

Collaborative Product Development

- Case Study within the Swedish Automotive Industry

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Preface

Writing this master thesis can be compared to a rescue mission, where three students have been trying to find the miracle solution to optimal product development collaborating within the Swedish automotive industry. The journey has been extended, containing numerous question marks, differences in opinions, and shortage of sleep. Three persons with large senses of humor, we have though overcome these obstacles through shrieks of laughter.

We want to express our gratitude to our assigner Svenåke Berglie, Managing Director for Scandinavian Automotive Suppliers, for initiating and making our research possible. Many thanks to our tutors, Claes Svensson, School of Economics and Management, Lund University and Robert Bjärnemo, Machine Design, Department of Design Sciences, Lund Institute of Technology, for your matchless guidance and feedback. Furthermore, we would like to thank Morgan Anne Munson for proofreading the entire thesis without falling asleep. We also would like to thank Anders Thornberg, consultant within product development, for being an excellent source of inspiration during our first faltering steps into the “Wild West” of the Swedish automotive industry. We would also particularly like to thank Andreas Quist, Human Resources Manager at Intentia, Malmö, for adding splendor into our work by giving us an office with as much fresh fruit and sparkling water as we could ever hope for. Finally, we would like to thank all participating companies for taking their time talking to us.

Lund, June 2nd, 2003



“No man is wise enough by himself”

Miles Gloriosus

Maria Becker

Per Henrik Johnson

Niklas Ruijsenaars

“Readers are plentiful; thinkers are rare”
Harriet Martineau (1802-1876)

Abstract

Title: Collaborative Product Development - Case Study within the Swedish Automotive Industry

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Problem: The relations between first and second tier suppliers within the automotive industry have changed drastically during recent years. Previously involving the supply of simple components, today the relation involves collaborative product development of complex subsystems. The situation is rather new for the actors, hence there are a number of problems that act as restraints for the collaboration. In order to come to terms with these problems, it is important to determine the underlying causes.

Purpose: The purpose of this thesis is to make a survey of the main problems in the collaborative product development between first and second tier suppliers within the Swedish automotive industry. Furthermore, the aim is to analyze these problems and find the underlying causes by compiling appropriate theories.

Methodology: We have chosen case study as the research method and have studied two projects focused on the development of car seats. We have carried on our study according to an abductive approach. The use of existing theories has been combined with empirical observations. First, we have studied existing theories in order to determine what to look for in the empirical study. During the empirical study, needs for new theories to help us explain the observations have emerged. Finally, during the analysis, we have combined existing theories and empirical observations in the creation of new theory. This has resulted in the model *The Wheel of Fortune*.

Conclusions: Through our analysis it has become obvious that the underlying reasons for the problems can be summarized with the lack of four critical factors: trust, mutual orientation, competence, and long-term view. Hence in order to solve the current problems in

the relations between the collaborating actors, the companies and their top management must focus on these underlying factors. However, in the process of dealing with these critical issues, the suppliers have to be aware of the industry wide factors – time and price pressure, and the power structure – that characterize the automotive industry. These factors have a great influence on how the individual companies act, but are hard to influence by single actors.

This research constitutes an important contribution in the work of Scandinavian Automotive Suppliers (SAS). It is crucial for SAS to illuminate the existing problems within the industry and enhance the common awareness about them and what are the reasons behind them. Here our *Wheel of Fortune* model is an important tool to increase understanding for why the problems occur.

Key Words:

Collaborative Product Development, Swedish Automotive Industry, Outsourcing, Customer-Supplier Integration, Supplier Involvement

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PART I

THESIS FOUNDATION

The first part of this thesis serves as an introduction to the research area and aims to create an interest and to make the reader familiar with the chosen subject of the thesis. First, the purpose and problem discussion are presented, followed by delimitation and an overview of the structure of the thesis. The last chapter is the methodology chapter. Here, an explanation of our thoughts about science and the approach taken in this study are presented.

“All progress is precarious, and the solution of one problem brings us face to face with another problem”

Martin Luther King Jr., 'Strength to Love,' 1963

Introduction

This chapter serves as an introduction to the area of research. The first section starts with a brief background description of the automotive industry. Focus lies on the situation today and what main problems the actors of the industry face. The industry description is followed by a description of the problem of the study. Furthermore, the purpose is discussed, proceeded by delimitations and an overview of the structure of the thesis.

1.1 Background

As a result of the intensified global competition during the 1980s, many manufacturers within the automotive industry have established interfirm coalitions in different component areas. This has compensated the limitation in specific models or technologies. A worldwide network has emerged in which companies compete and cooperate simultaneously. Virtually all main groups of actors in the worldwide industry are involved in the global network of cooperation.¹

Intense competition and over-capacity characterize the automotive industry of today, which has been a problem for a long period of time.^{2 3} Hence there has been immense restructuring during the last decades. This has led to new roles and responsibilities for different actors.^{4 5} The pressure is enormous on both auto manufacturers and suppliers to constantly improve their operations in order to survive. This has led to a number of mergers between OEMs.^{6 7} In order to overcome the over-capacity, there are a majority of niche markets developed within the industry. This has implied that the product complexity has been growing to a hardly manageable situation for the OEMs.⁸ Hence they have been outsourcing both production and product development to the suppliers.⁹

“Winds of change are blowing through the world auto industry”¹⁰

¹ Clark et al. (1991)

² Von Corswant (2000)

³ Heper (2000)

⁴ Lilliecreutz, February 7th, 2003

⁵ Wognum et al. (2002)

⁶ Original Equipment Manufacturer, e.g. automotive manufacturers.

⁷ von Corswant (2000)

⁸ Heper (2000)

⁹ von Corswant (2000)

¹⁰ Clark et al. (1991)

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The outsourcing has led to escalating cost and complexity of supplier relations. The OEMs have thus carried out an important reduction in the number of suppliers with whom they have direct contact.¹¹ This has been possible thanks to modularization, which means bundling products into models, systems, and platforms.¹² The remaining suppliers have been given increased design responsibility, and the restructured supply chain is characterized by tight coordination and control. The result of these changes is the development of a new industrial organization, which can be described as a pyramidal tier-structured supply base.¹³

The types of relations that appear between customers and suppliers in an industry generally reflect the character of the network. Short-term arm-length relationships are typically related to a broad supplier base where the suppliers participate in the product development to a limited extent. In contrast, there is the tiered structure, which characterizes the automotive industry. Here, the customers emphasize close cooperation in long-term relationships. This structure simplifies the communication if the division of responsibility is clearly defined. This means that the first tier suppliers should coordinate all activities performed by suppliers farther down the value chain.¹⁴

The described trends have changed the structure and the balance of power within the automotive industry. The OEMs are contributing with an ever-decreasing part of the value of the manufactured products. For instance, Volvo's share of contributed value has decreased from 70 per cent to just one half in ten years.¹⁵ This has, in turn, implied that the suppliers, especially a few global first tier suppliers, are getting more responsibility for production, product development, and logistics.¹⁶ The changes in the structure of the automotive network have major implications for the management of product development. There is a great need to balance coherence of internal product lines and product integrity with the advantage of product and component sharing across companies.¹⁷

1.1.1 The Swedish Automotive Industry

With export incomes around 96 billion SEK, which constitutes 14 per cent of the total Swedish export incomes, the automotive industry is one of the most important branches of Swedish industry. The automotive industry employs approximately 160 000 persons, about 10 per cent of the Swedish work force. In total, there are about 1200 Swedish companies which act as suppliers to the automotive industry.¹⁸ With inspiration from Japan, the auto manufacturers in Sweden have begun to restructure their supply base during the last decades. The previous large numbers of direct suppliers are now organized in a tier structure where only a few still supply the OEMs directly. The reduced number of suppliers has enabled closer cooperation on a more

¹¹ Karlsson et al. (1998)

¹² Sanchez (2000)

¹³ Karlsson et al. (1998)

¹⁴ von Corswant (2003)

¹⁵ The Vehicle Component, No 2 (2002)

¹⁶ Heper (2000)

¹⁷ Clark et al. (1991)

¹⁸ Berglie, January 17th, 2003

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long – term basis. Many companies, which previously provided the OEMs directly, have been moved down in the value chain and become second tier suppliers. The result is a limited number of large first tier suppliers, which control a complex network of subcontractors.¹⁹

1.1.2 Collaborative Product Development

The OEMs are handing over more and more of the responsibility for product development to the first tier suppliers, who, in turn, are passing it on to the second tier suppliers.²⁰ Reciprocity and commitment should characterize the relationships. In return for attaining long-term contracts, the suppliers have to take more responsibility. Reciprocal dependence implies great need for communication and close coordination.²¹ One of the most important capabilities of a company in such an environment is to be able to develop products effectively in close cooperation with other companies in the supplier network.²²

Important reasons for the extensive outsourcing of product development include the financial problems that many OEMs and suppliers face, and the constant demands for shorter development time.²³ During the past 15 years, both OEMs and suppliers are estimated to have reduced their product development time by as much as 50 per cent.²⁴ Extensive supplier involvement in product development makes it possible to gain access to knowledge and capabilities, and to share costs and risks between several parties.²⁵

It is of great importance for the manufacturers to involve suppliers with outstanding technology, sophisticated management, and global reach in the product development process. Therefore, the customer has to be very selective about which suppliers to develop long-term relationships with. Thus a key success factor in supplier integration is the customer's knowledge of the supplier's capabilities.²⁶ Management of relationships is, however, a very complex task, and research has shown that more than 50 per cent of the collaborative attempts are unsuccessful.²⁷ Hence manufacturers are developing closer links with fewer suppliers. The management of relationships is thus becoming more crucial in order to survive in the hardening competition.

1.2 Problem Discussion

As already mentioned, the trend of outsourcing product development does not only include the OEMs. The first tier suppliers have outsourced the development of

¹⁹ von Corswant (2003)

²⁰ www.fordonskomponentgruppen.se, February 3rd, 2003

²¹ Clark et al. (1991)

²² von Corswant (2003)

²³ Lilliecreutz, February 7th, 2003

²⁴ Global Automotive Survey (1999)

²⁵ Wognum (2002)

²⁶ Handfield et al. (1999)

²⁷ Littler et al. (1995)

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subsystems to the second tier suppliers.²⁸ This requires more communication between the involved actors²⁹. The relations between the first and second tier suppliers are not problem free, though.³⁰ As in any customer-supplier relation, there will always be problems that need to be taken care of in order to constantly improve the cooperation. Numerous studies have been performed in the area of collaboration between buyers and suppliers in order to find the key to successful management. Previous research makes it possible to identify several of these success factors for managing a fruitful cooperation.³¹

Collaborative product development has been the focus of many studies, especially within the automotive industry. Since most studies have focused on collaboration from the customer's perspective, however, there is still a need to investigate the relations from a dyadic perspective. Furthermore, practically all studies have focused on the collaboration between OEMs and first tier suppliers. Since outsourcing is spreading down the supply chain, it is interesting to study the collaborative product development between first and second tier suppliers.

The difficult situation of Swedish automotive suppliers necessitates the presence of an industry organization, whose main purpose is to improve the conditions within the industry. Scandinavian Automotive Suppliers (SAS) is a non-profit professional organization for Scandinavian companies that supply the automotive industry. There are currently almost 300 member companies. A large majority of which is Swedish. During SAS's 20-year history, the organization has acted as a face of the suppliers for vehicle manufacturers as well as the public sector. Another important mission of SAS is to conduct research with the aim of understanding underlying factors that affect the success of the industry.³² Hence SAS has initiated this study of collaborative product development, since it is one of the most critical issues in the industry today.

Figure 1.1 illustrates the supply chain of the Swedish automotive industry. The focus of this thesis is indicated with a circle around the relation between first and second tier suppliers. This relationship is especially interesting to study since it has changed drastically during recent years. From previously involving the supply of simple components, the relation today involves collaborative product development of complex subsystems. Since the OEM affects the relation between first and second tier suppliers, we also take Volvo into consideration within our study. The situation is rather new for the actors, hence there are a number of problems that act as restraints for the collaboration. In order to come to terms with these problems, it is important to determine the underlying causes.

²⁸ von Corswant et al. (2002)

²⁹ Wognum et al. (2002)

³⁰ von Corswant et al. (2002)

³¹ von Corswant (2003)

³² www.fordonskomponentgruppen.se, May 15th, 2003

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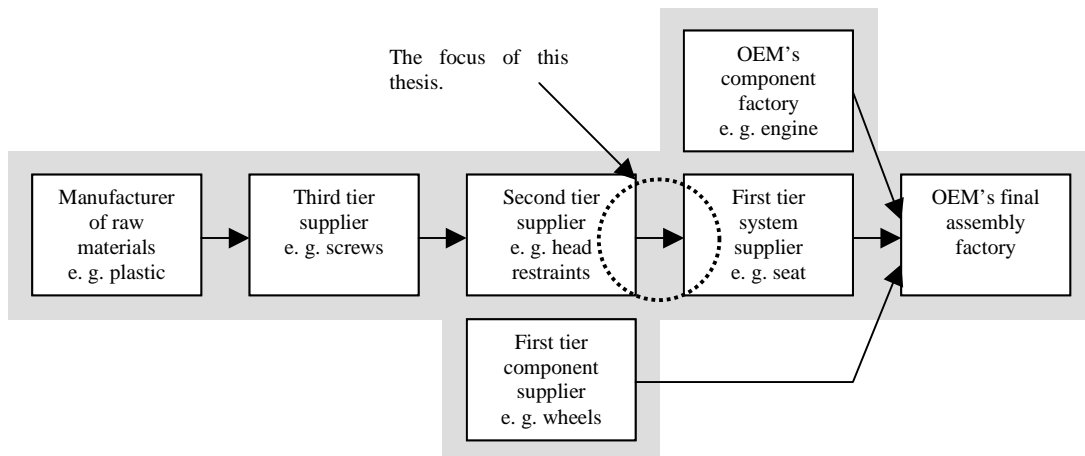


Figure 1.1 The value chain of the Swedish automotive industry.³³

1.3 Purpose

The purpose of this thesis is to make a survey of the main problems in the collaborative product development between first and second tier suppliers within the Swedish automotive industry. Furthermore, the aim is to analyze these problems and find the underlying causes by compiling appropriate theories.

1.4 Delimitations

In order to enable an in-depth study, we have chosen to focus solely on the development of seats. The observations and conclusions are, however, considered valid for collaborative product development regarding other products as well. This is supported by the fact that all of the studied companies also develop products other than seats.

³³ von Corswant (2000), modified

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1.5 Further Disposition and Reading Guidelines

To clarify the structure of this thesis, the seven chapters are divided into four different parts (see Figure 1.2).

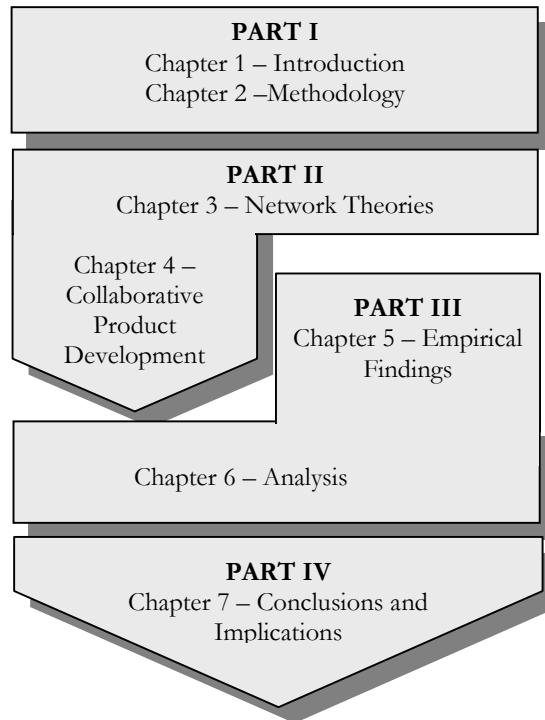


Figure 1.2 The structure of the thesis.

PART I

This first chapter provides an introduction to the research area, where the purpose and problem discussion are presented. The purpose of this chapter is to create an interest and to make the reader familiar with the chosen subject of the thesis. The remainder of this first part describes the methodological approach of the thesis. Here our thoughts about science and the approach taken in this study are discussed.

PART II

In the second part of the thesis, the theoretical approach is presented. The first chapter starts with a presentation of network theories, a description of the totality of relationships among companies in an industrial system. The aim is to increase the understanding for the underlying factors that affect the relations between actors within a business network, which are the basis of the problems regarding customer-supplier collaboration in product development. The actors, through different grades of investments, can directly affect some factors, such as bonds between companies. The actors may indirectly influence other factors, such as power structures and dependence.

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This serves as a basis for the second part, *Collaborative Product Development*. The chapter describes the characteristics of today's relationships regarding supplier involvement in product development. It also discusses critical factors for successful supplier involvement in product development. The chapter is summarized with the Ragatz et al. model, *Two Themes of Successful Supplier Integration In New Product Development*. This model is further used as the basis for the analysis as a structuring and analyzing tool for the problems found in our empirical research.

PART III

The third part of the thesis comprises the chapters *Empirical Findings* and *Analysis*. *Empirical Findings* is divided into two sections. The first section describes the Swedish automotive network and ends with a description of our two case studies. The following part describes facts regarding product development collaboration between the first and second tier suppliers. The relations are highlighted from both the customer and the supplier perspectives. This section discusses important problems from our empirical findings that regard supplier integration into product development. The second chapter is concluded by our analysis. The analysis is focused on discussing the problems found through our empirical study. Furthermore we aim to find the underlying factors, presented in the theoretical approach, that cause each problem.

PART IV

The last part of the thesis consists of our conclusions and implications. Here we aim to present our reflections on the work and to summarize the results of this study. This part of the thesis is our theoretical contribution. We present our model, *The Wheel of Fortune*, and reflect over the accuracy of the chosen theories. The chapter is finished with our recommendations for further research in related fields.

Methodology

This chapter describes the research method of the thesis in both theoretical and practical terms. The first part accounts for the basic assumptions of the research, since this is something that has a great impact on the methods used. The second part illustrates the practical approach. The differences between quantitative and qualitative data are explained, together with a description of the case study methodology. The gathering of primary and secondary data is also discussed and the data is criticized.

2.1 Basic Assumptions

The choice of method is supposed to reflect the authors' view of the ideals of research. However, we find the method to also be very dependent on the character of the problem. There are three main methodological approaches: the *analytical approach*, the *systems approach*, and the *actors approach*.³⁴

The *analytical approach* has its roots in natural science and is characterized by the basic assumption that reality is measurable, objective, and independent of individuals. Furthermore, reality is considered to have an additive character, which means that the whole equals the sum of all the parts.³⁵

In line with the analytical approach, the *systems approach* considers the reality to be objective. Contradictory to the analytical approach, however, the whole is considered to differ from the sum of the parts. This is due to positive or negative effects brought about by the relations between the parts. The system consists of a number of interacting parts, and focus is on relations between them. An important feature of the systems approach is that knowledge is regarded as system-dependent.³⁶

Contradictory to the other two approaches, the *actors approach* assumes there is no such thing as an objective reality. Instead, reality is viewed as a social construct, which is dependent on the viewer. When trying to explain an organization, the actors approach focuses on the actions of the significant actors. The idea is to explain the whole by the parts, with the basic assumption that only the individuals within an organization act, not the organization itself.³⁷

³⁴ Arbnor et al. (1977)

³⁵ Ibid

³⁶ Ibid

³⁷ Ibid

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We find the nature of our problem to be too complex to be solved by analytical methods. Furthermore, we believe that the sum of the parts do not equal the whole. Hence the analytical approach has been considered inappropriate for our study. Since we are focusing on the relations between first and second tier suppliers, and Volvo, the system approach felt most natural. Understanding the entire system gives us a better understanding of the competitive climate and the individual roles of the different actors in the network. The actors approach has been considered inappropriate since we do, indeed, find reality to be objective and aim to create a model that describes it.

2.2 Theory Development Approach

Theory can be developed through *deduction* or *induction*. While deduction implies development of new theories from old ones, induction implies development of new theories from empirical observations. We have carried out our study according to an *abductive* approach, which is a combination of deductive and inductive approaches.³⁸ Hence we have combined the use of existing theories with empirical observations. First we have studied existing theories in order to determine what to look for in the empirical study. During the empirical study, needs have emerged for new theories to help us explain the observations. This process has not been clearly structured and well defined, but more like an iterative and semi-structured process. Finally, during the analysis, we have combined existing theories and empirical observations in the creation of new theory.

2.3 Qualitative and Quantitative Data

An important choice in a scientific study is whether to use qualitative or quantitative data.³⁹ In our study, we have chosen to use qualitative data in order to achieve our purpose. While quantitative studies base their conclusions on measurable quantities, qualitative studies are based on non-measurable characteristics.⁴⁰

A common approach in gathering quantitative data is pre-designed questionnaires, which are the same for all the respondents.⁴¹ The received data can be presented in cold figures.⁴² Our choice to use a qualitative approach has its motive in the nature of our problem, which was considered to request data of the non-measurable kind. Qualitative data gathering is focused on interviews characterized by a more unplanned and informal discussion. The aim of the interviews is to establish opinions, attitudes, conceptions, and set of values.⁴³

³⁸ Alvesson et al. (1994)

³⁹ Halvorsen (1992)

⁴⁰ Ibid

⁴¹ Lundahl et al. (1992)

⁴² Halvorsen (1992)

⁴³ Lundahl et al. (1992)

METHODOLOGY

2.4 Case Study

A case study method implies in-depth investigation of a few central objects.⁴⁴ The purpose of our study, together with the nature of our problem, has made us choose case study as our research method. We consider this choice to go hand in hand with our choice to base our conclusions on qualitative data. A problem regarding case studies is that the possibilities to draw general conclusions might be questioned.⁴⁵ On the other hand, there are also opinions stating that case studies are heavily underrated when it comes to generalizations of empirical conditions. This is especially true for multiple-case designs, which lead to more robust conclusions than single-case designs.⁴⁶ Since we aim to draw general conclusions regarding collaborative product development within the Swedish automotive industry, we find the multiple case-design most well suited. By studying two different development projects involving partially different actors, we hope that the obtained results will reflect the general conditions in the industry.

When conducting multiple-case studies, it is important to use replication logic rather than sampling logic. Whereas sampling logic would equal multiple cases to multiple respondents in a survey, replication logic involves selecting cases so that they either predict similar results or produce contrary results for predictable reasons.⁴⁷ Hence the two different cases of our empirical study have been chosen so that they predicted the same result. In line with the purpose of the thesis, we have chosen to study two development projects that encompassed a lot of collaborative product development between the first and second tier suppliers. We have focused on the development of car seats since this is a clearly delimited physical product and consists of clearly separated subsystems. Thus it has been possible to study a number of different collaborations regarding the subsystems.

The two first tier suppliers in the respective case studies have been selected carefully. First of all, since they are American companies with global presence, they are typical for the large first tier suppliers that dominate the industry today. Secondly, they develop and manufacture seats, which, in line with the above discussion, is a suitable product to study. The two cases, one for each first tier supplier, represent two of the most recent development projects in the Swedish automotive industry. Hence they are suitable to study since they are fresh in people's minds. The second tier suppliers that have been studied represent the main sub-systems of the seats. Since most of the second tier suppliers had been involved in both of the case studies, the gathering of data was facilitated.

⁴⁴ Halvorsen (1992)

⁴⁵ Lundahl et al. (1992)

⁴⁶ Yin (1990)

⁴⁷ Ibid

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2.5 Gathering of Primary Data

Case studies are most often associated with interviews as the method for gathering primary data.⁴⁸ In the early phase of the study, we have interviewed nine persons whom we considered to possess expertise knowledge in the field of the study. The main purpose of these interviews has been to increase our knowledge within product development in the automotive industry. The early interviews have played a key role in the formulation of the purpose of the thesis, as well as having served as a basis for choosing the proper research method.

The selection of interviewees for the case studies has mainly been the result of a conscious, strategic choice. Due to the intense time pressure that characterizes the industry, however, we have sometimes been forced to adjust the choice depending on who has been able to participate. We have focused on two different groups of employees within the customers' and suppliers' organizations. The first group consists of people in the engineering departments, who have participated in either of the development projects of the case studies. The second group consists of people with customer/supplier responsibility, which means purchasers among the customers and key account managers or sales managers among the suppliers. In addition to the interviews with customers and suppliers, we have also interviewed people at the engineering and purchasing departments of Volvo in order to obtain an overall picture of the cases. This was considered necessary since Volvo, as the customer of the customer, to a large extent affects the collaboration between the first and second tier suppliers. Furthermore, all interviewees have been in leading positions within their respective purchase or development department. The reason for this was to get a more comprehensive picture of the collaborative product development.

Totally, we have interviewed 20 people within the case studies; three at Volvo, six at the first tier suppliers, and eleven at the second tier suppliers. While some interviews have been conducted with two or three people at a time, most interviews have been single-interviews. The duration of each interview has been between one to two hours. Due to geographical distance, we have conducted four of the interviews by telephone. Otherwise, we have prioritized visits to the companies at their respective locations in order to obtain as complete of an overall picture of their activities as possible.

The interview have been structured around a number of questions, presented in appendix A, and has been sent to the respondents in advance in order to obtain better-reasoned answers. We also prepared a set of more detailed questions to be used if needed during the interviews. These were not, however, sent to the respondents in advance. The data have been gathered by discussion rather than straightforward questions and answers. This is referred to as semi-structured interviews, which have the advantage that the questions can be reformulated and reordered during each interview in order to adapt to the answers of the respondent.⁴⁹ The main purpose of the questions has been to provide a framework for the interviews. Hence they have

⁴⁸ Lundahl et al. (1992)

⁴⁹ Rosengren et al. (1992)

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been formulated deliberately vague in order to allow more profound answers. The semi-structured interviews have also made it possible to ask many of follow-up questions depending on the answers of the respondents. There are also negative aspects of semi-structured interviews, which mainly involve the risk of the interviewee being affected by the interviewer to answer in certain ways.⁵⁰ Due to the complexity of our problem, however, we have considered semi-structured interviews a necessity in order to obtain profound qualitative answers.

During the interviews, we have taken separate notes, which minimizes the risk of misinterpretations. The notes have been compared and compiled into a single document immediately after each interview in order to avoid important information being forgotten. In most cases, when the interviewee insisted, the compiled notes were sent to the respondents so that they could comment on them and add further essential information.

