Supplier involvement in New Product Development

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Management Summary

In today’s competitive market environment a new product development process determines a firm’s success or failure. In order to control the challenges in the new product development process, buying companies involve their suppliers. The purpose of this study is to identify the positive and negative effects of a new product development process with a supplier involved. Eventually, this study can be of use for managers facing this challenge.

The new product development process consists of 5 stages in which suppliers can always be involved. In this study it is found that suppliers should only be involved early in case they deliver complex, crucial items or technologies. Different authors argue that early supplier involvement is always better, however most authors suggest that a manufacturer should only involve suppliers who represent high value and complexity.

This study concludes that the overall positive effects of supplier involvement are a decrease of development costs, development time and product costs as well as an increase of product value and quality. Long-term effects are know-how sharing, high investments on R&D by the supplier and helping each other when facing problems. The most common negative effects of supplier involvement are communication barriers, skills and knowledge barriers and commitment barriers.

As concluded from this study, a firm facing this challenge should consider when and to what extent a supplier should be involved, next to the capabilities and culture of the supplier. Also, shared training, risks and reward sharing, clear targets, and supplier representation on a manufacturer’s new product development team decreases the identified barriers. Furthermore, it is recommended that companies analyze their internal organization in order to decrease the internal resistance and to increase communication and commitment.
Preface

This bachelor thesis is the completion of the pre-master Logistics and Operations Management, which I started in September 2009. After completing my HBO Business Logistics study I felt I was not finished studying on this subject area. Therefore I enrolled this pre-master to be able to enroll to the MSc Supply Chain Management next September.

While briefly conducting the literature on Supply Chain Management my interest was attracted to the organization of new product development in manufacturing companies. Since this scope was too broad I further got into the literature and found that supplier involvement is, some say, critical in new product development. The questions arose how manufacturers should collaborate with their involved supplier as this must give challenges for both parties. Therefore, this study emphasizes on the effects of supplier involvement in new product development and studies how companies should deal with suppliers. Eventually, firms can use this thesis as a guideline to construct a successful new product development process.

I would like to thank dr. ir. Cindy Kuijpers for her support and help at the meetings while writing this thesis. For now, I hope you take pleasure in reading this thesis, and I appreciate your interest.

Tilburg, June 2010

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1. Introduction

In research it is found that today’s competitive markets faces several general trends; including rising global competition, more rapid technical change and the need for the faster development of products with higher quality and reliability (McIvor and Humphreys, 2004).

1.1 Problem indication

The above mentioned sentence implies that faster development of new products, it is one way to gain a competitive advantage over a firm’s direct competition. For many companies and industries new product development determines a company’s success or failure (Schilling and Hill, 1998).

In practice, Maffin and Braiden (2001) state, new product development represents a complex challenge for many companies today. They state that companies have to cope with an increasing number of product and process technologies. Therefore companies are increasingly involving their suppliers in their new product development process. Supplier involvement concerns the integration of the capabilities that suppliers can contribute to product development projects (Dowlatshahi, 1998).

Different papers suggest that supplier involvement in new product development could lead to higher innovation (Afuah, 2000) and even the manufacturer’s financial performance lead to an increase (Carr and Pearson, 1999). Van Echtelt, Wynstra, van Weele and Duysters (2008) concluded based on other studies that extensive supplier involvement in product development processes increases the productivity, speed and product quality in product development. The mentioned product and process technology complexity of product development could be decreased by involving a supplier (Maffin and Braiden, 2001)

However, there are also downsides on supplier involvement. Van Echtelt et al. (2008) state based on earlier studies, that managing supplier involvement in product development poses quite some challenges. Hoegl and Wagner (2005) found empirical evidence that not all managers support the proposed positive effects of supplier involvement in product development processes.

The purpose of this research is to identify all the possible positive and negative effects of supplier involvement in new product development. This paper can be used as an overview for companies to determine how companies can cope with these negative effects and optimize positive effects of supplier involvement in the new product development process. Eventually, this will help companies to construct a successful new product development process with a supplier involved.
1.2 Problem statement
Deriving from the problem indication, the following main question is determined:

‘How should companies construct a successful new product development process with a supplier involved?’

1.3 Research questions
In order to answer the main question the following sub questions are formulated:

1. What is new product development?
2. How can a supplier be involved in new product development?
3. What are the positive and negative effects of supplier involvement on new product development?
4. How should companies cope with these negative effects and optimize positive effects?

1.4 Methodology
The answers on the research questions are based on a literature review of the specific subjects. The literature on supplier involvement and new product development is conducted through article search engines ABI/Inform Global and ScienceDirect at the library of Tilburg University. Via those search engines academic journals and articles can be found which ensures the quality of the input of this particular study. The main topics of this study are ‘new product development/NPD’, ‘supplier involvement’, ‘integration’ and ‘long-term / short-term relationships’.

1.5 Structure of the report
The structure of this report is basically based on the research questions. In Chapter 2 new product development is defined and the characteristics of new product development are described. Chapter 3 deals with research question 2 and combines supplier involvement on new product development. Chapter 4 describes the positive and negative effects of supplier involvement on product development. Chapter 5 describes how companies should cope with these negative effects and optimize the positive effects found in Chapter 4. Chapter 6 concludes the earlier findings from the other chapters, gives the answer to the main question and gives recommendations for further research.
2. **New Product Development**

This chapter clarifies new product development and its characteristics as this is the basis for chapter 3 to chapter 6. Section 2.1 is the introduction of new product development. Section 2.2 describes where the new product development process takes place in the Product Lifetime Cycle. Section 2.3 shows the new product development process while Section 2.4 identifies the essence of new product development.

