different keywords was used to triangulate and make sure that all relevant literature was found. The keywords were searched in; Google Scholar and KTH Primo to find relevant articles and
books. The search for additional appropriate sources were done by reviewing reference lists. To be able to get an overview of the literature, a spreadsheet was created consisting of a categorization of the literature and a short summary.

The second phase was to identify the most critical articles and books to make an in-depth segmentation before starting to write the literature review. In this phase a spreadsheet was created consisted of the most cited critical factors, shown in Appendix C. The literature review had an iterative process, as the study progressed new literature and aspects were identified and necessary theories were added to the study. In order to ensure the quality of the literature review, the researchers have discussed and evaluated the literature and its implications and relevance. Since the studied area is broad, where multiple definitions of concepts exist, the definitions from different authors have been compared in order to evaluate the most suitable definition.

3.2.2 Case Study
The main reason for choosing a case study approach was due to the fact that it was aligned with the purpose of the study (Voss et al., 2002; Collis & Hussey, 2014). This case study has followed the approach of Collis & Hussey (2014), which consists of five phases; selecting the case, preliminary investigations, data collection, data analysis and writing the report. The following section consist of a description of how these phases were applied to this study.

Selecting the case
According to Voss et al. (2002) a single case study increases the depth of the study but limits the generalizability of conclusions. On the other hand, multiple case studies increase validity and help guard against biases, but involves more resources and decreases the depth per case. Cases can be used to identify new phenomenon, elaboration on existing theory. Furthermore, cases can also be chosen to confirm or contrast result of similar studies (Yin, 2013). In this case study, the cases were carefully chosen based on a discussion with supervisors at the case company and supervisor at KTH. The supervisors at the case company has a wide network of contacts in the industry and therefore recommended the reference company, Company D, to be included to widen the perspectives, since they believe they are in the forefront of the industry regarding supplier involvement.

The case study was performed at four different entities in order to triangulate the data, as shown in Figure 7 (Yin, 2013). In a buyer-supplier relationship in NPD, a supplier and a buyer are collaborating, which both are interesting to study in order to cover the whole context. In order to
get a realistic opinion of the relationship, both the views from the buyer as well as the supplier is taken into consideration. Furthermore, a reference company was studied in order to increase the strength and reliability of the findings as well as getting another perspective from a different manufacturing company. It was also done to increase the researcher’s knowledge of the field to secure that important aspects were considered. In total, four different cases were chosen; two group companies, one supplier and one reference company.

![Diagram of case companies](image)

**Figure 7. The companies included in the case study.**

*The Case Company* is the global leader in door opening solutions and a market leader in most of Europe, North America, China and Oceania. The case company was formed in mid-1990. Since then the case company have grown from a regional company to an international group with over 45,000 employees and annual sales of over SEK 70 billion. Their aim is to continue to be the industry’s most innovative supplier of door opening solutions.

*Company A* is an independent group company within the case company. The company develops locks and integrated security systems for any door environment and was founded in the late 19th century. The Company is today a strong brand internationally, with established positions around the world. In 2015, the revenue amounted to over 1100 MSEK and employed over 340 persons. The production is located in Sweden, with several sales offices in Sweden.

*Company B* is an independent group company within the case company. Since the start in early 1990, company B have worked hard to simplify key management for property owners in Scandinavia. Product development and manufacturing are all located in Sweden. However, sales offices are located in several locations in Scandinavian. In 2015, the revenue amounted to over 140 MSEK and employed approximately 60 persons.
Supplier C is a leading company within electronics manufacturing services and is a supplier to Company A and B, with aim to increase their business with the case company. Supplier C’s solution is to design, prototype, iterate and manufacture the buyer's product at their own facilities around the world. Their overall goal is to provide their customers with a competitive advantage through Sketch-to-Scale solutions from concept and prototyping to engineering and advanced manufacturing to reverse logistics. In 2015, the revenue amounted to over 400 MSEK for the Swedish division and they employed approximately 140 persons in Sweden, where they have been present since mid-1990.

The reference company, Company D, is one of the world’s leading manufacturers of heavy trucks and buses. The company was founded in Sweden and employs over 40 000 people in 100 countries with a revenue over 100 000 MSEK in 2015.

Preliminary investigations
In order to gain an overview and an initial understanding of the subject, preliminary investigations were conducted (Collis & Hussey, 2014). The aim with the preliminary investigations was to gain an overview of the current situation and existing methods for NPD at the case company, as well as an introduction to the culture and values at the case company. This was conducted through three unstructured interviews, all of them with managerial positions. The Supply Chain Manager was interviewed to get an understanding of the supply chain and how the suppliers are used. Furthermore, an Innovation Manager was interviewed to get an understanding of the NPD process. Finally, an R&D Manager was interviewed to get an overall understanding of the supplier’s role in NPD projects. The interviews were conducted in the same fashion where the interviewee was given open questions with the possibility to give their own explanations a description of how they work. The interviewees are presented briefly in Table 2.

Table 1. The interviewee during the preliminary investigations.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager 1</td>
<td>Supply Chain Manager</td>
</tr>
<tr>
<td>Manager 2</td>
<td>Global Lean Innovation Manager</td>
</tr>
<tr>
<td>Manager 3</td>
<td>R&amp;D Manager</td>
</tr>
</tbody>
</table>

The preliminary investigations have not been used to answer the research question and are therefore not referred to or presented in the result section. The preliminary investigations have
given the researchers a better understanding of the company’s problem as well as allowing further detailed planning of the research.

**Data collection**
The gathered data consisted of both primary and secondary sources. The primary data was based on qualitative data through semi-structured interviews. The secondary data was mainly gathered from internal documents at the case company.

**Interviews**
The interviews were all conducted in a semi-structured way, meaning a pre-planned agenda was followed through an interview template (See Appendix A). This approach is suitable since the aim is to understand the interviewee’s opinion of the situation (Collis & Hussey, 2014). The template was equal for all conducted interviews which resulted in the opportunity to triangulate the empirical material gathered. This means that the validity of the answers could be tested against each other. At the same time, space was given and encouraged for the interviewees to come with their own thoughts and reflections (Bryman & Bell, 2014). Furthermore, interviews were conducted either by telephone or face to face, with a length of 30 to 90 minutes where all interviews were conducted in Swedish. The interview questions were not sent to the interviewees in advance, to be able to obtain spontaneous answers. However, the purpose of the study was sent out as well as an urging to the interviewee to think of critical factors when involving suppliers in the NPD process in advance, which was done to ensure an ethically conducted research. By including a definition of the critical factors found in the literature, Appendix B, misunderstandings could be avoided. In line with the recommendations from Voss et al. (2002), both authors were present during all interviews. In all interviews the same researcher held the interview and the other researcher took notes. This approach increased the reliability of the interviews since all interviews were conducted in the same way (Voss et al., 2002). In order to get a clear view of what was said during the interviews, all interviews were all recorded and later structured and summarized according to the interview template.

The first prerequisite for interview candidate selection at all case companies was that the candidate had to be involved in the NPD process. Secondly, interview candidates were only selected from the purchasing and the R&D department. The interviews are displayed in Table 3. In total, 10 interviews were conducted. The empirical data collected after the 10 interviews was considered to be enough, since the same result occurred several times, and therefore no more interviews were conducted. The result obtained from the interviews served as the basis for the analysis. Moreover,
interviewee A2, B1, B2 and B3 have had similar positions at corresponding companies in the industry before joining respective case company.

Table 2. Interviewee for the case study.

<table>
<thead>
<tr>
<th>Role</th>
<th>Code</th>
<th>Interview Date</th>
<th>Years at company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic buyer</td>
<td>A1</td>
<td>2017-04-05</td>
<td>20</td>
</tr>
<tr>
<td>Manager</td>
<td>A2</td>
<td>2017-04-05</td>
<td>1</td>
</tr>
<tr>
<td>Project Leader</td>
<td>A3</td>
<td>2017-04-05</td>
<td>3</td>
</tr>
<tr>
<td>Strategic buyer</td>
<td>B1</td>
<td>2017-04-04</td>
<td>1</td>
</tr>
<tr>
<td>Project Leader</td>
<td>B2</td>
<td>2017-04-04</td>
<td>2</td>
</tr>
<tr>
<td>Project Leader</td>
<td>B3</td>
<td>2017-04-04</td>
<td>1</td>
</tr>
<tr>
<td>Supply Chain Manager</td>
<td>C1</td>
<td>2017-03-24</td>
<td>17</td>
</tr>
<tr>
<td>Key Account Manager</td>
<td>C2</td>
<td>2017-03-24</td>
<td>7</td>
</tr>
<tr>
<td>Manager</td>
<td>D1</td>
<td>2017-03-29</td>
<td>9</td>
</tr>
<tr>
<td>Manager</td>
<td>D2</td>
<td>2017-04-19</td>
<td>8</td>
</tr>
</tbody>
</table>

Observations and Internal documents

Beyond the interviews, the researchers were given their own desks at the case company, thus being able to observe the company at a daily basis, during a period of five months. The type has been non-participant observations, meaning the observed people are not aware that they are being observed (Collis & Hussey, 2014). The knowledge gained from the observations was mainly regarding corporate culture. There are several issues with observations, such as ethics and objectivity, which have to be taken into consideration (Collis & Hussey, 2014). In order to increase the ethical consideration regarding observation, all included departments was informed that non-participant observation has occurred during the process.

Secondary data was found in internal documents. The internal documents consist of guidelines, presentations, procedures, agreements and strategies etc. that were available at the case company. The internal documents are confidential and is therefore not in the reference list. However, the findings have given a better overview of the organization and previous projects in the area. The internal documents have been added to the gathered data, increasing the level of triangulation of the findings.

Data Analysis

There is no clear and universally accepted method for analyzing qualitative data which makes it challenging (Collis & Hussey, 2014). A non-quantifying method have been used when analyzing the gathered qualitative data. In this case, three simultaneous flows of activity have been used, which includes reducing the data, displaying the data and drawing conclusions and verifying the validity of the conclusions (Collis & Hussey, 2014).
The first step was to reduce the data by taking away irrelevant parts and focusing on data where relationships of interest exist. The data was then divided into two categories based on if it regarded supplier’s involvement in the NPD process or critical factors to succeed. The purpose of the first phase was to get an understanding for different NPD processes and how suppliers were used and involved as well as the advantages and disadvantages with involving suppliers. The purpose of the second phase was to gain an understanding of the most critical factors in NPD and when involving suppliers in different stages of the process. Spreadsheets regarding each category was created, making the data categorized and easily displayed. The next step was to analyze the data, first by doing a within-case analysis, presented under empirical findings where each case was displayed and organized in the same way, concluded with a written individual case report for each case (Yin, 2013). Thereafter, the data was compared and matched to existing knowledge and implications were analyzed. Conclusions could then be drawn and the research question could be answered.

**Writing the report**

The last phase of the case study was writing the report, which includes the presentation of the analysis and conclusion that have been drawn from the empirical findings, combined with the findings from the literature (Collis & Hussey, 2014). This was first done when the all other parts were completed.

**3.3 Research Quality**

When conducting a study, the quality is most important for the content to be relevant. The aim in this section is to present and argue for the credibility of the findings (Collis & Hussey, 2014). There are four important criteria that should be used to check the rigor of the case study: construct validity, internal validity, external validity and reliability. All areas are important and need to be addressed to overcome weaknesses of what a case study method entails (Yin, 2013). In Table 4, a summary over the measures taken to secure the quality of the research is presented. The section below, will evaluate and discuss each of these criteria.
Table 3. Summary of the quality of the research.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Case study tactic</th>
<th>Case study tactic used in this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct validity</td>
<td>Use multiple sources of evidence</td>
<td>Interviews, observations and internal documents.</td>
</tr>
<tr>
<td></td>
<td>Establish chain of evidence</td>
<td>A clear and comprehensive description of the research process.</td>
</tr>
<tr>
<td></td>
<td>Review from key informants</td>
<td>Fellow master thesis students have given feedback.</td>
</tr>
<tr>
<td>Internal validity</td>
<td>Pattern matching</td>
<td>Findings from the analysis were compared and matched with existing literature.</td>
</tr>
<tr>
<td></td>
<td>Explanation building</td>
<td>The case study was based on a thorough literature review.</td>
</tr>
<tr>
<td></td>
<td>Theory triangulation</td>
<td>Multiple literature sources were used.</td>
</tr>
<tr>
<td>External validity</td>
<td>Replication in case study</td>
<td>Similar settings for all cases.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Case study protocol</td>
<td>All cases followed the same protocols.</td>
</tr>
<tr>
<td></td>
<td>Case study database</td>
<td>Database consisting of notes and documents.</td>
</tr>
</tbody>
</table>

3.3.1 Construct validity
The first type of validity concerns the quality of the data collection and how well the study investigates the phenomena under study (Collis & Hussey, 2014; Yin, 2013; Voss et al., 2002). Construct validity can be increased by triangulation of the data, by establishing a chain of evidence and by letting key informants review the data. By collecting data from different and multiple sources the data can be triangulated, securing that the phenomena under study was covered from different angles. In order to increase the validity, data from multiple sources were gathered which included interviews, internal documents and observations. Furthermore, the interviews were conducted with both managers and employees in the same position at the different case companies to reduce bias. Establishing a clear chain of evidence is important to allow observers to follow the research from the research question to the final conclusion. By ensuring a detailed description of the research process, including all steps and decision taken in the case study, this has been achieved. The last measure has been achieved by letting other master thesis students review the report and giving feedback on the study (Yin, 2013).

