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**Development and Changes in Supplier Networks
- The Case of Volvo Trucks**

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ABSTRACT

The period from 1990 until today is characterized by dramatic changes in world economy, politics and in technological development. Not surprisingly, these changes had a clear impact on companies and their supplier networks. In this thesis, the authors in detail study the changes within a supplier network structure and the reasons behind these changes. In order to achieve this purpose, the case study of Volvo Trucks is employed. The main findings are that the changes in Volvo's supplier network can be explained by looking on interlinked factors, which derive from Volvo, the industrial environment and the world situation. The identified changes are the decrease of the number of direct suppliers, supplier's increased importance, a changed composition of the network, the changed geographical configuration of the supply base, and changes in the power relations between the customer firm and its suppliers. These changes, in turn, are the result of interplay between the modularization in truck production, the consolidation in the industry, the internationalization of Volvo itself and the increase of its production volumes.

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1 INTRODUCTION

The purpose of this section is to present the main ideas and reason behind the research topic of this master thesis. First the background of the whole thesis is discussed to provide a general overview. Then, the specific research problem is introduced and formulated. We continue by setting up the delimitations in order to clarify the research area and presenting the disposition of the thesis. Finally, a general introduction of the case company is provided.

1.1 *Background*

The fall of communist regimes and the Iron curtain during the end of the 1980's and beginning of the 1990's, the liberalization of eastern-block states and their integration into the global, market oriented economy are milestones in modern history. The opening of Asia, and especially the changes in China, that followed, changed the landscape of global economy. All these geopolitical changes forced companies to adapt not only in order to access these "new" territories, but also to face direct competition of companies from these "new" regions.

This period brought also a diffusion of new technologies. Communications became faster and easier, the distance diminished, and the technological process of manufacturing became more complex. Today there is no physical problem to move products or components from one continent to another and finalize the whole product there. These developments had tremendous impact on the global marketplace as well on firms themselves.

All these changes as in any other decades had influenced the structure of companies as well their supplier networks. Companies became more integrated into networks, expanded into new regions, developed new types of relationships, went through structural changes and altered their way of thinking and doing business. Changes have happened in industrial organization on both inter-firm and intra-firm level. Companies' structure and their networks were affected on company level, company-customer level, company-supplier level and supplier-supplier level.

Firms today are able to choose their suppliers on world-wide basis. Borders are not as important anymore as they used to be. It is a matter of costs, time and efficiency of allocation of resources. This is probably one of the major drivers behind the changes in the supplier network structure. With regard to suppliers, some of them have followed the pathways of the

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customer firms, some of them have moved to these new regions because of their own reasons and some new suppliers from these regions have got involved in the global game.

1.2 Problem discussion

Based on the facts described above, it is visible that many changes happened and they had to have some impact on supplier networks. These changes are not completely identified and described yet, mainly due to the fact they happened recently. Hence, there is space to research this issue from various angles. We can assume that some of the changes were forced by the customer firm itself. As it grew internationally, it needed its suppliers to follow to new regions or it just found better and more cost effective suppliers elsewhere. Another possibility is that it outsourced certain types of its activities and in contrast acquired some originally external suppliers. On the other hand there were changes caused by suppliers themselves. They grew as well, they found new customers, and probably they internationalized and moved to the new regions. Some of them started to supply the original customer firm from these new locations and moved from proximate distance of original firm. Of course there are many other reasons behind these changes.

Since the course of individual suppliers can be explained from various perspectives, it is interesting to see how the total picture of a supplier network has changed and thus the value and supply chain of multinational companies have changed. Was there some visible development in the structure of the company? Was there some development in the supplier network of the company? There are a lot of questions that can be asked with regard to the evolution of industrial organization and the structure of supplier networks.

How has the structure of a supplier network changed in a particular industry? What have been the trends with regard to the structural changes and how have they been manifested on a company level? How has the whole supplier base or more specifically the total structure of the supplier network changed? What have been the changes regarding subcontracting, outsourcing and global manufacturing? How has the number and geographical location of suppliers changed?

It seems very interesting to study these changes with a broad perspective regarding the network, namely not to focus on the individual suppliers, but on the totality of the changes.

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There is need to put all factors mentioned above into a comprehensive model, provide the complete overview of the changes in suppliers structure and to search for the reasons behind the structural changes in the supplier network. This paper should contribute to the research and theories on internationalization of a firm and supplier networks. It provides a view on what happened to the structure of supplier network of a specific customer firm that went through internationalization process.

1.3 Problem formulation

On the basis of the previous discussion, it can be seen that the topic of this study is the changes in a supplier network structure, notably on a aggregate level. The development in a supplier network with regard to the participating actors, their geographical location and their position in the network are the focus of this research, looking on the totality of the structure.

The questions, that will navigate us throughout this research and help us answer how and why the structure of supplier network has changed, are the following:

- How has the structure of a firm's supplier network changed?
- What have been the reasons behind these changes?

As mentioned above we will focus on the changes in a supplier network mainly in terms of: the number of suppliers, type of suppliers, geographical location of suppliers, power relations, and the linkages between these variables.

1.4 Research Purpose

The purpose of this thesis is to study the structural changes in a firm's supplier network on an aggregate level and the reasons behind these changes. This thesis will employ the case study of Volvo Trucks supplier network as a research tool. Based on this specific case, our goal is to contribute to the academic and theoretical field of internationalization of a firm, more specifically to the development of supplier networks.

1.5 Delimitations

With regard to the scope and potential this topic offers, clear delimitations have to be set up in order to keep the research focused and not to make the reader disoriented and deceived. The main reason behind setting these limits to our thesis was the timeframe given to conduct the study as well the need to keep the focus of the study.

This paper focuses on the time period from 1990 to 2005. The structural changes of supplier network are studied in this timeframe in order to provide reliable and enough detailed research with a given time for the thesis. This time period is chosen especially because, as mentioned in part *1.1 Background*, dramatic changes have occurred on a geopolitical basis as well with regard to the implementation of new technologies. It was the fall of communism in Eastern block and the opening of Asian markets. Secondly it was the development and implementation of new technologies into the business process. Both of these historical milestones had enormous impact on companies and their structures. It was during the 1990s when discussion about globalization got immense and internet became essential for the business world.