2.1 Introduction

Before continuing on supplier involvement in a new product development (NPD) process first the NPD process is defined:

Handfield, Ragatz, Petersen and Monczka (1999) define NPD as all efforts focused on creating a new product, process or service. Krishnan and Ulrich (2001) define NPD as the transformation of a market opportunity and a set of assumptions about product technology into a product available for sale. This implies that a firm should always link the customer’s need and a firm’s capabilities to create and develop a product to sell on a particular market (Krishnan and Ulrich, 2001).

2.2 **New product development in the Product Lifetime Cycle**

In order to clarify where the NPD process takes place the Product Lifetime Cycle (PLC) as Vernon (1966) has described it, is shown in Figure 1.

![Figure 1: Product Lifetime Cycle; Based on the Product Life Cycle-theory (Vernon, 1966)](image-url)
As can be seen in Figure 1, a PLC has 5 different stages in which the sales volume changes over time. A short explanation of the stages is as follows:

- 1. Development: In this stage there are no sales and a firm will focus on introducing the product in the market, which is the total NPD process described in Section 2.3.
- 2. Introduction: The in stage 1 developed product is introduced to a market. Also in this stage the product is exported to comparable countries.
- 3. Growth: A product is copied by other countries and production will move to other countries to lower production costs. The sales volumes are still rising.
- 4. Maturity: The product is facing its maturity state, such that sales volumes stop growing. The company who can produce the product at the lowest costs can gain an advantage over its competitors.
- 5. Decline: Countries who live in prosperity descent the product and to markets change to poorer markets, such that the sales volume is decreasing.

The NPD process happens in the ‘Development’ stage. This is the stage where this study focuses on.

2.3 New product development process

Cooper and Kleinschmidt (1995) state mainly based on their earlier studies, that a company’s overall new product performance depends on: the NPD process, organization for new products, a firm’s new product strategy, culture and climate and corporate commitment. Since the purpose of this study is to identify effects of supplier involvement in NPD processes, only this aspect is of interest. Organization for new products, for example, will be of interest when a supplier is involved, for now the NPD process is the most important aspect. Also because NPD process is about creating a new product and not about how to market that particular product, the distinction is made.

In order to clarify what is included in the NPD process, a process map is shown in Figure 2 below. It is a theoretical model of Handfield et al. (1999) which is based on 17 case studies and on results of survey on supplier involvement in 134 companies worldwide.

![Figure 2: New product development process (Handfield et al. 1999)](image-url)
As this model is created by Handfield et al. (1999) their stage description has been used to prevent inconsistencies.

- In stage 1, idea generation, marketers consider the need of a new product, what it has to do and how much it might cost. Generally, customers are involved to answer these fundamental questions.

- In stage 2 the company assesses its capabilities and resources to design and produce the proposed product.

- Stage 3, concept development, the creation is defined, a preliminary prototype model may be created for that purpose.

- In stage 4, the actual development process, the blueprints and design specifications are prepared.

- In stage 5 the final prototype can be built and tested. Also in stage 5 all the production facilities and processes are prepared for the production of the new designed product.

While studying the literature on NPD processes also another model was found, the model of Wynstra, van Weele and Weggemann (2001), which can be found in Appendix 1. Since the model of Handfield et al. (1999) was the foundation of the framework of Wynstra, van Weele and Weggemann (2001) this model is used.

2.4 Importance of new product development

Brown and Eisenhardt (1995) concluded that product development is the essential process for success, survival, and renewal of organizations, especially for firms in competitive markets. Product development, as Clark and Fujimoto (1991) describe, is critical as new or improved products are the essence of competition. In most of the existing industries, companies who develop exciting products are likely to win that competition (Clark and Fujimoto, 1991). Also Olsen, Walker and Ruekert (1995) state that companies in highly competitive marketplaces should develop new products and services that are both timely and responsive to customer needs.

Langerak and Hultink (2005) state that shorter time-to-market for new products can lead to premium pricing and higher sales volume. Due to the shorter PLCs the NPD cycle time to develop new products should also decrease, Griffin (1997) argues. He also states that Womak, Jones, and Roos (1990) have concluded that products will become quicker obsolete. Therefore, they concluded that it is crucial that firms streamline their NPD process.
Brown and Eisenhardt (1995) studied what influences the performance of NPD processes. Performance is characterized by profits, revenues and market share of the producing firm. They concluded based on the result of different researchers that performance of NPD is influenced by e.g. customer involvement and the use of cross-functional teams. Also supplier involvement is one of the eight variables and is the focus of this study. Since the purpose of this section is to identify the importance of NPD it is unnecessary to describe all the influencing variables. Therefore the results of Brown and Eisenhardt's study are shown in Appendix 2. In Chapter 3 the variable supplier involvement is further elaborated.
3. Supplier involvement on New Product Development

After defining and characterizing NPD the question arises when and how a supplier can be involved in a firm's NPD process. Section 3.1 defines supplier involvement in NPD. Section 3.2 identifies when a supplier can be involved in a NPD process. Finally, in Section 3.3 the answer is given to what extent a supplier should be involved.