Much of the information that has been gathered in the case studies is of a rather delicate nature. Due to the importance of the business relations, neither the customers nor the suppliers want the other one to know exactly how they perceive the relation. Hence, in order to obtain all relevant information, we have been forced to promise the respondents that we would not credit any information to single interviews. Instead, our empirical description presents the general opinions of the customers and suppliers, rather than individual opinions.

2.6 Criticism of the Primary Data

It is hard to comment on the validity and reliability of a qualitative study.⁵¹ We have therefore chosen to criticize our primary data according to four main issues that are especially important to consider; *realness criticism*, *tendency criticism*, *dependency criticism*, and *synchronous criticism*.⁵²

2.6.1 Realness Criticism

Realness criticism concerns whether an observation is real or fictitious. When making empirical observations, it might be hard to determine if the observations are distorted or even falsified. The respondents' personal interests in the current matter are something that has to be considered. There might sometimes be reasons to suspect that respondents let their own interests go before the truth.⁵³

During our interviews, we have perceived the respondents as answering the questions rather honestly, without modifying the truth for the benefit of their own personal interests. It has in some cases, however, been apparent that the respondents have withheld information that they want to keep to themselves. In a few cases, we have also gotten the impression that the respondents might have been modifying the truth

⁵⁰ Rosengren et al. (1992)

⁵¹ Eneroth (1979)

⁵² Alvesson et al. (1994)

⁵³ Thurén (1990)

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slightly. Being aware of the problem, we have put effort into explaining the purpose of our study to the interviewees. Our aim has been to convince the respondents that our study is of importance to them and that their truthful answers are vital to our study. In order to reassure the respondents that they do not have to worry about sensitive information causing damage to their business relationships, we have also thoroughly emphasized that we would present the information in such a way that it would not be possible to link information to individual respondents or companies. Since we have conducted many interviews with people representing different perspectives, we believe our observations reflect the truth rather well.

2.6.2 Tendency Criticism

Prejudice of the researchers might distort their interpretations of the observations.⁵⁴ Since all of us participated in almost all of the interviews, the risk of our personal prejudice affecting the interviews and data gathering has been minimized. The correctness of our interpretations has also been partially confirmed by letting the respondents comment on the compiled notes from the interviews.

2.6.3 Dependency Criticism

It may be a problem that the respondents answer the questions in the way that they believe the company expects them to answer. When interviewing more than one person at a time, it can also be a problem that the respondents are dependent on each other. Hence they might be influenced and affected by each other to answer the questions in a certain way.⁵⁵ We believe these problems are infrequently occurring, due to the fact that we have used semi-structured interviews. We did perceive that some of the interviewees were affected by the company policy of how to answer questions, however. But with this in mind, we consider it to cause little problem for the interpretation of the data. The open discussion that has characterized the interviews has led to the same questions appearing more than once in slightly different formulations. This increases the probability that the respondents' own opinions appear during the interview.

2.6.4 Synchronous Criticism

It is of great significance how long after an observation that it is written down and how this is done.⁵⁶ We believe to have minimized the risk of misinterpretations and forgetting of information, thanks to us all having written down the observations while they were made, and having compiled the notes immediately after the interviews.

2.7 Gathering and Criticism of Secondary Data

By using secondary data, i.e. data that have been gathered by others, it is possible to save both time and money.⁵⁷ We have explored existing research and theories through

⁵⁴ Alvesson et al. (1994)

⁵⁵ Ibid

⁵⁶ Ibid

⁵⁷ Halvorsen (1992)

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an extensive literature search. Due to collaborative product development being a rather new field of research, we have focused mainly on recent articles.

Even though we have mainly focused on new theories our theoretical research started with the exploration of network theories. These theories have turned out to be frequently used since they describe the features of the business networks accurately. Therefore we considered it to be adequate to use these theories in our research in order to broaden the dyadic perspective of our theories.

As we have reviewed existing theories and research regarding collaborative product development, it has become evident that most research takes a customer perspective. Furthermore, nearly all research focuses on the relations between OEMs and first tier suppliers. Hence we have found it hard to find relevant theories regarding collaborative product development between first and second tier suppliers. We have chosen to use the theories regarding collaboration between OEMs and first tier suppliers, assuming they are also relatively accurate for collaboration between first and second tier suppliers. This assumption is based on the fact that the automotive industry is characterized by very high product complexity and extensive outsourcing. Thus, the products developed by the first tier suppliers should be as complex and require as much collaboration as products developed by OEMs in other industries with lower product complexity and less outsourcing.

We have put large effort into studying literature by different authors to secure the correctness of the theories and minimize the risk of misinterpretations. Our analysis has, to a large extent, been structured according to one particular model: *Two Themes of Successful Supplier Integration In New Product Development*.⁵⁸ The features of this model are also apparent in other theories and research. Hence we have considered our approach to have enough support in existing theories.

In the early phases of our work, we have studied a lot of reports regarding the Swedish automotive industry. This has increased our understanding of the industry and helped us formulate a suitable purpose for the thesis. We have also attained knowledge in the different companies and their activities through their home pages, product descriptions, and annual reports.

2.8 Chapter Summary

This chapter has provided the background to the methodological approach to this study. The approach has also been described in detail in order to provide a thorough understanding of the character of the study. Since the outcome of the study is totally dependent on the methodology presented in this chapter, the rest of the thesis should be read with this chapter in mind.

⁵⁸ Ragatz et al. (1997)

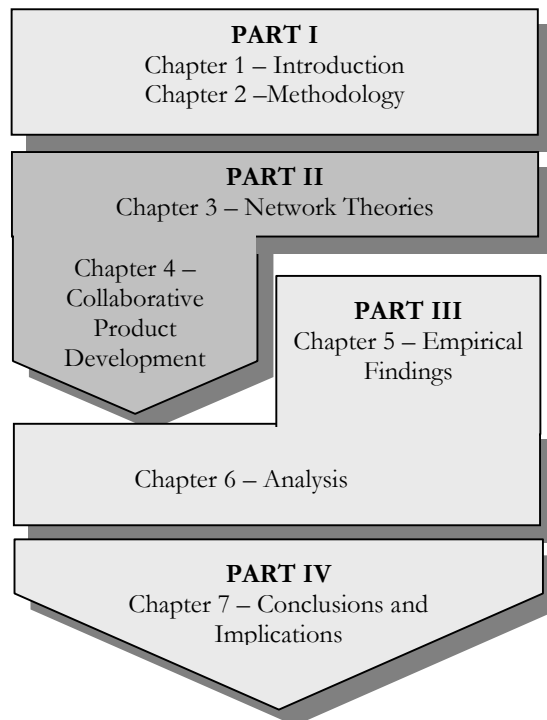
THEORETICAL APPROACH

The *Theoretical Approach* comprises two theoretical chapters, which is aimed for use when analyzing the empirical findings from the Swedish automotive industry. Chapter three describes networks theories, a description of the totality of relationships among companies in an industrial system. The aim is to increase the understanding of the underlying factors that affect the relationships between actors within a business network, which are the source of the problems regarding customer-supplier collaboration in product development.

This serves as a basis for chapter four, *Collaborative Product Development*, which is a theoretical study of the most recent research regarding the characteristics of today's relationships regarding supplier involvement in product development mainly within the Swedish automotive industry. Finally, critical factors for successful supplier involvement in product development are presented. The chapter is then summarized with the model by Ragatz et al, *Two Themes of Successful Supplier Integration In New Product Development*, which emphasizes the importance of previously discussed critical factors. This model is further used as the basis for the analysis since it is used for structuring and analyzing the problems found in our empirical research.

“It is possible to store the mind with a million facts and still be entirely uneducated”

Alec Bourne



Network Theories

This chapter intends to describe the different factors that affect the relationship between actors within a business network. The goal is to increase the understanding for the underlying factors of the problems regarding collaborative product development. Some factors, such as bonds between companies, can directly be affected by the actors through different levels of investments. Other factors, such as power structures and dependence, may just indirectly be influenced by the actors.

“Networks provide a rich and complex metaphor for economic exchange relationships. They offer an opportunity for managers to understand the complex set of relationships which managing a modern business organization involves.”⁵⁹

Numerous business activities are carried out in relationships involving various companies. None of these relationships exist in isolation; each of them is intimately linked to others in a network. The relations in a network affect all business actors, as well as the actors affect the network.⁶⁰ The network thus consists of both cooperation and conflict, and every company benefits from important links with other actors in its setting, and more or less systematically tries to affect and exploit the network in order to get a more advantageous position.⁶¹ It is, however, a difficult task for one single company to make changes happen in the events of the network, but in collaboration with others, almost any change becomes feasible. This leads to a process where actors search for support for their own proposals.⁶² When it comes to technological development the network is important as it links actors with unique knowledge in an exceptional way. For the company to fulfill its role in the network, it has to contribute with some particular capabilities that are referred to as resources in the industrial network. As resources are a very important part of the network, there are specific links between different resources. The companies in a network are characterized by that they manufacture either complementary or competitive products.⁶³

Business networks are not neatly structured lines of companies, designed and managed by a customer into “supply chains.” They consist of complex network structures where every company simultaneously has relationships with its customers and suppliers. These different relationships and the benefits and obligations that arise from them together add up to a company’s network position. The relationships in the

⁵⁹ Axelsson et al. (1992) p.1

⁶⁰ Ford et al. (2001)

⁶¹ Håkansson (1989)

⁶² Ibid

⁶³ Ibid

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network allow the company to prosper and develop, but they are also a constraint that restrict the development of the company and may restrict its activities.⁶⁴

Networks also imply two important features of the way that companies view each other. The first feature deals with a company's general interest in particular relationships, as the importance attached to different relationships in a relation portfolio varies widely. One important task is therefore to manage one's portfolio of relationships, each of which may be vital for different purposes, such as for technological development. The second feature deals with what actually takes place in a relationship, given a certain priority.⁶⁵

3.1 Power Structures within the Network

The power structure determines the role and the position of individual firms in relation to others in the network. By developing new relationships, or making new investments, the companies strive to improve their positions in the network.⁶⁶ A position in the network could be described as a role that the organization has for other organizations that it is related to, indirectly or directly. This means that the firm is expected by the other firms to behave according to the norms associated with the position. There are tensions in the relationships, which keep the firm in its position. The positions are balanced between the past and the future. History decides the present position but the future offers opportunities for change. A change in the position of one firm will change the positions of other firms in the network. Firms have desired positions in the network, which they may be striving to reach, but they may also be threatened by proposed changes. Processes within the network are dominated by the distribution of power and interest structures. Several firms do have access to better resources than others. This could be a result of historical factors or may be a result of too farsighted management of the resource base. This make some firms more powerful than others, and there are numerous relationships which are unbalanced with respect to power.⁶⁷ The power distributions state in which way the network operates and develops. A single powerful firm may dominate a part of the network and a part of the interest structure may be a wish to continue in control at the price of additional potential goals. On the other hand, a network where the power is equally distributed suggests several opportunities for development.⁶⁸

3.2 Relations within the Network

A relationship is the way resources and activities are coordinated in two companies and they are therefore obliged to be analyzed with this taken into consideration. The resources can be of many kinds, both physical and human, and they include the offerings and services of both companies involved.⁶⁹ Relations are important in

⁶⁴ Ford et al. (2001)

⁶⁵ Ford et al. (2001)

⁶⁶ Schary et al. (1995)

⁶⁷ Axelsson et al. (1992)

⁶⁸ Ibid

⁶⁹ Ford et al. (2001)

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determining network properties. The knowledge of their behavior has important implications for understanding the network.

Axelsson et al. present four different factors that comprise the relationship. Each of these factors is strongly interrelated with the others and is capable of being further decomposed and elucidated.⁷⁰ We have also chosen to complement these factors with the theory of Trust, which is an important factor that affects the actors within the industrial network.

3.2.1 Mutual Orientation

One of the preconditions for the existence of an inter-firm relationship is mutual orientation, which implies that the firms are ready to interact with each other and expect each other to do so. Cooperation is required and this depends on the relationships between the objectives of the firms. Each firm strives to get different ends from the same means, e.g. access to a new process and a new market entry from the same development program. Alternatively the objective might be shared, e.g. preceding a new technology. Reasons for entering into a relationship fall into two categories. The first utilizes the complementariness of an individual partner.⁷¹

“Relationships allow of a more effective acquisition of resources and sales of product”⁷²

It is possible to reduce costs, increase sales, and to provide stability and continuity. By knowing a partner company better and appreciating what they can do and have to offer, the need of the companies can be matched more exactly. Knowledge can be produced between companies by the combination of existing knowledge and skills that they have. The second reason for entering into a relationship concerns the ability of a company to exploit network access. A relationship means a measure of control over other organizations and the environment. Reduction of uncertainty and increase of stability are very valuable objectives for many organizations. The relationship can likewise give access to the third parties, which can have resources that are valuable or essential to survival. Information is one such resource. A relationship can serve data conduits and give the company information about what activities are taking place in distant parts of the network.⁷³

3.2.2 Dependence

Dependence may, in some senses, be viewed as the price the firm has to pay for the benefits that the relationship yields. Dependence is, to a degree, a matter of circumstances, and partly a matter of choice. An example is the case of dealing with a monopolist. The firm has no alternative, and circumstances dictate a strong level of dependence. Even where choice exists, a firm may decide to trade off the benefits of flexibility for the benefits, which normally accumulate from a strong relationship.

⁷⁰ Axelsson et al. (1992)

⁷¹ Ibid

⁷² Ibid p. 9

⁷³ Ibid

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Dependence may involve the problems of control and power. If firms are mutually dependent, they could have problems dealing with other relationships, but should be able to manage the central relationship fairly well. If the power is disproportionately spread, then the relationship will not only be hard to manage, but the benefits for the “junior” partner less easy to realize.⁷⁴

3.2.3 Bonds

Relationships between companies are built up of various bonds. Bonds may be thought of as having, variously, *economic, social, technical, logistical, administrative, informational, legal, and time* based dimension. The strength of the bond is difficult to measure. In network terms, strong bonds provide a more stable and unsurprising structure and one, which is more likely to endure change. Types of bonds are not independent of each other. Thus social bonds could be essential for the development of knowledge based bonds, and this in turn might be necessary for strong technical bonds.⁷⁵

The economic element of a relationship may be regarded as the main thing in the industrial network. The portfolio of products and services obtainable and the prices decided to consummate the exchange are important and noticeable evidence of a relationship. The economic underlying principle for strong bonding is dependent upon the approval with the terms of the current exchange and the presence or absence of alternatives. Furthermore, formal economic bonds can also exist as where companies invest in one another or in joint ventures or offer extensive credit facilities. The stronger the bond the less important the economical factors are. There are some types of relationships where direct economic exchange is missing, though other forms of relationships can exist, e.g. between competitors.⁷⁶

Technical bonds stem from the character of the products and the services, which are exchanged. Companies regulate processes and products to the requirements of the partners, subject to the constraints of economics and technology. They obtain technical knowledge, which could be rather specific to a relationship.⁷⁷

Social exchange is classified as important in inter-firm relationships. Individuals' social relations are a result of the relations between customers and suppliers. A relation has no guarantee of being consistent, although social pressures within a company can make conformity. It could also be that social bonds could exceed and even replace economic bonds as a reason for the relationship to remain. Social relationships extend outside individual firms. Networks normally have a social dimension characterized by patterns of individual social contacts.⁷⁸

⁷⁴ Axelsson et al. (1992)

⁷⁵ Ibid

⁷⁶ Ibid

⁷⁷ Ibid

⁷⁸ Ibid

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The administrative systems differ from organization to organization. The companies must integrate if there is to be a continuing relationship. Different kinds of procedures have to be adopted or sub-routines or heuristics developed to manage.⁷⁹

Actors in a network usually adjust logistically to each other in respect of the transfer of a product or implementation of service. These adjustments can be pretty stable or relatively flexible in nature.⁸⁰

A common currency of interfirm relations is information. All the other dimensions described work through the communication of information, from the way to communicate the formal transmission of the orders and the invoices to the tone of the voice that is used on the telephone. Stocks of information, i.e. knowledge, can also be seen as an investment that a company could do in admiration of a specific partner. The activity to assemble information is one of the main uncertainty reduction works that companies implement and here networks provide an essential vector. When the communication nodes are linked and in place the information can flow around a network quickly, which means a relative ease of exchange and transmission. In this meaning it is different from the slow-going responses that are characteristic of the technical or social dimensions.⁸¹

Contracts or more general articles of ownership or involvement may legally bind companies together. The bonds are very visible but they may be less binding than they seem. The need to raise legal frameworks is a suggestion that the other bonds may not work well enough. Learning to adjust to the rhythms of a partner is very important for a well working relationship.⁸²

Some specific activities, e.g. new product developments, have a particular time horizon and a particular rush for the organization concerned. The actors in the relationship have to learn time schedules of the crucial activities and how to regulate or adjust them.⁸³

3.2.4 Investments

Investments are processes in which the resources are committed in order to build, create, or acquire assets that can be used in the future. The investment has the entire characteristic of a traditional investment, i.e. the purchase of a new machine solely to supply a special customer. More likely, the resources are people and their time. Investments of this kind could include getting knowledge of the administrative, technical, or logistical characteristics of a partner. It could also be the time spent in creating a good social relationship.⁸⁴

⁷⁹ Axelsson et al. (1992)

⁸⁰ Ibid

⁸¹ Ibid

⁸² Ibid

⁸³ Ibid

⁸⁴ Ibid

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Relations between customers and suppliers can be categorized into four different groups of relationships, depending on specific investments of the suppliers and buyers. The model is based on the two dimensions of the buyers' and the suppliers' specific investments in the relationship.⁸⁵

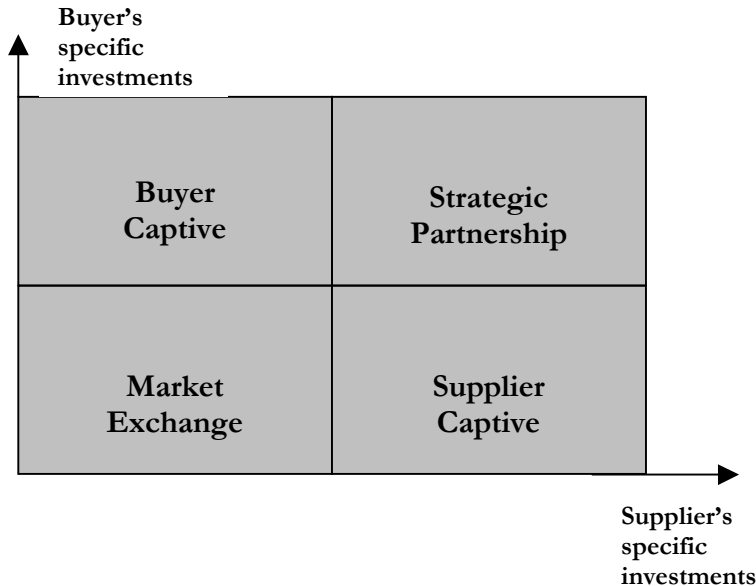


Figure 3.1 Bensaou's model of buyer and supplier specific investments.⁸⁶

Market exchange is defined by low specific investments of both supplier and buyer. The products are standardized, the number of suppliers is high and the technology is mature.⁸⁷

Supplier captive is defined by high suppliers' specific investments and low buyers' specific investments. The products are highly complex and the supplier market is characterized by a few qualified players and fierce competition. The buyers often shift between different suppliers. The suppliers make specific investments to win and to keep their customers. And the suppliers' bargaining power is low.⁸⁸

Buyer captive is defined by low suppliers' specific investments and high buyers' specific investments. The products are complex with a possible customization, and the suppliers are few, large, and well established.⁸⁹

Strategic partnership is defined by high specific investments of both supplier and buyer. The buyers' products are highly complex and normally integrated subsystem.

⁸⁵ Bensaou (1999)

⁸⁶ Ibid p. 4

⁸⁷ Ibid

⁸⁸ Ibid

⁸⁹ Ibid

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The suppliers' components are highly customized and close to the buyers' core competency. Tight mutual adjustments are needed in key processes with frequent design changes. Buyer maintains in-house design and testing capabilities, and the relationship between supplier and buyer is close and long-term.⁹⁰

3.2.5 Trust

There are two different modes of governance mechanisms in a commercial relationship, authority (control) and trust.⁹¹ Authority is when the collaboration is regulated by rules and procedures, while trust means regulation by social norms and personal relationships. An industrial relationship requires a combination of the two mechanisms to work properly.⁹²

The concept of trust is an important but very complex part of a relationship. Trust can be defined in many diverse ways depending on whether its perspective is psychological, sociological, anthropological, or economic. Three types of trust can be identified:

- Contractual trust – signifies that the partners of a relationship accept and fulfill the terms of a written or oral contract.
- Competence trust – this means having trust in the competence of ones partners and that you expect the partner to reach the quality demands.
- Goodwill trust – this is a more diffuse type of trust where the partners have a moral commitment to the relationship. This implies that the partners are prepared to build a strong relationship where they fulfill or exceed the demands of the other part. This means that both parties are expected to share both gains and risks equitably.⁹³

In the discussion of trust in an industrial relationship, two concepts should be taken into account, the concept of trust and trustworthiness. One definition of trust is the characteristic of relations between parties, while trustworthiness is a feature of the individuals of a relation. If properly utilized, trust and trustworthiness can be a source of competitive advantage.⁹⁴

In situations demanding a strong trust, which in turn requires trustworthiness, the behavior of the parties relies on values, principles, and standards within the cultural framework of the companies. Hence the outside parties connected by the collaborative activities determine the trustworthiness. If two collaborating parties have adequate trust in each other, that implies a competitive advantage over other less trustworthy parties. In supply chains or networks where technological development is

⁹⁰ Bensaou (1999)

⁹¹ Schary et al. (1995) According to Haugland et al (1995)

⁹² Schary et al. (1995)

⁹³ Schary et al. (1995) According to Sako (1992)

⁹⁴ Schary et al. (1995)

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an essential feature, the existence of strong trust is a crucial factor for developing inter-organizational relations.⁹⁵ One definition of trust is:

*“Trust implies that a company is willing to take a risk, or expose itself, in relation to another company.”*⁹⁶

3.3 Chapter Summary

This first chapter has aimed to give the reader an understanding of the underlying factors that affect the relations between the actors within a network. Some factors, such as bonds between companies, can directly be affected by the actors through different levels of investments. Other factors, such as power structures and dependence, may only indirectly be influenced by the actors.

The awareness of these factors will help us to understand the roots of the problems regarding customer-supplier collaboration in product development. This serves as a base for the next chapter in this part of the thesis, *Collaborative Product Development*.

⁹⁵ Schary et al. (1995) According to Barney and Hansen (1994)

⁹⁶ Svensson (2001) p. 1

Collaborative Product Development

This chapter starts with a description of the characteristics of today's relationships regarding supplier involvement in product development, which have a tendency to be of a closer character than before. Furthermore, the chapter explains different classifications of suppliers, concerning their involvement in the customers' product development, based on the product complexity. The last part describes critical issues for customer-supplier integration, which is summarized with the model of Ragatz et al, Two Themes of Successful Supplier Integration in New Product Development. This model emphasizes what other researchers have found critical for collaborative product development and thus acts as a good foundation for our analysis. The model will be the underpinning basis of the analysis in chapter six.

4.1 Benefits of Collaborative Product Development

Effective integration of suppliers in new product development can yield numerous short and long-time benefits. Some of them are reduced cost and improved quality of purchased materials, reduced product development time, and improved access to and application of technology.⁹⁷

The short-term goals of supplier involvement in product development can be divided into the areas of development efficiency and effectiveness.⁹⁸ When it comes to efficiency, supplier involvement can reduce both the development costs and the development lead-time.^{99 100 101} This is primarily due to the intense communication between customer and supplier, which prevents, reduces, or introduces design changes earlier in the process. Efficiency is also promoted by the fact that design responsibility can be given either to the customer or the supplier depending on which of the two has the greatest competence. The effectiveness benefits of supplier involvement lies mainly in reduced product cost and increased product value.¹⁰²

There are also potential long-term benefits of supplier involvement in product development. Product development makes a difference in the long-standing competitiveness of a firm and its products.¹⁰³ A common long-term goal is the access to the technological knowledge of the suppliers.¹⁰⁴ Especially in industries

⁹⁷ Ragatz et al. (1997)

⁹⁸ Wynstra et al. (2001)

⁹⁹ Ibid

¹⁰⁰ Ragatz et al. (1997)

¹⁰¹ Handfield et al. (1999)

¹⁰² Wynstra et al. (2001)

¹⁰³ Clark et al. (1991)

¹⁰⁴ Wynstra et al. (2001)

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characterized by complex product and process technologies, a single company can hardly master all the relevant technologies. Hence it is necessary to utilize the knowledge and expertise of suppliers, for design as well as manufacturing.¹⁰⁵ The customer may even want to influence the supplier's investments in new technologies in order to align these with its own needs and provide the best conditions for future technological cooperation.^{106 107} While short-term collaboration is focused on designing a new product, long-term development is much more focused on supporting the development of underlying technologies. This can be described as a difference between creating technological resources and exploiting them.¹⁰⁸

4.2 Different Types of Relationships

Today the role of the suppliers has changed compared to the situation a number of years ago. The suppliers stand for an increased added value, and are not only responsible for producing parts, but also for the development of them. Industrial relationships today are also long-term and suppliers are involved in product development at an earlier stage than before.¹⁰⁹ This has increased the mutual dependency between customers and suppliers, and thus led to the fact that trust is seen as one of the most important issues when developing and maintaining a fruitful relationship. Studies within the Swedish automotive industry have shown that the perceived level of trust towards customers is higher than towards suppliers.¹¹⁰

When it comes to strategic positioning, suppliers within the automotive industry can choose either to try to be a key player or a loyal collaborator. The key player strategy necessitates being a large first tier supplier with great technological competence. For companies lacking the resources for this strategy, and hence positioning themselves as loyal collaborators, the core strengths must be the ability to form collaboration with the customer and act as a responsive partner rather than a true equal. Since the loyal collaborator does not constitute a threat to the established position of the customer, it is possible to create a close relationship. For loyal collaborators in second tier position, although their customers are the first tier suppliers, it is also important to maintain a close contact with the OEM.¹¹¹

Regarding customer-supplier relationships, numerous researches have recognized large differences between US and European automotive manufactures and Japanese automotive manufactures.^{112 113} It seems like the US and European automotive manufactures traditionally have applied strategies with the center of attention on short-term contracts and numerous suppliers for the same part. In difference, Japanese

¹⁰⁵ Ragatz et al. (1997)

¹⁰⁶ Wynstra et al. (2001)

¹⁰⁷ Ragatz et al. (1997)

¹⁰⁸ Wynstra et al. (2001)

¹⁰⁹ Wognum et al. (2002)

¹¹⁰ Svensson (2001)

¹¹¹ Lamming (1993)

¹¹² Clark et al. (1991)

¹¹³ Lamming (1993)

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relationships are often referred to as “partnerships”, involving close collaboration, everyday communication, mutual dependency, knowledge sharing, and a long-term focus on the relationship. Most researchers point out that a close relationship or partnership seems to be the most desirable way to collaborate with the supplier.¹¹⁴

Helper distinguishes the character of the customer-supplier relationships before 1980 as exit-based and after as voice-based (see Figure 4.1). In an exit relationship, the customer, in attempt to solve a problem with a supplier, searches for a new supplier, while in a voice relationship, the customer instead tries to collaborate with the supplier in an effort to find a solution, and increasingly starts to build long-term relationships with the supplier.¹¹⁵

These relationships have two dimensions: *information exchange* and *commitment*. Information exchange is comprised of both the nature and mutuality of the information flow between customers and suppliers. Commitment is the suppliers’ degree of confidence that the customer will continue to buy its products for a longer period of time. To demonstrate their intentions, customers can, among other things, include equity investments, integrate vertically, and make long-term contracts.