Furthermore, the availability and quality of data that can be found for the preceding periods is questionable. As we research the historical development of a network, it is quite hard and sometimes even impossible to collect the primary data for earlier periods. Having in mind the difficulty to access archival data, we can see that it can be even more difficult to locate potential interviewees. People that were responsible for researched area during 1970's or 1980's will not be with high probability in the company anymore. Another aspect is, that with regard to the primary data, it will be hard for these people to remember in detail what was happening in the past or if they remember there is still danger it might be overlapping or mixed with more recent events.

The internationalization of the case company itself is taken for granted. The study focuses on the development and internationalization of its supplier network and changes in the structure of this network. It will not discuss the reasons behind the internationalization of the customer company itself.

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Lastly we decided to focus on the suppliers to the production of the customer firm, the suppliers delivering physical products. We do not focus on the suppliers of sales and after sales services but only on those that supply production plants of the customer firm.

1.6 Thesis Disposition

Thesis Disposition

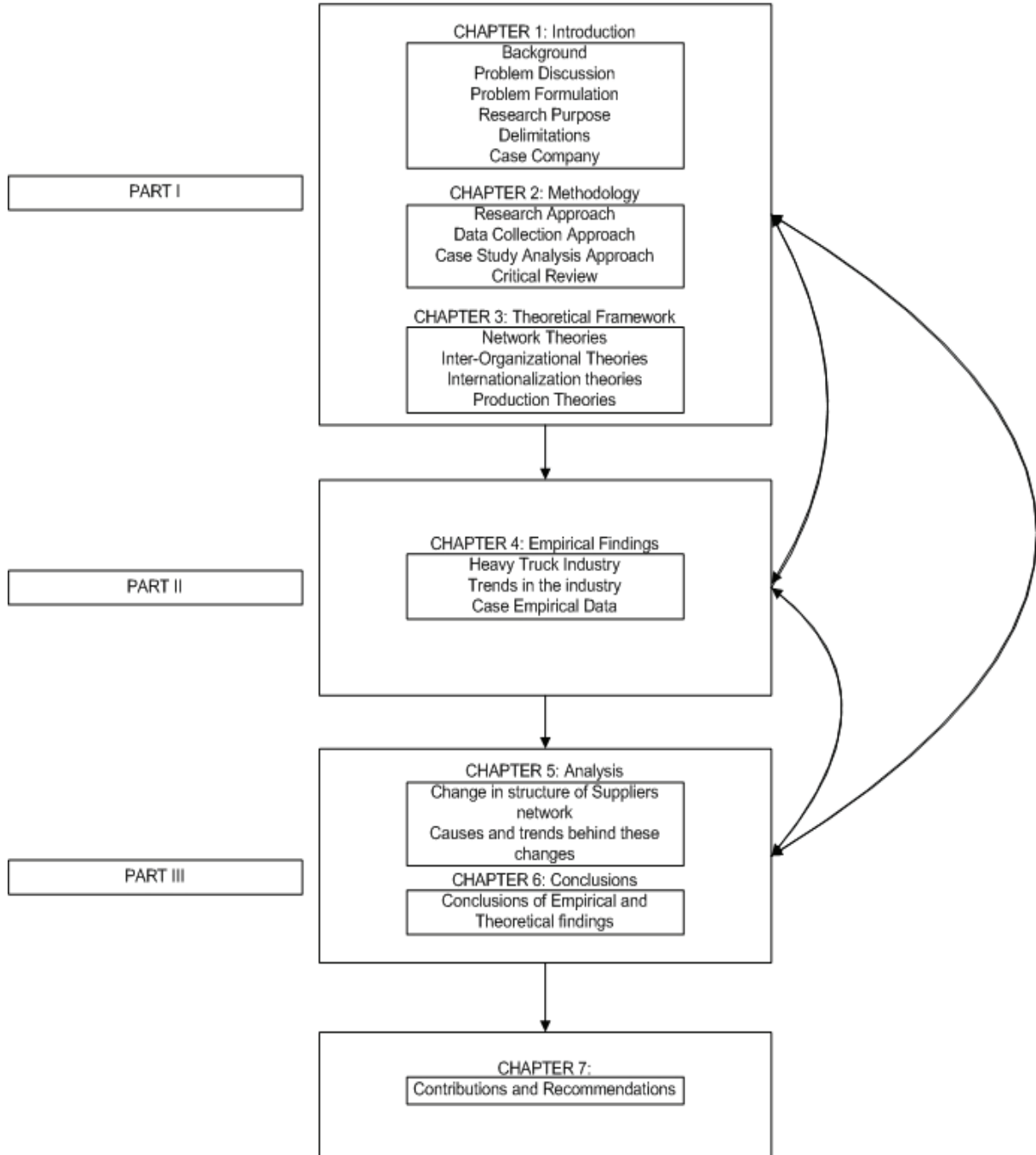


Figure 1 - Thesis Disposition

1.7 The Case Company

In this section we briefly introduce our case company in order to familiarize the reader with area of our focus and to help orient in the text that follows and the terminology used. It provides the description of the structure of the case company, relationships among individual business units as well introduction to its history. The reasoning, why we chose Volvo as a case company is provided in section 2.2.2 of the methodology.

Volvo is one of the companies associated with Swedish engineering and technology. The group has been active in many fields and since 1927 it has been manufacturing vehicles, marine and industrial power systems and aircraft engine components. The company had grown organically but also through acquisitions of competing and supplier firms. In this way it has managed to develop its product offering range and gain more control over the production activities.