3.1 Introduction

Van Echtelt et al. (2008) define supplier involvement as the resources (capabilities, investments, information, knowledge, ideas) that a firm's supplier can provide, the activities performed and the responsibilities they have regarding the development of a part or subassembly of a NPD or a existing project. Dowlatshahi (1998) supports this definition as he has described that supplier involvement concerns the integration of the capabilities that suppliers can contribute to product development projects.

Since these definitions are basically similar the definition of van Echtelt et al. (2008) is used throughout this study.

3.2 When to involve a supplier

Wynstra and ten Pierick (2000) argue that supplier involvement may range from small design suggestions to the full responsibility of developing, designing and engineering of a specific part or sub-assembly. In the automotive industry, for example, suppliers now have responsibility over the complete dashboard of a car which they completely deliver at the car manufacturer's production site (Helper and Levine, 1992).

The initial model by Handfield et al. (1999), described in Section 2.3, is used to show possible integration points. Although there are only 5 stages in the NPD process suppliers can be involved in every stage, as can be seen in Figure 3.

![Figure 3: Possible supplier integration point in NPD process (Handfield et al. 1999)](image-url)
The 6 arrows in Figure 3 represent the most common integration points, based on the research of Handfield et al. (1999). It is not unusual that in the third stage suppliers are commonly integrated at the end or at the beginning of a NPD project. This implies that a supplier can be involved in the design of the creation or only deliver the prototype. It depends on the preference of the buyer/manufacturer to share or not to share sensitive information. Handfield et al. (1999) found that about 1/3 of their 121 respondents involved their suppliers in stage 3 and roughly 45% in stage 1 and 2. Although, this research is dated, it gives a reasonable insight about the situation at global operating companies.

Decisions made in the beginning of the NPD process have a large impact on the resulting product quality, cycle time and costs (Ragatz et al. 1997, Handfield, 1994). Griffin and Hauser (1992) found that Early Supplier Involvement (ESI) in stage 1 or 2 is always better. Wasti and Liker (1997) have found evidence that ESI lead to improved performance. Also stated by Handfield (1999) is that it becomes increasingly difficult and costly to make design changes when the NPD process continues. Wynstra and ten Pierick (2000) found that is it useful to early involve a firm’s supplier if the focal firm decides to give the supplier a high responsibility. However, in the beginning the project has a high uncertainty which implies that efforts and made costs are not always profitable.

Handfield et al. (1999) found that there are 2 major decisions to be made in deciding when to integrate a supplier in a specific NPD process, the supplier expertise in a particular technology and the rate of change of that technology. When both of these points are high, a supplier should be early involved in that NPD process. In the beginning of a NPD process a design or customer need is not yet clearly determined, which means that both the parties confront risk.

In the overview below the common findings of the studies by Handfield et al. (1999) when to involve a supplier can be found.

<table>
<thead>
<tr>
<th>Earlier</th>
<th>NPD process</th>
<th>Later</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Supplier of complex items</td>
<td>- Suppliers of simpler items</td>
<td></td>
</tr>
<tr>
<td>- Suppliers of systems or subsystems</td>
<td>- Suppliers of single components</td>
<td></td>
</tr>
<tr>
<td>- Suppliers of critical items or technologies</td>
<td>- Supplier of less critical items or technologies</td>
<td></td>
</tr>
<tr>
<td>- Strategic alliance suppliers</td>
<td>- Non-allied suppliers</td>
<td></td>
</tr>
<tr>
<td>- 'Black box' suppliers¹</td>
<td>- 'White box' suppliers²</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4: Integration of suppliers at a NPD process (Handfield et al., 1999)

¹ Black box suppliers: Design is primarily supplier driven, based on buyer’s performance specifications. High supplier responsibility.
² White box suppliers: Informal supplier integration. Buyer consults with supplier on buyer’s design. Moderate supplier responsibility.
Figure 4 shows what kind of suppliers a manufacturer should integrate at what time of the NPD process. Griffin and Hauser (1992) state that ESI always better is, the research of Handfield et al. (1999) provided practical evidence that it depends on your product when to involve a supplier. Clark and Fujimoto (1991) suggest that a manufacturer should involve only suppliers who represent high value and complexity early.

Based on the study of Handfield et al. (1999) it can be concluded that it is the buyer/manufacturer’s choice to decide if they share their knowledge and processes and if the designed product needs early or late integration. However, it is not a question of involving all suppliers earlier—but the right suppliers (Johnsen, 2009).

3.3 Extent of supplier involvement
Clark and Fujimoto (1991) argue that supplier involvement can operate at various levels, depending on the amount of design consigned and information shared. A firm should involve a supplier depending on the complexity and technology of a specific item or system. However, they should also distinct between different suppliers (Wynstra and ten Pierick, 2000). The focal firm might spend too much time and efforts on all of their suppliers.

A research, in which the purchasing portfolio model of Kraljic (1983), shown in Figure 5, was tested for planning supplier involvement in a development project.