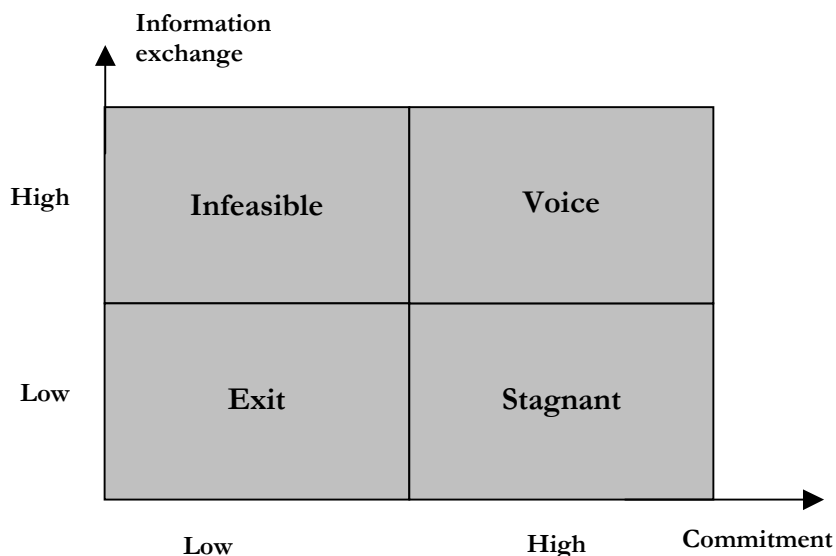


Figure 4.1 Helper's classification of relations regarding commitment and information exchange.¹¹⁶

¹¹⁴ von Corswant (2003)

¹¹⁵ Helper (1991)

¹¹⁶ Ibid

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The change in customer-supplier relationships is evident in the automotive industry. The characteristics of today's relationships regarding supplier involvement in product development have a propensity to be of a closer nature than before, with the potential for long-term benefits.¹¹⁷

To be able to apply the exit strategy successfully, the customer has to sustain a considerable threat to leave the relationship. Thus the commitment to the supplier has to be at a low level, and therefore the customer must maintain a large supplier base to avoid being too dependent on anyone. If the commitment is at a low level, then the information exchange also must be limited.¹¹⁸

4.2.1 Partner, Mature, Child and Contractual

Regarding product development, numerous attempts have been made to distinguish between different types of supplier relationships. Four different supplier roles can be identified (see Table 4.1): *Partner*, *Mature*, *Child* and *Contractual*. It is important to point out that the same supplier may play different roles for different customers. Each role means fundamentally different responsibilities during product development, and the relationship between the customer and the supplier varies considerably in closeness and intensity. It is very important to choose the right role for each supplier. The result may otherwise be a long-term cooperative relationship that yields no competitive advantage.¹¹⁹ For some types of products, early involvement of suppliers adds limited value and may even add cost and slow the development process.¹²⁰

Table 4.1 Supplier roles.¹²¹

	Partner	Mature	Child	Contractual
Design responsibility	Supplier	Supplier	Joint	Customer
Product Complexity	Entire subsystem	Complex Assembly	Simple Assembly	Simple Parts
Specifications provided	Concept	Critical specifications	Detailed specifications	Complete Design
Supplier's influence on specifications	Collaborate	Negotiate	Present capabilities	None
Stage of supplier's involvement	Pre-concept	Concept	Post-concept	Prototyping
Component-testing responsibility	Complete	Major	Moderate	Minor
Supplier's technological capabilities	Autonomous	High	Medium	Low

¹¹⁷ Wynstra et al. (2001)

¹¹⁸ Helper (1991)

¹¹⁹ Kamath et al. (1994)

¹²⁰ Laseter et al. (2002)

¹²¹ Kamath et al. (1994) p. 11

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Partners are responsible for entire subsystems. Their technological capabilities and their understanding of their products and processes are superior to those of the customers. Partners suggest solutions to meet their customers' price and performance objectives. They carry out the testing of their own products, and they may even be responsible for testing other suppliers' parts. The complexity of the subsystem makes it necessary for the partner to communicate intensively with the customer throughout the development cycle.¹²²

Like partners, *mature suppliers* design and manufacture complex assemblies. The big difference lies in the mature suppliers' lack of the technological capabilities of the partners. Hence mature suppliers have less influence on design and they develop their systems from the critical specifications of the customer. The communication between the mature suppliers and the customers is intensive from the concept stage to the production stage. The advanced development goals of the mature suppliers are mainly connected to the goals of the customer, unlike the partners, which have their own goals.¹²³

Child role suppliers have even less influence on design specifications. The specifications for the parts are determined in detail by the customers and the suppliers' role is limited to consultant participation during the concept stage. Communication between the customers and the child suppliers are sparse during the concept stage but intensify during prototyping, though not to the same degree as communication with partners and mature suppliers.¹²⁴

Contractual suppliers manufacture standard parts based on designs from the customer. There is little need for communication during the pre-concept and concept stages, but there may be frequent communication during the late-prototype and production-preparation stages.¹²⁵

Models that differentiate suppliers, such as this one, are often criticized for being inflexible and static in assuming that a supplier should be involved in the same way in different development projects. These types of models often focus more on suppliers' potential contributions than the actual need for such contributions. These models only present guidelines for the degree and timing of involvement. Advice regarding coordination, communication, and differentiation is then missing.¹²⁶

4.2.2 Product Complexity

The suppliers could be classified differently regarding their involvement in the customers' product development concerning the product complexity.

¹²² Kamath et al. (1994)

¹²³ Ibid

¹²⁴ Ibid

¹²⁵ Ibid

¹²⁶ Wynstra et al. (2001)

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Product parts can be separated in three categories: *Supplier proprietary parts*, *Black box parts* and *Detail-controlled parts*. The implications for the engineering process, the involvement of suppliers, and development performance are noticeably different for the three different categories of parts.¹²⁷

Supplier proprietary parts – Standard parts taken from concept to manufacturing by the supplier and sold to assemblers through a catalogue. The development is fully managed by the supplier.¹²⁸

Black box parts – The manufacturer specifies the functional requirements and the supplier carries out the detailed engineering. The development work is split between assembler and supplier. Characteristically the assembler generates interface details; exterior shapes, cost-performance requirements, and other essential design information based on the total vehicle planning and layout. Subassembly systems and functional parts fit in to this group. The supplier normally takes care of the engineering of one particular component in all the assembler's products. Sometimes the suppliers do not wait for inquiries from the assembler, and may begin development actions and suggestions. Once a supplier is chosen, it takes care of the detailed engineering, including prototyping, drafting, and unit testing. The automaker reviews parts and drawings, ensures that requirements are met, and approves the design.¹²⁹

As regards black box parts, the supplier develops the technology on the basis of the manufacturer's performance requirements. This makes the manufacturer able to make use of supplier engineering skills and still keep the power over totality vehicle integrity and basic design. Thus, in the development of the black box parts, the supplier can be regarded as involved in the product development. The engineering knowledge becomes its competitive border. To have only one source for producing and prototyping parts facilitate knowledge exchange and makes it possible for the supplier to notice likely production problems early and hence improve component quality.¹³⁰ Effective supplier involvement and management of black box parts systems goes beyond formal organizations and contracts. Well-functioning communication between customer and supplier are, together with proper attitudes and consistency in daily behaviors, extremely important.¹³¹

There are however potential risks with the black box system. The assemblers that are dependent on supplier's engineering capabilities can lose some power of negotiation. Ideas concerning styling and design may seep out to competitors via the supplier. Furthermore, to drop engineering expertise in a core component area may, in the long run, weaken the OEM's technological capability.¹³²

¹²⁷ Clark et al. (1991)

¹²⁸ Ibid

¹²⁹ Ibid

¹³⁰ Ibid

¹³¹ Ibid

¹³² Ibid

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While the process of supplier involvement is iterative, the expression “black box” is not satisfactory. Clark et al. argue that it is also necessary to distinguish gray box parts, which are black box parts where the auto manufacturers has more influence on the internal functioning of the parts.¹³³

Detail-controlled parts – The manufacturer is responsible for the entire development. Most of the component engineering work is done in-house. This is favorable when the OEM wants to keep technological capabilities in a specific component area, keep control over component quality and design, and keep bargaining control against the suppliers. To keep the component engineers in-house may also, on the other hand, make the engineering organization complicated, and make inter-parts management within the company hard. The detail work for many components may cause the in-house engineering organization to lose its total vehicle focus. The result can be the loss of competitiveness to suppliers that focus more on specific component technologies.¹³⁴

4.3 Critical Issues for Collaborative Product Development

Successful integration between the organizations of the customer and the supplier is a prerequisite for a fruitful cooperation in product development. A good managed supplier involvement in the product development will give access to new technologies, increased quality, and reduced development time and cost¹³⁵. The integration is thus not left without complications and there are several problems in managing supplier involvement in product development. The critical issues and problems, regarding collaborative product development, have been grouped under three closely related sources: *relational issues*, *supplier issues*, and finally *customer issues*.¹³⁶

4.3.1 Relational Issues

A typical relationship problem is lack of communication and trust, which may lead to unclear agreements and diverging expectations, while both parties will see large potential risks.¹³⁷ This hinders both the efficiency and the effectiveness of the cooperation. Therefore it is incredibly important that the customer communicates clearly to the suppliers what it expects from them in terms of development responsibility. Otherwise suppliers may base their strategies and investments on inaccurate assumptions. There are also more practical communication problems such as incompatible CAD-systems at customers and suppliers.

When suppliers are concerned in the process of product development, both suppliers and customers must get used to new roles. It is therefore necessary to identify the management tasks, improve their project management skills and processes in

¹³³ Clark et al. (1991)

¹³⁴ Ibid

¹³⁵ von Corswant et al. (2002)

¹³⁶ Wynstra et al. (2001)

¹³⁷ Ibid

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achieving an integrated product development and sourcing approach for both supplier and customer.¹³⁸ It is essential for the top managers of both customers and suppliers to create a culture that promotes cooperative behavior towards the other party. Another vital condition for successful supplier involvement is for both customer and supplier to have an internal organization that provides an interface between the technical function, the purchasing function, and the supplier. This demands new roles for both the technical and the marketing staff. It should also make the development become teamwork and integrate the suppliers into the company's product development process.¹³⁹

4.3.2 Supplier Issues

The development of a supplier most often occurs in close relationship with its customers.¹⁴⁰ Hence it is necessary for suppliers to adjust their technological plans to align them with those of their major customers.¹⁴¹ The customer-supplier relationship is almost always buyer-dominated. It is however of utmost importance for the suppliers that they develop their own strategies. Suppliers generally need to focus more on the function that their products need to satisfy, rather than the products themselves.¹⁴² Many suppliers try to increase their involvement in product development in order to provide more value to the customer. The transition can, however, be quite expensive, and it requires a broadening of the supplier's technological base.¹⁴³

Even if the customer tries to select suppliers with sufficient knowledge and skills, it is not always possible. This is due to the fact that supplier involvement in product development is a relatively new trend in most industries. Hence many suppliers have not yet been given the chance to acquire the competencies needed to meet the new demands placed on them by the customers.¹⁴⁴ The suppliers need to develop a long-term vision and to convince clients of their capabilities. Today suppliers still are too passive in this respect. Their sales people must have a more proactive approach towards the clients.¹⁴⁵ Pro-active suppliers should have the power to take a wide development project responsibility. With the increased responsibility for design, the suppliers have to be better in key technologies. This implies that they have to know what is in the technological front-line. If the suppliers make a proper benchmark of the competitors, they are able to better convince the manufacturer that they can offer a front-line design solution. The suppliers have to be more critical regarding their design solutions. This is especially important regarding their systems in interaction with other systems, to get a good understanding how the supplier's own systems connect with other interrelated systems.¹⁴⁶

¹³⁸ Arminas (2001)

¹³⁹ Wynstra et al. (2001)

¹⁴⁰ Lilliecreutz (1998)

¹⁴¹ Handfield et al. (1999)

¹⁴² Karlsson et al. (1998)

¹⁴³ Kamath et al. (1994)

¹⁴⁴ Wynstra et al. (2001)

¹⁴⁵ Wognum et al. (2002)

¹⁴⁶ von Corswant et al. (2002)

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There is a lower level of competition among suppliers that are highly involved in their customers' product development. This indicates that high in-house technical capabilities and high technological uncertainty of the product, which are dominant predictors of supplier involvement in product development, may serve as entry barriers in the market.¹⁴⁷ Therefore the suppliers' lack of resources or willingness to commit the necessary time, labor, and capital a further problem in the collaboration.¹⁴⁸ Few suppliers have the necessary financial resources to invest in the personnel, the CAD-systems, the prototyping facilities, and research and development capabilities that a true partnership with their customers requires. Smaller suppliers are often unable to devote major resources to the development of products that they will not make or sell for three more years. Their organizations are also often too lean to allow the stationing of engineers at the customer's office.¹⁴⁹ There may also be resistance within the organization of the supplier, based on concerns about revealing proprietary technologies or information.¹⁵⁰

4.3.3 Customer Issues

Adequate human resources are one of the most critical requirements for successful supplier involvement in product development. The in-house technical capabilities of the suppliers are a dominant predictor of successful supplier involvement in product development.¹⁵¹ Despite this, customers focusing on price as the supplier selection criteria may result in the selection of suppliers with little or limited experience in joint product development. The results of supplier involvement could be improved by weighing technological and innovative capabilities more heavily in the supplier selection.¹⁵² It is of utmost importance to staff the organization with people that have the right purchasing, engineering, and social skills. Important attributes of a purchaser are technical expertise and an understanding of how they can contribute to the product development process. Because of this, many companies hire purchasers with engineering backgrounds.¹⁵³ The engineers need to have an understanding of the purchasing process and the purchasing managers need to work closely with the product development teams in order to create supplier evaluation frameworks that consider more than the traditional factors of price, quality, delivery, and service.¹⁵⁴

One critical issue for successful collaboration is early supplier involvement. This effectively increase the supplier's perceived contribution to the product development project. Further, early supplier involvement reduces supplier-related problems and bottlenecks by allowing the supplier to plan necessary changes earlier. It enables the supplier's ideas for design improvements to be incorporated, which improves performance, increases quality, and reduces costs. The perceived contribution can

¹⁴⁷ Wasti et al. (1999)

¹⁴⁸ McCutcheon et al. (1997)

¹⁴⁹ Kamath et al. (1994)

¹⁵⁰ Ragatz et al. (1997)

¹⁵¹ Wasti et al. (1997)

¹⁵² Wynstra et al. (2001)

¹⁵³ Handfield et al. (1999)

¹⁵⁴ Ibid

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also be increased because early involvement makes the supplier more committed and part of the development team.¹⁵⁵

Problems can also originate from resistance at the purchasing and engineering departments. Many purchasers are reluctant to select suppliers at an early stage of development projects since they do not have a finished product to base their decision on.¹⁵⁶ Development engineers, on the other hand, may feel threatened by the supplier involvement, and so often resist giving up control over design decisions.¹⁵⁷ This causes them to wrongfully argue that the suppliers can never live up to the required quality standards or that the communication with the suppliers makes the development work too complex.¹⁵⁸ There is also often concern that proprietary information that is shared with suppliers may be revealed to competitors.¹⁵⁹

A close relationship between the supplier's production facilities and the product development department is very important for a good work. The result is that the development team can better design products appropriate for production in the supplier's facility. The outcome is reduced cost and a better quality.¹⁶⁰ Communication skills and the ability to collaborate in team settings are often neglected skills, but they are extremely important for both purchasers and engineers.¹⁶¹ The new role of the customer makes it important to not focus only on the management of supplier involvement in individual projects. It is important to establish general policies and guidelines for supplier involvement in product development, together with the technological areas in which to collaborate.¹⁶²

A common problem for the customer is their lack of a well-defined product development process and strategy. Hence there is not enough knowledge in the areas of when and how suppliers should be involved. This may lead to either the involvement of suppliers with limited innovative capabilities or the involvement of suppliers in areas where supplier involvement is not necessary.¹⁶³

4.3.4 Two Themes of Successful Supplier Integration In New Product Development

The critical issues that are highlighted in previous sections are also pointed out in the Ragatz et al. model, which demonstrate their importance. The model is based on twelve management practices, which are critical for thriving supplier integration in new product development. This model will now be introduced and further will be

¹⁵⁵ Hartley et al. (1997)

¹⁵⁶ Wynstra et al. (2001)

¹⁵⁷ Ragatz et al. (1997)

¹⁵⁸ Wynstra et al. (2001)

¹⁵⁹ Ragatz et al. (1997)

¹⁶⁰ von Corswant et al. (2002)

¹⁶¹ Wynstra et al. (2001)

¹⁶² Ibid

¹⁶³ Ibid

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used as the basis for our analysis as a structuring and analyzing tool for the problems found in our empirical research.¹⁶⁴

To integrate suppliers successfully into the development of new products, the customer must overcome barriers such as resistance to sharing proprietary information, and the not – invented-here syndrome. Overcoming these barriers successfully depends on two important factors: *relationship structuring* and *asset sharing*. Relationship structuring means shared education and training, formal trust development processes, formalized risk/reward sharing agreements, joint agreement on performance measurements, top management commitment from both companies, and confidence in the suppliers' capabilities. The asset sharing includes sharing of intellectual assets such as customer requirements, technology information, and cross-functional communication; physical assets such as linked information systems, technology, and shared plant and equipment; and human assets such as supplier participation on the project team, and co-location of personnel.¹⁶⁵

The critical factors for supplier integration in new product development can further be divided into two categories: *management practices* and *environmental factors*. Twelve management practices are identified as critical for thriving supplier integration, while four environmental factors are crucial for the integration of suppliers in new product development. In the following section the two categories of factors will be discussed in short to explain their meaning.¹⁶⁶

Management Practices

Supplier participation on buying company's project team (1) is the most crucial differentiator for success in the development work. Participation is often facilitated by periodic face-to-face meetings, selective co-location, and linked information systems.¹⁶⁷

Direct cross-functional, inter-company communication (2) is crucial to be able to identify and solve problems at an early stage. The importance of inter-company communication is reflected in other management practices as well, for example participation on project teams, common and linked information systems, and co-location of personnel.¹⁶⁸

Shared education and training (3) is not regarded as one of the most crucial factors for success, but might result in many improved performances. This allows parties to gain a greater insight into each other's internal processes, and further strengthens the mutual commitment and trust between the companies.¹⁶⁹

¹⁶⁴ Ragatz et al. (1997)

¹⁶⁵ Ibid

¹⁶⁶ Ibid

¹⁶⁷ Ibid

¹⁶⁸ Ibid

¹⁶⁹ Ibid

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Common and linked information systems (4) for real-time processing of technical data are systems such as EDI, CAD/CAM, E-mail, and Internet. These systems have become more and more important, and the lack of them implies a great barrier to implementation. These tools tend to be more frequently used for production management than product development activities.¹⁷⁰

Co-location of buyer/supplier personnel (5) is suggested to be selectively used to facilitate communication and information exchange as the nature of the project requires. The co-location is used for very specific short-term efforts during especially intense periods of the project and not from concept generation to production. Furthermore, it is used more frequently when the complexity of the purchased part is high, the supplier is involved in a higher level of assembly, the part is of strategic importance, and when electronically linked information systems are limited.¹⁷¹

Technology sharing (6) is generally made on an “as needed” basis, and is supplied by whichever party is the expert. The different parties have different objectives with the sharing of technology. The suppliers benefit from technology sharing by gaining long-term business, preferred market penetration through the buying company’s products. The customers, on the other hand, obtain such benefits as higher quality, more innovation, and lower cost for purchased products. However, to realize technology sharing, mutual trust, and strong business relationships are obligations.¹⁷²

Formal trust development (7). Even though mutual trust is an essential part of successful supplier integration, formal trust development processes are not widely used. Most of the trust developed between two parties is a result of the performance to the expectations over time in the active business relationship.¹⁷³

Customer requirements information sharing (8) implies sharing of full-uncensored information about the market situation with the suppliers, as if they were a part of the company. This information is not only what the customers want, but how much and when. This information sharing aligns suppliers with the requirements of the final customers, and strengthens the trust between supplier and customer. Collaboration with less strategic suppliers implies information sharing in form of specifications rather than requirements. Additionally many customers use their suppliers to help identify and define requirements.¹⁷⁴

Technology information sharing (9) often occurs before the actual supplier is selected for the new product development project. This information sharing may include both parties’ technology roadmaps, which facilitate identification of current and long-term product development capabilities that may lead to new product ideas. Information is then shared during the whole development process to ensure that the customer requirements are met. Contractual mechanisms are often used as a safeguard for the

¹⁷⁰ Ragatz et al. (1997)

¹⁷¹ Ibid

¹⁷² Ibid

¹⁷³ Ibid

¹⁷⁴ Ibid

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interests of the involved parties to permit higher levels of technology information sharing.¹⁷⁵

Shared physical assets (10) is a strategy not commonly used in new product development projects and is generally associated with co-location strategies and consisting of e.g. temporary office space. During production ramp-up and on-going production, however, shared physical assets are more frequently used. Often the buying company owns or shares tooling equipment at the suppliers' production facilities.¹⁷⁶

Formalized risk/reward sharing agreements (11) are not widely used in the supplier integration process. Even though no advance agreements are made to define the sharing of risks, formalized risk/reward sharing becomes especially important when development and production costs deviate a great deal from the forecasts.¹⁷⁷

Joint agreement on performance measurements (12) is crucial since it keeps the project on track by providing a common set of measurements to evaluate progress. This functions as the base for making tradeoffs and resolving conflicts during the life of the project.¹⁷⁸

Environmental Factors

There are four environmental factors that act as differentiators for successful supplier integration. The first two are "*strength of supplying firm's top management commitment to their involvement*," "*strength of the buying firm's top management commitment to supplier integration*," which are critical factors that enable the various management practices previously discussed. The other environmental factors are "*familiarity with the supplier's capabilities prior to integration in the project*," and "*strength of consensus that the right supplier was selected*," which are key enablers that give the development team the assurance to actively involve the supplier in the development process.¹⁷⁹

Non-differentiators

A number of factors cannot be regarded as differentiators for successful integration, but form a necessary foundation for supplier integration which, if not there, would hinder the success of the effort but which, if present, does not imply a guaranteed success.¹⁸⁰

Figure 4.2 describes two important conceptual themes of how the companies can minimize the barriers of supplier integration in product development. The first theme is relationship structuring, which facilitates integration and sharing of assets, but does

¹⁷⁵ Ragatz et al. (1997)

¹⁷⁶ Ibid

¹⁷⁷ Ibid

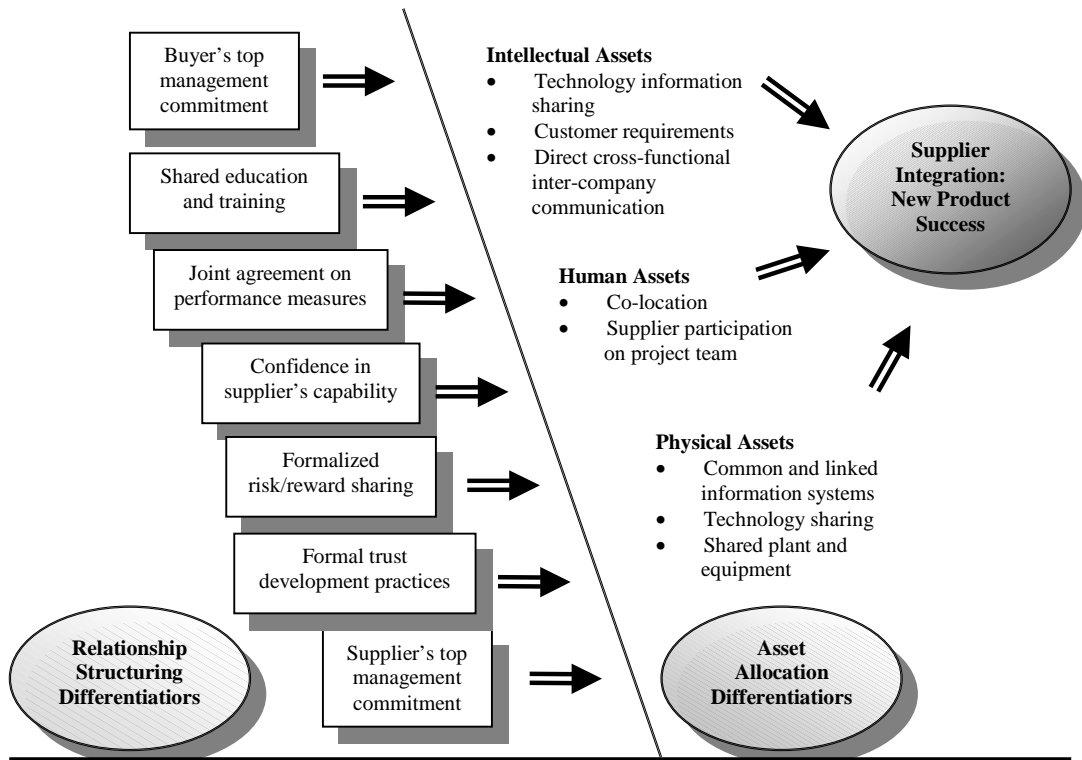
¹⁷⁸ Ibid

¹⁷⁹ Ibid

¹⁸⁰ Ibid

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not directly affect the speed, cost, or quality of the product development. The second theme is asset allocation, which more directly influences the results of the product development process.¹⁸¹



Confidentiality Agreements Formal - Assessment of Supplier's Capabilities - Formalized Process to Select Suppliers - Cross Functional Teams for Supplier Selection and Planning - Involvement in Establishing Goals - Clarity of Target/Metrics - Stability of Project Team - Consensus that Integration was Needed - Goal Consensus

Figure 4.2 Two themes of successful supplier integration in new product development.¹⁸²

4.4 Chapter Summary

This chapter has presented the most recent research regarding the characteristics of today's relationships regarding supplier involvement in product development mainly within the Swedish automotive industry. Our main focus has been the relationship between first and second tier suppliers.