Volvo, AB consists of: Volvo Trucks, Mack Trucks, Renault Trucks, Volvo Construction Equipment, Volvo Buses, Volvo Penta, Volvo Aero, Volvo Financial Services, Volvo Information Technology, Volvo Logistics, Volvo 3P, Volvo Powertrain, Volvo Parts, Volvo Technology, Volvo Technology Transfer, Volvo Business Services and Celero Support. It has to be mentioned that Celero (facilities management services' company) will be soon sold to Coor Service Management (Volvo, 2005 - press release 14.10.2005). Nevertheless, it will continue to be a service partner for Volvo.

In the organizational structure of Volvo Group there is a distinction between “business areas” and “business units”. The business areas are the core parts of Volvo AB (commercial transport products and financial services) and the business units are the supporting services companies that are the preferred partners for various functions and top tier suppliers. Volvo Parts is responsible for aftermarket services, Volvo Powertrain is the supplier of engines, Volvo 3P is taking care of purchasing, product development, product planning and range management for the truck businesses, Business Services are dealing with the administrative and accounting services, Volvo Logistics is running the logistics operations (see Figure 2).

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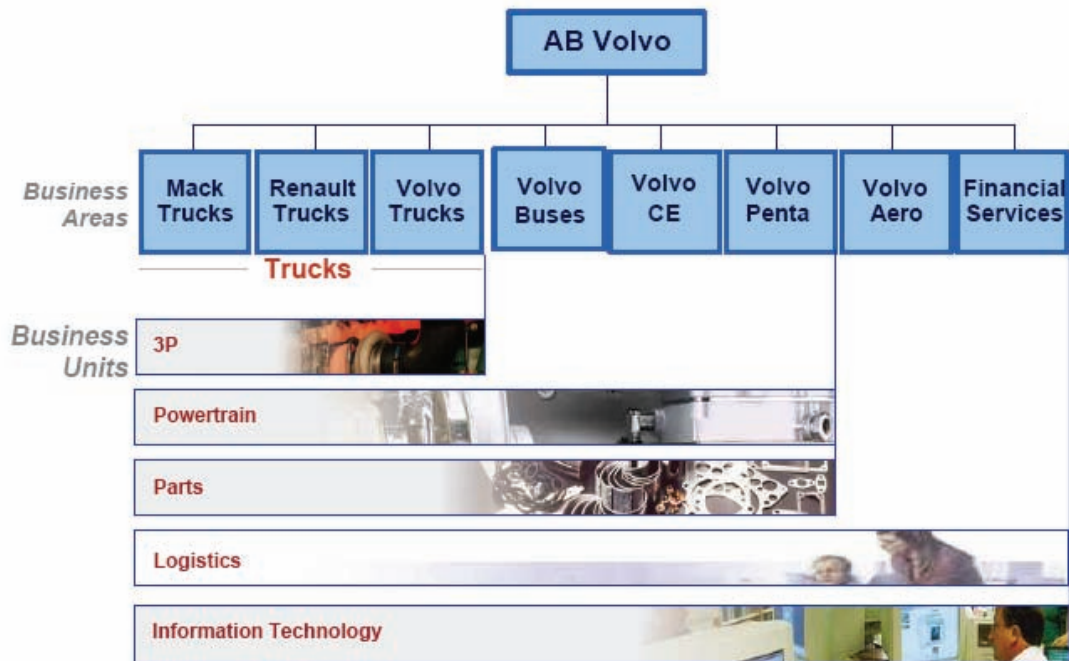


Figure 2 - Volvo Structure
(Source: Volvo, 2005)

1.7.1 Volvo Trucks

Volvo produced its first truck in 1928, a year after it was founded. From that time trucks have developed significantly, from simple trucks to the sophisticated trucks we know today. Volvo was participating on all major changes in the truck history and often introduced new technologies and systems to the industry (turbocharged diesel engine 1954, airbags for trucks 1994, environmental concept truck 1995, front underrun protection system 1996, etc.).

Volvo Trucks is today one of the most important parts of Volvo Group (see Figure 3) and ranks among global top three producers in the segment of heavy duty trucks. More than 95 percent of the trucks produced by Volvo and its affiliates are in this category (94 565 heavy weight trucks in 2004 in comparison to 2735 of light weight trucks) (Volvo, 2005).

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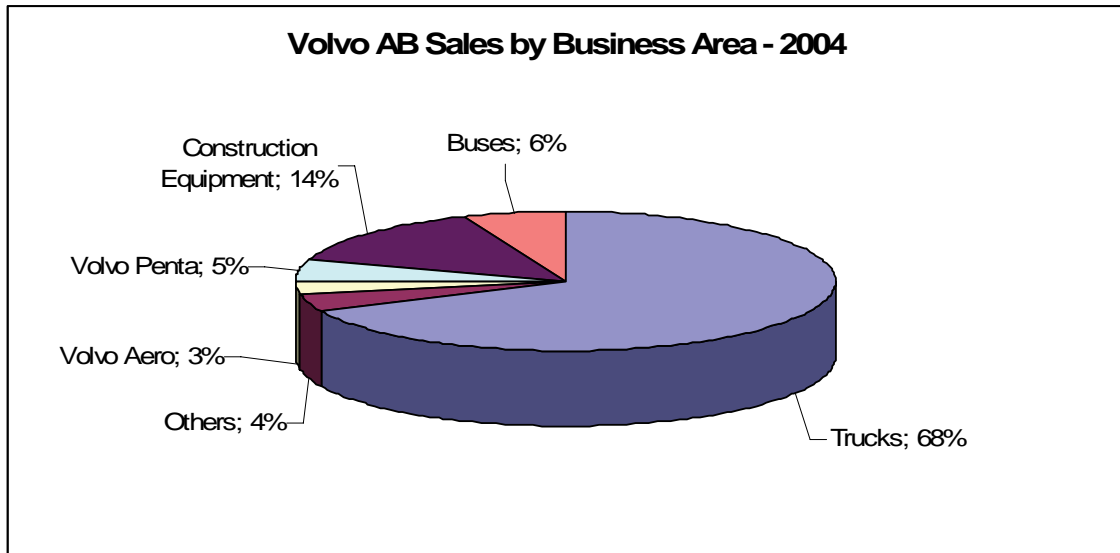


Figure 3 - Volvo Sales by business area
(Source: Volvo, 2005)

In 2000, Volvo acquired its two major competitors, Renault V.I. (Véhicules Industriels) in Europe and its affiliate Mack trucks in the USA. Today Volvo Trucks is producing in nine assembly plants and eight factories on a global basis. Its other brands as Renault and Mack are producing on another 16 places and Mack trucks on 5 locations.