![Figure 5: Purchasing portfolio matrix (Kraljic, 1983)](image_url)
In the model, Kraljic (1983) distinguishes 4 types of items:

- **Non-critical items**: There are many suppliers, such that their supplier risk is low. In general, this kind of products require 80% of purchasing department’s time, and only generates less than 20% of the purchasing turnover (Caniels and Gelderman, 2005).

- **Bottleneck items**: Kempeners and van Weele (1997) found that suppliers have dominant power for these kinds of products. For the focal company it has a moderate influence financially.

- **Leverage items**: Olsen and Ellram (1997) found that the buying company has more power as these products can be bought from more suppliers. This implies that has a low supplier risk.

- **Strategic items**: Strategic items are of large value for the buying company. It has a large impact financially and has a high supply risks. Examples are engines and gearboxes for automobile manufacturers (Caniels and Gelderman, 2005).

The study of Wynstra (1998) found that in the actual development phase, suppliers of leverage and bottleneck items become involved and in routine items suppliers do not involve until the final stage of an NPD project. The research also found that suppliers of strategic items are involved early in the concept phase of NPD process (Wynstra, 1998).

However, Wynstra and ten Pierick (2000) concluded that the purchasing model of Kraljic (1983) did not identify the development risk of supplier involvement. Therefore they created a matrix which identifies the risks and responsibilities held by the supplier, named the Supplier Involvement Portfolio, shown in Figure 6.

![Supplier Involvement Portfolio](image)

Figure 6: Supplier Involvement Portfolio (Wynstra and ten Pierick, 2000).
Wynstra and ten Pierick (2000) define development risk as ‘the importance, newness and complexity of the (successful) development of the part concerned.’ This portfolio only focuses on the development of products and distinguishes the certain involvement of a supplier.

Wynstra and ten Pierick (2000) identified 4 types of supplier relations; Strategic development, Critical development, Arm’s-length development and Routine development which are clarified below. Again, the explanation of these types of supplier relations are described as Wynstra and ten Pierick (2000) did, because they designed this theory.

3.3.1 Strategic development
Due to vague and imprecise information, given by the manufacturer, the supplier deals with a high level of uncertainty. The buyer has a high development risk which is the reason that the buyer wants close involvement. To decrease this discrepancy the firms should communicate on every level with each other. Ten Pierick and Beije (1998) state that face-to-face contact is necessary for the exchange of know-how and experience. Communication lines should be short such that departments or person from both sides can communicate directly with each other.

3.3.2 Critical development
The development of a product is characterized by low responsibility for the supplier but a high development risks for the buyer. The buyer wants to have concrete information. However, the supplier does not see the urge to share information and therefore the amount of communication is limited.

3.3.3 Arm’s length development
Arm’s length development is characterized by a formal manner of contracts and a less close relationship compared with Strategic development. Delivering information and a shared communication system is not that necessary as in Strategic development. The buyer experience low risks, such that the supplier faces the risk. This means that a buyer does not see the urge to be closely involved.

3.3.4 Routine development
Routine development has a low development risk and a low responsibility held by the supplier. The buyer organizes, co-ordinates and controls to ensure the prototypes are delivered on time. The relationship is based on keeping each other up-to-date. However, there is no elaborate shared communication system needed. In most companies, as Wynstra and ten Pierick (2000), state it is sufficient for both companies to appoint a contact person.

In Appendix 3 a guideline has been given on how a firm should collaborate with an involved supplier, in perspective of both the supplier and the buyer (Wynstra and ten Pierick, 2000).
4. Effects of supplier involvement on new product development

In this chapter all the possible effects of supplier involvement in a firm’s NPD process are described. These effects are from manufacturer’s point of perspective. In Section 4.1 positive effects are described while Section 4.2 identifies the negative effects.

4.1 Positive effects

According to Handfield et al. (1999) several studies have reported that supplier involvement can help to reduce costs and development time, increase quality and provide innovation to increase market share (McGinnis and Vallopra, 1998; Ragatz et al., 1997). Recent research of Johnsen (2009) shows that these factors have not changed over the last 10 years. He mentions that empirical evidence proves that early and extensive supplier involvement is the most important factor of NPD performance, which is again costs, quality and time-to-market benefits.

As stated in Chapter 3, supplier involvement could range from small design suggestions to full responsibility of a specific part or subassembly (Wynstra and ten Pierick, 2000). In this study on the positive effects there is no distinct made in high and low involvement as this is product-, firm- and situation specific. However, the literature does make a distinction between short- and long-term effects (Wynstra, van Weele and Weggemann, 2001).

4.1.1 Short-term effects

Wynstra, van Weele and Weggemann (2001) suggest that short-term goals are related to a specific development project in which the supplier is involved in. Short-term goals of supplier involvement can be divided into 2 main areas; development efficiency and development effectiveness (Clark, 1989; Ragatz, Handfield, and Scannell, 1997).

Efficiency in supplier involvement means reduction of development costs and development time, which is gained by preventing, reducing or introducing design changes earlier via extensive communication. Wynstra, van Weele and Weggemann (2001) argue that also that both companies should divide tasks to the most competent one. Development costs decrease when companies make more use of external ideas and technologies than internal (Kessler, 2000). Production costs also decrease due to better manufacturability of the new product (Wasti and Liker, 1997). Swink (1999) adds that better manufacturability tends to positively affect development time, reliability and overall product quality.