In the last part of the chapter, the critical issues regarding collaborative product development have been discussed. To emphasize the importance of these critical issues, they are summarized and highlighted in the model of Ragatz et al, *Two themes of successful supplier integration in new product development*. This model is based

¹⁸¹ Ragatz et al. (1997)

¹⁸² Ibid p. 200

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on twelve management practices, which show the critical issues for thriving supplier integration in new product development. This model will further be used as the basis for our analysis as a structuring and analyzing tool for the problems found in the our empirical research, which is the first chapter in the third and following part of this thesis.

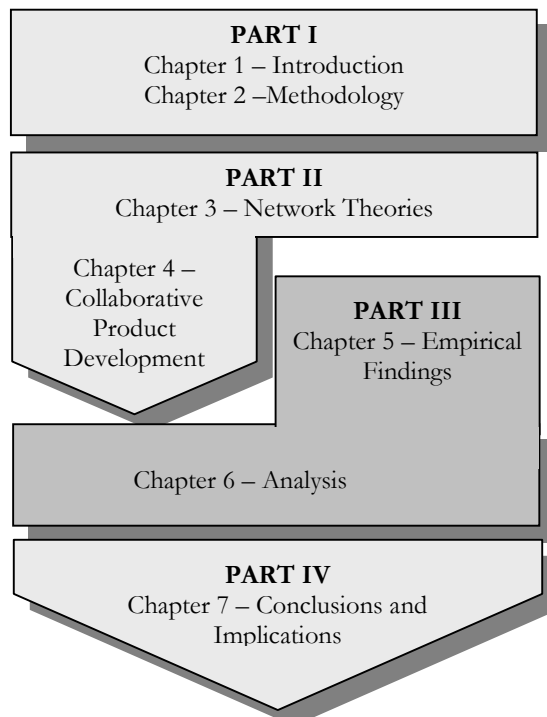
EMPIRICAL FINDINGS AND ANALYSIS

The third part of the thesis consists of the *Empirical Findings* and the *Analysis*. The empirical research is divided into two sections and the primary source of information is interviews conducted with the first and second tier suppliers, complemented by interviews with Volvo. The first section, describes the Swedish automotive network, and ends with a description of our two case studies. The following section describes facts regarding product development collaboration between the first and second tier suppliers. The relations are highlighted from both the customer and the supplier perspectives. Important problems regarding supplier integration into product development are presented.

Chapter 6 contains our analysis, which is focused on discussing the problems in our empirical findings. Guided by our theoretical approach; we try to find the underlying factors that cause each problem. In order to analyze and identify the main underlying factors, the model of Ragatz et al, *Two Themes of Successful Supplier Integration In New Product Development*, is used as help for structuring and analyzing the problems found in our empirical research.

“To acquire knowledge, one must study; but to acquire wisdom, one must observe”

Marilyn vos Savant



Empirical Findings

The following chapter starts with a description of the Swedish automotive network and our two case studies. Furthermore, facts regarding product development collaboration between the first and second tier suppliers will be described. Throughout the chapter, the term “customers” refer to the first tier suppliers, and “suppliers” refers to the second tier suppliers. The relations are highlighted from both the customer and the supplier perspectives. The primary source of information is interviews conducted with the first and second tier suppliers, and Volvo. Due to the sensitivity of much of the information received from the respondents, the presented facts will not be referred to single interviews except for facts received from articles or interviews with company independent experts.

5.1 The Swedish Automotive Network

A complex network of companies supplies the largest Swedish car manufacturer, Volvo Cars. During the last decades, the automotive industry has been characterized by increasing customer demands, rapid technology development, and the need for reduced development times for new car models. Additionally, the increasing focus on modules and the emergence of close relations between the actors imply an increasing demand of resources. This has forced the car manufacturers to strive for single sourcing, which have resulted in a vast reduction of the number of first tier suppliers.¹⁸³

For example, during the ‘70s and ‘80s Volvo’s cars were produced by parts from more than 800 first tier suppliers. Although the product range today is much larger, Volvo has been able to reduce the number of first tier suppliers continuously. Today there are approximately 175 direct suppliers engaged in the development and production of the P2-platform.¹⁸⁴ Many previous first tier suppliers have been forced to adapt new roles as second or third tier suppliers. There are today about ten large first tier system suppliers in Sweden of which almost all are foreign owned companies.¹⁸⁵

¹⁸³ von Corswant (2003)

¹⁸⁴ Gustafsson, February 10th, 2003

¹⁸⁵ von Corswant, February 10th, 2003

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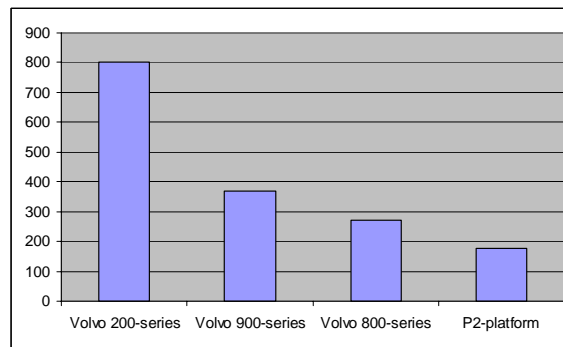


Figure 5.1 Number of direct suppliers to Volvo's different car models.

An illustration of the automotive industry value chain is given in Figure 5.2. The figure shows the different categories of companies and their roles in the value chain. It is, however, necessary to point out that the value chain approach gives an extremely simplified image of the situation. In reality, the suppliers' relations form a complex network where the companies can play many different roles. For instance, the first tier suppliers often play the role of second and third tier suppliers, as they supply not only the OEMs, but also other suppliers in the network.¹⁸⁶ In this thesis, the focus lies on the relations between the first and second tier suppliers and the following sections will therefore be focused especially on these relations. It is though important to point out that Volvo, as the customer of the customer, has great impact on the relations between the first and second tier suppliers.

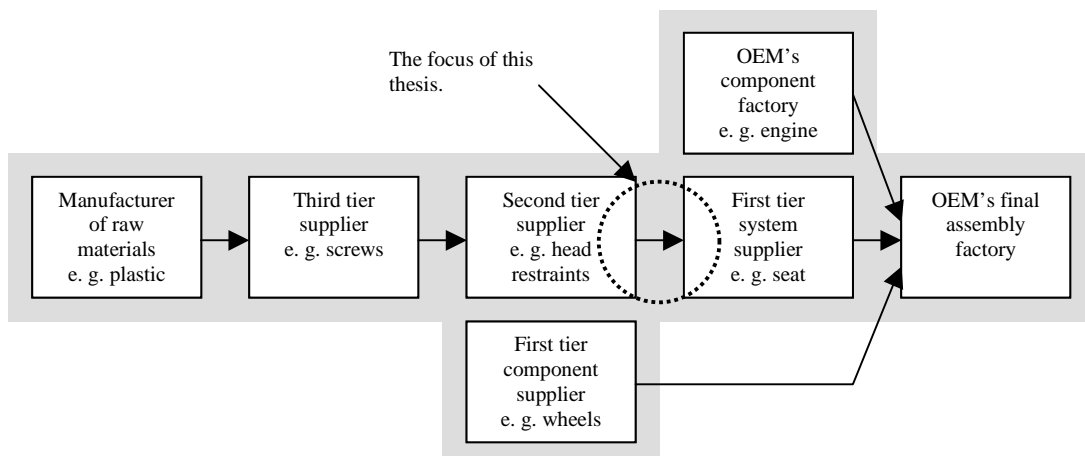


Figure 5.2 The value chain of the automotive industry.¹⁸⁷

An obvious reason for the close relations between Volvo and the system suppliers is the difficulty of changing suppliers due to the complex products and the limited

¹⁸⁶ von Corswant, February 10th, 2003

¹⁸⁷ von Corswant (2000), modified

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number of companies at the front-end of the value chain.¹⁸⁸ Further down the supply chain, however, the complexity of products decreases, while the number of suppliers to choose among grows. This results in a hardening competition, where the second tier suppliers are at the mercy of their customers' power. It is, in fact, so that second and third tier suppliers have to follow the rules made up by the OEMs and the large first tier suppliers as everybody tries to use their power positions to gain benefits. Even though the relations between these actors usually are close and long lasting, many second tier suppliers today feel insecure in their relations with the powerful customers. Today it is more frequently occurring that the first tier suppliers change their source of supply; even though the product development collaboration has been performed with one supplier, it is not a guarantee that this will result in orders for production.

5.1.1 Volvo's Choice of Suppliers

The characteristics of the Swedish automotive industry are largely influenced by the actors' choice of suppliers. This derives, to a large extent, from the acting of the OEMs, whose choice affects the behavior of the first tier suppliers, whose choice in turn influences the behavior of the second tier suppliers. Volvo's choice of suppliers for their own largely influences new product development projects, Ford. Due to economies of scale, the automobiles of Volvo have more than half of the components in common with Ford. The supplier choices are made in cooperation between the central and local purchasing departments. The process of supplier selection is, to a large extent, characterized by political strategy. Volvo wants to keep the competition and therefore spread their orders over a large base of suppliers.

When Volvo chooses the suppliers, the number one criterion is quality. Hence Volvo is very interested in the selection process of suppliers further down the supply chain. This implies that they, to a large extent, interfere in the first tier suppliers' choice of suppliers, especially regarding safety components. This often results in problems and disagreements, and in the long run, it also causes conflicts regarding the responsibility of the products.

Today, when purchasing decisions are often more centralized, the suppliers tend to be easier replaced in the early phases of a project than before. However, as the production starts, replacement of suppliers is not that frequent occurring. This has resulted in decreased importance of personal relations and previous impressions of the suppliers' cooperative ability. People at Volvo's operational level value different aspects of the suppliers than people at management level. At the operational level, personal relations and "the right person at the right place" are considered more important than price in order to achieve a fruitful collaboration. This is, however, neglected in most cases, since the choice of suppliers is a more strategic decision.

¹⁸⁸ Lilliecreutz, February 7th, 2003

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5.1.2 The First Tier Suppliers' Choice of Suppliers

The first tier suppliers' choice of suppliers more or less follows the same principles as Volvo's choice. They list the approved suppliers for every component and evaluate these suppliers when a new project is to begin. The evaluation parameters are, for example, price, quality, delivery assurance, management, product development, logistics, and financial situation. This list is made at the central purchasing department in collaboration with the different local purchasing departments. The suppliers present on this list are seen as competent enough, but as in the case of Volvo, a new supplier seldom enters the list. Since all suppliers on the list are considered competent enough, the primary selection criterion is price. The local purchasing departments select the suppliers and give their recommendations to the central sourcing board, which makes the final evaluation. The sourcing board often has the final responsibility for all sourcing. The evaluation process, however, occasionally means problems when the local and the central purchasing departments do not have the same opinion of which supplier should be chosen. After a supplier is chosen, it is hard to change, since it implies large efforts moving the tools.

It is quite clear that there are often diverging opinions at the purchasing and the development departments regarding the choice of suppliers. The common opinion at the development department is that the purchasers have to be more open-minded regarding the selection process. It has been expressed that the purchasers have to be more careful in their evaluation process; they should not consider price as the determining factor, but pay more attention to the product development capability of the suppliers. Another common view at the development department is that former established supplier relations are important in the selection, since personal relations greatly influence both the selection and the collaboration.

5.2 Case Description

Our empirical results derive from profound case studies of two major first tier suppliers in the Swedish automotive industry. The study has been focused on the development of car seats since this is a clearly delimited physical product and consists of clearly separated components. The front seat in a car can be divided into five main modules: the chassis (used for height and length adjustments), the seat cushion frame, a backrest frame (including the head restraints), foam, and upholstery. There are only a few direct physical interfaces between the front seat and the rest of the car (four screws to join the seat chassis to the car floor plus a few cable connectors). There are however, several other physical interfaces between the seat and other components in the car that must be considered as well. Furthermore, there are various functional dependencies created by the different functions of the car and the seat, respectively (for example, dependencies between the seat and the seatbelt, and the seat and the steering wheel).

The front seats are often very similar for different models based on the same platform. There are, however, larger differences between the rear seats. A rear seat consists of four main parts: a seat cushion frame, a backrest frame (including head restraints), foam, and upholstery. The differences between the rear seats of different models are

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especially obvious if you compare a saloon model to an estate model. In general, the development of rear seats for an estate is a more complex and demanding task, since the seats of an estate have to be able to endure the larger stress associated with larger luggage loads.



Figure 5.3 Example of a front seat design.

5.2.1 The Development of Seats for the P28 and P1 Projects

This study has been focused on two of the most recent development projects in the Swedish automotive industry conducted by Volvo. The first one is the recently completed P28 project, which concerned the development of Volvo's new sports utility vehicle, XC90. The development of XC90 was based on the already-existing P2 platform, which also serves as the base for the S80, S60 and V70 models. The demand for short time to market makes it impossible to develop a new car model from scratch. Hence, all car models are based on platforms, which serve as the technological base for several models. In order to keep up with the technological development, new platforms are developed regularly with a number of years in between. Figure 5.4 shows the different Volvo models based on the P2 platform.

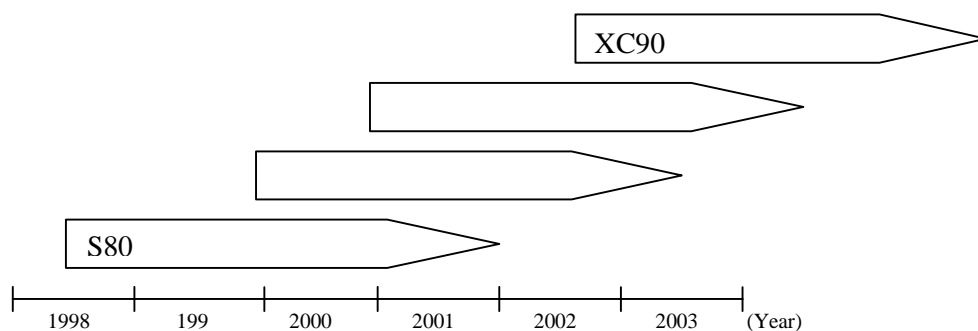


Figure 5.4 The different models based on the P2 platform. Start of arrows indicates time for market introduction.¹⁸⁹

¹⁸⁹ von Corswant (2003)

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The second project in this study is a still-ongoing Volvo project, namely the P1 platform project concerning the development of a platform for the not-yet-released successors of the old V40 and S40 models. Although the P1 project is still ongoing, the development phase of the project is completed. The P28 and P1 projects are especially well suited for the empirical study, since they are very recent and thus fresh in people's minds.

Lear Corporation (Lear) was engaged to conduct the product development for the seats in the P28 projects in close collaboration with Volvo. Though Lear had been working tightly with Volvo before, this project was quite different from other development projects performed in the Swedish automotive industry. Never before had a sports utility vehicle been developed, which implied quite a new challenge. Like all other Volvo models, the XC90 has two front seats and a rear seat with room for three passengers. In addition, the XC90 also has got an extra rear seat, called the third row seat, with room for two more passengers. The third row seat is easy to fold down in order to increase the trunk space. Though a practical feature, it demanded advanced technical solutions that meant a true challenge to the development team. The different parties of the development encountered numerous problems and obstacles, but the final result was, according to all parties, very satisfactory.

For the P1 project, Volvo employed Johnson Controls (Johnson) to accomplish the development of the seats. Today's Volvo S40 and V40 are manufactured in Volvo's plant in Gent, Belgium, which will be the case for the successor as well. While the old S40 and V40 models were developed in the Netherlands, the new ones are developed in Sweden. This is due to Volvo's intention to centralize their product development to Gothenburg in order to attain better control and less administration. Hence Johnson's Swedish department performed the product development closely located to Volvo's development department in Gothenburg. Both Lear and Johnson have platform organizations with different units dedicated to different auto manufacturers. The development units are very autonomous with basically no exchanges of information between the teams developing for different OEMs.

Volvo's selection of suppliers for the P28 and P1 projects was predominantly made from the criterion of price. Although Volvo aims to use more or less the same supplier structure for all models based on the same platform, the choice of suppliers for the P28 project was not very dependent on the suppliers' former participation in the P2 project. The suppliers of the P1 project cover a larger geographical area than the suppliers of the P28 project. This is mainly due to the fact that the sourcing of the P1 project was done in cooperation between Volvo and the central purchasing department at Ford, which acted in the best interest of the Ford group. The first question asked by the purchasing department today is whether a product should be brand unique or common within the group.

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5.3 Product Development in Collaboration

This case study has been focused on the collaboration between the first and the second tier suppliers who were engaged in the product development of the seats for the P28 model and the P1 platform. The purpose of this study is to show how the collaborative product development is conducted and what problems it entails. The following sections will therefore describe this collaborative work and its shortcomings expressed from both the customer and supplier perspectives.

5.3.1 Responsibility for Product Development

Product complexity generally increases as you move forward in the value chain. This is reflected in the product development of companies in the different categories. The first tier system suppliers develop entirely new systems while the other companies' development mainly concerns minor improvements of existing products. However, a considerable part of the first tier suppliers and the second tier suppliers develop new components and subsystems. The first tier system suppliers are, to a large extent, responsible for product development, while companies in the other categories mainly manufacture their products according to plans and specifications from the customers.¹⁹⁰

The first tier suppliers studied in this thesis are examples of companies with an extensive responsibility for development of their products. They are, however, in turn outsourcing much of the responsibility to the second tier suppliers, who have a large share of the product development. This has led to a situation where Volvo, to some extent, considers the first tier supplier to be only an intermediary of information. A general opinion at Volvo is that the first tier suppliers need to take more responsibility for all activities further down the supply chain.

Furthermore, the first tier suppliers are, to some extent, considered by Volvo to lack sufficient product development competence in-house. This fact makes the first tier suppliers unable to handle the product development cooperation with the second tier suppliers in a satisfactory way. Hence Volvo feels obligated to interfere in the activities further down the supply chain, although this is something that they actually want to avoid. In the future, Volvo wants the first tier suppliers to take full responsibility for the activities further down the value chain. As one respondent at Volvo expressed it, "What is the point of outsourcing the development to the first tier suppliers if we still have to interfere further down the supply chain?" Another common opinion within Volvo is that while outsourcing is good for production efficiency, it affects the success of product development projects negatively.

Clear technical requirements are considered important in order to facilitate effective product development collaboration. Volvo recognizes that they need to become better in developing clearer technical requirements to the first tier suppliers. It is, however, hard to communicate all necessary information through the technical requirements. Also, Volvo does not want to write too-detailed specifications, since this is supposed

¹⁹⁰ von Corswant (2000)

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to be done by the first tier suppliers who are responsible for the development of the systems. Nevertheless, it is evident that Volvo's technical requirements have not kept up with the high pace of the outsourcing.

It is the first tier suppliers that are responsible for the development and production of the seats. Hence it is the first tier suppliers that are responsible for involving the second tier suppliers. Volvo owns the products and pays the first tier suppliers for the product development. Most often, the second tier suppliers are paid by the first tier suppliers for their participation in product development. However, according to the suppliers, the income for development work never exceeds the costs, and hence it is the production orders that account for their profit. Since production tools require investments that are very large to many second tier suppliers, the tools are often owned by Volvo and bought by the first tier suppliers for Volvo's account.

X-marked Products

All products of second or third tier suppliers that are considered to be of particular strategic importance in a Volvo car are called X-marked products. The most common X-marked products are safety systems and surface materials. Safety systems are of large strategic importance to Volvo, since they have an established reputation as being a leader within car safety. Surface materials are strategically important since the customers highly value design. A front seat includes many X-marked products, including the recliner, fabrics, and air bags.

Volvo sources the X-marked products, and is responsible for the quality and construction, while the first tier supplier solely integrates the products in the seat. The X-marked products are, according to Volvo, a necessity, although they imply many problems. Regarding the distribution of responsibility for X-marked products, the supplier structure is very complex. Volvo communicates with the supplier that produces the safety products, which in turn delivers to the first tier supplier. A large problem for Volvo is that the occurrence of X-marked products makes it hard for them to hold the first tier suppliers responsible for the seat construction. If any faultiness appear in the product, it is easy for the first tier supplier to push the responsibility onto Volvo by blaming the X-marked products. For example, if there is a problem with a rattling noise in the seat construction, the first tier suppliers usually blame the recliner. Since this is an X-marked product, it is Volvo that is responsible for the problem and thus has to pay to take care of the problem.

5.3.2 Openness and Trustworthiness

The automotive industry is characterized by an open attitude towards cooperation and exchange of knowledge. Thus it is possible for suppliers to cooperate closely with different customers without the latter worrying too much about competitors getting access to their knowledge through the suppliers. The fact that the automotive industry is very research intense makes it hard to keep secrets. The general mentality is that it is better to exchange information with other actors than to be surprised by them. Many OEMs may even require their suppliers to collaborate with other OEMs since this increases the level of knowledge of the suppliers. The different parties might

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withhold information from each other during the negotiation phase, but as one respondent at a second tier supplier expressed it:

“Once the project has started, we are all one happy family. We do not keep any secrets from each other.”

5.3.3 Communication

According to all involved parties in this study, well-functioning communication is a prerequisite for prosperous collaborative product development. The level of communication that is necessary between customer and supplier during a development project depends on the complexity of the supplier's product and its interface with the customer's product. Hence the communication between Volvo and the first tier suppliers is extensive due to the high complexity of the products and the extremely complex interfaces that exist with the rest of the car.

The communication between the first and second tier suppliers is very extensive as well, even though it varies greatly depending on what kind of products it concerns. The level of communication also fluctuates significantly depending on the different phases of the project. This means that during the more intense periods, such as the early concept phase, the communication is extensive. During these periods the parties communicate on a daily basis since the projects advance at a very high pace. During the less intensive periods of a project, communication occurs once a week at project, though, tuning meetings. This is depends on the complexity of the product since a more complex product requires communication more or less every day, even during less intense periods.

The level and the quality of communication are significantly affected by the stressed situation that characterizes the automotive industry. The stress makes the involved parties prioritize in a way that does not facilitate communication, which has a large impact on the ongoing development process.

Communication is facilitated if the customer and the supplier are situated geographically closely together. The first tier suppliers have chosen to locate their product development and production facilities in close connection to Volvo. This is due to the high degree of complexity and the interface with the rest of the car. On the other hand, the situation looks a bit different between the first and second tier suppliers.

Though it is emphasized that communication is necessary on a daily basis during some periods, a geographically close location among the second tier suppliers is not regarded as important. It is considered that the communication can be handled through e-mail, phone calls, fax, or by visiting each other when needed, which requires a not-too-far distance. Most suppliers consider that they are situated at a close enough distance to be able to reach their customer in a couple of hours if needed. If the supplier's development department is located abroad, communication, and deteriorates the speed of the collaborative product development slows.

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The need for close geographical location is more important when it comes to production. Here, many suppliers say it is crucial to be closely located to one's customers to be able to deliver the products in time. There are, of course, suppliers that represent the exception that confirms the rule by handling production of products abroad despite the time-consuming transports.

Resident Engineers

To handle the requirement of intense communication, the second tier suppliers of more complex products often have resident engineers at the customer. Resident engineers bring a lot of benefits to the collaborative parties. The main benefit is the possibility of daily spontaneous communication, which is sometimes necessary due to the high pace of the development projects. However, the majority of the second tier suppliers have resident engineers located at their customer only for periods when the situation so requires, especially during the early stages of product development when the need for communication is large. Additionally, the need for resident engineers is dependent on the product complexity as well as the complexity of the interface between the supplier's and customer's products.

Some of the smaller second tier suppliers have expressed that due to the small projects conducted, it is impossible to have resident engineers, since it would be too large of a sacrifice for the project group. The closeness to the customer is satisfactory for their situation.

Furthermore, the usage of resident engineers makes it easier for the first tier suppliers to hold the second tier suppliers responsible if they, through their resident engineers, have access to all the necessary information. However, as one second tier supplier states it, due to information security issues, is impossible to have resident engineers stationed at their customers. The project members must have access to the company information-sharing network, which cannot be shared with the customers, and thus does not allow the project members to be located at the customer.

Electronic media is also a very important part of the communication between first and second tier suppliers. E-mail, Internet, and electronic CAD-models are the most important. E-mail and information exchange over the Internet have become daily practices which facilitate fast communication, but which are also perceived as time consuming, due to the information overload. Exchange of CAD-models is, however, one important factor that has smoothed the progress of collaborative product development. CAD-models are electronically transferred frequently between the different parties during the development projects. It is important that the suppliers use the same CAD-standard as their customers. Because different OEMs use different standards, this necessitates large investments, which can be a problem for smaller suppliers.