The Volvo truck brands are organized and supported by the 3P business unit that covers all three truck brands (Volvo, Renault, Mack). It is responsible for their suppliers, research and development, and coordination of activities.

1.7.2 Volvo 3P

With regard to the fact that our research focuses on the supplier networks we see necessary to provide brief description of Volvo 3P that is from the year 2001 responsible for dealing with suppliers and for the purchasing for all three Volvo truck brands.

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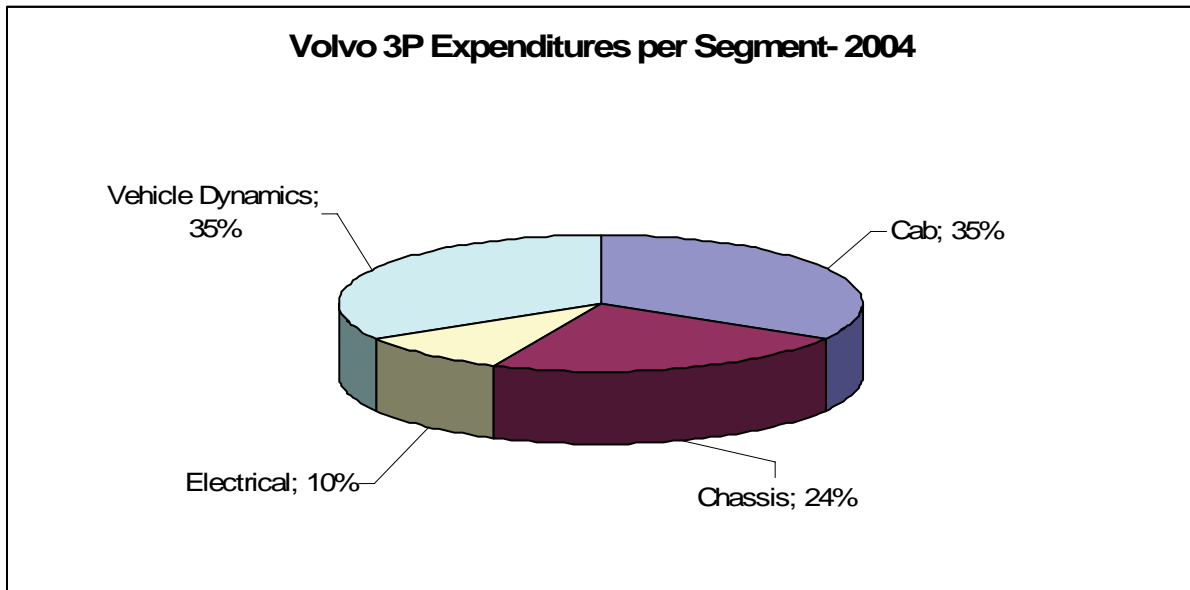


Figure 4 - Volvo 3P Expenditures per Segment
(Source: Volvo, 2005)

Volvo 3P is the business unit within the Volvo AB group and in parallel to the purchasing function it is also responsible for the planning, product development, and product range management for the three truck companies, Mack, Renault Trucks and Volvo Trucks (Volvo, 2005). Its task is the coordination of the truck companies' resources in order to achieve economies of scale through common platforms and production rationalization, but at the same time to maintain the brand distinctiveness.

As visible from Figure 4 the purchasing activities are divided according to the type of suppliers; these are suppliers of cab, chassis, electrical and vehicle dynamics components. The suppliers of engine components are not responsibility of Volvo 3P but of another Volvo AB company, Volvo Powertrain (which supplies engines to whole Volvo AB group).

The reason we saw important to briefly introduce Volvo 3P is because we decided to use the same categorization of suppliers during our data collection. Each category of suppliers (cab, chassis, electrical and vehicle dynamics) is unique and they are distinct from each other.

2 METHODOLOGY

The purpose of this section is to introduce the methodology we decided to use throughout our research. This section provides description and explanation of methods used as well reasoning behind our decisions. It offers justification for the use of an abductive and qualitative approach. Furthermore, it explains why we decided to conduct a case study as well our approach to the data collection and analysis. We conclude this chapter with an evaluation of our research approach in the critical review section.

2.1 Research Approach

There are various types of approaches to a research problem. They differ by the type of the research, field of study as well the timeframe and budget of the research. Usually researchers have to combine more methods in order to gain desired results as methods are complementary and each of them suits different situation. Some of the most basic and used divisions of the research approaches is the deductive, inductive and abductive approach.

During our research we are frequently moving from theoretical level to the empirical level as visible in Figure 5. Furthermore, with regard to the fact this paper focuses on the research of structural changes in a supplier network we see the abductive approach as the one that fits. We believe that this approach helps us to deal with the complexity of the examined phenomenon. It provides us with the flexibility to move from the theoretical to the empirical domain and back and to adjust our reasoning in the light of new findings during each step.