3.3.2 Internal validity
Internal validity concerns the data analysis and refers to which extent the study can establish a causal relationship between the variables and the final result, where specific conditions are shown to lead to other conditions (Voss et al., 2002). Internal validity can be enhanced by three measures: pattern matching, explanation building and theory triangulation. Distinct explanation building from the literature is needed for case studies to evince that an outcome derives from a certain variable (Yin, 2013). The researchers did an in-depth literature review to review supplier involvement in the NPD process as well as decide which success factors to include in the study,
based on how often they were mentioned. These were used as foundation when designing the data collection and analysis method. Furthermore, empirically observed patterns were matched with each other as well with existing patterns found in the literature. This was done in the cross-case analysis to increase the internal validity. Lastly, theory triangulation concerns the use of different sources to triangulate the theory. This method was used during the literature review by using different viewpoints and bodies of literature. The study has looked into different areas of the literature from purchasing, R&D and supplier perspective. Different articles that have been published in the areas of NPD, as well as buyer-supplier collaboration, were studied to achieve theory triangulation.

3.3.3 External validity
The third type of validity concerns to which extent the research findings can be applicable to other cases (Collis & Hussey, 2014). One of the major drawbacks of case studies is that they are based on specific settings which offer a poor basis for generalizing (Yin, 2013). Case studies cannot provide statistical generalization, however, case studies can provide analytical generalization. By repeating the same procedure and comparing findings in similar context, external validity can be increased, but the generalization of the case study is not automatic and need to be replicated (Yin, 2013). Therefore, four cases were selected, also included a reference company to increase the external validity argued for in the chapter 3.2.2 “Selecting the case”.

3.3.4 Reliability
According to Collis & Hussey (2014), reliability is the criteria that determine the replicability of the study. A high reliability indicates that if the case study were to be repeated, following the same method, the same result would be obtained. To achieve high reliability research, protocols should be used and collection of all data should be stored in a case database (Yin, 2013). The protocols ensure that the same procedure occur in all cases, especially when conducting multiple case studies to ensure that each case follows the same procedure. The method chapter’s aim is to secure that other researcher can replicate the study by following the method used in the research. However, it can be difficult to reproduce the findings due to the use of qualitative data in form of interviews which can consist of experiences and opinions that can differ between the cases. The use of a case study database consisting of notes and documentations can increase the possibilities to achieve replication. In Appendix A, the interview questions are presented to increase the reliability of the study. However, some internal documents can’t be provided in the report due to company confidentiality. Furthermore, due to company confidentiality, the company names aren’t displayed.
in the report, but this gave the researchers the opportunity to achieve in-depth answers. The interviewees name were kept confidential providing an environment of free speech.
4. Empirical findings

In this chapter the empirical findings from the case study are presented. Each case is presented separately and is divided into two parts. The first part consists of the results regarding the supplier involvement in the NPD process. The second part covers the critical factors when involving suppliers in the NPD process.

The first part of the analysis presents the four different cases separately. The four cases are: Company A, Company B, Supplier C, Company D and Table 5 displays an overview over the companies included in the case study.

Table 4. Overview of the companies included in the case study.

<table>
<thead>
<tr>
<th>Company Code</th>
<th>Company</th>
<th>Department</th>
<th>Role</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>Group Company</td>
<td>Purchasing</td>
<td>Strategic buyer</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R&amp;D</td>
<td>Manager</td>
<td>A2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project Leader</td>
<td>A3</td>
</tr>
<tr>
<td>Company B</td>
<td>Group Company</td>
<td>Purchasing</td>
<td>Strategic buyer</td>
<td>B1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R&amp;D</td>
<td>Project Leader</td>
<td>B2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project Leader</td>
<td>B3</td>
</tr>
<tr>
<td>Supplier C</td>
<td>Supplier</td>
<td>Supplier</td>
<td>Supply Chain Manager</td>
<td>C1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Key Account Manager</td>
<td>C2</td>
</tr>
<tr>
<td>Company D</td>
<td>Reference Company</td>
<td>R&amp;D</td>
<td>Manager</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Manager</td>
<td>D2</td>
</tr>
</tbody>
</table>

4.1. Company A

Company A is a group company within the case company operating in Sweden with suppliers around the world. They both manufacture/assemble as well as sell their own products.

Company A and Company B both follow the gateway process that have been developed at group level and shall thus be followed by the whole organization. Main characteristics of the process will therefore only be explained in the section below.

4.1.1 NPD process and supplier involvement

Company A is using a gateway process that is similar to the process developed by Cooper (Cooper, 1993). It consists of six stages with six gates as shown in Figure 8. Each gate consists of different requirements that needs to be fulfilled before moving on to the next stage. A generalized timeline, typical for projects in Company A, are also shown in Figure 8.
Figure 8. Generalized NPD process and timeline for a typical product at Company A and B.

Due to the financial and strategic effect of the decision made at gate 0, 2 and 4, the decision to move to the next stage need to be decided by the “Scandinavian Product Council”, which includes all company directors in Scandinavia. Gate 1, 3 and 5 doesn’t need to be included in the Scandinavian product council. The product manager shall create a rough business case, a one pager of the whole product, before GW0. Historically the work in this stage is carried out by the product manager, but can include help from others if needed. The product must pass GW0 before designers and a project leader can be assigned to the project. When the business case has been accepted in the Scandinavian product council, the work towards the requirements in GW1 can begin.

In this stage the market requirements and competitor analysis is done to understand the market and the competition. A thorough project plan must be created and project members shall be assigned to all affected areas. This is done in-house without any support from suppliers. Before GW1, the project doesn’t have any drawings, which usually means that you don’t need to involve suppliers, although a discussion with suppliers regarding the manufacturability of the product can occur. Company A also works with an in-house supplier, which they call ‘center of excellence’, a supplier that is included in the group and is preferred to use if possible. According to the interviewees, one of the benefits of including an in-house supplier instead of an external supplier, is that the project does not need to work under a non-disclosure agreement (NDA). Thus, Company A feel that they are able to share more information with an internal supplier than with external. They are also able to understand the supplier’s capacity and capabilities, which makes it easier when discussing the project. On the other hand, Strategic Buyer A1 argues that the in-house supplier knows that they will get the order no matter what, hence doesn’t put any extra effort into the deal. They will not make themselves competitive which can have devastating consequences in the long run for both parts. When competitors produce better products than the in-house supplier, the in-house supplier will have a hard time keeping up with the progress in the industry.
To be allowed to move on to stage 2 and work towards GW2, above mentioned requirements need to be fulfilled. Towards GW2 the main goal is to create a technical requirements specification, done by the R&D department. This includes how the functions specified in the market requirements shall work and be constructed. Included in this stage is testing of the concept where CAD drawings and 3D models is created for testing. A lot of work will be re-tested and altered before it can pass GW2. Also included in the stage is the market specification showing if all requirements are met. Furthermore, a sourcing and capability plan is constructed that is closely connected to the suppliers which is performed by the purchasing department. According to interviews, the process could benefit from involving the suppliers even more in this stage.

“We would like to get the supplier's opinion regarding manufacturability and that they question and challenge the ideas behind the product” – Project Leader A3

One specific area that comes up throughout the interviews, is to include the suppliers in the Value Added/Value Engineering (VA/VE) process. There is a resistance and a challenge with including the suppliers in this process since the drawings aren’t completed in this stage. If the design is ready, but it’s felt that they can challenge the design regarding fulfillment of requirements, components or price, internal help exist in form of a coaching team. However, by involving an external team, they could be able to identify any possible changes that can result in cost reduction or removal of unnecessary material or components much earlier in the process.

“It would be beneficial to include a supplier in this team” – Project Leader A3

According to interviewees, it is not possible to include several suppliers in this stage. However, if the suppliers already have been decided in this stage, it would definitely be beneficial to include the suppliers in the VA/VE. To pass GW2, the CAD drawings is top priority since without the drawings the purchasing department will not be able to order tools. When the Scandinavian product council have accepted the requirements in GW2 the project can move on to stage 3 with the knowledge of having a concept that have been critical tested. According to the interviewees, stage 3 is the most time consuming part and also requires the most development resources and thus a lot of costs are associated with this stage. Moreover, the prototypes need to be tested and the drawings need to go on to manufacturing. In this stage the bill of material (BOM), which the purchasing department sends to the suppliers, need to be completed. Historically, the suppliers are first involved in this stage. According to the interviewees, there can exist a misalignment between R&D and purchasing. Usually the purchasing department want to source suppliers with a complete
product, whereas R&D would like to send out the BOM earlier since the tools can take very long time to order. R&D also want to get the drawings out to suppliers as quickly as possible, to be able to get feedback on manufacturability or if it can be done in another way.

“It would be welcomed if we, earlier in the project, could lock in certain specification that we cannot change later. This gives us a security that we don’t need to test and redo components later on in the process.” – Project Leader A3

Company A’s products often contain both mechanics and electronics. Most often, it’s the mechanics that is reason to late changes, whereas electronic designers usually have their drawings done early. Manager A2 definitely thinks that suppliers can be involved earlier when it comes to mechanics, but also seeing risks with involving a supplier earlier when it comes to electronics. When they have a prototype and are letting the purchasers contact suppliers, they sometimes realize problems with the design later on in the process. This leads to redesign and that new suppliers need to be contacted. It is therefore a challenge for R&D to decide if the prototype is good enough, so that they don’t involve suppliers too early.

“I don’t want to be involved in the development stage, or prototype stage, since it will require me to send blank drawings and it will only give me counter questions from suppliers. I want to have a finished specification/BOM with volume, finished drawings and when we would like to start.” - Strategic Buyer A1

However, Strategic Buyer A1 welcomes the idea of involving suppliers in the prototype stage or earlier. This must however be done in the right way. There have been cases when designers have contacted suppliers on their own in order to know how a certain component should be produced, resulting in an increase in the supplier base and a misalignment between different departments. Strategic Buyer A1 advocates a solution towards openness between the designers and the purchasing department so that the designer let the purchaser help out to find suppliers within the supplier base.

“I can’t say at what time in the process they should be involved, but you will certainly see cases where they should have been involved earlier” – Project Leader A3

However, Company A believes that the suppliers should come in earlier in stage 3 to help out with the development and testing of the prototype in order to get input regarding manufacturability.
Usually, the prototype is produced in 3D, before the tools have been ordered. In some cases, components or products are not producible in a 3D syringe, meaning that it’s needed to develop and manufacture a tool and by doing so they are also able to ensure that the part could be manufactured.

“Here I can image that purchasing wants clear information from R&D early on. That R&D gives clear information regarding which components that will be ready for the first round of production and which won’t be.” – **Project Leader A3**

According to Manager A2, this would shorten the process significantly, since it otherwise will require extra time. Based on above, Manager A2 believe that the drawings should be given to the purchasing department earlier to let them order the tools sooner. A good business case and a good margin, would justify the ordering of tools earlier to shorten the lead time for a product.

In stage 2 and 3, Company A also does an official evaluation of their suppliers. When it comes to electronics, Company A doesn’t have that much internal production. They usually outsource or cooperate with specific suppliers, which all need to be evaluated. According to Project Leader A3, they try to use system vendors, like Supplier C, which can do both the electronics and some sort of assembly, of which they will have overall responsibility. In stage 3, the purchasing department requires a complete and final material list, not be modified or updated further on. This is needed in order to get the investment request approved.