Communication Involving Three Parties

Although the second tier suppliers communicate mainly with the first tier suppliers, they are sometimes invited to participate in the meetings between the first tier suppliers and Volvo. This occurs mostly in the early phases of the project and when

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problems occur later on. Volvo finds this participation necessary to a certain extent, but they do not wish to increase it. The second tier suppliers want to have as much contact with Volvo as possible during the development projects, since communication with Volvo is considered to simplify the development work. The first tier suppliers do not fully approve of this contact, since they feel it might undermine their position with Volvo. According to Volvo, there are more disadvantages than advantages with common meetings between them and the second tier suppliers.

Since Volvo is responsible for the sourcing of X-marked products, they communicate directly with the second tier suppliers. In these cases, the relation between first tier suppliers and second tier suppliers is limited to the production phase. This relation is not always satisfactory, and the communication between the first and second tier suppliers is almost non-existent. Even for other products, there is sometimes direct contact between Volvo and the second tier suppliers, without the participation of the first tier suppliers, although this is officially not the case and is to some extent denied by the first tier suppliers. Some second tier suppliers want to have as much direct contact with Volvo as possible, while others avoid it since they consider it as going behind the back of the first tier suppliers. Volvo is trying to avoid direct contact with the second tier suppliers, since it makes it harder for them to hold the first tier suppliers responsible for the products.

Volvo does not want to take over the role of the first tier suppliers, which includes responsibility for the second tier suppliers. Volvo does want the first tier suppliers to keep them well updated on the problems at the second tier level, which is where most problems occur. The first tier suppliers normally cannot explain to Volvo what is going on further down the chain, usually due to lack of detail competence. According to Volvo, the first tier suppliers are not passing on enough information, and are not coordinating the activities further down the chain satisfactorily. This predominantly concerns communication. Engineers at Volvo find that the information from the second tier suppliers is filtered because of the additional step through the first tier supplier. It is therefore considered necessary with occasional participation of second tier suppliers in project meetings. The first tier supplier, on the other hand, sometimes feels sidestepped when the engineers at Volvo communicate with the second tier supplier.

According to many of the second tier suppliers, it is important to be careful about what information is exchanged in the relation to Volvo. The second tier suppliers mean that they must only discuss technological issues with Volvo, and no business-related questions, since this would harm the relation to their customers. Many second tier suppliers feel it is very important for them to show their technological competence to Volvo so that they are aware of their appropriateness for future projects.

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5.4 Customer Perspective

In this chapter we present issues of collaboration as seen from the perspective of the customers (the first tier suppliers). The opinions regarding supplier collaboration are shared by more or less all of the respondents.

5.4.1 Relational Issues of Collaboration

The predominant view of the first tier suppliers among the interviewees is that a close relation is the most important factor for fruitful collaboration. The opinions differ regarding the openness of the information exchange with the suppliers. Some think the climate is very open and that secret information is not a problem. Others perceive the communication as not totally open, but consider it a minor problem. The high degree of stress in the automotive industry was mentioned as one of the reasons for insufficient communication in the entire supply chain. Compatible CAD-systems are considered a prerequisite for well-functioning collaboration.

The general opinion among the first tier suppliers is that cultural differences are not a big problem when concerning the collaboration. There are, in general, more similarities than dissimilarities, and the American company culture of the first tier suppliers does not influence the relations to their suppliers. All companies today are used to working with foreign suppliers and customers. The collaboration usually works well, and engineers from the second tier suppliers are normally represented at Volvo during a project.

Improvements can be made in the business agreements between the first and second tier suppliers. The agreements have to be made more complete and transparent from the start of a project. This is something that is often neglected because of the intense time pressure. Inadequate agreements lead to unclear division of responsibility, which is considered a large problem.

5.4.2 Customer Issues of Collaboration

The first tier suppliers generally consider themselves to be aware of the critical issues that they have to improve as customers. According to themselves, they know they have to improve their ability to communicate and spread information. The first tier suppliers think that they should involve the second tier suppliers at an earlier stage. It is also important, at the early stage, that both parties take time to get to know each other and to develop a detailed time schedule. The first tier suppliers need to communicate more clearly with their suppliers and invest more time in the ramp-up phase. This will create a common belief in what will be delivered, and will reduce misunderstandings and costs down the line.

The customers know that they have to become better in communicating their technical requirements to the suppliers. A legible specification of the technical requirements, which breaks down the liability more efficiently, leads to fewer misunderstandings, better time schedules, and superior price information. The first tier suppliers also need to improve their skills in project management and supply

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management. Another problem at the customer's end is lack of communication between the purchasing department and the technical department.

5.4.3 Supplier Issues of Collaboration

The first tier suppliers' opinions about the second tier suppliers vary a lot. Some of them are considered to be excellent suppliers, while others are considered unsatisfactory. A common mistake of the suppliers is to misjudge the complexity level of a product development project. Some of the respondents mentioned the importance of the second tier suppliers being more focused on their customers, the first tier suppliers, instead of focusing on Volvo. They also need to improve their knowledge of the consumer, take more responsibility, show their knowledge to the customer, and improve the quality. Swedish suppliers have got production competence, but they need to learn how to take advantage of this more in their business. Although the ability to produce efficiently is important, the second tier suppliers tend to be too process oriented, while forgetting the importance of product development capabilities. The first tier suppliers expect the second tier suppliers to have the same ability to react quickly, and the same customer focus that they have.

The first tier suppliers want the second tier suppliers to take responsibility for involving themselves earlier in the product development process. The predominant view among the respondents of the first tier suppliers is that the second tier suppliers have to be more proactive and come up with new and original design solutions. The suppliers also have to review the customer's specifications more thoroughly and communicate to the customer what is possible and what is not. It is important that the suppliers question the customers earlier in the development process, instead of complaining halfway into the project when it is often too late to solve the problems. Furthermore, the suppliers need to more actively ask the customers for information, rather than just waiting for it.

In order to broaden their competencies, it is necessary for the Swedish suppliers to cooperate with customers in other countries. It is very important that the suppliers are able to rationally produce products and deliver on time. The biggest problems appear when the supplier is not used to the automotive industry's high level of demand and fast pace.

A common view among first tier suppliers is that the occurrence of direct contact between second tier suppliers and Volvo is a problem, which creates a complex communication situation. Second tier suppliers acting behind the back of the first tier suppliers leads to misunderstandings. The general opinion of the first tier suppliers is that the second tier suppliers want to maintain the direct contact because of an earlier established relation with Volvo. The first tier supplier cannot prevent this relation, merely emphasize that the first tier supplier is the actual customer of the second tier suppliers. According to the first tier suppliers, Volvo is no longer (except for X-marked products) interested in any communication with the second tier suppliers, which is something that the latter have yet to understand.

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A majority of the respondents at the first tier suppliers believe that local presence of the second tier suppliers was a prerequisite for well-functioning collaboration. It is more complicated to work with suppliers with development departments situated abroad. The cooperation between the supplier's local office in Sweden and its head office abroad is not always working sufficiently well, and the local offices often suffer from a lack of authority regarding decision making. A minority of the respondents does not see the geographical distance as a problem. It is, however, of utmost importance for the suppliers to master the language of the customer.

Furthermore, one opinion among the first tier suppliers is that it is easier to collaborate with external second tier suppliers than with internal ones. It is considered a problem that internal suppliers do not have the same respect as external ones. Also, when problems occur in the case of internal suppliers, Volvo sees the company as a whole, and thus holds the first tier supplier responsible without understanding that the problems occur at second tier suppliers.

5.5 Supplier Perspective

In this chapter we present issues of collaboration as seen from the perspective of the second tier suppliers, who have a quite common experience of the relations to their customers.

5.5.1 Relational Issues of Collaboration

When it comes to business relations, the automotive industry is characterized by rather low trust between the actors. To change this situation, it is important to build secure and long lasting customer relations, according to the second tier suppliers. Comparisons are often made between the Japanese and the European automotive industry culture. The Japanese customers cooperate with their suppliers on a long-term basis, where the suppliers often feel very secure. The second tier suppliers in the Swedish market, on the other hand, feel very insecure in their relationship with the customer, upon whom they are very dependent.

Although the trust is generally low regarding business relations, there is very high trust in the development projects. The predominant opinion among the second tier suppliers is that the communication is characterized by openness. Hence there are no substantial problems with the different parties withholding information from each other. Some of the respondents state that they withhold some sensitive information from the customer in the start-up phase of the projects as long as the customer has not yet decided in their choice of supplier. This is not considered a major problem. One second tier supplier also states that the first tier suppliers tries to milk them for as much information as possible, while giving little information back.

Much of the problems in the relations between first and second tier suppliers arise from the companies lacking knowledge about each other's capabilities and limitations. The understanding and communication in the supply chain would benefit from all actors having more knowledge about each other's production systems and development capabilities.

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One of the most frequent opinions among the second tier suppliers regarding the collaborative product development is that the division of responsibility ought to be more clearly defined. Unclear division of responsibility is indeed a source of inefficiency where many hours are being spent on reinventing the wheel. The contracts written between the customers and suppliers must be more carefully and precisely written so that no doubts occur. It is important to have clear business agreements in order to avoid responsibility discussions later on in the projects. Due to the previously mentioned intense time pressure, the planning phase often becomes less prioritized which leads to insufficient contracts. If the responsibility question is profoundly investigated this will result in great timesaving and thus the projects will be more efficient in the long run. Many suppliers experience that the lack of emphasizes on this matter results in a confused development process, where duplication of work is not unusual.

5.5.2 Customer Issues of Collaboration

Many of the second tier suppliers are worried about the ever-hardening conditions in the industry. The development has lead to an extreme focus on price and time reductions, where the customers put a huge pressure on the suppliers to fulfill their commissions within very tight time frames and at almost no cost. Today, customers make use of suppliers to squeeze the price levels more widely than some years ago. Many suppliers perceive the demands from the customers as impossible to satisfy in a long-term perspective. As one supplier describes the situation:

“Today the customer demands price reductions on a yearly basis despite the increasing cost for wages, energy, and materials. This makes it hard to gain profit.”

The second tier suppliers criticize their customer for being much too focused on short-term earnings, which is partially blamed on their American company culture. It is considered a problem that the performance of the purchasers is appraised only by their ability to cut costs.

The tough price pressure complicates the communication and thus the development of a good relation. Additionally, many customers do not keep their promises regarding costs and volumes, which may be very distressing for the suppliers. Some suppliers also indicated that when problems arise in the development collaboration, customers should handle it with creativity, and not with punishments as they do today.

The ever-growing demand for shorter lead times has a great impact on the ongoing collaborative product development. It is considered of great importance to spend much time on profound and careful planning in the start-up phase of a development project. However, according to many of the second tier suppliers, the first tier suppliers spend too little time on planning, which, among other things, causes unclear division of responsibility. The general opinion is that better planning would result in a much more well-organized development process. Even though this is a widely accepted fact, it is not a goal that the industry in general works towards. Many of the suppliers have expressed a frustration over the escalating time demands and the way

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they affect the development process. Additionally, the orders from the customers often come very late and thus result in a very tight schedule for the suppliers.

A common view among the second tier suppliers is that the customers have clear problems in allowing suppliers to take full responsibility for their respective part of the project. Even though the suppliers are given the responsibility, the customers interfere and have opinions regarding the design of the product or subsystem. Even though the customers do not have the sufficient knowledge regarding the specific product, they may question the suppliers' competence. Additionally, they may criticize the price fixing of the suppliers without enough knowledge of the background.

Another immense question according to the suppliers is organizational shortcoming of the customers. When organizing a product development project, it is of the utmost importance to have structured project management, which in many cases the customer has not been able to fulfill. The projects are very complex and fast moving, which make them difficult to manage, but not less important. The lack of competence regarding project management is one of the major imperfections that affect the development collaboration, and does thus a large area need improvement. This shortcoming of project management competence is, according to many suppliers, a result of the fast staff turn over and thus lack of continuity in the project teams. This, in turn, may be a consequence of the American company culture that characterizes the customers. Furthermore, the customers' lack of competence and knowledge in general is an area of complaint where suppliers consider that customers get into many discussions regarding price etcetera without the requested knowledge.

As expressed by all actors involved in this study, communication is one of the most important attributes to attaining a successful cooperative product development. The organizational shortcomings that were mentioned during our research involved the way that communication is organized. Some suppliers consider that more efforts should be paid to develop a better performing organization for communication with well-defined ways of communication. One step to reach this could be, for instance, for the first tier suppliers to appoint one responsible contact person for each subsystem.

When it comes to organization of a development project, many suppliers also consider it important that the customers have the right project staffing. This means the project manager and other central persons must be powerful and in a position to make the required decisions. Today, though, it is frequently occurring that the project groups of the customers do not have the power to make required decisions. The project manager has to get approval from a higher level in the organizational hierarchy, which results in irritatingly long decision times. Many second tier suppliers also believe that this is a result of the dissimilar cultural styles that characterize the companies originating from the US and Europe. The US style of organization culture differs from the European, in that the US companies have a more hierarchical structure compared to the European flat organizations. Additionally, the American style implies very tough negotiating conditions and in many cases scare mongering,

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which the suppliers have learned to handle. The second tier suppliers' opinions regarding the organizations of the first tier suppliers are partially supported by Volvo. The predominant opinion at Volvo is that the big hierarchical organizations of the first tier suppliers causes unnecessary long lead-times for decision making, which is considered a problem in the cooperation.

Regarding the impact of cultural differences, the opinions are widely spread. It is a common fact that there are major cultural differences between companies in the automotive industry, especially between companies from different countries. However, some interviewees state that cultural differences can be a major problem, while others state that it does not matter at all. It is a general opinion, though, that the cultural differences are affecting the collaboration less and less, thanks to extended use of standards and the fact that the English language is becoming more and more accepted.

Some second tier suppliers think that for a fruitful collaborative product development, it is necessary to have more frequent joint meetings with Volvo, the first tier supplier, and themselves present. This is to be able to solve problems that arise suddenly during the project in a more convenient and efficient way. The cross-functional teams, which would facilitate the three-part communication, could even be jointly located during intense periods. Today, it is more common that Volvo contacts the first tier suppliers, who in turn spread the information to the second tier suppliers. According to some second tier suppliers, Volvo thinks that more frequent three-party meetings would be beneficial to the development projects, even though they emphasize the importance of not taking over the system responsibility from the first tier suppliers. The second tier suppliers are, however, well aware of the advantages and disadvantages that arise when all three parties interact. This three-party meetings should thus, according to all second tier suppliers, merely concern the technological areas and not any commercial issues, which should be handled solely between the customer and the supplier. Today, the first tier suppliers often consider these three-part meetings unnecessary and thus prevent them in order to keep the total control over their system delivered to Volvo. First tier system suppliers are thus, according to the second tier suppliers, often regarded as an obstacle both by Volvo and the second tier suppliers.

The specifications originating from Volvo are subjects of discussion at many second tier suppliers. The specifications are sent from Volvo down through the supply chain to the first tier suppliers who in turn try to decompose the specifications to make them accurate for the subsystems. The specification is often made rather vaguely, which increases the need for communication in order to sort out the problems that arise. The first tier suppliers often pass the specifications from Volvo more or less directly on to the second tier suppliers without decomposing them properly. The development work of the second tier suppliers would be much easier if the first tier suppliers would take the time to decompose the specifications in a clear way. However, much of the problems are caused by Volvo's specifications to the first tier suppliers being rather poor. The first tier suppliers' decomposition of the specifications would be much easier if the specifications were clearer to begin with. One second tier supplier, for

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example, mentioned that the specifications from Volvo occasionally might be deliberately written in a vague way. A typical example of this is the requirement that a subsystem should be noise free, which is impossible for a single second tier supplier to fulfill since noise might occur in the interface between different subsystems. By writing deliberately vague requirements, Volvo can easier hold the suppliers responsible even for problems that might not be their fault.

5.5.3 Supplier Issues of Collaboration

The second tier suppliers are well aware of the most important factors that they have to change to improve their product development collaboration. Most respondents agree that price is the most essential factor they have to improve. The pressure from above in the supply chain forces them to focus on cost in order to be able to lower their prices even more. It is crucial that the suppliers manage to improve the efficiency in their processes in order to be able to cut the costs according to the demands from the customers.

Since many suppliers are getting more and more responsible for product development and production, they have had rapid organizational growth. This growth in addition with fast staff turn-around implies a large number of inexperienced personnel. This, in turn, has resulted in a lack of project management and project staffing, which has affected the collaborative capability of the suppliers. Additionally, it is common that the suppliers take orders even though they do not have the resources to manage them. Many suppliers, though, consider it better to be honest about one's deficiencies. Some respondents believe that many suppliers further down the value chain have to focus on and improve their process-development capability. In an effort to become more efficient regarding production, there should be more active benchmarking performed.

Many suppliers regard themselves as not being as proactive and active in the product development process as desirable. Suppliers also must dare to question the first tier suppliers and criticize their specifications and technical regulations. Since the specifications received from the customers are often insufficient, the suppliers must have a model to concretize these specifications. Furthermore, some suppliers have experienced that their comparatively small size influences their relations with the customers. They do not have the power required to affect and influence their superior and powerful customers. Instead, they have to accept the rules dictated by the customers.

5.6 Restraints of Collaboration

The restraints of collaboration that have been presented from both the customer and the supplier perspectives are summarized in Table 5.1. Restraints that occur in both the customer and the supplier perspectives have been marked with bold type.

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Table 5.1 The restraints of collaboration summarized from the perspectives of both the first and second tier suppliers.

	Customer Perspective	Supplier Perspective
Relational Restraints	<ul style="list-style-type: none"> • High degree of stress within the industry • Contracts written are inadequate, thus the division of responsibility is unclear. 	<ul style="list-style-type: none"> • The actors' knowledge of each other's capabilities is insufficient. • Contracts written are inadequate, thus the division of responsibility is unclear.
Customer Restraints	<ul style="list-style-type: none"> • Poor communications of information down the supply chain. • The second tier suppliers are not involved early enough in product development • Insufficient time is spent on planning in the start-up phase. • Unsatisfactory communication of specifications. • Unsatisfactory project management skills. • Lack of communication between purchasing and technology department. 	<ul style="list-style-type: none"> • Too much focus on price. • Promises regarding cost and volumes are not kept. • Problems are handled with punishment instead of creativity. • Insufficient time is spent on planning in the start-up phase. • Suppliers are not given the chance to take full responsibility. • Interferes with the activities of the suppliers without having sufficient knowledge. • Unsatisfactory project-management skills. • Staff turn around is much too fast. • Communication is insufficiently organized. • The decision hierarchy is too centralized. • Too few three-party meetings are organized. • Decomposition of requirements is scarce.
Supplier Restraints	<ul style="list-style-type: none"> • Too much focus on Volvo instead of the customers (first tier suppliers). • Lack of knowledge about the consumer. • Suppliers do not take enough responsibility for product development. • Too much focus on process development instead of product development. • Lack of proactiveness and own design solutions. Suppliers do not show their knowledge to the customers. • Suppliers do not question the technical requirements enough. • Suppliers do not question the customers enough early in the project. • Suppliers are too passive in the collaboration – they wait for information instead of asking for it. • Lack of competencies due to not enough collaboration with customers abroad. • Desire for direct contact with Volvo. • Development department abroad leads to problems with communication. 	<ul style="list-style-type: none"> • Lack of project management and project staffing. • Inadequate involvement in product development. • Lack of proactiveness • Suppliers do not question the technical requirements enough.

5.7 Chapter Summary

In this chapter our empirical findings have been described. First, an explanation of the Swedish automotive network was provided. This was followed by a description of our case studies of the collaboration between two first tier suppliers and their second tier suppliers within the Swedish automotive industry. We have presented important problems from our empirical findings regarding collaborative product development. The relations have been highlighted from both the customer and the supplier perspectives, which has displayed the problem areas clearly. These restraints of collaboration will be further analyzed and discussed in the next chapter, the *Analysis*.

Analysis

This section contains our analytic reasoning in accordance with the purpose of the thesis. In the first part of this chapter, we will try to find the underlying reasons for the problems found during our empirical research. In the second part of the analysis, we put together the discovered reasons to create the model called the Wheel of Fortune.

6.1 Underlying Reasons for Problems in the Collaboration

Through our empirical research, we have focused on the problems and obstacles that complicate the collaborative product development between the first and second tier suppliers within the Swedish automotive industry. In the following analysis, we will discuss these problems and try to find the underlying causes of each problem. This is, however, a very complicated task since the relations between all problems and causes are very complex. Some problems cause other problems, while these in turn are the origin of other problems. This makes it very hard to sort the problems logically and explain what the cause of every problem is.

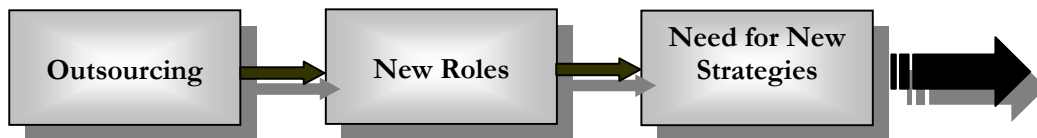


Figure 6.1 The effects of outsourcing in the automotive industry.

Outsourcing has led to new roles for the actors within the automotive industry. These new roles are the starting point of the problems we have encountered during our empirical research. They have implied a need for developing new strategies (see Figure 6.1) in order to attain the goals of the industry, the supply chain, and the individual company. Hence the knowledge and understanding of the top management at the different levels of the supply chain is very important for success. It is the top management that has the main responsibility for strategy development and thus the way of acting in the industry. During our empirical research, we have seen that it is a common fact that the actors, and thus their top management, have not yet fully adapted to the new situation.

In the new situation within the automotive industry, long-term relations and supplier integration in product development have been emphasized. According to Wynstra et al. supplier integration into new product development can yield numerous short- and long-term benefits. Furthermore, Ragatz et al. and Handfield et al. state that the

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supplier involvement render long-term competitive advantages. Even though the theory suggests close collaboration with equal investments, trust, and intense communication, this is not yet fully attained. The empirical study has shown that there are some behaviors that restrain the fulfillment of close and well-functioning collaboration.

6.2 Different Supplier Roles

Supplier involvement tends to be more complex and extra difficult to manage than may be expected. Before presenting the analysis of the discovered problems within customer-supplier collaboration, the main characteristics of the suppliers will be discussed.

In accordance with Kamath et al., four of the seven suppliers can be classified to have child roles. Three of the suppliers are in some respects classified as having mature roles and, in some respects, such as product complexity and technological capabilities, to have partner roles (see Figure 6.2).

The suppliers that are classified as mature design and manufacture complex assemblies, but not entire subsystems. Their technological capabilities and their processes and products are in general superior to those of the customers. The product complexity of the suppliers can in general be classified somewhere between partner and mature. The suppliers do not have as much influence on design as if they were partners; although the suppliers develop their systems according to specifications from the customers, they normally suggest design solutions. Because of the complexity of the systems, communication with the customers is intense from the concept stage on. Resident engineers stationed at the customers are common because of the complexity of the products and their interfaces with other systems.

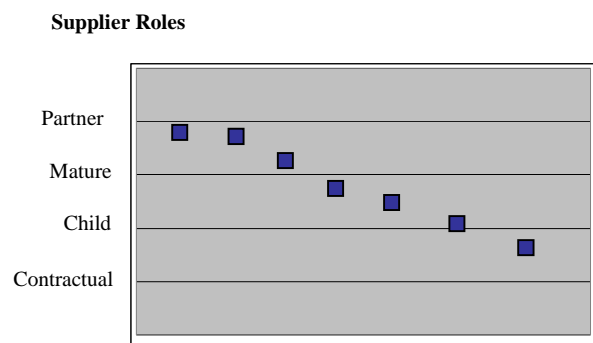


Figure 6.2 Characteristics of the second tier suppliers.

The suppliers that are classified as child have less influence on the design specifications than the mature suppliers do. They manufacture more or less after determined specifications from the customers. The communication between suppliers and customers is frequent after the concept stage, though. The suppliers sometimes

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have residential engineers at the customers. This is, however, not as common as in the case of the mature suppliers. The suppliers' technological capabilities are generally high, and in that respect they may thus be classified as mature rather than child.

The classification of suppliers by Clark et al. is very similar to the one discussed above, concerning their involvement in the customers' product development. The products of the second tier suppliers can be classified as black-box products. The development work is split between customers and suppliers, but as noted in the empirical study, the customers do not only specify the technical requirements and send them over to the suppliers; rather the development work is an iterative process. Additionally, Volvo has a large influence on the specifications and requirements that are sent down the supply chain. The suppliers and customers work closely together and the suppliers have their own project managers and engineers for different development projects at the customer. This means that the black-box term tends to be somewhat incorrect, and the expression gray-box will therefore further be used instead.

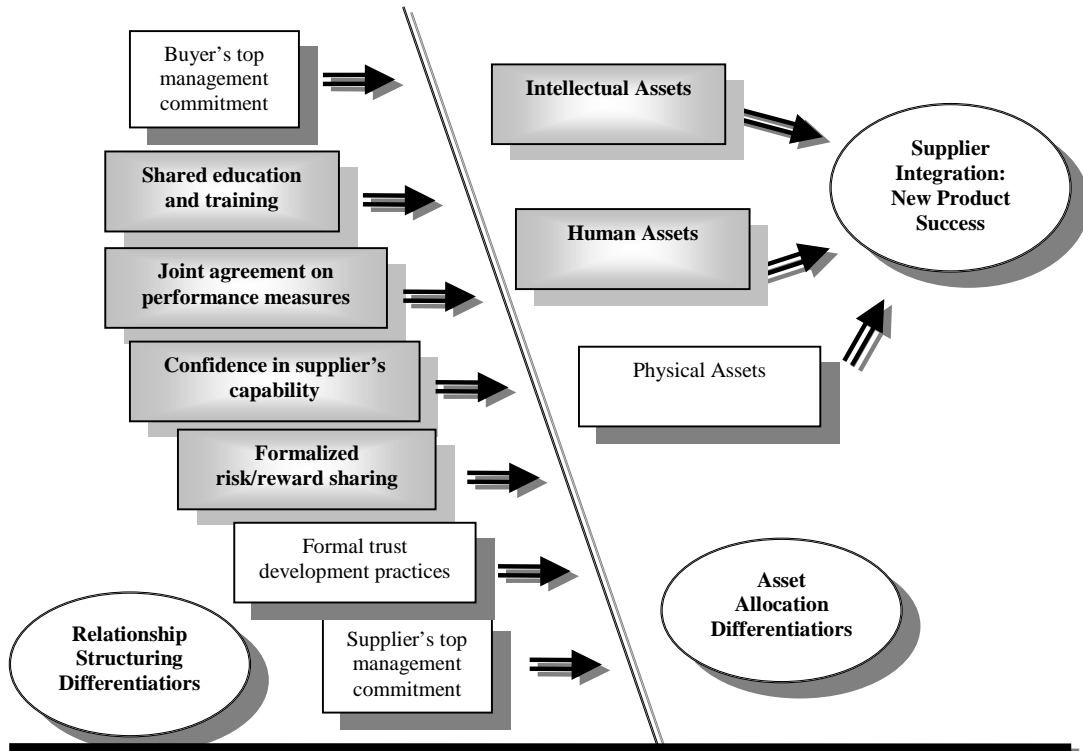
As seen in the theory, the above models used for differentiation of suppliers are often criticized for the way they classify different suppliers. They are normally static and inflexible in assuming that a supplier should be involved in the same way in different development projects. During the empirical study, the insufficiency of this kind of models has been noted. It is difficult to classify a supplier accurately based on some parameters. The collaboration between customer and supplier is very complex and differs from one project to another.