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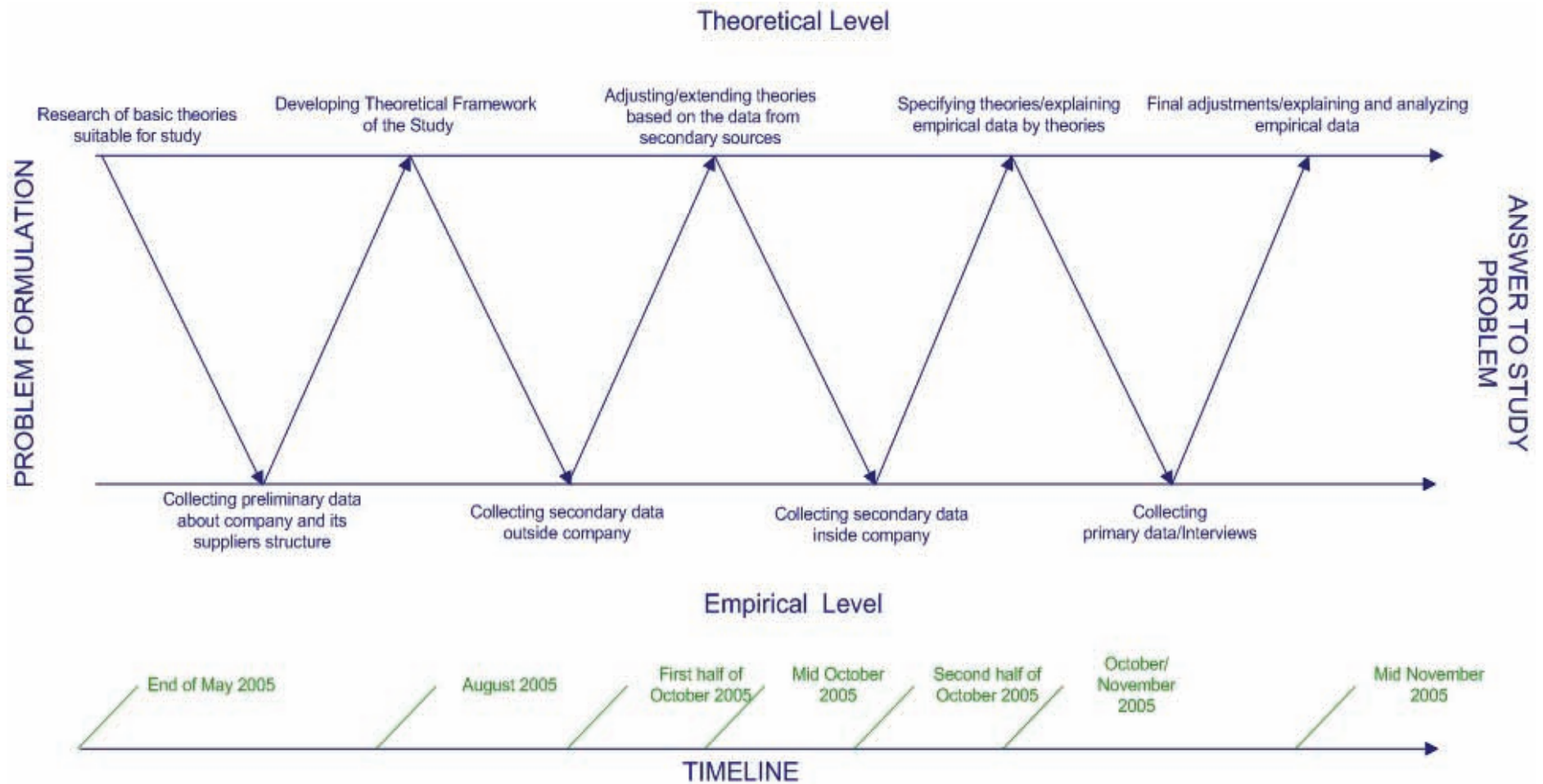


Figure 5 - Research Approach
(Source: Authors)

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In order to cope with the research problem a good theoretical background and knowledge of the field of the research was needed before studying phenomenon itself. First, we saw necessary to create general overview of the theories in our field of study (network theories, internationalization theories, supplier theories and industrial marketing theories) as well of the latest academic articles on the topic. This provided us with basic ideas on what to focus and what kind of empirical data to collect. Then we moved to the preliminary data collection in order to gain a basic overview about our case company and first insights to its supplier network. During this stage we also focused on the evaluation of the availability of data for further research

This was followed by the development of detailed theoretical framework and the completion of the methodological approach. After that the collection of secondary data outside the case company was initiated. This allowed us to research the study problem from outside and provided us with a very good background about both the case company itself and with general knowledge about its supplier network. Basically it helped us to assess on what specifically we should focus on when we will be collecting data inside Volvo itself and while conducting the interviews. The other important part of this stage of research was the creation of a list of names and organizations that should be contacted in order to collect more data as well to request interviews in a later stage of the research.

Next step in our abductive research took us back to the theories. As the new data were collected and new facts revealed there was need to modify the theoretical framework. It was necessary to adapt and extend it as we got new information and ideas. We had to adjust in some areas our research focus and clarify or specify our goals.

Based on the previous discussion, the theoretical part did not served us only as the source of the background information but also for explanatory purposes for the variables observed in our case study. It provided us with new ideas for the data collection and research.

The following step was the collection of data inside the company. We collected the data about Volvo suppliers inside Volvo library. In this stage we focused on printed material, reports on suppliers, intranet (Violin) and other Volvo printed material. These data were then analyzed and confronted with theory in order to explain the observed phenomena. In this part theories

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were extended by more specialized ones. As we already saw some trends influencing supplier network (ex.: type of production of a customer firm), we needed to add theories about these phenomenon to our theoretical framework.

The final step in the collection of empirical data was the interviews conducted with the responsible personnel inside the case company. It provided us with very specific data as well with possibility to expand, clarify and most importantly discuss the topics already observed during the previous data collection and theoretical framework development. Then the final analysis of empirical data was completed and the whole findings were conceptualized and summarized.

Beside the abductive approach we decided to use a qualitative research method. With regard to the specifics of this thesis and the fact that only one case study is conducted, we see qualitative approach more suitable, not only from the timeframe perspective, but also in order to provide a complete picture of the problem.

According to the situation, both qualitative and quantitative methods have advantages and disadvantages. Qualitative research focuses not on “*how many people say something*” as the quantitative but rather on “*what is being said and how it is being said*” (Ruyter and Scholl, 1998:8). Moreover the qualitative approach will allow us to go into the depth and provide the full and complex view on the problem. On the other hand as opposed by many academics it cannot provide absolute confidence in generalizing as the quantitative research and part of the academia still do not believe in its validity with regard to “global” applicability of the results of qualitative research (Ruyter and Scholl, 1998, Denzin and Lincoln, 1994, Marschan–Piekkari and Welch, 2004). This does not concern our research problem as our main aim is not to provide generalization but rather to problematize on the research question.