When all requirements are met the process goes on to stage 4 and towards GW4. In this stage the investment request for tools have been approved, tools are manufactured and trials are done. The purchasing department sends out a request for quotation (RFQ) and waits for them to get approved by suppliers. The production processes are also tested and approved. When all is done, it’s time to launch the product. In GW4, the product and product team should be ready to launch, take orders and start selling the product. In stage 5, the project manager performs a follow up of the project, usually done a year after the launch of the product, after which the project is closed. According to Project Leader A3, it’s the supplier’s responsibility to clearly state, in a transparent manner, whether it’s possible to manufacture the product seen to its targeted costs. Even if Company A doesn’t have the capability to perform potential required changes, is important the supplier inform them about them.
“Based on the contact I have with the suppliers, I would like the suppliers to give me their personal and professional suggestions” – **Project Leader A3**

Cost is very important at Company A, as the business model is based on the existence of a high cost margin. If the supplier can give feedback and suggestion on changes to meet the cost requirements, the relationship would improve. It’s important that the supplier have an early dialogue with R&D and the designers. If a construction is modified and adjusted, the supplier must have time and be able to make the changes, without stressing the cost requirements from the purchasing department. Otherwise it might end up in a situation when purchasing need to find another supplier. Therefore, the contact should be initiated early on so the supplier can exaggerate in design without losing function of the product. According to Project Leader A3, they feel that suppliers doesn’t share information due to the risk of losing the deal. Project Leader A3 feels that there can be a resistance from the supplier if they are involved late in the process, since the supplier might think he is only allowed to follow the BOM, and not give input. Project Leader A3 also points out cases when the supplier has come back with crucial and basic suggestion that helped to manufacture and to industrialize the product. Strategic Buyer A1 argues that the supplier is giving better and more valuable suggestion if they are involved earlier than they are today.

Furthermore, Project Leader A3 is convinced that gateway process would be more efficient if the suppliers were involved earlier. He believes that the crucial part is to decrease the level of NDAs that the climate needs to be opened. Moreover, if the supplier already has been audited, they know that they can rely on that the supplier will provide the best price possible and best overall product. A recurring phrase, is the importance of not having to change supplier during the process. And on the other hand, the supplier must feel secure and safe in their relationship towards the buyer to be able provide suggestions. Manager A2 emphasizes the need to have a win-win situation. Project Leader A3 doesn’t know if Company A is ready to share information regarding the requirement specification since it requires an open dialogue consisting of sensitive information. But if the supplier could contribute with information during the VA/VE, the process could be shortened with less costs.

“In an ideal world, there’s a model where all benefits are included without any of the risks” – **Project Leader A3**

According to the Manager A2, the relationship with the supplier is important. If they work closely with a supplier, opportunities such as knowledge sharing and sharing of solutions occur. The
supplier might have obtained solutions in earlier projects, with the buyer or with other customers, that can be used and result in a shorter lead time. Company A doesn’t need to start from scratch in every project and especially the design stage could be shortened.

“It’s hard to identify when components in a project should be developed in-house or be outsourced to a supplier, but some areas that we today develop in-house would benefit of being outsourced earlier.” – Project Leader A3

It’s especially hard when it comes to electronics whereas there are several example when mechanic components could have been manufactured or design outside the company. On the other hand, if the collaboration with the supplier is built on a demand of giving suggestions, it could be beneficial regarding new technology or processes that would shorten the overall time.

4.1.2 Critical factors
Company A has a strong belief that early involvement of suppliers will be good for the outcome of NPD projects. Factors that have a big impact on efficiency today are mainly internal alignment and partner capabilities. Today, R&D need to deliver a full packaged deal to the purchasing department before they or suppliers are involved. The result is most often that one supplier wins the deal, mainly based on costs, and only then the supplier will give their input on all changes that needs to be done. A lot of time consuming activities starts after choosing a supplier and potential changes in design and material needs to be changed beforehand. Altering the order of things and, with management support, changing how the process is built today will reduce time-to-market significantly.

“There must exist a collaboration based on Purchasing, who needs to commit to the project. It’s they who are in charge of the supplier process.” - Project Leader A3

Partner capabilities are thus an important factor to consider since it’s really useful to know what, and what not, a supplier can do. R&D would like to use this in order to get input as early as possible and to really use the capabilities of suppliers, purchasing and their own in R&D.
Using a supplier more than once will help to understand their capabilities and how committed they are to projects. This will in turn build trust which R&D believe will make all activities faster and better in many ways since there will exist a belief that both parties want what’s best for the project.

Purchasing also believe that both they and suppliers should be involved early since their capabilities and expertise are of much use to reduce the iterations of design and material changes. From a purchasing point of view, trust is the basis for a much more successful collaboration. The problem today is the fact that the purchasing department doesn’t believe that they can trust any of the suppliers. This in turn, leads to a lot of time consuming follow-ups and controlling. The communication becomes very important to achieve an active collaboration of any kind, which must be based on a clear and fully completed requirement specifications. This is crucial for procurement in order to do their jobs according to how the process is formed today.

“I always plan for follow-ups, sometimes as often as daily. This is a necessity, since I know that nothing will be done if I don’t.” - Strategic Buyer A1

Today, commitment is a big problem when working with intra-suppliers, within the company group. Since upper directives forces Company A to use some suppliers, these suppliers no longer feel the need to truly commit to projects and to deliver the best possible solutions. The safety of no competition has driven up prices as well as lowered the commitment and trust, which in turn has led to longer lead time and a lot of controlling and follow-ups.

Relevance of factors within NPD
The importance of factors will vary in the different stages according to Company A. If collaboration in the early stages, a common vision, commitment and trust will be the most crucial factors for success. Since the project still is in the idea and scoping stage, it’s very important that all parties have an understanding of the vision and commits in trying to achieve it. Apart from an understanding, you must also trust that all involved actually will and can perform as expected. It’s also important that the right circumstances for change already are implemented to be able to make a change and not be tied to pre-determined structures. This means that management support will play a bigger role in the start of projects.

Involving a supplier later on in a project, other factors will have a larger impact on the potential success. Communication and internal alignment will be more important as a business plan and
concept needs to be formed. In order to succeed here, all capabilities and expertise needs to be combined from R&D, Purchasing and supplier. In order to do so, all need to communicate as well as be aligned internally.

In the stages of development and launch, the most important factors are believed to be partner capabilities and once again common vision, communication and trust. In the development stages, the partner capabilities will become important as they need to be able to produce the product and beforehand give input on improvement and changes based on their expertise. Again, it will be important to have a common vision for the outcome of the project as well as communicate to achieve it. Trust in a supplier in this stage will be helpful as the need for control and follow-ups then will decrease. Some suppliers take on projects that they can’t handle which will lead to a lot of changing, resulting in delays and increased costs.

**Outcome**

By better aligning the internal capabilities and knowledge, suppliers could be utilized for their core knowledge in the first stages. This could drastically reduce the time-to-market as well as costs, since fewer iteration will be needed. Better understanding of the process internally and becoming more flexible, could help in choosing the right supplier early on and to priorities the most time consuming activities from start.

### 4.2 Company B

Company B is a group company within the case company and are operating in Sweden with suppliers around the world. They both manufacture/assemble and sell their own products. Company A and Company B both follow the gateway process presented in 4.1 Company A.

#### 4.2.1 NPD process and supplier involvement

The gateway process has not been used for that long at Company B. According to Project Leader B2, stage 4 of the process, industrialization and choice of supplier, is the stage that requires most of the time even if stage 3, the design of the product, also requires a great deal of the total time. The reason for this is that the time spent on choosing supplier and especially tools to a specific design, is very time consuming. The time spent in these stages could be reduced significantly if the suppliers were involved earlier in the design stage. It is extremely hard to design a product to have high manufacturability without asking the actual manufacturer. The result is a back and forth process after the product have been designed to secure that the manufacturability is high. A
solution would be to include the tool manufacturer and suppliers in the design team early on in the project. On the other hand, a resistance within the company is that they don’t want to be tied up too early with one supplier since it could result in escalating prices. It can also be difficult for suppliers to set a price on a product that is still being designed. Project Leader B2 would like to see involvement from the purchasing department earlier due to this fact. Today, they are involved when it is time to ask suppliers for price, which happens in the design stage before GW3, and requires that the first drawings are completed. If the purchaser would be involved earlier they could be able to understand the product and what the designer is aiming for to help them to understand what type of supplier the project needs. Project Leader B2 would like to see an involvement from the purchasing department before GW2 to get them to understand the concept and to enable supplier involvement before the concept is set. This is especially important with projects with a tight budget since the supplier's will be able to give input regarding costs and budget. By doing so the supplier would be part of the team and feel commitment to the projects, resulting in a partnership and relationship that will favor both.

Project Leader B3 argues that there are two different products: straightforward products and complex products. A straightforward product is a product where they have all in-house knowledge. This product doesn’t require a process that involves a supplier or external parts early on since most stages are easier to handle. On the other hand, when developing a complex product which requires a more agile process, where stage 2 takes a lot of time, the process would benefit from using the knowledge from the suppliers early on. Today, the supplier’s knowledge is used in the same way regardless of what type of project it is. It often follows the process of a straightforward product which means that there is a transactional relationship. Project Leader B3 would like to see that there is a certain collaboration with the supplier, depending on project. If the product is complex, the need of getting supplier's input early is more important, otherwise the project will risk getting unwanted surprises later on.

The purchasing department usually gets involved in stage 3, in the product & process design stage, which Strategic Buyer B1 generally believe is too late. The purchaser would like to get involved earlier in order to help designers and go through components and materials to secure its manufacturability and finding the right supplier. Letting the designer have free hand could result in a product consisting unnecessary complex components and material choices. Whereas the purchasing department will have requirements from group center regarding cost. There can be a clear misalignment between designers and the purchaser if they don’t get involved earlier. By achieving a relationship with the supplier, based on trust, the knowledge from the supplier can be
used in a more comprehensive way. According to Strategic Buyer B1, the suppliers are usually eager to be assigned a project and is therefore often willing to give advice for free. Unfortunately, this opportunity is rarely pursued.

4.2.2 Critical factors
Company B see benefits in early supplier involvement as many important aspects then could be performed more efficiently. With early involvement you could benefit from supplier knowledge in manufacturability, thus reducing iteration of the design and industrialization process. This will in turn have a positive effect on cost, time-to-market and quality.

One of the most crucial risks in early involvement, as Company B sees it, is being tied to one supplier from the beginning. This is mainly because of the difficulties in determine the total costs since the deliverables aren’t set and will give suppliers a better situation for negotiation.

“The process will go a lot faster and smoother if constructors could communicate directly between buyer and supplier.” - Project Leader B3

Company B found communication to be an important factor in achieving a successful collaboration. Communication is needed in order to clarify and to understand what needs to be done. If both parts aren’t on the same page in what’s to be done, it will lead to delays and further costs.

By involving the supplier in the first stages, the capabilities and expertise of the supplier could be utilized in a better way. Input when it comes to design for production, materials and tools are important in order to finalize a product with less iterations and redesigns. By being part of the whole process, the supplier will most likely become more committed to the project which in turn will lead to harder work and reductions in time.

What Company B believe to be one vital aspect is internal alignment. R&D would like to involve purchasing in order to get an understanding when it comes to cost, material and supplier capabilities. Today, R&D believes that the purchasing department only cares about a complete requirement specification before they can start investigating suppliers and thus aren’t interested in getting involved in the first stages.
“By being involved earlier, I can control lead times and costs in a better way and influence the choice of material so that orders arrive much faster. Some materials need to be ordered long before which also requires warehousing, leading to inefficiency and higher costs.” - Strategic Buyer B1

On the other hand, the purchasing department wants to be involved as early as possible in order to influence the choices to achieve a more efficient process. Purchasing at Company B believe that by being involved in the design stages they can give input on different costs, easy to order material, suggestions on suppliers that could be contacted for a first opinion etc. This way they can control lead times, warehousing and flexibility. Purchasing sees internal alignment as an important step to reduce time-to-market and costs as well as to increase quality of the product and process.

“It needs to be a supplier that I choose. I don’t want constructors to contact suppliers themselves because who knows what we will end up with then.” - Strategic Buyer B1

The insights that purchasing has concerning their suppliers, are that they are most willing to help and to give early input, as they are eager to get the deal. So by identifying the core capabilities of the suppliers they can be contacted for input regarding this knowledge. It’s a win-win situation.

Company B believes that communication, commitment, partner capabilities and trust are important factors in order to successfully collaborate with suppliers. Suppliers that succeed in delivering what’s expected of them, are easy to communicate with and are committed and willing to go the extra mile, are also perceived to have good capabilities and can be trusted in possible future projects. The purchasing department builds a relation with certain suppliers that could help in the early stages of a project as both purchasing can give input as well as point constructors to contact the right supplier for other input.

Relevance of factors within NPD
According to Company B, some factors are more important to consider in the different stages of a NPD project, although it’s hard to pinpoint. In the early stages it’s crucial with understanding, a common vision, in order to help in developing something in the same direction. This also means that commitment and partner capabilities are important to reach a particular goal. Communication will be the factor that makes it possible as it will help in bridging the capabilities in order to make the most out of all knowledge.
Involving a supplier later on will put more pressure on the internal alignment. This needs to be sorted out before as R&D and purchasing can’t be pulling in different direction as the supplier needs to be involved. Partner capabilities and commitment will again be important as well as communication. Incentives might play a bigger role as a supplier that is involved later on can have a harder time to feel committed. This is something that can’t be neglected since a supplier most definitely will commit and work harder if they feel that there are more to gain from the collaboration.