Effectiveness in supplier involvement means the reduction of product costs and the increase of product value. This can be achieved by mobilizing and leveraging supplier expertise (Wynstra, van Weele and Weggemann, 2001).
Ragatz et al. (1997) argue that the quality of purchased materials increases when involving a competent supplier. Handfield et al. (1999) concluded, based on prior research, that experience and expertise with the specific technology of the supplier is greater than of the manufacturer. This implies that a supplier has accurate information on where the technology can be applied. Also, the supplier can take the technological risks (Handfield et al., 1999). Although, Petersen et al. (2003) concluded that the degree of technology may be a mitigating factor, Handfield et al. (1999) found evidence that shows that earlier integration is beneficial in cases of higher technology uncertainty.

Wasti and Liker (1997) found evidence that performance improves when supplier are involved early in the NPD process. For example, in the automotive industry involving a supplier early in the NPD process has a positive effect on project cycle time and costs (Clark, 1989). Based on a large database of NPD project, Gupta and Souder (1998) concluded that the companies with short NPD cycle times mostly have involved their supplier.

4.1.2 Long-term effects
Long-term goals involve access to technological knowledge of the firms’ suppliers (Bonaccorsi and Lipparini, 1994). In the long run a firm could have interest to influence supplier decisions to invest in new technologies. Also a long-term goal could be that the two parties discuss future investments. For instance, manufacturers and suppliers in the Japanese automotive industry are highly committed to the long-term relationship. The manufacturer will help the supplier if they experience problem with costs and quality before switching to another supplier (Helper and Levine, 1992). Helper and Levine (1992) argue that these forms of high commitment lead to high investments from both sides. Ring and van de Ven (1994) concluded that a balance of formal, economic and legal and informal, socio-psychological, factors are very important for long-term relationships. Clark (1989) state that in Japan the long-term relationships include investments, sharing of knowledge and helping both parties to solve their problems.
If the companies sustain a proper communication and integration procedure the manufacturer may influence the R&D efforts of the supplier which is beneficial for the manufacturer’s future. Also when having a close relationship, the supplier may be sharing know-how on the technology (Handfield et al., 1999).

Wynstra, van Weele and Weggemann (2001) compared short-term collaboration with long-term collaboration and concluded that long-term collaboration is much more focused on supporting the development of underlying technologies and capabilities on designing new products. This is what short-term goals are not focusing on as they only make use of the technologies and capabilities. A long-term relationship between manufacturer and supplier allows the manufacturer to receive better services. Also it provides access to know-how and capabilities that the manufacturer does not master (Kalwani and Narayandas, 1995). Wasti and Liker (1997) state that in long-term relationship a supplier’s engineer and other experts can be involved in specific subprojects to finalize the new product or prototype.
4.2 Negative effects

Birou (1994) and Harley (1994) state that supplier involvement in a NPD process does not always lead to improvements in project efficiency and effectiveness. Hartley, Meredith, McCutcheon, and Kamath (1997a) even found that a supplier involved in the NPD process has little influence on the overall project success.

Wynstra and ten Pierick (2000) concluded that supplier involvement is not a poor strategy but it should be managed carefully. Also Johnsen (2009) and Primo and Amundson (2002) argue that supplier involvement faces major challenges for the management. For example, in their study to NPD project team effectiveness Petersen, Handfield and Ragatz (2005) have interviewed engineers of manufacturing companies. They state that the majority has expressed their uncomfortableness of an external supplier in their NPD team where technical information is shared and discussed.

In the following sections common barriers in supplier involvement in NPD processes are described.

4.2.1 Communication barriers

Wynstra and ten Pierick (2000) state that it takes time, effort and money for both manufacturer and supplier to set up an efficient and effective integrated NPD process. There is a chance that the manufacturer invests the same amount of time in additional communication with the supplier than it did on engineering. Supplier involvement is not useful if that is the case.

In Section 3.3 the importance of communication between the supplier and manufacturer, especially in Strategic development, is stressed. Wynstra, van Weele and Weggemann (2001) state that efficiency and effectiveness are hindered when a manufacturer cannot communicate what is expected from the supplier. A research of Gemunden and Walter (1997) has indicated exchange and communication barriers. Exchange barriers are circumstances that hinder or even prevent a timely, purposeful, and/or continued communication between manufacturer and buyer;

- diverse languages,
- group thinking, which is the phenomenon that; people tend to think what other wants them to think.
- mismatches in coding schemes, which are different interpretations of data and systems.

4.2.2 Skills and knowledge barriers

Wynstra, van Weele and Weggemann (2001) found that problems can arise when suppliers do not have sufficient knowledge and skills. In some industries supplier involvement is new, such that suppliers do not know what manufacturers expect or vice versa. However, such problems can also arise at the manufacturer itself as they cannot define their NPD process and strategy, which could lead to choosing the wrong supplier (Wynstra, van Weele and Weggemann, 2001). Due to choosing the wrong supplier the
innovation of a product may decrease such that the manufacturer may lose its competitive advantage over its competitors (Handfield et al., 1999).

In Section 4.1 it said that the degree of technology may be mitigating factor in supplier involvement. In high technology uncertainty it will be beneficial to involve a supplier early, the downside of this is that the manufacturer is dependent on the supplier (Handfield et al., 1999). This could lead to a loss of innovation, know-how and experience. The dependence of a supplier is higher when the NPD is difficult (Primo and Amundson, 2002).