Going more into detail, the quantitative approach better suits the research of phenomena that have/possess more specific characteristics, differences and casual relations and rely on the interactions and connections between these (Labuschagne, 2003). In our case we were able to observe different trends going on during researched time period as well the changes in the network itself (geographical reallocation of suppliers, change in power relations, trend toward modularization, etc.). Furthermore, qualitative research focuses more on the nature of

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phenomenon itself and allows in-depth analysis while it enables to collect more data about researched case.

To summarize, a qualitative and abductive approach is used in our research. These two approaches should be seen on the same level and not colliding with each other but rather complementing and extending the effectiveness of the research.

2.2 Research Design

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context (Yin, 2003:13).

As explained by Yin (2003) the selection of the strategy how to conduct research depends on three main pillars. Those are: the type of a research question, the extent of a control an investigator has over the events and the degree of the focus on contemporary as opposed to historical events (Yin, 2003). Based on the combination of these three, the researcher may decide whether to conduct an experiment, a survey, an archival analysis, a history or a case study.

A case study allows the research of a “unit” in a substantial way with the possibility to go into the depth. It provides the researcher with the opportunity to focus only on his/her case and collect adequate and rich amount of data. It allows to research the problem from all possible angles in various levels and not to focus only on specific set of variables as in other research methods (Stake, 1994; Yin, 2003).

The research approach suitability, according to Yin (2003), depends on the meaning of the research question. When the research tries to answer “how” and “why” questions then there are three alternative strategies to follow while conducting research: an experiment, history and case study. The problem formulation as presented in previous section does not fully comply with these prerequisites. Nevertheless, it is the essence of this study to describe changes in the supplier network structure and find the reasons behind these changes. Applying Yin’s ideas further on our research problem, it is clear that a case study design fits our research purpose as we do not possess any control of behavioral events, based on the fact we research historical data, and we focus on contemporary events (see Table 1).

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Strategy	Form of research question	Requires control of behavioral	Focus on contemporary events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how	No	Yes
Archival Analysis	Who, what, where, how many, how	No	Yes/No
History	How, Why?	No	No
Case Study	How, why?	No	Yes

Table 1 - Research Strategies
(Source: Yin, 2003)

The choice to employ a case study is also strongly supported by the tradition in case studies that exist in network studies (Easton, 1998) and the need to examine the phenomenon in its context, since it is difficult to treat it separately (Yin, 2003).

2.2.1 Case Study Design

There are two main divisions of case studies. First it is on exploratory, explanatory and descriptive case studies and secondly it is on single and multiple-cases studies (Yin, 2003). Both of them are closely interlinked and each of these methods fits different type of study. In our research we decided to use the single case study, not only because of the limited timeframe, but most importantly because we see it as appropriate in order to fulfill our aim to provide in-depth analysis.

With regard to the first division on the various types of case studies, we find it restricting to use only one of them. We see that our task will be best realized by the combination of two of them. First, as we research historical changes, the descriptive approach will be applied. In this first part we will collect and compile data on the development of supplier network over past fifteen years. It means we will describe how does this network changed. Next, we will try to explain why it changed in this certain way and by what it was caused. By that we will get to the explanatory method. We see that only the combination of these two approaches will suit the challenges of our research.

The descriptive approach will help us answer who, where and when. For example where the suppliers were located, what type of suppliers (who) and when they were in that certain location. It should provide us with accurate picture or better to say a map of the supplier

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network over the years. The explanatory part will help us answer how and why this structure changed.

2.2.2 Selecting the case

With regard to the fact that our research is based on a case study and more specifically on a single case study, the selection of case company is crucial to the reliability of whole research. We looked for a case company that is globally or internationally based and has a supplier network large enough to be the focus of our research. Furthermore, from preliminary findings we centered our attention on a company that went through changes and its supplier network has possibly changed over the researched time period. Our decision was based on the degree of interest, from the perspective of originality and particularity. On a practical level, the proximity of the headquarters was important to us in order to get the access to the company data as well to the interviewees.

2.3 Data Collection

Evidence for case studies may come from six sources: documents, archival records, interviews, direct observation, participant-observation and physical artifacts (Yin, 2003:83).

These six sources may be divided on two main subgroups: a collection of primary data and secondary data. As our research is a qualitative one, the selection of data sources and the data collection approach is critical in order to provide complete, reliable, in-depth and credible analysis of the thesis problem. It was necessary to use more than one method to conduct the whole study. There was need to combine both the primary and secondary data as well some of the six main sources.

As there was a lot of written on our research topic, either on different case companies or on different industries, we decided to use such articles to better understand our own research case. This was the main reason, we saw necessary to include academic resources in our data collection, in order to help us explain variables in our case as well to give us suggestions on what to focus.

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The data collection procedure, started with secondary data in order to get general knowledge and overview about the industry, the environment as well about the company. Next, we moved to the primary data, which were very specific and focused on the explanation of researched problem (see Figure 6).