Something that, according to Company B, always is crucial in all stages for success, are trust and management support. Trusting a supplier means in a way, that other factors already are fulfilled or achieved. You don’t need to communicate with, or control, a supplier as much if trust is established. Management support is also always important as projects needs to be backed, especially when problems occur. Managers and decision makers can step in to sort out problems more efficiently which is helpful and saves time as well as showing commitment to the project.

**Outcome**

By better internal alignment, important input from suppliers could be more easily accessible and guided to. In doing so, design, material and supplier choice can be factored in from start, leading to a decrease in time-to-market and costs as well as increasing quality of both process and product.

**4.3 Supplier C**

The section below presents and analyses a large Original design manufacturer (ODM) within Electronics manufacturing services (EMS), seen as a supplier.

**4.3.1 NPD process and supplier involvement**

Supplier C is working with three different models, all connected to where in the NPD process they are introduced. The traditional model is called EMS engagement model. This model is based on the assumption that the buyer already has developed the product and starting to ask questions regarding how to produce it in-house or to outsource it to an EMS partner. In this stage the buyer has developed a BOM including a list of raw materials, sub-assemblies, sub-components, all needed to manufacture the end product. In the same stage, the buyer sends out a RFQ to different suppliers and a bidding process starts for the deal. According to Supply Chain Manager C1, the relationship between the case company and Supplier C is, according to this model, that they are seen as a supplier of gods rather than a supplier that can contribute with knowledge.
“It is probably late in the process that we are involved today, probably first in the launch stage” – Supply Chain Manager C1

The second model has been developed to be beneficial for both the supplier and the buyer. This model is based on being engaged earlier in the NPD process, after the concept development but before or early in the design and development stage. In this case, the supplier's core capability is to manufacture products so by being involved earlier, the supplier is able to help the buyer decide on manufacturing processes that will increase the manufacturability.

“We can design out possible errors and we can choose components that are not at the end of their life cycle so that the product doesn’t need replacement of components early on in the product life cycle” – Key Account Manager C2

Included in this model are different pre-developed platforms that can be used by Supplier C. The platforms are commercially marketable today and can be used in different situations to give the buyer advantages. A pre-developed platform is a confirmed platform that have been developed to easier and faster help customers with common problems that can occur.

The third model is an idea incubator which is considerably earlier in the process. Supplier C will no longer only be involved in the design stage, but also in the idea stage, and usually involves the development of a product that will be launched in 2-3 years’ time. The idea incubator is built around several companies that have been specifically selected for their knowledge within their field. They then develop different solutions that are packaged into several different platforms that can be sold to customers that requires innovative solutions.

“Suppliers are trying to be involved earlier. We have chosen to use our idea incubator.” – Key Account Manager C2

In this model, the relationship between the supplier and buyer starts at the very beginning. Companies with cutting edge technology in different fields can be chosen to be included in the incubator. The different technologies are modified and assembled to a platform that later can be sold to customers in different industries.
“We conceptualize companies’ technology in a platform that we later sell to our customers.” – **Key Account Manager C2**

The relationship between Supplier C and buyers in different stages are explained to be the same with the exception of the involvement and contact with different departments. In the third model the supplier is communicating at idea level with employees from innovation and design (I&D) where in model two with R&D and model one with the purchasing department.

4.3.2 Critical factors
Supplier C do see the value in early involvement which is why they launched the idea incubator. This initiative will both give incentives to collaborate as well as needing to commit to something in order to benefit. A win-win situation could be created early on in the process which can help in succeeding in the later stages since the supplier is able to help with their expertise early on. The collaboration will lead to enhanced capabilities for both Supplier C and involved buyers which can give a competitive advantage and increase their businesses.

“I believe trust to be even more important in the early stages of the NPD-process.” - **Supply Chain Manager C1**

Trust and communication is something that is more important in the first stages of the process. When Supplier C inspect a component or a prototype, proposed changes can be seen as both criticism and something that will benefit the supplier. This is why trust needs to be established together with clear communication between both parties for the collaboration to function without unnecessary friction. According to Supplier C, much of the delay derives from unclear specifications and a lack of understanding of what the buyer actually wants. Direct parallels can be drawn to the communication and in trusting one another with more information. Since the collaboration isn’t as complex later on in the process, the importance of trust and communication declines, but doesn’t lose its importance.

Supplier C also highlights the aspect of internal alignment in an organization. Many times the collaboration between different parts of an organization differ to such an extent that it’s not sustainable. To be able to help in the earlier stages, Supplier C needs to understand what the buyer truly is looking for, a roadmap. To be able to deliver this to a supplier the organization needs to be aligned and willing to go in the same direction seen to R&D and purchasing. This is why Supplier
C see the need for internal alignment before involving them in order to get the most out of a collaboration.

“You see the whole process of design and development as a part of the core capabilities, but the reality is that it’s most often only a small part that truly are core capabilities” - **Key Account Manager C2**

It’s important for the supplier to understand where their own core capabilities can help and what the core capabilities of the buyer is, which then wouldn’t be interfered. Supplier C see a gap between what truly core capabilities are and what’s only perceived to be. This would be something for top management to sort out while also establishing internal alignment.

*Relevance of factors within NPD*

Supplier C found all factors to be important in all stages and thus hard to place specifically in the process. Although, trust is believed to be a main factor in early involvement as it’s being built and formed over time by excelling in the other factors. Internal alignment is crucial to establish before a supplier is involved to be able to understand the vision. For this to be able, Supplier C see management support as an important start, since they decides the structure of the collaboration and if a roadmap can be shared at all.

*Outcome*

Successfully collaborating with Supplier C will reap the benefits of knowledge in production and manufacturing, such as: manufacturability, design, components, PLM (Product Lifecycle Management) and automation. This can in the end reduce production costs as well as cost for design and development and eliminate iterations of the process to meet requirements of the supplier. A higher quality of the product/component can also be achieved by utilizing this knowledge. By using existing expertise and pre-developed platforms, not having to develop this in-house, drastic reductions in time-to-market could be achieved.

### 4.4 Company D

Below section presents and analyses a major automotive industry manufacturer and will in this case be referenced to as Company D.
4.4.1 NPD process and supplier involvement

Company D have an internal gateway process that is similar to Cooper's and the case companies process although it consists of three main blocks: Pre-development; Continuous introduction; Product follow up. The pre-development stage consists of pre research and concept development. The continuous introduction consists of configuration, development, process verification & market prepare and finally a ramp & close. The product follow-up consists of a follow up on customer experience, quality and cost. According to Company D, suppliers are most often involved late in the continuous introduction stage. Communication usually occurs between the purchasing department and the suppliers, where the purchaser sends a BOM to the supplier. This is not an effective solution according to the interviewees. If the suppliers are involved late in the pre-development stage they will not be able to help out with the design and configurations of the product. Late involvement in the continuous introduction might hinder the project. Suggestion given by the supplier might result in changes in the design, causing the whole project to be delayed since the design needs to be redone. On the other hand, it's not optimal to be tied up to one supplier early on, because then are they able to increase their margin on all components, since they will have a higher influence in project outcome.

“My standpoint is to get them involved as early as possible.” - Manager D2

According to Manager D2, Company D must understand which components they need help with but also which components that are appropriate to pre-develop themselves, and if they need help they must involve the supplier early. If it’s a large and complex product, then it is preferable to involve the supplier early, but it is also important that Company D have ownership over the product.

In the case of setting up a production line to be able to manufacture a complex product, there is indeed very important to involve the supplier early on. A production line can cost up to 100 MSEK and late changes could drastically increase the cost. Late changes will not only increase the cost of the production line but also result in several extra development loops that will increase lead time. This could be hindered by involving suppliers when the first prototype has been developed to get their expert opinion on material and manufacturability. Problems has been found to usually occur due to late process involvement of suppliers.
4.4.2 Critical factors

Company D has a long experience working with their suppliers and have gained insights from different types of collaboration and involvement. The general recommendation, when it comes to collaboration, is to involve the suppliers as early as possible. Collaboration in the first stages of NPD will lead to a faster and more efficient process. A supplier can give their input as the work is progressing, leading to the elimination of ‘trial and error’. Company D has learned that late involvement of suppliers most often leads to many iteration of the process, thus leading to larger costs and substantially longer time-to-market.

There are still risks that are important to consider with early involvement and could be seen as one of the main factors there still are some resistance to collaboration in the first stages. Cost is still one of the most important factors when choosing a supplier. This means that the alternatives must be held open in order to negotiate the best price. By involving a supplier early on might result in less power over costs as the project possibly could become dependent and intertwined to the one supplier.

“We want to do better and we want to learn from our suppliers, a better collaboration with purchasing is required to succeed since we need suppliers to work more closely with.” - Manager D1

There are several factors of importance when it comes to succeeding in collaboration and minimizing the risk mentioned above. Internal alignment is most important as R&D and purchasing needs to cooperate better and work more closely through this process. This could help in finding the right supplier for the project so that capabilities and costs are both taken into account. This way supplier input could be given early on, reducing iterations, while purchasing can monitor costs in a better way.

“Communication is required to continuously be updated and feel confident about the process to come. A clear structure for communication is needed in order to always know who to contact, trusting that this person will commit to solve potential problems.” - Manager D2

During a collaboration, communication will be one crucial factor for success. Company D can recall many project that, due to lack of clear communication, the time-to-market could be doubled. By focusing on clarity in the communication and in the requirement specifications, misunderstandings and inefficiencies can be minimized, thus leading to resource maximization.
Other factors that are important to consider are trust and commitment. These are also two main reasons as to why suppliers aren’t included earlier. Company D have a lot of responsibility and deadlines when it comes to NPD. These need to be met, and to ensure this, project leaders need to trust and to know that involved parties are committed to the task. The pressure of deliverance will often result in task being taken on in-house due to the established trust and knowledge of the commitment in their own company. Due to this fact, Company D have a much larger R&D division seen to some peers who have focused on, and excelled in, writing clear requirement specification and using suppliers to a higher extent.

“We need to categorize and understand our own core capabilities and what activities that are strategically important and the things that are just plain work.” - Manager D1

Company D found their own core capabilities to be a most important issue when reviewing the process from an internal point of view. Components that are strategically important and has a crucial impact on performance must be kept in-house. Processes that doesn’t qualify to this area could be performed by suppliers, but this isn’t the case. Company D still see a lot of activities as core capabilities, resulting in resources being spent in processes that aren’t leading to innovation and giving them a competitive edge.

Relevance of factors within NPD
Company D finds some factors to pay higher attention to in the early stages. Trust and communication are the basis for a successful collaboration. It’s important to feel and believe that the suppliers are committed and understand the vision for the project as well as having the capabilities to execute it. Trusting the supplier means that the communication will be more about status and check-ups than intensive monitoring and control.

Involving suppliers later on, management support will increase in importance to see to or keep a supplier committed. For a buyer, this will be crucial since they need to feel that their project is being prioritized and not pushed aside as bigger orders come about. These stages are also much about partner capabilities when it comes to producing the product so that no unexpected changes have to be made in the late stages. The communication and trust will be as important here as in the first stages to collaborate in the best way.

Outcome
By involving suppliers early on, Company D has a strong belief that cost and time-to-market could be reduced while also increasing quality. The early involvement will help Company D develop much needed capabilities by learning from their suppliers. Cost will decrease due to less iterations in the process and quality can be increased by in a better way utilizing the core capabilities of the suppliers.

5. Analysis and Discussion

In this chapter the analysis is presented and is divided into three parts. The two first parts consists of a cross case analysis based on the empirical findings and the literature. The first part consists of an analysis of where suppliers should be involved. The second part is focusing on analyzing the critical factors when involving suppliers in the NPD process. The third part consist of the key findings and key takeaways from the analysis and discussion. This analysis is performed with focus on answering the two research questions presented in the introduction chapter.

5.1 NPD process and supplier involvement

All references made to NPD processes and its stages and gates are presented in chapter 2, Figure 1.

All case companies agree upon that the supplier possess, and can provide, valuable knowledge. Nevertheless, the suppliers are usually used in the later parts of the NPD process. The common stage to involve the supplier are in stage 3. Today, the BOM needs to be done before suppliers are involved. Even though there is a general agreement that stage 3 and 4 are the common stages to involve the suppliers, everyone believe that an earlier involvement would be beneficial for projects. According to Company A, suppliers could be involved already in stage 1, even before the project have any drawings, to have a discussion with suppliers regarding the manufacturability of a product.