4.3.3 Commitment barriers
Another important issue is the priority and co-operation of suppliers which may also delay the NPD process (Primo and Amundson, 2002). Based on their empirical study in the electronics industry they concluded that managers do not perceive that suppliers can speed up the NPD process, and even slow it down. McCutcheon, Grant and Hartley (1997) argue that limited commitment of the supplier makes the collaboration more difficult. According to Ragatz et al. (1997) is trust in each other’s capabilities and commitment of great influence of a healthy relationship. The larger difference between the supplier and manufacturer the greater the efforts, time and costs may be to strive towards common goals (Susman and Ray, 1999). Also, King and Pensleskey (1992) found that by means of vendor monitoring; along with manager selection, attention to physical engineering design, and bureaucratic checkpoints a supplier could even have a negative impact and delay the NPD process.

Even as important for a manufacturer is to keep their own resources, skills and supplier relations intact, suppliers with high innovation power may decrease the manufacturer’s value of these elements (Song and Parry, 1999). Exactly that is the reason why the manufacturer can come across internal resistance at the departments who are mostly affected by the supplier involvement. For example, Wynstra, van Weele and Weggemann (2001) found at their empirical study at DAF Trucks, a Dutch producer of trucks, that development engineers felt threatened when supplier involvement was introduced.

As described in the beginning of this section, Johnsen (2009) found that supplier involvement has major challenges. By these challenges he means the need for internal coordination, advanced supplier selection processes, and long-term relationship adaptation to create supplier relationships with high levels of trust and commitment (Johnsen, 2009).
5. Dealing with negative effects and optimizing positive effects

Companies which are trying to set up a successful NPD process are facing the effects described in Chapter 4. This chapter provides information how company should cope with the negative effects and optimize the positive effects found. In Section 5.1 is described the main reasons for failure. Managers should consider the time to involve a supplier in a NPD process which is stressed in Section 5.2. Section 5.3 explains the factors that lead to successful supplier involvement. Section 5.4 describes a manufacturer should organize their internal organization regarding NPD.

5.1 Reasons for failure
Research indicates that supplier involvement in NPD could be beneficial for both long and short term effects (Wynstra, van Weele and Weggemann, 2001). Wynstra, van Weele and Weggemann (2001) state that not all companies are able to realize these benefits. Most problems are due to lack of communication and trust, insufficient supplier abilities and willingness, and internal resistance at the manufacturer (Wynstra, van Weele and Weggemann, 2001). MacDuffie and Helper (1997) state that manufacturers often find it hard to motivate and mobilize a supplier to collaborate since the supplier has more customers who ask the same when having the same kind of products.

5.2 When to involve a supplier
It is a different study to find the right time to involve a supplier in a NPD process. Although it is stated in that a supplier should not always be early involved, most studies have identified that for Strategic development fast NPD is associated with early (Gupta and Wilemon, 1990) and extensive (Clark and Fujimoto, 1991) supplier involvement. This implies that early supplier involvement is critical for Strategic items. However, McGinnes and Vallopra (1999) state that the success of a new product is not depending on the early involvement of a supplier, instead it depends on the situation and kind of products. It may also be difficult to achieve the early involvement as there is no certainty which suppliers will be used (Eisenhardt and Tabrizi, 1995). Primo and Amundson (2002) concluded that there is full support to use suppliers in NPD process, however there is mixed support for early involvement. Like mentioned above, this is a different study but is something managers should consider while starting a NPD process.

Wynstra and ten Pierick (2000) concluded that if manufacturing companies do not make any distinction between different types of supplier involvement, it would lead to unnecessary co-ordination and managing of the supplier relationship.
5.3 Successful supplier involvement

Additional to the manufacturer’s internal organization Littler, Leverick and Bruce (1995) concluded on a research of 106 UK manufacturers that successful supplier involvement is affected by frequent intercompany communication, building trust, establishing partnership equity, ensuring that parties contribute as expected, and employing a product or collaboration representative.

According to Ragatz et al. (1997) barriers in the supplier relationship can be structured by; Shared education/training, a formal trust development process, formalized risk/reward sharing agreements, joint agreement on performance measurements, top management commitment from both companies and confidence in the supplier's capabilities. Relationship structuring, as described above, ease integration and sharing of assets. However, it does not directly affect the speed, costs and quality benefits of NPD. The model of Ragatz et al. (1997) is included in Appendix 4.

5.3.1 Successful supplier involvement model

The model of Johnsen (2009) is more recent than the model of Ragatz et al. (1997). Since this model includes all the aspects of the model of Ragatz et al. (1997) and demonstrates that these aspects still count for supplier involvement on NPD, the model of Johnsen (2009) is shown in Figure 7. The model below is fed by literature research from the last 30 years.

![Figure 7: Factors affecting supplier involvement success (Johnsen, 2009)](image-url)
The result of these factors should lead to shorter time-to-market, improved product quality and reduced development/product costs, which are the most important overall positive effects of supplier involvement on NPD (Johnsen, 2009). In the following sections the influencing main groups are further elaborated.