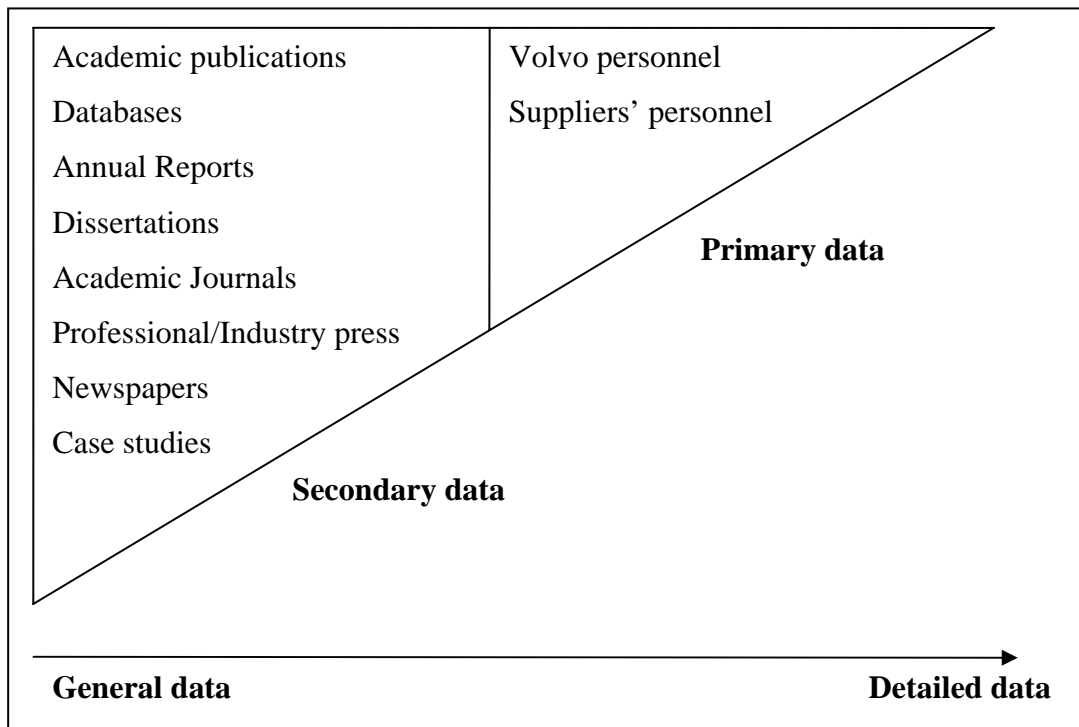


Figure 6 - Data Collection
(Source: Authors)

2.3.1 Secondary Data Collection

We regarded secondary data as supportive ones that should help us to get general idea about the case company as well its supplier network. These data were more of the informative character and were used as a ground for the collection of more specific primary data and for conducting interviews. It helped us to see the case company and its supplier network from outside. Furthermore it provided a very good background for the interviews that followed and helped us to select proper areas to be discussed as well to locate the right managers to contact.

The purpose of collecting secondary data was not to provide us fully with explanations of the observed trends and changes in the network, but rather to help us to identify and describe trends and changes, adjust the theoretical framework and move to primary data collection.

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Secondary data were collected from both external and internal sources of the company. With regard to the specifics of our research, a combination of both had to be used with a crucial role being played by internal data. Secondary data were especially useful with regard to historical events and changes. It provided mainly the answers to what happened to the structure in certain historical milestones.

The internal sources of secondary data were mainly annual reports of the company, company library, company magazines and brochures, newspapers as well other Volvo and industry printed material available in the Volvo library. Furthermore, other interesting sources of data were found in electronic form in the company's website and on Violin (Volvo's intranet).

External sources were based mainly on academic articles and information from the electronic databases as well printed material. What we found very useful were the dissertations and articles of others academics who research particular parts of the Volvo company. They wrote a lot of cases on Volvo presence in particular regions or specific markets as well on various individual phenomena inside Volvo Trucks as outsourcing, quality transfer to suppliers, etc. (e.g. Studies of Inge Ivarsson and Claes Göran Alvstam (2005), Anders Larsson (1999) and others). Furthermore we used various websites, mainly industry and other specialized websites.

2.3.2 Primary Data Collection

As the area of our research, supplier networks, is a very sensitive part of the information company possesses, it is not usually available publicly. Thus, we had to put our main effort on the collection of data inside the company itself. With regard to the fact that these data were crucial in order to conduct analysis and deliver conclusions, the primary data were the main focus of our empirical data collection. They were important in our effort to provide qualitative and detailed description of the researched area as we stated so many times before.

Primary data were very helpful in answering unanswered phenomena and explaining decisions taken by the company. Nevertheless, there was also an initial small collection of primary data on the beginning of the research in order to assess and customize the research

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itself. This was not possible without primary data as only the company can provide us with information which data they are willing to provide and which will stay behind closed doors.

From the primary data collection methods, we found that the most suitable and appropriate were the interviews. This is due to the fact that we focus on historical events. From this point of view, direct observations or participant, surveys or observations, etc. would not fulfill desired goal (Yin, 2003).

2.3.2.1 Interviews

Interviews are one of the most suitable methods of data collection in case study research (Yin, 2003) and qualitative research (Richards, 2005). The interview as defined by Daniels and Cannice (2004) are data and findings based on the direct researcher to respondent conversation. It is a two-way conversation initiated on the side of researcher. This may be done either in person or by phone. Interviewer is supposed to be able to control the direction and topic of the conversation (Cooper and Schindler, 1998). Interviews may provide us with two important types of knowledge. First it is a knowledge that helps us to answer the research problem, or in other words to find missing data or provide explanations to our topic. Second one is to give us advice how to discover and know. It means finding out how the information may be collected, where and from whom (Wilkinson and Young, 2004).

We decided to record the interviews on digital recorder after the permission of the interviewees. This has enabled us to step back, listen again and uncover information that was originally overlooked or hidden between the lines.

2.3.2.2 Interviewee selection

In order to research the structural changes in a network over time there was need to have interviews with more than one person in Volvo. To deal with the complexity of the problem we had to interview people inside and outside of Volvo organization.

The first step, that we saw necessary, was to collect more general data about the changes in the supplier network of Volvo trucks. From this point of view a logical consequence would be to contact some of the Volvo suppliers. While setting up the list of the potential suppliers we

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went over the name of Svenåke Berglie, the Managing Director of Swedish Automotive Supplier Association. As our effort to set up interview with suppliers failed, this organization looked even more suitable as it covers the majority of Swedish suppliers to automotive industry. The interview with Mr. Berglie provided us with a lot of useful information about the industry in general but as well with some specific insights to the Volvo's supplier network. It created also useful background for the interviews conducted inside Volvo trucks.