Even though this is extremely early, Company B advocates an earlier involvement as well. It is extremely hard to design a product to have high manufacturing ability without asking the manufacturer. The result is a back and forth process. A solution to this is to include the tool manufacturer and suppliers in the design team early in the project, before stage 3. Company D is on the same track as they believe that problems usually occur due to late process involvement of suppliers. Late changes will not only increase the cost but also result in several extra development loops that will increase the lead time.
This has also been discussed in the literature. In many sectors, especially technology heavy sectors, suppliers understand the technology challenges and the manufacturability of their parts of the end product much better than the OEMs do and their knowledge is often essential for the success of the product (Bughin, Chui & Johnson, 2008). In line with this, Supplier C argues for the fact that a supplier's core capability is to manufacture products, so by being involved earlier, the supplier is able to help the buyer to decide on manufacturing processes that will increase the manufacturability. Furthermore, Company A would like to involve the supplier in stage 2 to get the supplier's opinion regarding the ideas and fundamentals behind the product but also to question the product. They even take it a step further and want the suppliers to be included in their VA/VE process, which would require that the suppliers already have been chosen. By involving an external team, they are able to identify any possible changes that can result in cost and time reduction or removal of unnecessary material or components. Moreover, an early initiated contact with the supplier can highlight design suggestion without losing function of the product. Company B sees a solution to this by involving a purchaser earlier so that they would be able to understand the product and what the designer is aiming for. This would help them to understand what type of supplier the project needs. By doing so the supplier and purchaser would be part of the team and feel committed to the projects, resulting in a partnership and relationship that could favor both. Something that also is mentioned in the literature is that there are several advantages of involving supplier in cross-functional teams at early stages of product development (Johnsen, 2009). The aim is also to formalize the process for working with suppliers to ensure alignment and accountability throughout the product launch innovation process. Furthermore, the relationship between project team effectiveness and design quality is stronger when the supplier is involved early in the process (Petersen et al, 2003). On the other hand, there can be a resistance from the supplier if they are involved late in the process, the reason for this is that the supplier might only think they are allowed to follow the BOM without giving any advice on improvements. Company A argues that the supplier is giving better and more valuable suggestion if they are involved earlier than they are today.

Involving the suppliers in the NPD process is also a source to gain competitive advantage (Ragatz et al., 1997). Benefits when involving suppliers in the NPD process yield reduced cost and improved quality of purchased materials, reduced NPD time and improved access to and application of technology. But as mentioned in the literature, to succeed, a firm need to involve the supplier in the correct way (Ragatz et al., 1997). This is further developed by Johnsen (2009), it is not a question of involving all suppliers earlier, but the right suppliers. According to Company
B, there are two different products: straightforward products and complex products. A straightforward product is when a Company have all in-house knowledge needed. Straightforward products do not require a process were suppliers or external parts are involved early since there are few activities in need of input. On the other hand, when developing a complex product which requires a more agile process, where stage 2 takes a lot of time, then the process would benefit from using the knowledge from the suppliers early on. Today, the supplier’s knowledge is used in the same way regardless of what type of project it is. It most often follows the process of a straightforward products which means that there is only a transactional relationship. Company B would like to see that there is a collaboration with the supplier depending on project. This is aligned with how projects at Company A sometimes been proceed where there have been cases when designers have found suppliers on their own since they do not know how a certain component should be produced, which resulted in an increase in the supplier base and a misalignment towards the purchasing department.

If the product is complex, the need of getting supplier's input early is more important, otherwise the risk of unwanted surprises later on in stage 3, will increase. An extra loop in the design stage will increase the lead time and in the end result in a longer time to market. Looking at Company A and B’s internal NPD process in Figure 8, late changes in the stage 3 or early in stage 4, could increase the time to market with up to 12 months, because of activities having to be redone in stage 1 and 2. Changes that most likely would have been eliminated by involving suppliers earlier. Furthermore, looking at the research by Moczka (2000), over the performance improvements when involving a supplier, the improvements are tremendous. The idea with complex products is similar to what Handfield et al. (1999) presents as one major reason that decides when to integrate a supplier in a specific stage of the NPD process. They found that there is the level of supplier expertise in the given technology. In general, if a supplier possesses a high design expertise and their technology experts can help with key insights in creating new product, then the supplier should be included early in the process which in this case would be the more complex product. The supplier would then be able to increase the knowledge regarding the product, resulting in fewer design loops.

One idea that both Supplier C and Company A mentions, is to have a close relationship with each other. Looking at Figure 4, the most performance improvements is when the suppliers are involved earlier, both in terms of development time, cost and quality but also the opportunity to achieve a more agile process that both companies can benefit from in the future. Supplier Cs view on this, is to develop a platform together with companies with cutting edge technology. By doing so the idea
stage can be severely shortened since companies can use their platform as a basis and add their own in-house expertise to assembly a product. Looking back at Figure 1, stage 0 (Pre-study) could be significantly shortened since the pre-study often concerns areas and technologies that the company does not possess today, which they in this case could get directly from a supplier. In using a supplier this way, component costs could also be reduced as the supplier would have larger ordering batches as other companies also use their platforms. Of course, this would not be applicable for all cases but it shows the power of turning to suppliers earlier on to become more effective. According to Cooper (1993) the first stage in the NPD process is to generate a number of ideas and choose the most appropriate one. Historically, the work in stage 0 is carried out by one designer, meaning that a lot of ideas get overlooked just because of this reason. Another take to succeed with involvement of suppliers, pointed out by Company A, is to establish a strategically close relationship with key suppliers. By doing so, opportunities such as knowledge sharing and sharing of solutions occur. As mentioned earlier, it is important to understand the supplier they might have obtained solutions in earlier projects, which can be used and are superior to existing solutions. Moreover, the company would not need to start from scratch in every new project and as discussed above, the design stage, could be shortened since existing solution could be used and modified. This could be achieved by auditing key suppliers and let them be part of a group of preferred supplier that should be used when developing new products. Furthermore, this would entail that the supplier is more willing to give feedback regardless of where they are involved and also give the company the extra motivation to share proprietary information and reduce the not-invented-here syndrome. This would also secure, what Company A believe is crucial part, a decreased level of NDA as the climate would be much more opened and the company would be able to rely on that the supplier will provide the best price and best overall product. This would in turn shorten the whole process, but especially stage 4, during industrialization since a lot of administrative agreement would already be set.

One part that all companies agree upon is that the investment decision to order tools and the manufacturing of the tools takes too much time. Company A requires a completed material list in order to get the investment request approved, when the request have been sent, which occurs in stage 3, it can take up to 8-10 weeks for the request to get approved. The first action in stage 4 is to order the tools. The tools need to be manufactured before trials are done, which can take up to 8-12 weeks. Two actions that takes too much time according to Company A and B. This process could be reduced both by aligning internal capabilities as well as using the suppliers more efficiently.
“It would be welcomed if we, earlier in the project, could lock in certain specification that we cannot change later. This will give us a security that we don’t need to test and redo components later on in the process.” – **Project Leader A3**

To be able to do so, the drawings need be given to the purchasing department earlier, so they will be able to order the tools sooner. However, then the suppliers need to be involved earlier to help out with development and testing of the prototype, to get answers regarding manufacturability and if it is even possible to produce in a machine. Company A argues that a good business case should justify that the tools can be ordered earlier, even though some drawings are unfinished. According to Company B, stage 4 of the process, industrialization and choice of supplier, is the stage that requires most of the time, even if stage 3, the design of the product, also requires a great deal of the total time. The reason for this is that the time spent on choosing supplier and especially tools to a specific design, always is time consuming. If the suppliers were involved in the earlier stages, the time spent in stage 3 and 4 could be reduced since the time spent just waiting on the tools would be reduced as well as choice of supplier.

5.2 Critical factors

*The following chapter presents an analysis of the critical factors found in literature and how they compare to the empirical findings.*

5.2.1 Trust

According to Monczka et al. (1998), trust is the most crucial action needed to collaborate successfully. This is something that is confirmed in many ways in all cases of the study. In all stages of a NPD project, trust will be a central aspect to consider as it will help in streamlining the process as conflicts and problems can be sorted out more quickly and in a better way.

Dyer (2000), defines trust as “one party’s confidence that the other party in the exchange relationship will fulfill its promises, commitments and will not exploit its vulnerabilities”. This definition is a good fit seeing how the purchasing departments of Company A and B defines trust with their suppliers.

Company D believes that it’s important to feel and believe that the suppliers are committed and understand the vision for the project as well as having the capabilities to execute it. Company B further believes that suppliers that succeed in delivering what’s expected of them, are committed
and willing to go the extra mile, are thus believed to have good capabilities and can therefore be trusted in possible future projects. Purchasing at Company B builds a relation with certain suppliers that fulfill these requirements. This is in line with Ragatz et al (1997), who explains that trust is developed over time and builds on understanding the expectations the both buyer and supplier has. By being able to evaluate these in NPD based on the actual performance, trust can be built by succeeding in meeting the expectations.

From a purchasing point of view at Company A, trust is the basis for a much more successful collaboration in accordance to the definition of Dyer (2000). The problem however, is the fact that they don’t believe that they can trust any of their suppliers, mainly due to lack of commitment and the risk of exploiting vulnerabilities when it comes to price. Benefits with trust are just that it, according to Dyer (2000), can substantially lower the transactions costs as it reduces costs related to negotiating, monitoring as well as administration of contracts which also is something that Company A, B and D highlights. As it turns out, Company A are stuck with a lot of time consuming follow-ups and controlling.

On the other hand, lack of trust can have an influence on other types of costs. Due to a lot of responsibility and deadlines when it comes to the NPD, Company D wants to ensure that all involved parties are committed to the task. The pressure of deliverance will often result in tasks being taken on in-house, resulting in a much larger R&D division seen to some peers.

In all cases, there are elements of the importance of trust in a NPD project. Trust is built over time by fulfilling expectations, goals and requirements. Company B and Supplier C sees an extremely clear link between trust and all other factors. In a way, trust is built by excelling in all other factors. In relation to this fact, Wynstra et al. (2001), who believes that an increased trust will lower the potential risk in NPD, becomes factual. A collaboration with a new supplier will thus be seen as riskier as a higher level of trust hasn’t yet been built meaning that parts in the collaboration, dependent on some factors, have a higher risk of failure.

According to Walter (2003), the buyer often has a position of power they might be tempted to implement high levels of competitions to push performance and lower prices. This move will most often decrease the level of trust from the supplier side. According to Supplier C, an inspection of a component or a prototype with proposed changes can be seen as both criticism and something that will benefit the supplier. This can result in fear of sharing input which can be bad for the buyer as they then might end up with an inferior product.
Trust can thus lead to important input for the sake of the project and product. If trust is established, it can lead to benefits in the collaboration. Walter (2003) explains that the intent of a long term business has a positive effect on trust and will thus lead to an improved outcome of the collaboration in NPD projects. This is further supported by Company B who knows that suppliers are eager to give input for free as it could lead to them getting the deal in the end. Company A also uses to term “preferred suppliers” which basically are suppliers that they use more often. Letting suppliers know that they are on such a list will tell them that the buyer has an intent of a long term business which will help in building trust and give suppliers incentives to give input on projects they might not end up executing.

5.2.2 Commitment
Commitment is highly connected to trust and something that all case companies see as crucial in collaborations, which is in line with Wynstra et al. (2001), who believe commitment to be important to enable a responsive and active collaboration.

R&D and purchasing in Company A and B as well as Supplier C, believes that commitment to the project and its tasks will have a huge positive effect on the outcome. They all feel that this, many times, is an issue since commitment sometimes can be hard to achieve due to various reasons. R&D at Company A feels that purchasing need to be more linked to the project and commit to solving supplier issues. It’s not believed that they are willing to go the extra mile to solve problems faster as they rarely feel involved in the project. The same goes for Purchasing at Company A when in contact with suppliers. Committed suppliers doesn’t need as much follow-ups and are eager to help and giving input. Lack of commitment has a direct impact on time as all tasks takes a lot longer to complete.

Ragatz et al. (1997), lists commitment from both buyer’s top management and supplier’s top management as crucial parts in the success in NPD. This is something that is supported by Company A as they feel that the process of working today could be altered in order to improve the outcome. What’s needed is commitment from decision makers as these issues lies with pre-determined processes that only top management can change. Examples of this could be investment decisions, prioritizing in projects, usage of intra-suppliers and clear expectations on all involved parties. Company D sees the need for clear and more efficient structures for how to handle communication etc. both internally and externally. Today it’s unclear whose responsibility it is to see to that certain tasks gets executed.
According to Company B, involvement will most likely lead to a higher degree of commitment. This goes for all parties from R&D, purchasing, top management and suppliers. Commitment is seen as crucial for collaboration as it will help lead to harder work and thus reductions in time. Company B also see that suppliers are willing to commit when they believe it can lead to a good deal.