These types of models are also often criticized for focusing more on suppliers' potential contribution than the actual need for such contributions. The models only present guidelines for the degree and timing of involvement and important advice regarding coordination, communication, and differentiation are missing. The use of the Ragatz et al. model, *Two Themes of Successful Supplier Integration In New Product Development*, will help us to make a more thorough analysis of the empirical material. Critical factors concerning coordination of the activities of the customer and the supplier will be used as a tool to analyze and identify the main and thoroughgoing causes of each problem identified in the empirical study.

6.3 Successful Supplier Integration in New Product Development

The empirical problems are structured with the model of Ragatz et al. as a base, and are analyzed under the differentiators and non-differentiators marked in the model.

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Confidentiality Agreements Formal - Assessment of Supplier's Capabilities - Formalized Process to Select Suppliers - **Cross Functional Teams for Supplier Selection and Planning** - Involvement in Establishing Goals - Clarity of Target/Metrics - **Stability of Project Team** - Consensus that Integration was Needed - Goal Consensus

Figure 6.3 The Ragatz et al. model of critical factors for successful supplier integration. The darkened fields represent the fields where problems are identified. These fields plus the highlighted non-differentiators at the bottom will constitute the structure of the following analysis.

The problems are grouped into relationship-structuring problems, asset-allocation problems, and non-differentiator problems. The third category represents the problems found among the non-significant differentiators. According to the theory, these factors are crucial for the existence of a good working collaboration but cannot be regarded as differentiators. The empirical results indicate that they are indeed important, since some of them are considered to be major problems in the collaborations.

Some of the differentiators are not linked to the empirical problems. It is, however, important to point out that this does not mean that these differentiators are less important. Rather it is probably so that they represent aspects of the studied customer-supplier relationships that are not considered as problems. A short discussion of these differentiators is given below.

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There are no problems from the empirical study that are directly connected to *shared education and training*. The problem that the actors lack knowledge in each other's capabilities might be affected by more shared education and training. However, since there are no direct connections, this problem will be analyzed under the differentiator intellectual assets, in connection with technology information sharing and direct cross-functional inter-company communication.

The empirical study shows that lack of trust is a big problem. However, since it is doubtful that mutual trust can be attained through *formal trust development practices*, the problems regarding trust will be analyzed in connection with other factors.

Top management commitment of the buyer and the supplier is truly an important factor. The outsourcing in the automotive industry has made customer-supplier collaboration in product development an important matter, which managers focus a lot of their attention on. During the empirical study, no problems directly related to top management commitment were found.

The empirical study implies no substantial problems regarding *physical assets*. Common and linked information systems, such as CAD-systems, are prerequisites for product development cooperation within the automotive industry. Thus all actors have sufficient and compatible information systems. Technology sharing is also rather well functioning, since the general attitude regarding inter-company sharing of knowledge is very positive. The number of shared physical assets is very limited during the product development phase. Under the production phase, there may be shared physical assets, such as production tools.

6.3.1 Relationship Structuring Problems

Joint Agreement on Performance Measures

It is clearly a problem that the suppliers find the customers much too focused on price. Ragatz et al. point out the importance of an agreement on performance measures that keep the projects on track by providing a common way to evaluate progress. Since the suppliers are aware of the customers' extreme price focus, and have no other choice than accepting the rules of the game, there is a sort of agreement on price as the main measure of evaluating progress. This can be considered a problem since there may be other performance measures that have greater impact on the success of the product development projects. Though not desirable, the first tier suppliers' focus on price is understandable since they, in turn, have pressure from Volvo to reduce the costs. The focus on price is something that characterizes the entire automotive industry due to the intense competition.

The customers' main focus on price indicates that the relationships are not partnerships. In accordance with Bensaou, it might instead be argued that the suppliers are captive, since the supplier market is competitive and the customers often shift between different suppliers in order to cut the prices. While partnerships require a focus on the long-term benefits, the suppliers consider the customers much too focused on short-term earnings. The fact that the suppliers consider the customers to

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be focusing on the wrong performance measures also shows that there might not be enough mutual orientation (Axelsson et al.) in the relation. The customers seem to lack understanding of the suppliers' product development processes and how they are affected by the focus on price.

Confidence in Supplier's Capability

Ragatz et al. mean that confidence in supplier's capabilities consists of two important factors: *familiarity with the supplier's capabilities prior to integration in the project* and *the strength of consensus that the right supplier was selected*. These two factors facilitate the collaboration, since they give the members of the project team the confidence to actively involve the supplier in the development process. During our empirical research, we have found some problems that can be related to the confidence in the supplier's capability, and hence are crucial to solve. In the following section, problems related to these two factors will be discussed.

One could easily get the impression that the lack of confidence is a matter, which must be dealt with at the customers' end. However, the empirical study suggests that there are reasons for the first tier suppliers' lack of confidence in the second tier suppliers' capabilities. Several problems in the cooperation, which have been mentioned by the first tier suppliers, can be seen as possible causes for their lack of confidence in the capabilities of the second tier suppliers.

First of all, the lack of proactiveness among the second tier suppliers is something that is considered a problem both by themselves and the first tier suppliers. The first tier suppliers would like their suppliers to come up with more design solutions and be more active in the product development process. The relations between customers and suppliers in the automotive industry today are very close, and are in some respects becoming more like partnerships according to Kamath et al.'s classification. According to most researchers, partnerships seem to be the most desirable way of customer-supplier collaboration. However, von Corswant et al. state that this requires a supplier that is proactive and takes great responsibility.

Proactiveness

The lack of proactiveness among the second tier suppliers probably does not originate from that neither the suppliers nor the customers have really gotten used to their new roles regarding collaborative product development (the new roles also cause further problems that will be discussed later on). Additionally, many suppliers who are relatively small cannot afford all investments that a close collaboration requires. To increase the involvement in the product development, and thus become more proactive, requires the suppliers to broaden their technological base, which can be quite expensive according to Kamath et al. Becoming more proactive is, however, much of a management task. According to Wynstra et al., it is crucial for the top management of both suppliers and customers to create a culture that promotes collaborative product development. Hence it is very important that the suppliers' top management creates customs that emphasize proactiveness.

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One of the problems that can be seen as part of the lack of proactiveness is that the suppliers are too passive in the collaboration. The customers think that the suppliers have to get better in asking them for information, rather than just expecting them to deliver it. This may originate from the fact that the customers are not committed enough to the collaboration, which Helper mentions as an important factor. This may lead to passiveness at the suppliers, which results in not enough investment in the relationships. For relations of the type we have studied, it is of great importance that both parties are investing equally in accordance with Bensaou's definition of strategic partnership. The lack of effort that the suppliers put in is thus partially a result of the lack of commitment of the customers. Hence both parties in some cases give signals that they are not committed enough, which leads to a negative trend for the collaboration. This is a matter for both to solve in cooperation; the customer has to encourage their suppliers to be more active and the suppliers need to change their attitude.

On the other hand, there are crucial reasons for the supplier to act as good as possible in the collaboration with their customers. The suppliers are very dependent on the few customers they have. The customers are not as dependent on the suppliers, since they are able to choose among several different ones. This forces the suppliers to be very active and to protect their position, which is a very clear indication of the relation that Bensaou refers to as supplier captive. The captive role also implies high product complexity and a supplier market that is characterized by intense competition, which also is significant for the market studied. The second tier suppliers have, however, mentioned that they are not involving themselves enough in product development. This demonstrates that at least some of the suppliers are aware of the changes they have to make.

Division of Responsibility

Another interesting problem, according to the suppliers, is that the customers do not let them take full responsibility for their respective subsystems. This contradicts the opinion of the customers, who think that the suppliers are not taking enough responsibility for the product development. This contradiction shows clear lack of communication, but also the customers' lack of confidence in the suppliers' capabilities. This problem is also part of the explanation of the previously discussed problem. When the suppliers feel that they do not get the full responsibility for their subsystems, they lose some of their motivation to act proactively since they are not treated respectfully.

The customers' lack of confidence in the suppliers derives both from insufficient trust, and that the customers are not used to the new division of responsibility. Today the second tier suppliers are getting an increasing responsibility for the product development, which also requires that the customers fully accept this fact and leave the responsibility to the suppliers. As mentioned earlier, the trend in the industry for the last years has been characterized by relations that in some respects become more like partnerships, with complex products that the suppliers have superior knowledge of (Kamath et al.). In line with the theoretical discussion of Svensson, this has increased the mutual dependency between the first and second tier suppliers, which in

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turn has led to trust becoming crucial to attain a well-functioning collaborative product development.

In order to overcome this trust problem, mutual orientation is one way to increase the trust in each other. In relation to Axelsson et al., the knowledge of ones partner's capabilities facilitates the improvement of trust towards each other. Furthermore, the knowledge of each other's firms gives the opportunity to align the objectives of the parties, which in turn may increase trust. An increased knowledge in each other's needs would also make them easier to satisfy. In addition, it is easier for the customers to give responsibility to suppliers whom they know understand their needs. In order to increase the mutual orientation, the second tier suppliers must, according to theory, become more active in the collaboration.

Product Development Focus

Another complaint that was found during the empirical research was that the customers consider the suppliers to be too focused on process development instead of product development. The problem mainly concerns child role suppliers (Kamath et al.), whose products are not that complex, but still have a lot of variable dimensions. Many suppliers have not kept up with the changes in the industry which have given them more responsibility. Hence they are not fully prepared and lack the competence to take the required responsibility. Additionally, it is very hazardous to participate in development projects since they do not render any profit; and not even further engagement in the project is guaranteed. This naturally explains why suppliers are more focused on process development instead of product development. Suppliers do not venture anything, since trust towards their customers is too low in this respect. Hence the customers need to take action in order to increase their trustworthiness.

Early Supplier Involvement

One opinion among some of the actors within our research is that the suppliers are not involved early enough in the product development. According to Hartley et al., early supplier involvement is one of the critical factors for success which increases the suppliers' perceived contribution to the product development. Additionally, early involvement of suppliers reduces problems at the suppliers, since it allows early planning for necessary changes. Hence it seems to be appropriate to involve suppliers at a very early stage, but there are obviously some factors that make this difficult to realize.

Today, the suppliers are not earning their money through product development, but through production. This makes the suppliers reluctant to participate in the development at a too early stage, since it is associated with a great risk of losing money, as receiving the production order is not a guarantee. Furthermore, the customers in many cases are also hesitant to involve the suppliers at an early stage. They are often afraid of leaving some of their share of responsibility to the suppliers. Besides this, they are afraid of involving suppliers at a too early stage and thereby risk losing some of their power and control.

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Exit-Voice Relationships

Some suppliers have complained about the way customers handle problems that arise. The customers are said to handle problems with the suppliers with punishment rather than creativity. This is a clear signal of what Helper classifies as an exit relationship. According to Helper, the automotive industry has developed more towards voice relations with exceptions in some respects. The empirical study, however, implies that all relations are not fully voice-based but more towards exit relations, where the customers frighten the suppliers by punishment and threats of leaving the collaboration.

This way of solving problems seems to be more common in the relations classified as child (Kamath et al.), since the responsibility of the suppliers is limited and the suppliers thus are much more dependent on the customers than the other way around. This kind of collaboration does not require the high level of communication mature relations do. Furthermore, when communication occurs, it is often regarding problems and thus the communication is negative in nature. One of the features of an exit relation is a low level of information exchange, where the nature of the information flow is negative and not mutual. Classifying customer-supplier relations in this way may be a bit inflexible, but many of the features of an exit relation seem to be fulfilled in the relations studied.

Furthermore, the commitment in a voice-based relationship should be mutual and at a high level, which represents the suppliers' confidence that the customer will continue to buy their products. In the exit relations, though, the commitment and thus the confidence is not at a high level. This can be seen mostly in the child relations studied but also in the relations classified as mature. In some respects the collaboration is working very well, but the suppliers are constantly afraid that the customers might change collaboration partners. This is also due to the trend in the industry that suppliers could easily be exchanged. Even if they have been engaged in the product development process, they can be replaced before the production phase if another partner with lower prices can be found. Hence in the early stages of a project, the customers do not want to tie themselves too much to particular suppliers, since this would make it hard to change suppliers.

Formalized Risk/Reward Sharing

Along with the discussion of Ragatz et al., formalized risk and reward agreements may be important, especially when development costs might deviate from forecasts. Today the companies typically agree on acceptable prices for development and production based on predicted volumes. However, few companies have formal agreements on who takes care of costs that exceed predictions. The occurrence of oral agreements regarding risks and responsibility emphasizes the importance of mutual trust.

Formal Business Agreements

According to both customers and suppliers in the empirical study, a big problem regarding collaboration is the lack of formal business agreements and contracts. The

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opinion among the suppliers is that this leads to inefficiency due to duplication of work. Furthermore, it leads to unclear division of responsibility, and a confused development process as a result of many customers not keeping their promises regarding costs and volumes. Both parties agree that the contracts have to be made more complete and transparent. Furthermore, contracts should be written as early as possible in the collaboration. If the responsibility question is investigated, this will save time, make the projects more efficient, and avoid doubts. According to both parties, the intense time pressure in the planning phase is an important reason that the contracts do not receive enough attention.

Both parties are aware of the problems and consequences regarding inadequate written business agreements. This is a good start, but it seems hard to explain the underlying factors and the real reason why it is so hard to make proper business agreements. It is therefore suitable to start analyzing the problem from a network perspective.

Many of the problems appearing within the Swedish automotive network seem to have their roots in the power structure. According to Håkansson and Axelsson et al., the relationships between customers and suppliers consist of both co-operation and conflicts, which was a thoroughgoing fact throughout the empirical study. The relationships in general are quite unbalanced, and the companies benefit from important links with other actors in their setting and try to affect and exploit the network in order to reach more advantageous positions. The firms are then expected to behave according to the norms associated with their positions. This was especially evident in the relationships between customers and child role suppliers, since these suppliers were normally smaller and had less power than the customers.

In order to work properly, the customer-supplier relationships require a combination of the two mechanisms authority and control (Haugland et al.). The empirical study suggests that there is not enough mutual trust between the parties, though. Without trust it may be hard to govern a relationship, which makes proper business agreements even more important. An increased grade of goodwill trust is needed, where the customer and supplier have a moral commitment to the relationship. This means that both parties are expected to share both gains and risks equitably. According to Schary et al., adequate trust between the customers and suppliers can render competitive advantage. The first step towards a higher degree of mutual trust might be the development of complete and transparent business agreements.

In line with the theoretical discussion of Axelsson et al. regarding mutual orientation and dependencies, some relations of the empirical study are unbalanced. Full mutual orientation between the parties is not successfully reached. The suppliers want to feel more secure, which can be obtained by better business agreements. At the same time, the powerful customers do not really want to trade off their flexibility for closer collaboration regulated through contracts. According to Axelsson et al., a firm may decide to trade off the benefits of flexibility for the benefits that strong relationships render. Furthermore, mutually dependent firms can have problems dealing with other relationships but should be able to manage the central relationship fairly well. Since

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the customers do not want to be tied up to particular suppliers in the early stages of a project, the result in the long run is a lack of benefits that close relationships would accumulate. This discussion is in line with the theory regarding bonds, where the opinion of Axelsson et al. is that contracts may legally tie companies together. The bonds are visible but they may be less cogent than they seem. The need to raise legal frameworks indicates that the other bonds may not work well enough, which can be seen in the empirical study.

Intellectual Assets

In the section of intellectual assets, Ragatz et al. discuss the importance of being open towards one's partners and sharing necessary information. If the suppliers will be able to satisfy their customers' needs, it is of crucial importance that the customers share all information needed. It is also necessary for the suppliers to actively search for the right information. For this to work, it is crucial to have well-established ways of communication and to share information at an early stage to be able to prevent and solve problems. This will, according to Ragatz et al., also lead to identification of each other's current and long-term product development capabilities. The empirical research indicates not only that these factors are crucial for well-functioning product development collaboration, but also that they are associated with a lot of deficiencies, which will be discussed in the following section.

Communication Between First and Second Tier Suppliers

The most common theme of the empirical problems is communication. The severity of this fact is evident by the fact that Ragatz et al. point out direct cross-functional intercompany communication as the most extensively used technique in successful supplier integration into new product development. There are indeed major communication problems, which is evident from the empirical study where it was frequently mentioned (see Table 5.1). Most of the problems are expressed by the second tier suppliers regarding the first tier suppliers' ability to communicate efficiently.

It is quite evident that the first tier suppliers have problems when it comes to communicating information to the second tier suppliers. Although they are aware of the problems, they do not appear to be dealing with them properly. It is thus necessary to develop well-defined ways of communication. According to Wynstra et al., the lack of communication is a typical relational problem. If not dealt with properly, it may lead to unclear agreements and diverging expectations, which in turn will lead to deteriorated efficiency and effectiveness. As mentioned earlier, the communication problems may have their roots in that the customers are not enough committed to the collaboration and exit-based relationships still seem to be more common than voice-based ones. As Helper states, information exchange is comprised of both the nature and mutuality of the information flow between customers and suppliers. Equal investment by both parties is therefore needed in order to make both parties more committed to each other.

Many of the problems regarding communication can also be blamed on organizational shortcomings of the customers. Both the second tier suppliers and Volvo think that

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the hierarchical organization of the first tier suppliers causes problems in the relations. It is thus obvious that there are cultural conflicts between the flat organizations of Swedish companies and the hierarchical organizations of American companies.

Of course it is necessary for both parties to take responsibility for improving the communication. However, since most problems seem to occur at the customers, they might want to consider some organizational change in order to improve their way of communicating with the suppliers. In order to attain successful collaborative product development, successful integration between the organizations of the customers and the suppliers is a prerequisite according to Wynstra et al. Although the hierarchical organization feels natural and is considered to be well functioning by American companies, such as the first tier suppliers of the empirical study, it might be necessary to adopt a flatter organization in order to facilitate communication and cooperation with the second tier suppliers. This will lead to better access to new technologies, increased quality, and reduced development time and cost (Wynstra et al.). Thus, the crucial organizational problems must be dealt with for successful supplier integration. Furthermore, communication would probably benefit by the appointment of one responsible contact at the customers for each subsystem of the seat.

There are also problems at the supplier end regarding communication. While the second tier suppliers blame most of the communication problems on the customers, the first tier suppliers think that both parties are responsible for the problems. The second tier suppliers are accused of being too passive in the communication, since the customers perceive them as just waiting for information rather than asking for it. When engaged in close relations where complex sub-systems are delivered, it is important that the suppliers act proactively, take more responsibility, and have a better knowledge of key technologies (Wognum et al., von Corswant). Additionally, the second tier suppliers see many communication problems at the customer end, but none at their own end. This makes it evident that the second tier suppliers consider communication to be the responsibility of the customers. As discussed earlier, the problem regarding commitment seems obvious. Both parties give signals that they are not committed enough, which leads to a negative trend for the collaboration. In order to be able to reach a voice-based relationship, equity investments are needed. The parties will then be more committed to each other, and the information flow will be better.

Communication Between Volvo and Second Tier Suppliers

According to Lamming, it is important for the second tier suppliers to maintain close contact not only with the first tier suppliers, but also with the OEM. This is something that is agreed on by the second tier suppliers, but not at all by the first tier suppliers. Instead, they argue that the second tier suppliers have too much focus on Volvo instead of on them. The second tier suppliers claim that Volvo wants to maintain a close contact with them. This is, however, denied by Volvo who wants to use the first tier suppliers as communication channels in order to receive information from the second tier suppliers. An illustration is given in Figure 6.4, where the fat arrows

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represent Volvo's desired way of communication, while the dashed arrow represents their undesired way of communication.

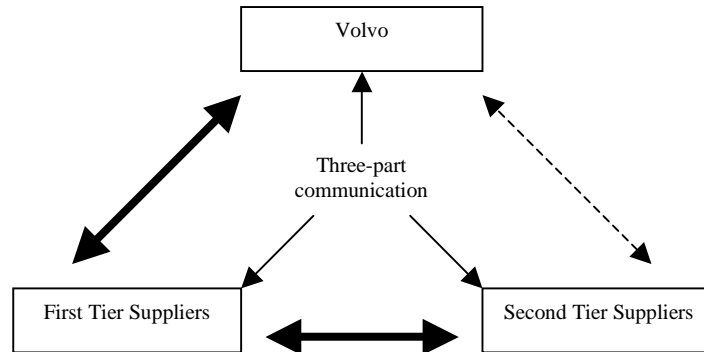


Figure 6.4 Different ways of communication between Volvo, and the first and second tier suppliers. The fat arrows indicate the main ways of communication, while the thin arrows indicate a more rarely used way of communication. The dashed arrow indicates an almost non-existing way of communication.

It is very interesting that the different parties in the empirical study can describe the same situation in such different ways. It certainly raises questions when many of the second tier suppliers (even those who do not deliver X-marked products) state that they have frequent contact with Volvo, while the first tier suppliers state that (besides for X-marked products) no such contact exist. Volvo's view is somewhere in between, along with the statement that they occasionally have contact with the second tier suppliers.

As discussed earlier in this chapter, the conflict may be related to the theoretical discussion of power structures within the network. According to Håkansson, the relations within the Swedish automotive industry indeed consist of both cooperation and conflict. Along with the theoretical discussion of Schary et al., all the actors within the industry try to exploit and affect the network in order to get a more advantageous position. This is something that is seen very evidently in the empirical study. Although the first and second tier suppliers are probably not lying deliberately, they are possibly modifying the truth in order to fit it into their official policy. The first tier suppliers market themselves towards Volvo as being able to coordinate all the activities further down the supply chain. Hence they are reluctant to admit that direct contact exists between Volvo and the second tier suppliers. It might, however, also be that the first tier suppliers, due to insufficient communication, are not aware of the existence of direct contact. Although most of the second tier suppliers strive for direct contact with Volvo, they emphasize that the communication has to be limited to technological issues. It is obvious that they, regarding the power structure, have enough respect for the first tier suppliers not to discuss business-related issues with Volvo behind their back. The fact that some of the second tier suppliers claim to have no contact at all with Volvo, because of the first tier suppliers' disapproval, show that they do indeed have respect for their customers.

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According to Axelsson et al., the positions in the network are balanced between the past and the future. History decides the present position but the future offers opportunities for change. A change in the position of one company changes the position of other companies in the network, which can make them feel threatened. According to Wynstra et al., outsourcing has meant that the parties within the automotive industry have been forced to get used to new roles. The second tier suppliers want to emphasize their role in the supply chain by exaggerating their relation with Volvo. Most of them used to be first tier suppliers before Volvo outsourced the production and development of the seats. They have not yet fully gotten used to and accepted their new roles as second tier suppliers.

The outsourcing trend has also caused a new way of thinking for Volvo, and thus a new role and position within the network. Even if Volvo remains on top of the value chain, outsourcing has led to the appearance of large powerful first tier suppliers. Though Volvo still has their powerful position in the network, they may feel threatened by the first tier suppliers, which are growing bigger and bigger. It is evident that Volvo does not want to lose power and control over what is happening farther down the chain.

In accordance with Axelsson et al., avoidance of direct contact might be hard because of social bonds in terms of old remaining personal relations between employees at Volvo and the second tier suppliers. Axelsson et al. state that social bonds can exceed and even replace economic bonds as a reason for the relationship to remain. This phenomenon is truly evident in the discussion above. Thus it may take some time before the bonds between Volvo and the second tier suppliers get weaker. It is very important that more social bonds between the first and second tier suppliers replace these old bonds.

Another reason why Volvo has not been able to totally eliminate the direct contact with the second tier suppliers may be that they do not have enough trust in the capabilities of the first tier suppliers. Today, Volvo has problems in giving the first tier supplier the whole responsibility. According to Schary et al., trust is a very important but complex part of the relationship. Goodwill and competence trust between Volvo and first tier suppliers therefore need to become better and stronger. Only then will Volvo feel more secure, and hence have no need to interfere with the work of the first tier suppliers.

X-marked Products

While most suppliers have little or no contact with Volvo, the suppliers of X-marked products have very much contact with them. The outcome of this contact can however be regarded as proving the first tier suppliers right in their opinion that the second tier suppliers should have no contact with Volvo. When it comes to X-marked products, it is in fact so that the relations between the first and second tier suppliers are rather inadequate. The communication is non-existent during the development phase, and very limited during the production phase. Although it is more important that the second tier suppliers communicate with Volvo, since they are the ones responsible for the development, the lack of communication with the first tier suppliers is most

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certainly a problem. The first tier suppliers are not at all involved in the development of X-marked products. However, the X-marked products, like all other products, have got more or less complex interfaces with other products. Hence there should be a need for communication between the first and second tier suppliers regarding the assembly and integration of the X-marked products into the seats.

The first tier suppliers' unwillingness to communicate with the suppliers of X-marked products may stem from a general disapproval of the occurrence of such products. It would be hard for Volvo to eliminate them, due to their strategic importance in attracting the consumers. However, it is evident that the X-marked products cause a lot of problems for the first tier suppliers in their collaboration with both Volvo and the second tier suppliers. Although Volvo is aware of the problems, it is not likely that they will eliminate the X-marked products within the nearest future, since they do not fully trust the first tier suppliers to be totally responsible for the seat. Hence the first and second tier suppliers have to make the best of the situation and learn to handle cooperation regarding X-marked products. Since the first tier suppliers are not directly involved in the development, the relations to the second tier suppliers are naturally not as close as for other products. Still, the different parties should be able to communicate more in order to integrate the X-marked products into the seats in an optimal way.