5.3.2 Supplier selection
As stated earlier there is support for ESI in the first stages of the NPD process. However, Johnsen (2009) concluded that not all the suppliers should be involved early but only the right suppliers. The suppliers that should be involved early are the suppliers of high value parts and complexity (Kamath and Liker, 1994). These suppliers have to be chosen according to their capabilities and commitment (Petersen et al., 2005).

5.3.3 Supplier Relationship Development & Adaptation
This main group includes the factors concerning the integration of the manufacturer and supplier. This can be stimulated by shared training (Ragatz et al., 1997), mutual trust, and commitment (LaBahn and Krapfel, 2000; Song and Benedetto, 2008), risk and reward sharing (Ragatz et al., 1997), agreed performance targets and measures (Petersen et al., 2005), and supplier representation on the manufacturer’s NPD team (Ragatz et al., 1997).

5.3.4 Internal Customer Capabilities
This main group includes the factors for the internal organization of the manufacturer, which is divided by commitment and cross-functional coordination (Hillebrand and Biemans, 2004). This ensures the right basis for trust and commitment in the relationship (Johnsen, 2009). Since the internal organization is the basis for the most common negative effects described in Chapter 4 it is even further elaborated in Section 5.4.

5.4 Manufacturer’s internal organization
In order to minimize the internal resistance a manufacturer should analyze its internal organization. Wynstra, van Weele and Weggemann (2001) discussed 3 issues that a manufacturer faces in achieving effective and efficient supplier involvement. To manage supplier involvement appropriately, a firm should:

5.4.1 Processes
1. Identify the specific processes and tasks that need to be carried out. According to Wynstra, van Weele and Weggemann (2001) it is important that companies not only focus on individual development projects.
They suggest to distinct 4 types of management areas with different time horizons, which would have to be seen as complementary, namely:

- Development Management; general policies and strategies of supplier involvement in NPD.
- Supplier Interface Management; setting up an infrastructure or network that can be of use in the NPD process.
- Project Management; management of the actual development process
- Product Management; this is closely complementary with product management as this defines the actual product specifications of the NPD process.

Since distinction between these different management areas it is possible to define more adequate what is expected of the supplier involved. Research of Wynstra, van Weele and Weggemann (2001) indicated that not many companies are trying to manage all of these areas. In Figure 8 these different areas of management graphically reproduced (Wynstra, van Weele and Weggemann, 2001). In this framework the different time horizons and activities of the management areas can be recognized.
5.4.2 Organization

2. Form an organization that supports the execution of those tasks to the purpose of supplier involvement. Wynstra, van Weele and Weggemann (2001) stress the importance of an internal organization which supports the involvement of a supplier. Communication needs to be organized and it seems to be preferable to have close physical communication lines in NPD teams (Anklesaria and Burt, 1987; Moenaert and Caeldries, 1996). Also it is important that a company decides what they expect of the supplier. According to Handfield et al. (1999) the manufacturer should for example decide which company remains the technology leader.

5.4.3 Staff

3. Staffing the organization with people that have the right skills. Wynstra, van Weele and Weggemann (2001) argue that human resources are critical in supplier involvement. Also from the supplier’s perspective, if an engineer of the supplier do not find the manufacturer’s representative capable of adding value in the process their involvement would not be very effective (Dobler and Burt, 1996). Value in staff is created by;

- the kind of previous experience,
- kind and level of education/training,
- degree of technical expertise,
- degree of pro-activeness,
- abilities as perceived by others,
- social skills.

As a closing remark; organizing the internal organization decreases the internal resistance, increases communication and commitment, all common negative effects of supplier involvement (Johnsen, 2009).
6. Conclusion

6.1 Conclusions and recommendations

In the introduction it is mentioned that a new product development (NPD) process determines a firm’s success or failure, which implies that a successful NPD process can be a competitive advantage. It was found that involving a supplier in the NPD process could have benefits for the manufacturing company. However, involving a supplier in a critical process has negative effects. Therefore, this study focused on the possible positive and negative effects of supplier involvement in a firm’s NPD process. Eventually, managers could use this study as a guideline, since it also determines how a firm should cope with negative effects and optimize positive effects.

In the previous chapters, all sub-questions formulated in Section 1.3 have been answered in order to draw a conclusion. This conclusion answers the problem statement, formulated as follows: ‘How should companies construct a successful new product development process with a supplier involved?’

Via a literature study of academic articles and journals the NPD process is clarified in Chapter 2. It is found that the NPD process consist of 5 stages. Since shorter time-to-market for products can lead to premium pricing and higher sales volumes it is crucial for companies to streamline their NPD process. In order to emphasize the importance of supplier involvement the study of Brown and Eisenhardt (1995) is conducted, as they concluded that supplier involvement is one of the eight influencing variables on NPD performance.

That variable is elaborated in Chapter 3. In that chapter the construct is defined and it is determined when as well as to what extent a supplier should be involved. Adapted from literature, there are 6 common integration points in the NPD process. It is found that suppliers should be involved early in case they deliver complex, crucial items or technologies. Different authors argue that Early Supplier Involvement (ESI) is always better, however most authors suggest that a manufacturer should only involve suppliers who represent high value and complexity. To what extent a supplier should be involved is also a vital decision a manager should make. Therefore, Wynstra and ten Pierick (2000) introduced the Supplier Involvement Portfolio in which they distinct 4 types of supplier relations determined by development risk and degree of responsibility held by the supplier. Firms should decide what kind of product they are about to develop which in turn means that they know how they should set up that relationship.