Angle & Peery (1981) believe that success in a collaboration is highly dependent on the commitment and that it exists a balance between short and long term goals. This is true according to Company A and Supplier C who believes that an understanding of goals and visions will help in achieving them. Company A believes this is most important for a supplier who is involved early on is committed. Supplier C explains that early involvement will increase commitment to a project as they get a better understanding of short and long term goals. This way they can focus their core capabilities on helping achieving short and possible long term goals which will keep them committed to the project.

5.2.3 Communication
Throughout the cases all involved highlights communication as crucial for any type of collaborating activities. Communication is the one thing that always is needed to bridge knowledge and expertise and to create an understanding for what’s to be done. Communication of different forms, follow-ups or controlling, are needed depending on activities and to what degree you trust and know the supplier. All case companies agree that communication is vital for success in collaboration. This matches the description of Anderson & Narus (1990), who defines communication as “the formal as well as informal sharing of meaningful and timely information between firms”. Communication will thus keep both parts updated on issues like financials, quality and production aspects as well as incorporate new ideas.

Lack of communication is found to be one of the main reasons for collaborations to fail (Mohr & Spekman, 1994; Ellram & Edis, 1996). According to Company B, communication is needed in order to clarify and to understand the goals. Lack of understanding will lead to delays and further costs. Supplier C, has found that much of the delay derives from unclear specifications and a lack of understanding of what the buyer actually wants. This is further supported by Company D, who believe themselves to have a lot to work on when it comes to requirement specifications. This fact speaks for the importance of communication. Wynstra et al. (2001), has found that clear communication will lead to fewer misunderstandings in the supplier’s development work, since
less assumptions has to be made. Clear communication is also important for technical specifications so that they are formulated in a way that is agreed upon and performed in a standardized way.

In order to achieve clear and efficient communication, a structure is needed. Lemke et al (2003) explains that a more personal business relationship is an important factor in successful buyer-supplier collaboration. Sjoerdsma & Van Weele (2015), further address the importance that individuals should be able to connect and collaborate on a personal basis for effective knowledge exchange. Purchasing at Company A, finds that the best collaboration is achieved when there exists a more personal relationship to the contact person in the supplier company. Many times the relationship exist on a personal basis and not company to company. This way communication is simpler and the understanding easier to establish. This is something that Supplier C agreed upon as they often find it hard to create a common understanding when it’s hard to communicate. This is usually since they are in contact with different people at a buying company who all have different takes on what’s to be accomplished. Supplier C finds it to be best if the buyer first understands each other internally and then establish a contact between companies. This is why communication is as important internally as externally for a project and supported by Bonnacorsi & Lipparini (1994), who has found that intra- and inter-organizational communication in all hierarchical levels is needed for a more effective process and will in lead to a shortened NPD process overall but also a more agile one.

Lambert et al. (1996), who has found that effective communication is required both on regular day-to-day activities and non-routine activities and connections between the two companies should encompass all levels of both organizations. According to Company B, this is true as the find to process to go a lot faster if constructors could talk to each other directly between buyer and supplier. A clear structure on communication and who to contact would be helpful in projects and have a direct impact on efficiency.

5.2.4 Common vision
Common vision goes hand in hand with communication and understanding. Company A and B both find common vision to be crucial in collaborations as it will help guide companies in their daily work. Communication is important to understand the goals and expectations of a project and will help in producing a common vision. With a common view on long term strategy and product development, the companies can reach a higher degree of trust according to Swink & Mabert (2000). Company A finds that a common vision can help a supplier to commit and focus their
expertise on areas that can fulfill this vision. Not really understanding the long term strategy will, according to Company B, lead to misunderstandings and thus delays and further costs. Brinkerhoff (2002) also found that, in setting up common goals you also provide a roadmap for the collaboration which in turn will enhance the commitment to the project and thus increase the chances of success.

Furthermore, Petersen et al. (2003) also mentions the importance of sharing information on the strategic and technical direction of each company. They found that it will give the supplier the opportunity to adapt solutions based on the shared information, so that it matches the imaginary direction the buyer intends to go much in accordance to the belief of all case companies.

As mentioned earlier, common vision is as important internally as between buyer and supplier. Supplier C do find it much more fruitful to collaborate with a company that are aligned internally with a clear vision so that they can help in fulfilling it. This is found to be true according to Lambert et al. (2004) who found that clearly stating the individual goals can help in creating an alignment in the collaboration and will increase business performance. Cullen et al. (2000) also found that in sharing this information it can further lead to, or increase, trust between both parties and enable the relationship to become more flexible and adaptive to potential changes during the projects, which is what especially Company A is striving for.

5.2.5 Management support

Internal alignment depends to a large degree on management support which is why it’s so important. According to previous studies, change management has been found to be critical in order to implement something as complex as a collaboration plan. The organizational structure, culture and way of working most often need to be changed and are thus dependent on the support from management (Mohr & Spekman, 1994; Maheshwari et al, 2006; Wong, 2001). This is exactly what Company A has pointed out in when discussing the internal alignment. Management need to be a part in enabling a change so that NPD projects can run more smoothly and efficient.

The support from management is crucial in many aspects of collaboration both on the buyer side as well as supplier side (Ragatz et al, 1997). Company B finds management support to be important as projects needs to be backed especially when problems occur. Managers and decision makers need to step in to sort out problems which saves time as well as showing commitment to the project. This will have an impact on the project as it shows that it’s important which also will influence the overall commitment from all involved parties. This is also supported by Johnsen (2009) and
Takeishi (2001) who finds management support to lead to a higher degree of trust and commitment as the support itself will be incentive to do so and that it increases the success rate of cross functional work, both internally and externally.

5.2.6 Internal alignment
As mentioned before, Supplier C has found collaboration to work more efficiently when the buying company first are aligned internally. This is also backed by the other case companies as they too find internal alignment to be a much important factor to succeed with to first be more efficient, but also to enable a better collaboration. Wynstra et al. (2001), find it to be important to align the different divisions and find it to be possible by, for example, creating cross-functional teams including engineers or buyers to coordinate work and information flow between internal divisions. A common vision isn’t only important externally but are also crucial for efficiency when working internally. Company A and B finds internal alignment to be a key to success since much knowledge and expertise, vital for the projects, already exist within the company. They believe that R&D and Purchasing should be involved early on in some type of setup that could be seen as a cross-functional team. This would allow them to create a common understanding more easily, use all capabilities they already possess and to incorporate a supplier in a better and much more efficient way when needed. Working together in the whole process will also help in discovering inefficiencies in the process that could be changed for the better, but this is believed to be out of their hands and up to top management. This is also something that Tevelson et al. (2013) points out to be important as a company needs to build credibility for the collaboration at senior level and within the organization. This requires discussing the opportunities generated by the relationship with all parties involved since this is critical to be able to mobilize the internal team and persuading suppliers to develop a shared vision.

Many opportunities could be captured if R&D and Purchasing worked more closely, but involving other decision makers could bring a lot of advantages as well seen to efficiency. Company A finds to process itself to be static and believe time advantages could be reached if altered. Analyzed properly, they believe that many activities could be ongoing parallel to each other instead of after one another, putting the projects on standby for long periods of time. This is believed to be doable with a better internal collaboration and alignment as well as with support from management.

When discussing internal alignment, both Supplier C and Company D points out an important aspect. They believe that it’s is most important for a buying company to align internally when it comes to which activities and components that should be done in-house and what to let suppliers
handle. A company need to analyze and decide what’s strategically important to the company and what can be trusted with suppliers. This will allow the company’s R&D-division to focus on the competitive edge and let right suppliers know their part in the plan in order to create a better understanding that will help the collaboration. This way the process becomes more structured and it will help R&D and Purchasing to know what they should focus on and can thus cooperate in a better way.

5.2.7 Partner capability

Partner capabilities are very important in collaborations since the supplier is supposed to contribute with expertise or to manufacture something. Company B found the capabilities of a supplier most important if involved early on in a project. Since early input could help with efficiency and time advantages, it’s most crucial that a supplier have sufficient knowledge in the area. Many suppliers take on deals that they can’t fully handle since it might be important to win a deal, to later point out designs that cannot be manufactured. Due to this fact, evaluating partner capability will be most important when establishing a buyer and supplier collaboration according to Beach et al. (2005). Therefore, it’s not only important that the supplier have the right capabilities, it’s also most important that the buying company knows about them and trust that they can fulfill set goals. This way the right supplier could be contacted much faster to help in giving valuable input in NPD projects which Company A and Supplier C find to be a key factor for the outcome of a project.

Supplier C finds capabilities to be most important which is why they launched the idea incubator. They find that the more expertise they have, the more competitive they will become. Being involved earlier, they believe that they can give input regarding their own expertise which will help the buyer in many ways seen to efficiency and innovation. Since suppliers develop their capabilities over time it's important, according to Van Echtel et al. (2008), to evaluate supplier capabilities on a continuously basis in order for the NPD to be successful. Supplier C believes that a successful collaboration can enhance the capabilities of both buyer and supplier, creating a win-win situation. Company D have similar thoughts concerning the subject as they believe that they can learn valuable capabilities from suppliers in order to use them in future projects.

Supplier C and Company D also believes that by knowing your own capabilities in comparison to suppliers, it will be easier to prioritize when to do something on your own and when to let a supplier be helpful. This way both internal and external capabilities could be utilized in an optimal way.
5.2.8 Incentive

Incentives are an important factor to consider in any type of work or collaborations which all case companies agree upon. According to previous research, generating incentive will increase the probability of success and also increase the willingness to collaborate. For the sake of a good collaboration, it’s important for the buyer to offer advantages in order to motivate a supplier and to be able to begin a NPD collaboration at all. (Wynstra et al, 2001; Swink & Mabert, 2000, Tevelson et al, 2013)

Without incentives, the collaboration won’t function in an optimal way, which is something that Company A has experiences with their intra-suppliers. Since no competition exist for many of the deals, it’s hard to generate commitment for a better collaboration. There will be no win-win situation as it’s already predetermined to use this supplier. Incentives and commitment are closely related and will have a huge impact on the outcome of a project seen to time and quality.

When using external suppliers, Company A and B have found that many times the possibility to win a deal at all will be incentive enough for a supplier to help out. Generally, suppliers are found to be willing to give early input for free if they feel that it will increase the chances of winning the deal. This is however not taken advantage of.

Supplier C and Company D further supports the findings. Supplier C believe that a closer collaboration will lead to enhanced capabilities for both parts as knowledge will be shared during a project. This is also what Company D wants to achieve as they are eager to learn useful capabilities in order obtain a competitive edge and thus be able to use it in future project for a more efficient process. Brinkerhoff (2002) further implies that a win-win situation is of importance to maintain since it can be seen as a base for the value creation in a collaboration.

Identified incentives should be measurable in order to continuously evaluate them to be able to modify and make changes to maintain the win-win situation (Lambert et al, 2004). Buyers should demand a lot of their suppliers and at the same time treat them fairly to set a tone of mutual interest that makes the collaboration far more productive (Tevelson et al, 2013). This is something that could be of use to a company who works with many suppliers. As mentioned earlier, Company A, uses something they call ‘preferred suppliers’. Being on this list means that a supplier has fulfilled some requirements and will thus be chosen as an option in more deals. This tool could be used to generate incentives and commitment as it has the potential to create win-win situations. Suppliers’ increase the deals and the buyer get a more efficient way of choosing a good supplier and the more
suppliers are used, the more they can be trusted if continuing to fulfil the requirements. The number of deal a supplier win is measurable and could be used as a KPI as well as the buyer could measure saved costs and time by using already approved and controlled suppliers.

5.3 Requirements for involvement

The following chapter presents priorities and requirements from an industrial manufacturer in order to create the right circumstances for an efficient involvement of a supplier and for a collaboration to be successful.

It has been found that all companies see trust as a critical factor for a successful collaboration. Supplier C also finds that internal involvement has significant value for them to be involved in a good way and to be important in order to be successful. Furthermore, Company A sees the need of management support to be able to implement needed changes to enable a common vision and thus align internally.

5.3.1 Strategical importance

In order to enable a better collaboration, there are certain things that need to be dealt with. The first step would be for top management to sort out which capabilities and activities that are strategically important, making it the core of the company. It will then be important to create a structure and guidelines for how to work internally and how to prioritize between projects and processes. All activities that are decided to be strategically important could be performed in-house and other activities, whole or parts of, should be trusted with suppliers. This way a company won’t risk any of its competitive expertise to end up in the hands of a competitor through a supplier. According to previous studies, change management has been found to be critical in order to implement something as complex as a collaboration plan. The organizational structure, culture and way of working most often need to be changed and are thus dependent on the support from management.