Communication Involving Three Parties

Regarding the participation of second tier suppliers in the meeting between the first tier suppliers and Volvo, the opinions differ once again between the first and second tier suppliers. While the first tier suppliers consider the participation necessary only in rarely occurring emergency issues, the second tier suppliers consider regular participation necessary in order to achieve well-functioning product development cooperation. It is obvious that the second tier suppliers' view regarding their role in the product development collaboration differs a lot from the view of the first tier suppliers. This could be seen as a lack of mutual orientation in the relation, where the objectives of the parties are not shared. This is indeed a problem, since it is very important in customer-supplier relationships that the supplier understands their role in the customer's development process. It is also alarming that the second tier suppliers think that Volvo wants more three-part meetings, while Volvo states that this is not true. However, the second tier suppliers might be right in their opinion that more three-part communication would improve the collaboration. Perhaps Volvo and the first tier suppliers need to realize that the second tier suppliers actually can contribute more to the development projects if they are allowed to participate more frequently in their meetings.

One reason for the diverging opinions regarding three-part meetings is the first tier suppliers' fear of losing some of their control, and hence some of their power. Furthermore, the first tier suppliers might feel sidestepped if their suppliers and Volvo lead the discussions that should be led by Volvo and them. These reasons originate from the power structure of the industry, where all actors are protecting their position and their share of the rewards. As discussed earlier in the analysis, the first tier suppliers are afraid that business-related information, such as price, would leak from

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their suppliers directly to Volvo, which would weaken their power in price negotiations with Volvo. This becomes evident in the development process where in many cases, the first tier suppliers do not want to involve their suppliers at a too early stage. This is because they do not want to become locked to particular suppliers and thus not be able to change suppliers at a later stage in the process. The first tier suppliers express a wish to keep all possibilities open as long as possible, which their power allows them to do. The game of power can be considered a constraint for closer collaboration, which affects the effectiveness and the efficiency in the whole network. Furthermore, it is evident that the first tier suppliers are pleased with this situation, while the second tier suppliers regard it as characterized by silly precautions. This clearly demonstrates, as stated in the theory by Schary et al., that the game of power and politics affects the acting of the companies and thus the collaboration.

During the empirical study, it was noticed that the first tier suppliers use their powerful positions to rule the second tier suppliers in a cunning way. Above all, they are watching their power position and are very careful not to give the second tier suppliers any share of the power. Additionally, it is quite clear that this is also a matter of trust. The first tier suppliers do not trust the suppliers to delimit their discussions with Volvo to technological issues only, even though the first tier suppliers are present themselves. In order to increase the trust, it is therefore important for the second tier suppliers to be careful with what information they share, which is something they seem to be well aware of.

We believe three-part meetings are necessary in the case of complex products that are defined as gray-box products. The second tier suppliers have the most knowledge in their own products, which makes it difficult for the first tier supplier to handle all communication with Volvo. Gray-box products also require relations that facilitate intense communication during the whole development process. To make this communication possible between the three parties involved, it will require more goodwill trust (Sako) between the first and second tier suppliers. They have to be confident in each other's capabilities and have a moral commitment to the relationships, which is not the case today.

Management Skills and Knowledge

It is evident that the suppliers of X-marked products need to work in close cooperation with Volvo. This might not, however, be necessary for other suppliers, whose products are not of large strategic importance to Volvo. Much of the benefits of outsourcing would disappear if Volvo were to remain in close contact with all of the second tier suppliers. This is, however, not understood by some of the second tier suppliers. It appears like the awareness of supply chain management decisions and their affect on the supplier structure is declining the farther down the supply chain you go. This would seem natural since management awareness in general is less in smaller companies with less complex products. Therefore, the second tier suppliers might not fully understand the management decisions of the first tier suppliers, and especially of Volvo. Since they lack a profound understanding of their customers' strategic decisions, it is hard for the second tier suppliers to adapt themselves to their

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constantly changing roles in the supply chain. According to Axelsson et al., mutual orientation is a precondition for a well-functioning relation. For the suppliers, this encompasses a thorough knowledge and understanding of their customers. Also, it is important for the suppliers to understand how they can contribute to the success of the customers. Much of the problems observed in the empirical study are, however, partially due to the second tier suppliers' lack of understanding of where their products and capabilities fit in to the supply chain. Furthermore, according to theory (Karlsson), suppliers generally need to focus more on the function their products have to satisfy rather than the products themselves. This seems to be something for the second tier suppliers to think about.

The first tier suppliers seem to be well aware of the strategic decisions at Volvo and how they affect them. This is thanks to a general awareness regarding management issues, together with the fact that Volvo is good at communicating their decisions and the effects of them on the first tier suppliers. The second tier suppliers' unawareness of the strategic decisions made by Volvo and the first tier suppliers, can be blamed both on their lack of management competence and the fact that Volvo and the first tier suppliers do not put enough effort in communicating the decisions to the second tier suppliers. The farther down the supply chain you go, the more focus is put on efficient production, and hence most employees are concerned with operational matters rather than management issues. It is indeed true that smaller companies farther down the supply chain have less highly-educated personnel, and they lack the financial resources to keep a large management staff. However, the second tier suppliers might benefit from focusing more on management and strategic issues rather than operational efficiency.

The problem of too little focus on management and strategic issues is more or less evident for all of the second tier suppliers in the empirical study. There are, however, large differences regarding companies in different supplier roles. Suppliers in the child role are mainly focused on operational efficiency. Hence they appear to be suffering from a lack of understanding regarding how their products fit into the customer's value chain. Suppliers in the partner and mature roles have much more focus on management and strategic issues. However, being a supplier in the partner or mature role demands a much more thorough understanding of the customers' activities and value chain, i.e. more mutual orientation (Axelsson et al.). Therefore, the lack of focus on management and strategic issues is also a fact for these suppliers.

Regarding mutual orientation, there are also problems at the customer end of the relations. The suppliers feel that the customers are questioning their competence and interfering with their work without having sufficient knowledge about their products and competencies. From the empirical study, it is quite evident that the product development would benefit from all actors increasing their knowledge in each other's capabilities. The needs of the different companies can, according to Axelsson et al., be matched more exactly by increased mutual orientation, which requires that the parties' objectives must be related and aligned. The fact that the customers interfere with the work of the suppliers without sufficient knowledge also indicates lack of competence trust (Sako).

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Requirements and Specifications

The technical bonds between the suppliers and customers are important for the parties in order to be able to adapt to each other's requirements (Axelsson et al.). An important problem associated to these bonds, according to the second tier suppliers, is the first tier suppliers' inability to decompose the technical requirements enough to facilitate the development work of the second tier suppliers. This is a crucial part of the collaborative product development, since it is the basis for the division of responsibility, and if not clearly made means declined efficiency and effectiveness. There are several reasons for the insufficiency of the technical requirements. First of all, the requirements that the first tier suppliers are given by Volvo are not as complete as they ought to be. Secondly, the time pressure that occurs in all development projects makes it hard for the first tier suppliers to take the time needed to decompose the requirements in a proper way. The first tier suppliers are however aware of the need for investing more time in the planning phase, which would enable them to decompose the requirements more thoroughly.

Furthermore, as mentioned by one of the second tier suppliers, Volvo's requirements are sometimes deliberately written vaguely in order to make the suppliers responsible for eventual problems. This might seem strange since it would logically be easier to hold the suppliers responsible if they were given very precise technical requirements. It is so that no matter how precise the requirements are formulated, there will always arise problems that are not related to a specific requirement.

The parts or sub-systems concerned are mostly gray-box parts that, according to Clark et al., require an extremely well-functioning communication, together with proper attitudes and consistency in daily behaviors. This is not fulfilled, however, which implies some communication and responsibility problems. Many problems arise in the interfaces between different subsystems and it is thus hard to hold individual suppliers responsible for them. For instance, if a rattling noise occurs when the different subsystems are assembled together, it is impossible to hold the suppliers responsible if the technical requirements are precise and are fulfilled by the suppliers. On the other hand, if the requirements are written deliberately vaguely, for example including that the subsystem has to be noise free, the supplier can be held responsible even if it might not be the one causing the problem.

Volvo's formulation of vague requirements of course makes the second tier suppliers' participation in the development work unnecessarily hard. All parties would probably benefit by clearer technical requirements if the first tier suppliers were to take the time needed to decompose the specifications to the second tier suppliers in a clearer way. Improving the requirements is, however, not entirely the responsibility of the first tier suppliers. The second tier suppliers have to question the technical requirements to a larger extent, which is something that they know themselves that they need to improve. The first tier suppliers point out that the second tier suppliers need to question the customers earlier in the projects instead of complaining later on when the problems are much harder to solve. This might be explained by the suppliers having too much respect for their customers due to the power structure of the industry. Ideally, the decomposition of the technical requirements should be made in

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close contact with the second tier suppliers in order to attain the proper requirements that all parties agree on.

Although the second tier suppliers want their customers to provide them with more detailed specifications, the theory suggests that detailed specifications are something that characterizes suppliers in the child role. Suppliers in the mature role, which some of the companies of the empirical study are, typically develop their subsystems according to critical specifications rather than detailed ones. Perhaps the mature second tier suppliers need to realize that they have to learn to develop their products without detailed specifications. On the other hand, this might be difficult since the first tier suppliers have problems when it comes to letting the second tier suppliers take full responsibility for the development of the subsystems. It is however quite evident that the opinions of the second tier suppliers are a bit contradictory. On one hand, they want the first tier suppliers to give them more responsibility, but on the other hand they want more detailed specifications. The second tier suppliers should probably review their role as suppliers, and give some thought to what role they aim to have and how to get there. It is very important for both customer and suppliers that each supplier has the right role in the product development.

Human Assets

Human asset allocation is, according to Ragatz et al., considered as an important asset-sharing factor in overcoming the barriers for supplier integration. Our empirical research confirms the fact that this seems to be important, but also associated with some major problem areas. Human assets allocation concerns the co-location of team members and supplier to participation on project teams. Another factor we have found important regarding human assets is the management of the projects performed.

Project Management Skills

In line with the theoretical discussion of Arminas, our empirical results show that a frequently mentioned problem is the lack of competent project management skills. It is interesting that both the customers and the suppliers perceive the problem to be located at their counterpart. This, however, must be interpreted that the lack of competent project management skills is a common problem in the industry. The lack of project management affects the complete development process, and implies an increase of development time and cost. In order to facilitate collaborative product development and increase the efficiency of the process, it is, however, necessary to have a structured projects management.

The reason for the previously discussed problem can be related to both customers' and suppliers' inexperience of managing large complex product development projects. This is clearly seen at the suppliers in the mature role, which, along with the outsourcing trend, have gotten a more extensive responsibility, and therefore have to acquire and keep the appropriate management skills and competences in-house. The pace of outsourcing has been very high, and the suppliers have not succeeded to keep up with this pace. Consequently, lack of the right competence and ability to manage a project is the result.

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6.3.2 Non Differentiator Problems

As Ragatz et al. state in their model, the non-differentiator factors are vital, but non-differentiating, for the fortune of supplier integration into new product development. These factors are certainly an essential part of the collaboration, and are thus important to reflect on. Our study has shown that two of these factors are more immediate than the others, since some of the problems we have encountered can be related to them. The two factors are *cross-functional teams for supplier selection and planning*, and *stability of project team*. Therefore, these factors will be discussed separately in the following sections. The other factors that are not brought up should not, however, be seen as less important factors in the process of supplier integration. They are not considered as major areas of problems in the Swedish automotive industry, and are hence not included in the purpose of this thesis.

Cross Functional Teams for Supplier Selection and Planning

Cross-functional teams for supplier selection and planning is a factor that emphasizes better communication across the subdivision boundaries within the company, especially in the early phase of supplier involvement. During the empirical study it has become evident that this communication often fails at the first tier suppliers. They are, however, aware that a lack of communication and coordination exists between predominantly the purchasing department and the technical department. This indicates that there is potential for improvements through more cross-functional teams for supplier selection and planning.

Diverging Objectives

We have experienced that the lack of communication and coordination between the purchasing and technological departments to a large extent depends on the diverging objectives of the respective departments. In the supplier selection phase, the purchasing department often receives instructions from the central purchasing division, which is predominantly focused on cost savings and thus encourages the purchasers to save as much money as possible. This affects the purchasers' way of acting in the selection process, and appears as an obstacle in the communication with the development department, whose objectives are quite different.

The development department's objectives have to meet quite different requirements, such as quality and supreme product features. Additionally, the development department performs the actual collaborative product development, and hence the communication and cooperating skills of the suppliers become essential factors for their choice. Thus the characteristics that the purchasing department is prioritizing in supplier selection, are not those that the development department prioritizes. Consistent with the theoretical discussion of Handfield et al., purchasing managers need to work closely with product development teams in order to create supplier evaluation frameworks that consider more than the traditional factors of price, quality, delivery, and service. Furthermore, the educational background of the purchasers and the engineers differs, which results in further communication problems.

Better communication and coordination between the purchasing and the development department would also facilitate a better and more widely-supported product

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development strategy. If they would be aligned on this matter, this would also facilitate a better supply strategy, which otherwise is not designed during the ultimate prerequisite. According to Wynstra et al., a lacking product development strategy might lead to involvement of suppliers with limited innovative capabilities or involvement of suppliers where it is not appropriate. Therefore, it is of crucial importance to bring together and make use of all knowledge of the suppliers' capabilities within the company. Here the development department has a key knowledge about the supplier features that are central for well-functioning collaborative product development.

It is therefore important to increase purchasers' expertise of how they contribute to the product development process. Of course it is also important to increase the engineers' understanding of the purchasing process, in order to facilitate better communication between the departments and thus receive better supplier integration in new product development.

This problem, however, becomes less relevant since the global first tier suppliers' purchasing to a large extent is centrally governed. In the cases we have studied, the central purchasing departments make the final decision according to recommendations from the local departments. Hence the knowledge of the local purchasers and engineers becomes less important as the central departments follow global strategies.

Stability of Project Team

Another non-differentiating factor according to Ragatz et al. is the stability of membership on the product development team during the project. Lack of stability has, during our research, proved to be an obstacle that hinders the effectiveness of the development process within the Swedish automotive industry. Therefore, we consider stability of project team to be more urgent than the other non-differentiating factors.

Fast Staff Turnover

A wide-spread opinion among the second tier suppliers is that the customers does not have sufficient stability in their staffing of the project teams. This makes it difficult to get consistency in the product development work. The development projects lose speed when a person who is familiar with the current project is replaced, which results in a lot of lost knowledge. Furthermore, the learning period for the new person also slows down the rest of the project team.

The suppliers are slightly differently affected of project team stability, depending on which category they belong to. It is, unsurprisingly, the mature suppliers that are the most affected, since they are most dependent on close collaboration. They have a lot more frequent project team meetings and are generally more tightly involved in the project teams. The child suppliers, on the other hand, who deliver less complex products that have fewer complex interfaces with the customers' products, do not have the same need for stability of project teams. The following discussion is therefore more focused on the mature customer-supplier relationships.

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In line with Bensaou, when customers staff project teams in a temporary way, it sends signals that they do not invest in the relationships with their suppliers. This may deteriorate the relations and keep the suppliers in the captive position. It also shows the customers' lack of commitment in the relation, which in accordance with Helper's theory of voice relations implies that both parties are not equally committed. In order to create and sustain a close collaborative relationship, it ought to be most appropriate to invest equally in the relation. The investments referred to are not economical but concern the time invested in creating a good social relationship, whose importance is mentioned by Axelsson et al.

The fact that the customers shift personnel on the projects at the pace they are doing affects the bonds between themselves and their suppliers. In keeping with Axelsson et al., the social bonds that are developed between the different team members, and thus the companies, during a project are strong and have a great influence on other bonds between the companies and the collaborative product development performed. Social bonds are especially important for a smooth-working and effective collaboration. For example they affect the informational and technological bonds between the companies in a negative manner if they are not utilized properly.

The informational bonds are affected since the information ways are strongly related to the persons involved. Hence if new persons are involved the social bonds disappear, the previous well-functioning information channels lose much of their superior features. This affects the product development process negatively and much of the timesaving needed are lost due to the lost social bonds.

Broken social bonds also have an effect on the technical bonds within the relation, since much of the technological knowledge and competence are developed due to the uniqueness of the specific relation. The cooperation between some individuals might be very successful if the social features are accurate. Deteriorated social bonds are thus a crucial factor to improve, but they are also hard to develop. Hence it is important to protect existing social bonds.

6.4 The Wheel of Fortune

In the previous analysis, we discussed the problems we have encountered during our empirical research. Most of these problems derive from the fact that the actors are not yet used to the new roles in the industry. Some of the problems are frequently-occurring relational problems that may occur in all industrial relations. The new roles and the increased product complexity that characterizes the industry imply different ways of collaboration. Customer-supplier relations have to be very close in order to fulfill the demands of low price, short lead times, efficiency, and effectiveness. The theories we have studied all emphasize the importance of close collaboration between customers and suppliers regarding product development. In order to reach this level of cooperation in product development, some critical issues must be fulfilled.

These issues have been discussed by many researchers, e.g. Ragatz et al., whose model of critical factors for supplier integration in product development serves as a basis for the first part of the analysis. As we see in the previous analysis, almost all problems encountered can be related to some of the areas of the critical differentiators mentioned. In order to reach a successful collaboration, it is hence necessary to solve the related problems.

If these problems are to be solved, it is necessary to find the underlying reasons for them. Through previous analysis, it has become obvious that there are various underlying reasons for the problems. The further the analysis is made, the more clearly it seems that the causes can be summarized by four elementary issues that explain the perceived problems in the collaborations. The relations studied have all shown a clear lack of four important constituents that need to be regarded. These four factors appear to be: trust, mutual orientation, competence, and long-term view (see Figure 6.5). Thus, in order to solve the present problems in the collaborative relations, the companies lead by their top management (TM) must focus on these underlying factors.

Action should thus be taken to improve the lack of trust, competence, mutual orientation, and long-term view. It is, however, important to be aware of the most important industry-wide factors that affect the actors. These factors are difficult to manage by a single actor, and they are all result of the intense competition and the huge overcapacity that the industry has to fight.

6.4.1 Industry Wide Factors

The first factor that affects relations within the industry is the intense time pressure that increases the level of stress in the development processes. The time pressure is a fact that must be accepted and must be managed in a first-class way in order to decrease the level of stress that today is the reason for many mistakes.

Secondly, the automotive industry is also characterized by price pressure, which is a factor that makes the survival of many actors difficult. In order to survive, the actors must be able to manufacture parts more cheaply than their competitors and at the

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same time with improved quality. This, of course, affects the climate in the industry and is one of the factors that forces the industry to improve.

The third factor that has a clear effect on the climate in the industry, and thus the relations within it, is the power structure. In the severe climate that prevails, all actors are very concerned with keeping or improving the power they have obtained. As mentioned in the previous analysis, the industry is characterized by a clear unbalance in the relations between the customers and the suppliers. We have experienced that the power structure and its consequences are very evident as both customers and suppliers try to maximize the benefits from their relations with other actors. They try to affect and exploit the network in order to get a more advantageous position, exactly as Håkansson states in his network theories. This is most obvious farther up the supply chain, while it is decreasing farther down.

Our research has shown that the most frequently-occurring relationship is where the supplier is captive, in accordance with Bensaou's model of buyer and supplier-specific investments. The tendencies of captive relations are most clearly observed when the supplier is classified in the child role, while the suppliers in the mature role are not as captive. The fact that the suppliers are captive is quite surprising, since many researchers have pointed out that relationships today are becoming more like strategic partnerships. Furthermore, during our empirical research we have found that the automotive industry is characterized by close collaboration regarding product development, but that the relations are distinguished by a lack of mutual investments and trust.

According to theory, the new situation in the automotive industry requires close collaboration regarding product development to be able to reduce lead times and cut costs. Therefore, it is of crucial importance to focus on the underlying reasons for the problems in the product development collaborations. If the factors (presented in Figure 6.5) are prioritized and improved, there are large profits to render through increased efficiency and effectiveness.

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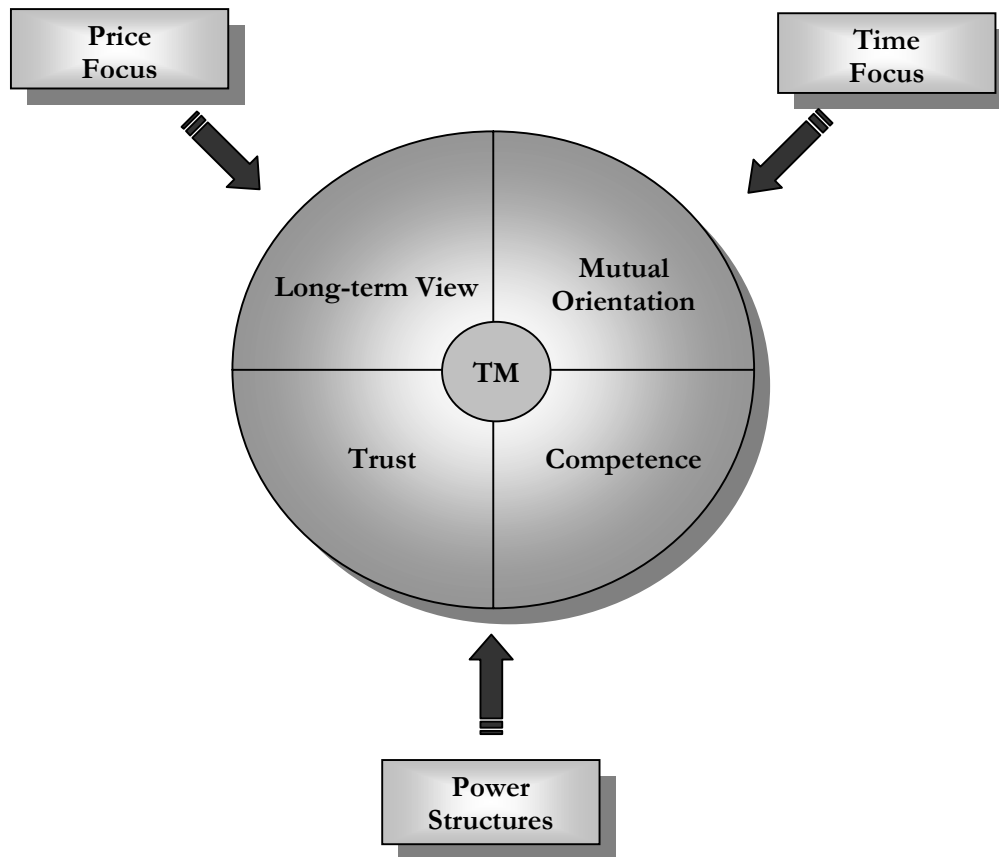


Figure 6.5 The Wheel of Fortune – in order to come to terms with the problems in the collaborative product development, the top management (TM) of customers and suppliers have to focus on the four most urgent factors: long term view, mutual orientation, trust, and competence.

6.4.2 Long-term View

From previous analysis, it is evident that many of the problems regarding collaboration in product development are partially caused by the lack of long-term view. This is something that in turn is an outcome of the intense competition within the industry. Most companies are in such precarious situations that they are focusing solely on surviving. Hence they find it necessary to focus on short-term earnings in order to stay alive. Although this is fully understandable, it is our firm belief that it is absolutely necessary for the companies to develop strategies with a more long-term focus. This necessitates investments in long-term customer-supplier relations.

According to Kamath et al., partnerships are characterized by long-term relations, which require substantial investments in the relations. This in turn requires a great deal of commitment. Previous analysis indicates that the different parties might not be

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committed enough to the relations, which is an evident indication of the lack of long-term view.

The lack of a long-term view is especially obvious in the customers' attitude towards their suppliers. Already in the supplier selection phase, the first tier suppliers focus their attention on price in order to reduce the short-term costs, even though this might lead to larger costs in the long run due to poor quality, for example. Furthermore, the fact that suppliers sometimes are exchanged between the development phase and the production phase makes it hard for both parties to commit to a long-term relation.

The lack of stability of project teams, due to large staff turnover, is another example of how the short-term view of the first tier suppliers affects the relations negatively. Furthermore, short-term focus prevents the first tier suppliers from investing enough time in the planning phase, with inadequate division of responsibility and insufficient technical requirements as result.

6.4.3 Mutual Orientation

Mutual orientation means that the customers and suppliers are ready to interact with each other and expect each other to do so. It is also important that the objectives of the involved actors are aligned so that the customers and the suppliers are not striving in different directions.

Lack of mutual orientation is the underlying reason for many of the problems encountered in the empirical research. Many communication problems are related to lack of mutual orientation, since the knowledge of each other's needs and offers facilitate the exchange of the right information. Additionally, the parties' lack of knowledge in each other's objectives becomes evident when, for example, the suppliers think that the customers are focusing on the wrong performance measures.

With better mutual orientation, the parties would be better aware of each other's opinions and thus be able to come up with better solutions in the development work. It is important that the actors have good knowledge of each other's capabilities and needs, which also Ragatz et al. point out as a critical factor for success. This knowledge facilitates that the needs of the companies can be matched more exactly. The lack of knowledge in each other's capabilities becomes evident when the customers interfere without sufficient knowledge, which causes relations to deteriorate.

6.4.4 Trust

As the preceding analysis illustrates, it is obvious that the lack of trust between customers and suppliers is a fundamental cause of the discovered problems concerning supplier integration into product development. The roles of the customers and suppliers have changed. This has caused a need for long-term relations and increased the mutual dependency between customers and suppliers. Hence trust is seen as one of the most important issues for a fruitful collaboration.

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According to previous analysis, the presence of trust is the base for confidence in the suppliers' capabilities and the division of responsibility. Furthermore, it is evident that trust is the basis for long-term relationships and is a requirement for investments to be made, which in turn will lead to an even stronger trust. Many of the problems found in the empirical study can be related to the lack of trust and thus the lack of investments. Without different types of mutual investments, the bonds between the parties will not be as strong, which results in for example deteriorated communication. Lack of bonds also makes it easy for the customers to change suppliers, which leads to the suppliers constantly feeling insecure in the relations.