In Chapter 4 the positive and negative effects of supplier involvement are identified. All authors agree that short-term efficiency and effectiveness increases when involving a supplier. By this it is meant, decrease of development costs, development time and product costs as well as an increase of product value and quality. Long-term effects are know-how sharing, high investments on R&D by the supplier and helping each other when facing problems. The most common negative effects of supplier involvement are communication barriers, skills and knowledge barriers and commitment barriers.
Conclusively, in order to streamline a NPD process it is interesting for managers to see how they can construct a successful NPD process while having a supplier involved. A successful NPD process is characterized by shorter time-to-market, improved quality and costs reduction.

A firm facing this challenge should consider to what extent a supplier should be involved. The extent of supplier involvement depends on the importance of the item or technology such that a manufacturer could distinguish the suppliers. Otherwise, the focal firm might spend too much time and efforts on all of their suppliers. Since the degree of development risks determines the extent of relation between the parties it is crucial that the manufacturer, next to the capabilities, consider the culture of the supplier. This streamlines the communication and commitment, which are barriers in supplier involvement on NPD processes. Furthermore, derived from the study of Johnsen (2009), barriers are decreased when the roles, responsibilities and levels are clearly distinct. Also, shared training, risks and reward sharing, clear targets, and supplier representation on a manufacturer’s NPD team increases the success of a NPD process.

For manufacturers who involve their supplier in their NPD process it is essential that they analyze their internal organization. To manage supplier involvement appropriately, a firm should determine what specific processes and tasks need to be carried out, form an organization that supports those tasks and staff the right people in that organization. Internal organization decreases internal resistance and increases communication and commitment.

6.2 Future research

Although this study clarifies and identifies all the general effects of supplier involvement in NPD processes and how companies should make use of these effects it is not item specific. Different items need different buying strategies since, concluded in Section 6.1, a firm should not spend too much time and efforts on all of their suppliers. For example, strategic development therefore needs more and/or different attention than arm’s length development. For managers or companies facing this challenge, this study therefore might be too general. Future research could identify effects which are item specific such that managers can make appropriate decisions accordingly.

Furthermore, this study is written in perspective of the buying company. Suppliers on the other might face other challenges in their relation with a manufacturer than vice versa. Not only for suppliers it is interesting to see how they should cope with the manufacturer but also the manufacturer could learn from their own behavior. Future research should identify the effects that suppliers experience.

At last, the power of the manufacturer or/and the supplier in the relationship is not admitted in this study. Most research concentrates on large powerful manufacturer/buyer and their les powerful suppliers (Johnsen, 2009). Future research could reverse this research, such that the supplier is powerful and the manufacturer is less powerful.
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Appendices

Appendix 1: NPD process

Figure 9: NPD process (Wynstra, van Weele and Weggemann, 2001).
Appendix 2: Variables influencing NPD performance

Rational Plan Model of Product Development

Team Composition
*Cross-functional

Team Organization of Work
*Planning

Team Process
*Cross-functional communication

Senior Management
*Support

Product Effectiveness
*Fit with market needs
  Unique benefits
  Quality
  Cost
  Clear concept
*Fit with firm competencies

Market
*Large
*High growth
*Low competition

Customer
*Involvement

Supplier
*Involvement

Performance
*Profits
*Revenues
*Market share

Figure 10: Variables influencing NPD performance (Brown and Eisenhardt, 1995).
Appendix 3: Collaboration relationships

<table>
<thead>
<tr>
<th>Kind of Collaboration</th>
<th>Strategic Development</th>
<th>Critical Development</th>
<th>Arm's-Length Development</th>
<th>Routine Development</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Close co-operation as 'sparring partners'; Joint development</td>
<td>Focus on obtaining information</td>
<td>Independent development by supplier</td>
<td>Informing each other about changes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direction of Communication</th>
<th>‘Two-way traffic’</th>
<th>‘One-way traffic’, at manufacturer’s initiative</th>
<th>‘One-way traffic’, at supplier’s initiative</th>
<th>‘Two-way traffic’</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Communication Medium</th>
<th>Rich media such as face-to-face group meetings</th>
<th>Lean media such as telephone and fax</th>
<th>Rich media such as face-to-face meetings</th>
<th>Lean media such as fax, mail and e-mail</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Amount of Communication</th>
<th>High</th>
<th>Medium</th>
<th>Medium</th>
<th>Low</th>
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</table>

<table>
<thead>
<tr>
<th>Functional Disciplines</th>
<th>Diverse</th>
<th>Purchasing/sales (and development)</th>
<th>Development (and purchasing/sales)</th>
<th>Purchasing/sales</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Content of Communication</th>
<th>Technical and commercial information</th>
<th>Market (and technical) information</th>
<th>Technical (and status) information</th>
<th>Status information</th>
</tr>
</thead>
</table>

| Communication Structure | ![Communication Structure](image) | ![Communication Structure](image) | ![Communication Structure](image) | ![Communication Structure](image) |

Figure 11: Different collaboration relationships (Wynstra and ten Pierick, 2000).
Appendix 4: Successful supplier integration

Figure 12: Model successful supplier integration into new product development (Ragatz et al., 1997).