A clear structure could lead to a reduced workload for R&D who now can focus on activities that will enhance the competitiveness of the company, not wasting resources on “plain work” that suppliers could do more efficiently. Due to a lot of responsibility and deadlines when it comes the NPD, company needs to ensure that all involved parties are committed to the task. The pressure of deliverance will often result in tasks being taken on in house, resulting in a much larger R&D
division seen to some peers. This depends on trusting suppliers which is why it will be important to build.

The requirements of work tasks must be specified in order to use the knowledge and expertise in the best way. Today R&D and the purchasing department see themselves as separate entities, resulting in tasks that will help the project, not being done. Many crucial activities don’t fall under any regular day-to-day routines, meaning more work than usual. Today it’s unclear whose responsibility it is to see to that certain tasks gets executed. Cross-functional teams could help in solving this issue as it will increase the commitment to the project and enable all capabilities to be used as work proceeds.

Today the process is rather segmented as R&D first does what’s expected of them and deliver this to Purchasing who either gives input that results in another loop for R&D or sends RFQs to suppliers. Suppliers are then involved, resulting in questions or further input to purchasing who must deliver this to R&D, many times resulting in more development or design loops. Late changes in the stage 3, or early in stage 4, could increase the time-to-market with up to 12 months, because of activities having to be redone in stage 1 and 2. Basically, a lot of work and information is being sent back and forth many times over. This process could go on until the requirements are met and the price is set. A lot of time consuming activities then starts after choosing a supplier, and potential changes in design and material often needs to be changed beforehand. Many opportunities could be captured if R&D and Purchasing worked more closely, and involving other decision makers could bring a lot of advantages as well seen to efficiency. The stage-gate process itself has been found to be static where time advantages could be reached if altered. It can take up to 8-10 weeks for the investment request to get approved and the first action in stage 4 is to order the tools which can take up to 8-12 weeks before work continues. Analyzed properly, it’s believed that many activities could be ongoing parallel to each other instead of after one another putting the projects on standby for long periods of time. This is believed to be doable with a better internal collaboration and alignment, first enabled by management.

Knowing what’s strategically important could also mean that much of the R&D projects today could be drastically shortened. Suppliers today have expertise and knowledge that a buyer can come close to achieving and as it shows, they offer innovative solutions that could be used straight away in projects giving cutting edge technology, competitive advantage and no cost or time spent on the first stage of R&D. Using commercialized platforms can also mean piggy-back riding on manufacturing batches, lowering the cost of many components.
5.3.2 Internal alignment

Internal alignment has been found to be a crucial factor, both for internal efficiency as well as enabling circumstances that will benefit a collaboration. A structure for what’s strategically important for the company and what capabilities are needed, will allow for an internal alignment, mainly between R&D and purchasing, but also upper management. A company first needs to build credibility for the collaboration at senior level and within the organization. This requires discussing the opportunities generated by a better collaboration with all parties involved since it’s critical to be able to mobilize the internal team and persuading suppliers to develop a shared vision. Working together in the whole process will also help in discovering inefficiencies in the process to find a more functional way. Creating cross-functional teams, consisting of engineers, purchasing and possible suppliers, would enable the work to be coordinated and information and knowledge to flow better between internal divisions.

Using suppliers in a better way, also puts pressure on capabilities that might not exist in the company today. One important capability would be creating sufficient and clear requirement specifications. Knowing what suppliers needs in a specification and what they can do, will enable a buyer to deliver what’s necessary in order to minimize misunderstandings and reduce do-overs. Close work will allow R&D and Purchasing to use all internal knowledge and expertise in the best way and to create a common vision, as lack of understanding will lead to delays and higher costs. Purchasing has a lot of important knowledge concerning a BOM, requirement specifications and capabilities of suppliers and many times a closer collaboration could eliminate loops of some stages just by utilizing knowledge that that already exist. If internal capabilities are insufficient, a supplier could be used either to take over the whole deal, or to give valuable input making the buyer acquire necessary capabilities. Since it’s found that much of the delay derives from unclear specifications and a lack of understanding of what the buyer actually wants, clear communication between divisions will lead to fewer misunderstandings since less assumptions has to be made.

A common vision internally and a clear structure on expectations regarding activities will help the communication between buyer and supplier and thus to share and agree upon a vision, a roadmap. Intra- and inter-organizational communication in all hierarchical levels is needed for a more effective process and will in turn lead to a shortened NPD process overall but also a more agile one. A clear structure on communication and who to contact would be helpful in projects and have a direct impact on efficiency. The process will go a lot faster if for example, constructors could
talk to each other directly between buyer and supplier instead of communicating through the purchasing department who doesn’t have this particular knowledge.

5.3.3 Building trust
Trust is found to be the most important factor to establish for the sake of a successful collaboration as it can lead to many benefits seen to outcome in NPD. A successful collaboration can enhance the capabilities of both buyer and supplier, creating a win-win situation. Building trust will thus be important for the outcome of projects and should therefore be prioritized and have a larger focus. Dyers (2000) definition of trust; “one party’s confidence that the other party in the exchange relationship will fulfill its promises, commitments and will not exploit its vulnerabilities”, basically means that other factors must be achieved first, making trust an assembly of all the other factors.

Trust is earned and isn’t something that is built in a day, it takes time. This means that a company must start somewhere. It has been found that a supplier wants to understand their part in the bigger picture, so involving a supplier earlier in order to create a common vision would be a start. It’s important to show the intent of a long term business as it has a positive effect on trust. The case companies found that a common vision and commitment were important in early involvement. So by focusing extra hard on communication in the start, will lead to an understanding, a common vision, that will help a supplier see the potential in what they can accomplish. This can in turn generate commitment to a project, becoming a good start in leading to something more and closer to the definition of trust. It’s found that a common vision can help a supplier to commit and focus their expertise on areas that can fulfill this vision. Not really understanding the long term strategy will lead to misunderstandings and thus delays and further costs. In setting up common goals you also provide a roadmap for the collaboration which in turn will enhance the commitment to the project and thus increase the chances of success.

A tool, that exists today, for building trust is the insurance of being a ‘preferred supplier’. This concept should be used more actively as it has the potential of generating incentives and commitment. The suppliers should be chosen based their capabilities where clear requirements, are set for the participants to be a part of, and stay on, the list. This shows that the buyer is willing to build a longer relationship, still having high requirements. This will give suppliers incentives to go the extra mile and perform their very best as well as commit to the project as well as it generates incentives to give input on projects they might not end up finishing. This way the buyer gets a large pool of knowledge and capabilities that can be used and learned from, and the suppliers will
get more deals. A lot of time and cost can be saved just by the convenience of having suppliers close to hands not having to go through a long process of choosing, controlling and learning about what capabilities suppliers possess, just to get a low price that in the end could cost more nonetheless.

The risks with this approach will be to be locked and too dependent on one supplier, losing the power and control over costs. This is why identified incentives should be measurable in order to continuously evaluate them to be able to modify and make changes to maintain the win-win situation. Buyers should demand a lot of their suppliers and at the same time treat them fairly to set a tone of mutual interest that makes the collaboration far more productive. The number of deals a supplier win is measurable and could be used as a KPI as well as the buyer could measure saved costs and time by using approved suppliers. This way you can control the risks and more easily see if a supplier exploits vulnerabilities in this setup.

5.4 Summary of results and analysis

*In this chapter the summary of the findings is presented. The concluded findings from the analysis is presented through a graphical framework.*

By analyzing the literature and the empirical findings from the case study, a framework have been produced seen below. It consists of the stage gate process developed by Cooper (1993), and the different stages, divided into two main blocks; early and late supplier involvement. Figure 9 presents the main characteristics of when to involve a supplier, early or late. However, when analyzing the literature and data from the case study, the result shows that involving the supplier as early as possible are far more beneficial. It was confirmed that eight factors are of high importance to successfully collaborate with a supplier. This study further found that, depending on product, some factors should have a higher focus to enable an effective involvement and collaboration. Figure 9 illustrates the main critical factors to focus on depending on supplier involvement. The investigation finds that internal alignment is crucial to an efficient collaboration. This is only possible through the support from management to enable the right organizational circumstances and to agree upon a common vison and to involve the right supplier that can help in fulfilling it. Thus, management support, communication, internal alignment, common vision and partner capabilities are, in this order, in need of a higher focus when involving a supplier early on. A clear focus on these particular factors in the early stages will most certainly generate incentives and commitment and in time, possibly lead to trust, thus fulfilling all eight factors.
Introducing a supplier in the late stages will require a higher focus on internal alignment, communication and incentives as the collaboration will be more of a transactional form.

Figure 9. Summary of the findings from the analysis.
6. Conclusions and further research

This chapter presents the conclusion of the study where the research questions are answered followed by managerial implications, sustainability and ethical aspects and further research.

6.1 Research questions and contribution

The purpose of this study was to investigate the process of NPD with focus on buyer-supplier collaboration in order to achieve resource advantages. This study aims to understand “What” is needed for a buyer-supplier collaboration to succeed, depending on “Where” the supplier is involved, in order to give recommendations on “How” suppliers should be integrated in order to obtain time-to-market, cost and quality advantages. This was achieved by formulating a main research question, which could be answered through formulating two research questions. The foundation for answering the research questions was a literature review as well as a case study at four different companies. In the previous chapter the findings for the research questions are presented and the following section will present the conclusions and answer to each research question.

Previous research has primarily focused on only identifying challenges in the process of supplier integration in the NPD process. Other research has focused on the correlation between supplier integration and time-to-market in general, not focusing on the process in particular. Some literature suggests the importance of factors in order to succeed, however, it’s not specified which factors that needs the most focus and how they are connected, depending on where suppliers are involved. This study has complemented existing literature by investigating which critical factors that should have a higher priority, from a process perspective, in order to succeed in a buyer-supplier collaboration and how they ultimately can lead to time-to-market, cost and quality advantages. This has been done by investigating for two different angles, both buyer and supplier, something that previously has had a low focus.

RQ1: What are the most crucial factors in order to implement a buyer-supplier collaboration in different stages of a NPD process?

The crucial factors where both studied through the literature and then confirmed through the case study. All case companies agree that all eight factors are important for a successful collaboration.
It has been found that trust is the single most important factor when involving a supplier in the early stages. Dyers (2000) definition of trust; “one party’s confidence that the other party in the exchange relationship will fulfill its promises, commitments and will not exploit its vulnerabilities”, basically means that other factors then would be achieved which makes trust an assembly of all the other factors. This makes it more understandable why just trust often is mentioned as the most important factor.

This study further found that, depending on product, some factors should have a higher focus to increase the chance of success. The investigation found that internal alignment is crucial to an efficient collaboration. This is only possible to achieve through the support from management who need to enable the right organizational circumstances and to agree upon a common vision in order to involve the right supplier that can help in fulfilling it. Thus, management support, communication, internal alignment, common vision and partner capabilities are in need of a higher focus, in that particular order, when involving a supplier early on. A clear focus on these factors will in turn generate incentives and commitment and in time, possibly lead to trust.

To create an understanding, a common vision, is found to be very important in the early stages of the process, since the hope is to help each other in creating something that fulfils a goal. This will require management support to sort out how the organization should work. In turn, the divisions can align internally and better incorporate and understand which suppliers to use and what their capabilities are. This was found to be most important from both buyer and supplier in order to become more resource efficient.

Introducing a supplier in the late stages will require a higher focus on internal alignment, but not to the same extent as early involvement, communication and incentives as the collaboration will be more of a transactional form. If the buyer has knowledge of what they want to achieve and how, the collaboration will become much smoother as it will be easier for the supplier to obtain the same understanding. Incentives will also be vital in these stages since the supplier can find it hard to commit to the project when involved in such a late stage.

RQ2: What are the requirements for an industrial manufacturer for involving a supplier in different stages of the NPD process?

The case study has complemented the literature with requirements to consider when involving a supplier in different stages of the NPD process. It’s important for the supplier to understand where
their own core capabilities can help and what the core capabilities of the buyer is, which then would be left for the buyer to handle. This will also help a company decide on a vision to which an organization can align. Components that are strategically important and has a crucial impact on performance must be kept in-house. Processes that doesn’t qualify to this area could be performed by suppliers. If the component is within core competence then the suppliers can be involved later to have a more transactional relationship, since all competence is in-house and the buyer can reduce the risk of being locked in with one supplier. On the other hand, if there is knowledge that the company does not possess than it is important to involve the supplier as early as possible to get needed knowledge and insight from the supplier.