The concept of trust is a complex part of the relationships. It is thus of great importance that both customers and suppliers are aware of the problems caused by the lack of trust. To be able to reach a successful integration of the suppliers into product development demands efforts from both parties and an understanding of the importance of trust for long-term collaboration.

6.4.5 Competence

Lack of competence at both customers and suppliers causes a lot of problems in the product development collaborations. This is a consequence of an increased need for competence at the customers and suppliers, caused by the new roles that outsourcing has given them. It is naturally not easy for the first and second tier suppliers to acquire the competence needed to perform the product development that Volvo used to perform in-house. In order to improve the collaboration, we find it necessary for both parties to focus on how to acquire more competence in their organizations.

According to previous analysis, the lack of competence is most evident at the second tier suppliers, probably due to their smaller organizations. It is also them who have had their roles changed most radically. Smaller organizations have thus had the most increasing demand for new competence, which is hard for them to achieve with their limited resources. Both themselves and the customers want them to take more responsibility for product development. In order to make this possible, it is important for the second tier suppliers to increase their competence.

The first tier suppliers mainly lack competence within the areas of project management and communication. This is something that needs to be dealt with urgently, since well-functioning communication and project management are very crucial factors for fruitful product development collaboration.

6.5 Chapter Summary

This chapter has described our analytic reasoning in accordance with the purpose of the thesis. In the first part of the chapter, we have tried to find the underlying reasons for the problems regarding collaborative product development found during the empirical research. The problems have been structured with the model by Ragatz et al. as a base, and analyzed under the differentiators and non-differentiators. In the second part of the analysis, the underlying causes have been summarized under four

PART III

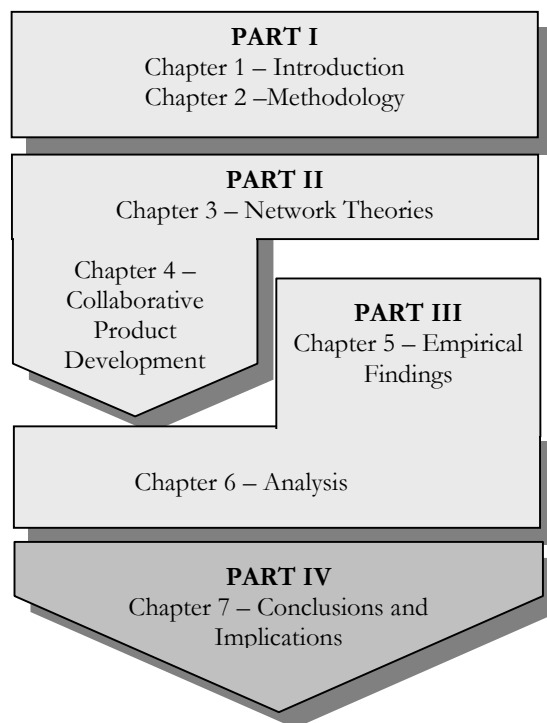
basic factors: trust, mutual orientation, competence, and long-term view. These factors have been presented in our model, *The Wheel of Fortune*.

CONCLUSIONS AND IMPLICATIONS

The last part of the thesis consists of our conclusions and implications where we summarize the results of the study. This part of the thesis contains our theoretical contribution, which is summarized in our model *The Wheel of Fortune*. Furthermore, we reflect over the accuracy of the chosen theories. The chapter is finished by our recommendations for further research.

“You always pass failure on the way to success”

Mickey Rooney (1920)



Conclusions and Implications

In this chapter we aim to summarize the results of the study. Our model, The Wheel of Fortune, is a result of the analysis of our empirical and theoretical research. It is the theoretical contribution of this thesis. Furthermore, we will discuss the appropriateness of the two sections of our theoretical framework, the choice of them and their relevance for our result. Finally, the research has also lead to the discovery of some interesting areas of further research, which will be mentioned in the last section.

7.1 Conclusions Regarding the Wheel of Fortune

The outsourcing that characterizes the industry has implied new roles, which requires different forms of collaboration between the first and second tier suppliers. The most frequent opinion of the researchers in the field is the one that emphasizes close collaboration between customers and suppliers regarding product development. The new relations therefore have to be very close in order to fulfill the demands of low price, short lead times, efficiency and effectiveness. However, in order to reach this level of cooperation regarding product development, some critical issues must be solved.

These critical issues are summarized in the model by Ragatz et al, *Two Themes of Successful Supplier Integration in New Product Development*. Here Ragatz et al. discuss critical issues that are crucial to supplier integration succeeding. Through the analysis we have observed that almost all problems we have encountered in the empirical research can be related to some of the areas of the critical differentiators mentioned. In order to reach a successful collaboration it is hence necessary to solve the related problems.

If these problems are to be solved, it is necessary to find the underlying reasons for them. Through the analysis, it has become obvious that the causes can be summarized by four elementary issues that explain the perceived problems in the collaborations: trust, mutual orientation, competence, and long-term view, (see Figure 7.1). Thus in order to solve the present problems in the collaborative relations, the companies led by their top management (TM) must focus on these underlying factors.

Action should thus be taken to improve the lack of trust, competence, mutual orientation, and long-term view. It is, however, important to be aware of the most important industry-wide factors that affect the actors. These factors are difficult to manage by a single actor and they are all result of the intense competition and the huge overcapacity that the industry has to fight.

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Industry Wide Factors

The first factor that affects relations within the industry is the intense time pressure that increases the level of stress in the development process. This time pressure is a fact that must be accepted and managed properly in order to decrease the level of stress that causes many mistakes. Secondly, the automotive industry is also characterized by price pressure, which is a factor that makes the survival of many actors difficult. In order to survive, you must be able to manufacture parts more cheaply than your competitors and also in less time and with improved quality. This of course affects the climate in the industry, and is one of the factors that forces the industry to constantly improve. The third factor which has a clear effect on the climate in the industry, and thus the relations within it, is the power structure. In the severe climate that prevails, all actors are very concerned with keeping or improving the power they have obtained.

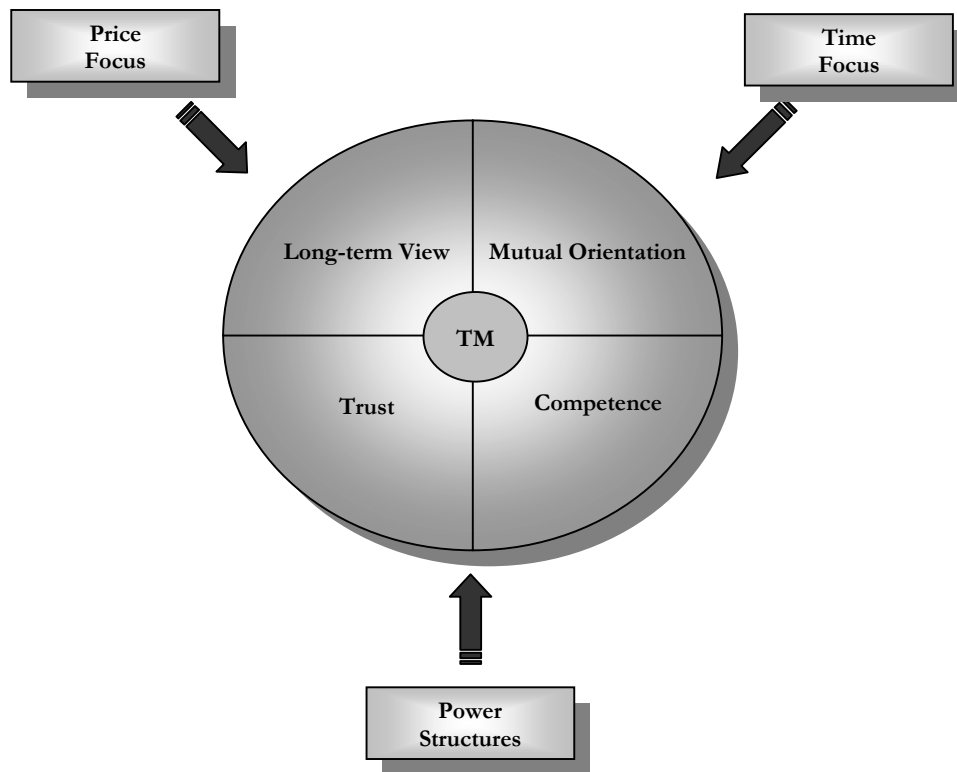


Figure 7.1 The Wheel of Fortune – in order to come to terms with the problems in the collaborative product development, the top management (TM) of customers and suppliers have to focus on the four most urgent factors: long term view, mutual orientation, trust, and competence.

Long-term view

From the previous analysis, it is evident that many of the problems regarding collaboration in product development are partially caused by the lack of long-term

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view. Although this is fully understandable, it is our firm belief that it is absolutely necessary for the companies to develop strategies with a more long-term focus. This necessitates investment in long-term customer-supplier relations.

The lack of a long-term view is especially obvious in the first tier suppliers' attitudes towards their suppliers. Already in the supplier selection phase, the first tier suppliers focus their attention on price in order to reduce the short-term costs, even though this might lead to larger costs in the long run due to poor quality, for example. Furthermore, the fact that suppliers are sometimes substituted between the development phase and the production phase makes it hard for both parties to commit to a long-term relation.

Mutual Orientation

Lack of mutual orientation is the underlying reason for many of the problems encountered in the empirical research. Many communication problems are related to lack of mutual orientation, since the lack of knowledge of each other's needs and offers hinders the exchange of the right information.

It is important that the actors have good knowledge of each other's capabilities and needs, which also Ragatz et al. point out as a critical factor for success. This knowledge facilitates the needs of the companies being matched more exactly. The lack of knowledge in each other's capabilities becomes evident when the customers interfere without sufficient knowledge, which causes relations to deteriorate.

Trust

The presence of trust is the base for confidence in the suppliers' capabilities and the division of responsibility. Furthermore, it is evident that trust is the basis for long-term relationships and a requirement for investments to be made, which in turn leads to an even stronger trust. Many of the problems found in the empirical study can be related to the lack of trust and thus the lack of investments.

The concept of trust is a complex part of the relationship. It is thus of great importance that both customers and suppliers are aware of the problems caused by the lack of trust. To be able to reach a successful integration of suppliers into product development demands efforts from both parties and an understanding of the importance of trust for long-term collaboration.

Competence

Lack of competence at both customers and suppliers causes a lot of problems in the product development collaborations. This is a consequence of an increased need for competence at the customers and suppliers, caused by the new roles that outsourcing has given them. According to the analysis, the lack of competence is most evident at the second tier suppliers, which is probably due to their smaller organizations. Both themselves and the customers want them to take more responsibility for product development. In order to make this possible, it is important for the second tier suppliers to increase their competence.

PART IV

The first tier suppliers mainly lack competence within the areas of project management and communication. This is something that needs to be dealt with urgently, since well-functioning communication and project management are crucial factors for fruitful product development collaboration.

7.2 Contribution to Scandinavian Automotive Suppliers

Our research has resulted in a thorough survey of the relational problems regarding collaborative product development within the Swedish automotive industry. We believe that this survey will be of certain interest for the Scandinavian Automotive Suppliers (SAS) in their work to spread the knowledge of these existing problems to their member companies that are concerned by collaborative product development. The mission to enhance the knowledge of these problems is an important factor for the improvement of the collaboration, which, if successfully done, will lead to increased competitive skills for the suppliers in the Swedish automotive industry. Furthermore, this survey has been important to illuminate some problem areas that need to be further explored. This thesis will therefore be of importance for SAS in their work to initiate further research in the field of collaborative product development.

The theoretical contribution of this thesis, our model *The Wheel of Fortune*, is also a very important discovery that should be spread to those parties involved in collaborative product development. This model is the result of the discussion in our analysis and is composed of four factors that are crucial to have when conducting collaborative product development to avoid the problems that are present today. The model will help Scandinavian Automotive Suppliers to enlighten the suppliers as to the importance of handling the present problems in a correct way. Thus it will act as a guide to understanding why the problems occur. By informing the suppliers of what factors actually cause the problems, it will be easier to tackle them accurately. With this model, we have also summarized the most recent research in the fields of collaborative product development. Since the thesis illustrates the accumulated research in the field, it is appropriate for SAS to study and spread the knowledge to the actors involved in collaborative product development. Hence this thesis should be used to enhance the common knowledge in the industry and prepare the suppliers for the even more hardening conditions within the industry.

7.3 Conclusions Regarding the Theoretical Approach

Network theories have been an important way of describing the relations within the automotive industry. The relations we have studied are those between first and second tier suppliers, which are clearly affected by other actors in the network. We have therefore chosen to use network theories that describe relations within the network from different points of view appropriate for our purpose.

During our continuous theoretical study, which has been going on parallelly with our empirical study, we have recognized that collaborative product development within the automotive industry is a well-explored area of interest. We have therefore chosen

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to present the most recent research on the topic in order to get the full picture of different types of existing product development collaborations and critical issues for a well-functioning collaboration.

7.3.1 Network Theories

Network theories contribute an essential understanding to the complexity of problems observed in this thesis. We believe that it is necessary to study the actors from a network perspective, since they are affected by each other whether they are indirectly or directly linked. The theories that are sorted under the network concept represent many different researchers' views of the same features, but they emphasize different characteristics. This made it difficult to get a consistent and full image of all features of the network. However, we consider ourselves to have summarized a relevant set of theories in order to describe and provide deeper understanding for our problem.

Within network theories, the power structure of the network is an important part of the theoretical approach to this thesis. It became evident at an early stage in our empirical research that the power structure was an affecting factor that was necessary to discuss and relate the empirical findings to. It even turned out to be so important that it became a part of our model, *The Wheel of Fortune*.

In the section, *Relations Within the Network*, we have brought up four different factors that, according to Axelsson et al., comprise a relation. We have chosen to complement these factors with trust, which we regard as an important factor in describing the relations within the automotive industry. Although these five factors sometimes describe the same aspects from a different point of view, they embrace what we think are the most important factors of a business relation. These corner stones of the relationships have been the foundation of our analysis and have been used to discuss the problems encountered in the empirical research with successful result.

7.3.2 Collaborative Product Development

The theories describing collaborative product development are the result of our theoretical study of the most recent research on the subject. Here we have put together what we have considered to be the most relevant observations of other researchers. These observations have been mostly made within the automotive industry, but they also represent other industries, which makes them more relevant. Since we have encountered roughly the same results from several researchers, we consider it to be accurate to define it as theory and thus use it as part of our theoretical approach.

This part of our theoretical approach has been used as a reference in the analysis to confirm the perceived features from our empirical research. In the section *Different Types of Relationships*, we have examined what classifications researchers recommend in order to distinguish between different types of collaboration. This section has been useful to get an appropriate picture of how to further analyze the different types of collaborations. The discussion in the analysis would have given a distorted view of the product development collaborations if all relations were seen as

PART IV

equal. Thus, it has been important to make some sort of classification during our research.

The section *Critical Issues for Collaborative Product Development* is a compound of different researchers' views of what is critical for successful integration of suppliers into the product development. We have found that most researchers point out the same characteristics as being most important for success in collaborations, though expressed and emphasized differently. This made it hard at first to summarize all facts in a structured manner. After a lot of consideration, we found presenting the features as relational, customer, and supplier issues as the most appropriate way.

The model by Ragatz et al., *Two Themes of Successful Supplier Integration in New Product Development*, has acted as a summary of the critical issues. This model represents the most detailed features of a relationship, which must be fulfilled in order to succeed with customer-supplier collaboration. Furthermore, it is strengthened by the other researchers' findings of what is crucial in product development collaborations. Hence the model is the natural choice for the structure of the analysis, which would have been very difficult without this model. Additionally, it has clearly showed that most of our discovered problems are closely related to these critical issues, which has made it a crucial part of our theoretical approach.

7.4 Concluding Remarks on Future Research

During our research in the relations between first and second tier suppliers within the Swedish automotive industry, we have encountered some problem areas that need further exploration. We have found that these problems have been frequently mentioned during our empirical research. Furthermore, we have experienced a lack of research in these problems, which is why we recommend the following areas of future research:

- The process of formulating requirements and specifications is perceived as a process in need of improvements. Here further research is needed in order to find ways of formulating proper requirements well matched for different situations. The problem is especially important since it seems to be evident from the top of the supply chain down to at least the third tier of the Swedish automotive industry.
- In further research there is also a need to refine the methods of risk and reward sharing, which means improvement of the business agreements and contracts. We have experienced that this is one of the most clearly visible problems in the relations we have studied. Additionally, insufficient contracts are the origin of several other problems that deteriorate the collaborative product development. Hence it is crucial to find a proper way to formulate contracts, which would facilitate the situation especially for the suppliers.
- The customer-supplier relations are becoming closer in many respects and many researchers are recommending the relations become even closer. In order to

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handle the demands for shorter time to market and higher quality, it is necessary to lead the collaboration better. We have noticed that there is a need for more research in the area of management of collaborative product development, specially the management of what is going on between the customers and the suppliers, where there is a need for development of knowledge and theory.

- How to organize communication is an important question, since it is perceived as a problem within the industry and restricts the efficiency of the development work. The need for well-organized communication becomes more important since the information overload becomes more evident. Further research on how to develop more structured forms of information exchange between customers and suppliers is therefore needed.
- As seen in the theory, models that differentiate suppliers are often criticized for being inflexible and static in assuming that suppliers should be involved in the same way in different development projects. Hence these models only present guidelines for the degree and timing of involvement, while advice regarding coordination, communication, and differentiation is missing. Further research is therefore important in the area of how to classify suppliers and how to improve existing models.

7.5 Chapter Summary

In this chapter we have summarized the results of our study with our model *The Wheel of Fortune*, which is a result of the analysis of our empirical and theoretical research. Furthermore, we have discussed the appropriateness of the two sections of our theoretical framework, the choice of them, and their relevance for our result. Finally, the research has led to the discovery of some interesting areas of further research.

Appendix A – Company Descriptions

Lear Corporation

Lear Corporation (Lear) is a supplier of automotive interior systems and its headquarters are located in Southfield, Michigan, USA. It is the world's fifth-largest automotive supplier, with more than 115,000 employees located in 33 countries.¹⁹¹ The Swedish business employs approximately 5,000 people and is represented by production facilities at several locations: Gothenburg, Tanum, Färgelanda, Trollhättan, and Tidaholm. The product development is centered in Gothenburg and Trollhättan, close to the respective customers Volvo and Saab.¹⁹² Lear is one of the fastest growing system suppliers within the automotive industry, with a growth of 300 per cent the last decade.¹⁹³

Johnson Controls

Johnson Controls (Johnson), which is the world's largest independent supplier of automotive interiors, was founded in 1885 and has its headquarters in Milwaukee, Wisconsin, USA. It employs more than 77,000 people worldwide. In the automotive market, Johnson is a major supplier of seating and interior systems.¹⁹⁴ It has only been present on the Swedish market (concerning seats) for four years; it is however growing fast and captures a constantly larger share of the market. Though it is a newcomer on the Swedish market, Johnson has cooperated with Volvo before, since they provide the seats to Volvo's production plant in Holland. Johnson has most of the competencies in-house, though it represents a minor part of the volumes of each product. Other companies supply approximately 80 per cent of the components while 20 per cent is supplied by Johnson's own production facilities.¹⁹⁵

Brose Sweden

Brose Sweden is part of the family owned company Brose Group with its head office in Coburg, Germany.¹⁹⁶ Brose Sweden supplies Johnson with seat chassis for the P1 project. Brose's business unit seat adjusters, holds approximately 65 per cent of the electronically adjustable seat market. This part of their business is the smallest one, but also the one that is growing the fastest. Brose's European production facilities are located mainly in Germany (these facilities provide the Swedish market), but also in Great Britain, Czechia, Slovakia, and Spain. The fundamental product development is centered in Germany, but adjustments for Swedish customers are made at the development department in Gothenburg. There is, however, a trend that Brose is forced to move their product development and production closer to their customers.¹⁹⁷

¹⁹¹ www.lear.com, April 2nd, 2003

¹⁹² Ahlm and Ljungberg, March 11th, 2003

¹⁹³ www.lear.com, April 2nd, 2003

¹⁹⁴ www.johnsoncontrols.com, April 2nd, 2003

¹⁹⁵ Börjesson, March 19th, 2003

¹⁹⁶ www.brose.net, April 3rd, 2003

¹⁹⁷ Kagerin, March 11th, 2003

Kongsberg Automotive

Kongsberg Automotive is active within three main business areas: seat comfort (head restraints and seat heating), gearshift systems, and trucks. It is a company with roots in Scandinavia and it consists of the former Scandmek (the Swedish part) and Kongsberg (the Norwegian part), today owned by the Norwegian financial investor FSN Capital. The business area head restraints represent 32 per cent of Kongsberg's revenues. On the Swedish market, it is a dominant player. Volvo, and to some extent Saab, through their first tier suppliers (e.g. Lear, Johnson, and Faurecia) represent the main part of Kongsberg's turnover. The company's Swedish activities are located in Mullsjö, near Jönköping, where both product development and production are performed.¹⁹⁸

Recticel Woodbridge

Recticel Woodbridge (Recticel) is a Belgian-owned company with global presence. Customers within the automotive industry account for 30 per cent of the company's total turnover. Recticel's Automotive Business Line has been the fastest-growing sector of the group in recent years.¹⁹⁹ One of the reasons is that polyurethane foam is used increasingly in the automotive industry. The company has three business areas within the automotive industry: manufacturing molded seat cushions, window encapsulation, and manufacturing interior trim components.²⁰⁰ Recticel has no production facilities for seat upholstery in Sweden, so it is transported to the Swedish market from the manufacturing site in Germany. The P28 project was the first project where Recticel supplied the upholstery for further manufacturing in Sweden. Previously they had only supplied Volvos production in Belgium.²⁰¹

Fehrer Sweden

Fehrer is a German family-owned company with its core competence in polyurethane for the automotive industry. It is a global actor with a leading position on seat upholstery.²⁰² Since 1995, when it bought the second half of Volvo's production plant in Ed, it has production located in Sweden. From the production site in Ed, Dalsland, the company supplies the entire Swedish market, which represents 6-8 per cent of the total turnover. Until recently, Fehrer has been the only actor on the Swedish market with a share of almost 100 per cent and with Lear as the dominating customer.²⁰³

Autoliv Mekan

Autoliv Mekan is part of the Autoliv Group and develops and manufactures seat chassis for the automotive industry. It is one of few Swedish-owned upper tier suppliers in the automotive industry and is a minor actor on the seat chassis market. Unlike other Autoliv subsidiaries, Autoliv Mekan is solely a second tier supplier and

¹⁹⁸ Josefsson, Biesse, Granath, March 28th, 2003

¹⁹⁹ www.rwmf.com, April 2nd, 2003

²⁰⁰ www.rwmf.com, April 2nd, 2003

²⁰¹ Fredriksson, March 11th, 2003

²⁰² www.fehrer.com, April 2nd, 2003

²⁰³ Gunnarsson, March 25th, 2003

provides seat chassis constructions mainly to Lear. The company's production plants are located in both Växjö and Hässleholm, while its product development department is located in Gothenburg.²⁰⁴

Segerström & Svensson

Segerström & Svensson (Segerström) is part of the global Sanmina-SCI group, which has its company headquarters in San Jose, California, United States. Sanmina's automotive services include design and engineering, PCB fabrication and assembly, stamping, die casting, plastic injection molding, and post manufacturing services.²⁰⁵ Segerström has its competencies within manufacturing of advanced pressed, welded, and surface treated metal subsystems. Customers within the automotive industry account for approximately 98 per cent of the company's turnover. The main products are suspension, seating frames, and safety systems.²⁰⁶

Borgstena

Borgstena was founded in 1925 in the textile district of Sweden, and at that time manufactured knitted clothes. Through alliances, the company has a global presence today and approximately 400 employees.²⁰⁷ Production facilities are located in Sweden (knitting), Portugal (weaving), and USA (supplies the US market). The customers are solely within the automotive industry, and the products include textiles for seats, panels, ceilings, and curtains. Volvo Cars dominate Borgstena's production, thus Lear and Johnson are their predominant customers.²⁰⁸

²⁰⁴ Stenfelt, March 19th, 2003

²⁰⁵ www.sanmina-sci.com, April 2nd, 2003

²⁰⁶ Larsson, March 21th, 2003

²⁰⁷ www.borgstena.com, April 2nd, 2003

²⁰⁸ Fagervall-Sliti, April 8th, 2003

Appendix B – Interview Questions

- *What does the product development cooperation look like today?*
 - What does the supply chain look like regarding product development?
 - What does the constellation of the project group look like?
 - Do the suppliers/customers have enough competence in-house?
 - How proactive are the suppliers?
 - How does the information exchange work? Do you have common and linked information systems (EDI, CAD/CAM, e-mail) with your suppliers/customers?
 - How open are the suppliers/customers in their way of communicating?
 - What kinds of business agreements do you have with the suppliers/customers? Are they working satisfactorily?
 - How does the personal chemistry influence the relation to the suppliers/customers?
 - Do suppliers/customers need to change the organization to facilitate the product development collaboration?
 - How much do you invest in the relation with the suppliers/customer to get the product development collaboration to work well?
 - How much do social bonds influence the relations with your suppliers/customers?
 - How much trust do you have in your suppliers/customers?
 - How much trust do you think that your suppliers/customers have in you?

- *In what way has the product development cooperation changed over time?*
 - How are the suppliers dealing with the increasing responsibility regarding product development?

- *What will the product development cooperation look like in the future?*

- *What are your five most important customer/supplier relations (regarding product development)?*
 - Names of the companies?
 - In what way do these relations differ from your other relations?

- *What are the most important issues in obtaining optimal product development collaboration?*
- *What does optimal product development cooperation look like?*
 - Why does it not work like this in practice?
- *What characterizes the perfect supplier/customer (regarding product development)?*
 - Criteria for cooperation with suppliers?
 - Criteria for a good supplier/customer?
 - How important is product development ability when it comes to choosing suppliers?
- *What problems exist in the product development cooperation between customers and suppliers?*
 - What aspects of the cooperation are unsatisfactory?
 - What are the sources of the problems?
 - How should the problems be handled?

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