This also goes hand in hand with the concept of involving supplier late when it concerns straightforward products. These are often products that are similar to products that have been developed before and therefore does not require any external input since all knowledge needed exist in-house. When developing a complex product, a more agile process is required, since the technology or processes might be new, the process would benefit from using the knowledge from the suppliers early on. If the product is complex the need of getting supplier's input early is more important, otherwise the project will risk getting unwanted surprises later on. In general, if a supplier possesses a high design expertise and their technology experts can help with key insights in creating new product, then the supplier should be included early in the process. The supplier would in this case be able to increase the knowledge regarding product, resulting in fewer design loops.

By establish a strategically close relationship with key suppliers, opportunities such as knowledge sharing and sharing of solutions occur. This could be achieved by auditing key suppliers and let them be part of a group of preferred suppliers that should be preferable used when developing new products. Letting suppliers know that they are on such a list will tell them that the buyer has an intent of a long term business which will help in building trust and give suppliers incentives to give input on projects they might not end up executing.

The investment decision to order tools and the manufacturing of the tools takes usually too much time. This process could be reduced both by aligning internal capabilities as well as using the suppliers more efficiently. The drawings need be given to the purchasing department earlier, so they will be able to order the tools sooner. However, then the suppliers need to be involved earlier to help out with development and testing of the prototype, to get answers regarding manufacturability and if it is even possible to produce in a machine. If the suppliers were involved
in the earlier stages, the time spent in stage 3 and 4 could be reduced since the time spent just waiting on the tools would be reduced as well as choice of supplier.

**MRQ: How can supplier involvement in the NPD process provide time-to-market, cost and quality advantages?**

Based on RQ1 and RQ2 the main research question could be answered.

A structure for what’s strategically important will lead to an organization that better can collaborate with a supplier which will require support from management. Time-to-market will be shortened as the process becomes more agile, resulting in less stand-by time as well as reduced iterations of activities by doing them correctly from start. A clear structure for work tasks and whose job it’s to execute them will also help with efficiency since everyone will know what’s expected of them, resulting in less activities just waiting for someone to start with. By using pre-developed technology and using innovative ideas of suppliers, time-to-market advantages could also be achieved, meaning that less time is spent in the first stages.

Internal alignment will result in a shorter time-to-market as activities won’t have to go through as many iterations. Using existing capabilities and knowledge from the start will help in developing better solutions from the beginning. Better internal cooperation will have a positive outcome on the whole NPD project as communication will function better and lead to a better flow of knowledge and information and less misunderstandings between R&D, Purchasing and suppliers. The key is to involve the purchasing department, making them work more active in establishing connections to suppliers and obtaining in depth knowledge about them in order to assist R&D in a better way. Establishing a base of ‘preferred suppliers’ will result in a much more efficient process and valuable access to knowledge and capabilities as R&D and Purchasing will know who to contact, what information they need and what they can do. This allows for faster input to solve problems as it minimize standby time, trying to find everything needed. This fact will drastically reduce the time-to-market and development costs and in the same time increasing the quality. This requires trust and will lead to less controlling and monitoring activities, both when already knowing a supplier and trying to find a new one, which both takes a lot of time and cost a lot of money.

Becoming more structured and efficient in using all capabilities, will lead to reduced labor and development costs. By having a clear focus in R&D could mean a reduced labor force or increased
competitive advantage as the whole department won’t be in charge of ‘plain work’. Using a supplier for their innovative ideas and pre-developed platforms, could also lead to reduced costs seen to components as they no longer will be specific for one company, meaning that larger quantities are manufactured resulting in lower prices. It will also reduce the time it takes for locking in tools and the time it takes in ordering these which is a process that puts projects on standby.

By having a clear focus on what to do and not to do will also lead to higher quality as activities will be performed or supported by the company that actually does it best. More knowledge and expertise results in less defects and better designs, thus increasing the quality of both process and product. Knowing what’s expected and understand what’s to be accomplished seen to all involved parties, will reduce errors, iterations and other delays resulting in lower costs and at the same time increasing quality as knowledge is better shared.

### 6.2 Managerial implications

In order to enable a better collaboration, there are certain things that need to be dealt with. These form managerial implications, which can be seen as strategic objectives for managers.

- Sort out which capabilities and activities that are strategically important. Change management has been found to be critical in order to implement something as complex as a collaboration plan. The organizational structure, culture and way of working most often need to be changed and are thus dependent on management. It’s important to create a structure and guidelines for how to work internally and externally.

- The stage-gate process itself has been found to be static where time advantages could be reached if altered. It’s believed that many activities could be ongoing parallel to each other instead of after one another putting the projects on standby for long periods of time. This will require the process to be analyzed and tested in depth.

- A company first needs to build credibility for the collaboration at senior level and within the organization. This requires discussing the opportunities generated by a better collaboration with all parties involved. Today it’s unclear whose responsibility it is to see to that certain tasks, valuable for collaboration, gets executed. Creating cross-functional teams, consisting of R&D, Purchasing and possible suppliers, would enable the work to be
coordinated and information and knowledge to flow better between internal divisions.

- Trust is earned and isn’t something that is built in a day. This means that a company must start somewhere. It’s important to show the intent of a long term business as it has a positive effect on trust. In setting up common goals you provide a roadmap for the collaboration which can increase the chances of success. Taking risks is a part of the journey towards trust, possibly leading to success.

- The suppliers should be chosen based their capabilities where clear requirements are set to form and develop preferred suppliers. Setting these requirements can be hard as well as the risk of becoming locked and too dependent on one supplier, losing the power and control over costs. This is why identified incentives should be measurable in order to continuously evaluate them to be able to modify and make changes to maintain a win-win situation. A structure containing KPI will be an important tool to handle risk and reward.

### 6.3 Sustainability and ethical aspects

Because of the complexity of the concept ‘sustainability’, there are several different definitions of the term. Perhaps the most common definition of sustainable development comes from the Brundtland commission “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations Commission on Sustainable Development, 2007). To reach above definition, many organizations have adopted the concept of triple bottom line which refers to the three sustainability aspects (Elkington, 1994);

- Environmental
- Social
- Financial

In this study the two aspects, social and financial, has been in focus since the managing of relationship has no direct impact in the environmental aspects. However, this research enables companies to understand the difference that are required in the relationship between a buyer and supplier depending when and where the supplier is involved, which in turn can lead to a more efficient use of manufacturing processes and raw material, increasing the level of environmental
sustainability. Social sustainability pertains the welfare of the employees, while economical sustainability regards capturing economic value (Elkington, 1994).

Several interviewees, both buyer and suppliers, comment that there is important to trust each other to be able to sustain an efficient relationship. By working and having a closer relationship with selected preferred suppliers a sense of trust is achieved since a familiarity of the working procedures and the contact people is established, which in turn leads to more efficient processes and less stressful employees. Furthermore, the importance of letting the suppliers know what is expected from them will increase their willingness to share their knowledge, which in turn will increase the relationship between the two parts. This shows that involving the suppliers in the right way can increase the social aspects of sustainability.

The focus of this study is mainly to achieve resource efficiency by using the supplier in a better way in the NPD process to create a long term financial sustainability for both parts. By shortening the time-to-market, the company increase its value creation, both in terms of less resources used and in terms of competitive advantage of being faster to the market. Through involving the supplier more efficient and through more efficient relationships, the suppliers can sustain a longer financial perspective, since the supplier can focus on value creation rather than competing for new business. This will in turn lead to increased level of economical sustainability.

Lastly, the research was conducted with the aim of achieving a high level of ethical standards. Through respecting the interviewee’s integrity during the case study, explained in the method chapter, the ethical standard of this research was achieved.

### 6.4 Further research

Based on the limitations and the chosen method have led to suggestions for future research as well as aspects to considered if the study would have been done again.

The insights from the case study is limited to include only one supplier, to broader the insights and to increase the study’s external validity a case study including more suppliers would have been interesting, since a lot of insight that the study base its conclusion on are based on the opinion from the supplier. It would also be of interest to expand this research to involve more departments at both the buyer and the supplier in order to draw broader conclusions regarding the study’s external validity on an organizational level.
On the other hand, studies could be conducted as a single case study, which would probably give more in-depth information regarding the study under investigation. Both from the perspective of a supplier as well as the perspective from buyer. Given the time frame, these solutions could justify that the study includes more departments and not only purchasing and R&D at the buyer and sales and supply chain manager at the supplier. This would increase the in-depth of the study as well as giving a broader view of the entire value chain under study.

Further, there are limitations when it comes to the number of interviews that was conducted in the case study. By conducting additional interviews, a higher validity would have been achieved. This would also decrease the risk of bias from the interviewees since it would be able to identify invalid data and triangulated valid data. By expanding the time frame of the study more interviews would be able to be conducted at the case company, and therefore it is of great interest to include more interviewees and more companies connected to the area.

Last, this study has given recommendations on different action points that an organization has to consider when involving a supplier. However, the action points have not been tested and a research area could thus be to test these findings.
References


Appendix
Appendix A - Interview Guide

A. Introduction
● Present a brief description of our project.
● Purpose of the thesis

B. Background of interviewee
● How long have you been at the company?
● What is your role at the company? In the project?

C. NPD specific questions
● What does this process look like in general terms?
● How does this process differ from the generic framework?
● What areas are the most time consuming part in the NPD process?

D. NPD involving supplier
● How would you define a buyer-supplier relationship?
● What is the supplier’s role in the NPD process? Why?
● Could the process be more efficiently executed if collaborating with the supplier? If so, what is then needed seen to critical factors?
● Is the supplier only seen as a supplier of gods or/and as a part of the innovation process? How? Why?
● Where and how are they involved in the process? Early? Later? Why?
● To what extent is the supplier involved in the process?
● What critical factors are needed to succeed in buyer-supplier collaboration? Any difference between early and late supplier involvement?
● Could you indicate how you go about and ensure that these factors are present within the relationship? Which practical actions do you undertake?
● Do you think it is important to involve suppliers in the NPD process for the success of the project?
● Do you agree that the more successful the collaboration is with the supplier, the better the performance of the NPD project? Why or why not?

E. Internal Collaboration
● How are purchasing involved in NPD projects and do you collaborate? And their role regarding the collaboration with suppliers?
● How are the goals aligned between purchasing and R&D when working with a supplier in NPD?

F. Success factors with own words.
● Can you give me, according to you, the most critical factors to succeed in buyer-supplier collaboration in NPD?
● How do you know a project is successful? What is the outcome when successful? Metrics?
● When a supplier are involved in the NPD process do you achieve a shorter time-to-market? Better quality? Less cost?
Success Factors

G. Please discuss these success factors, depending on in which phase the supplier is involved, for supplier involvement in the NPD (gate-way) process.

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<tr>
<th>Success factor</th>
<th>Very Early (Phase 1 and 2) Idea and scoping</th>
<th>Early (Phase 3) Business case /Concept development</th>
<th>Middle (Phase 4) Design and Development</th>
<th>Late (Phase 5) Testing &amp; validation /Ramp-up and launch</th>
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H. Last thoughts
- Based on our questions, what could Company A do with regard to collaboration to be more successful, seen to time-to market and innovativeness?
- What are your thought of the topic in general?
- Any questions or feedback to us?
### Appendix B - Definition of factors used during the interviews

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<th>Factor</th>
<th>Explanation</th>
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<td>“One party’s confidence that the other party in the exchange relationship will fulfill its promises, commitments and will not exploit its vulnerabilities.”</td>
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<td>Communication</td>
<td>“The formal as well as informal sharing of meaningful and timely information between firms”</td>
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<td>“Clear communication will lead to less assumptions and is also important for technical specifications so that they are formulated in a way that is agreed upon.”</td>
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<td>Partner capability</td>
<td>“Organization’s capability to achieve the set goals of the partnership based on its resources.”</td>
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<td>“Innovation abilities of the supplier as well as its technical adaptation to market changes to determine feasibility of long term success as the end goal with the collaboration is to achieve a sustainable competitive advantage.”</td>
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<tr>
<td>Commitment</td>
<td>“Responsive and active cooperation.”</td>
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<td>“Belief that a relationship will last indefinitely and therefore requires the highest potential effort to achieve it.”</td>
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<td>“The commitment can be demonstrated by allocation resources in form of investments, manpower and facilities to operate in.”</td>
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<td>Incentive</td>
<td>“Feeling that there is something to gain by collaborating.”</td>
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<td>Common vision</td>
<td>“A common view on long term strategy and product development.”</td>
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<td></td>
<td>“Sharing information on the strategic and technical direction of each company.”</td>
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<td>Internal alignment</td>
<td>“Build credibility for the collaboration at senior level and all parties involved within the organization, to create an understanding for the opportunities generated by the relationship.”</td>
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<td>Management support</td>
<td>“Supervise crucial changes in organizational structure, culture and way of working to create internal consensus with regard to long and short term goals as well as strategic and technological direction.”</td>
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## Appendix C - Critical factors for buyer-supplier collaboration

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