In Volvo trucks the selection of right managers for interviews was crucial as our research was supposed to be based mainly on the information retrieved from these interviews. Based on our secondary data we had already prepared the list of people that might be interesting for our research and that might help us to collect necessary data.

Here we have to mention that we were very lucky as these people were willing to conduct interviews and they were very open to discussion. In order to cover most of the supply chain of truck production we decided to contact the managers responsible for dealing with suppliers to chassis, cab, electrical and vehicle dynamics (main parts of which the truck is composed). As that we contact Mr. Niklas Hamnstedt, Chassis Purchasing Vice President, Mr. Dzeki Mackinovsi, Cab and Electrical Purchasing Vice President, and Mr. Johan Marchner, Vehicle Dynamics Purchasing Vice President. All of them were from Volvo 3P that is responsible for sourcing for Volvo trucks.

The interviews with Mr. Hamnsted and Mr. Mackinovski and Mr. Berglie were face to face interviews and with Mr. Marchner a teleconference was conducted.

2.3.2.3 Interview Structure

In both cases we decided to use semi-structured open-ended interviews. Open ended questions are quite commonly used while conducting interviews and in this study it helped to complete our interviews. They provide the opportunity to ask key respondents about the researched events directly but also to hear their opinion on the problem discussed. As mentioned also by Yin (2003) it was even possible to obtain in some cases their proposal on some explanation or future development.

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In our case, we first introduced our area of research and our expectation of data we need to collect. Then we provided space to interviewees to answer and describe the major areas requested and give us their insights into the problem discussed. Then we followed by more specific questions that were not covered in previous discussion. On the end, we found very helpful to ask each interviewee if there is something specific or particular he sees interesting to us and we should know. Surprisingly, from such a simple question, quite often we obtained very detailed insights into the specificity of the particular segment of suppliers.

2.3.2.3.1 Face to face interviews

The main advantage in personal interviews lies in the depth of information and the detail that might be provided as it is the richest source of information in comparison to other methods (Cooper and Schindler, 1998). The role of interviewer is mainly to control the topic and patterns of the session; on the other hand he/she has to provide enough space for interviewee to express himself and to feel comfortable. There are three main conditions that are characteristic for successful personal interview; these are the availability of needed information from the respondent, understanding by respondent of his role and adequate motivation and willingness of respondent to cooperate (Cooper and Schindler, 1998).

We can say that our interviews fulfilled all these three points as the interviewees were willing to conduct the interview, had the necessary information that we discussed into the detail with them and were interested in the outcome of our research as they pointed out that it might be interesting for themselves as well for the company.

2.3.2.3.2 Telephone interviews

As mentioned by Cooper and Schindler (1998) telephone interviews is a very unique method of communication with very good potential for collecting in depth data (almost on the same level as face to face interviews). The main advantage of telephone interviews lies in the fact they are low cost and enable distance diminishing. It allows to conduct interviews with distant places (in our case with the Volvo 3P office in Lyon, France) in a short time without need of traveling (Cooper and Schindler, 1998).

2.4 Analyzing Case Study Findings

With regard to the specifics of qualitative data there is no standardized approach toward the analysis of qualitative data. For our purpose and especially with regard to the fact that our most important data were collected through interviews we will rely on the approach presented by Saunders et al in “Research Methods for Business Students”. According to their approach the analysis of empirical data consist of the four main steps. Firstly the categorization and unitization of empirical data is necessary, then relationships has to be recognized and developed into the categories and only then these data may be transformed to the hypotheses and conclusions derived (Saunders et al, 2000).

The first two steps categorization and unitization of data will allow us to set up categories and units in order to later on, during the collection of empirical data, be able to assign the data retrieved to individual categories. It will provide us with structure for later analysis. As visible later on, our main areas or categories of data collection are chassis, cab, vehicle dynamics and electrical suppliers.

In the following step, recognizing relationships and developing categories, the actual data collected during the empirical data collection period are sorted and assigned to the categories set up in previous steps. We personally see these first three parts as being more a preparation for analysis, therefore being part of the empirical data collection rather than analysis itself.

The last step is the analysis itself. During this stage hypotheses are created and their validity is tested. With regard to the strategy that is used in the analysis of our empirical data we see the abductive approach as the most suitable as the both theoretical and descriptive framework has to be used (Saunders et al, 2000) as we will use both existing theories as well our own empirical data (match and combine them) in order to develop the hypotheses and conclusions.

2.5 Critical Review

The reliability of a study can be assessed by asking what would happen, if it was redone by another researcher: would the results be the same or have the assumptions of the individuals conducting the original study have caused an important bias that diminished the quality (Yin, 2003; Saunders et al, 2000)? As this study has followed a qualitative approach, it is important to realize that our own assumptions and interpretations might have affected the results. Yin (2003) proposes that the actions to guarantee the reliability of a case study lie in the data collection procedure. On the other hand, Merriam (cited in Schweizer, 2005) tries to deal with the specifics of qualitative research suggests that the important question is if there is consistency between the data collected and the findings.

Our data collection is clearly described in our report. Providing the course of actions gives not only the possibility to run the same procedure again, but also to make judgments about it. The consistency of data collection and findings was secured, as the solving of any disputes on the interpretations by the authors was done by referring back to the digital recordings and handwritten notes from the interviews.

Another criterion of the quality of a research is its validity, the connection between the findings and the purpose of the study. This has implications for the data collection that has to be adequate and free from personal bias of informants and authors as much as possible. Moreover, the data analysis that has to be thorough, providing explanations and justifying them (Yin 2003; Saunders et al, 2000).

We have used multiple sources for collecting our data. In a great extent they provided us with complementary aspects of the researched phenomenon, but there was always a common frame of reference and therefore it was possible to cross check the interviews. Concerning with data extracted from websites and other general information about our case were discussed with peers that had been working in related topics and had also knowledge of the company history. In the analysis we provide adequate reasoning about the causal relations between the interlinked issues that came up. The cooperation between the authors in analyzing the empirical data and the continuous confrontation with the theory helped us to reduce the bias and establish clear relations between the factors leading to changes in the supplier network

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and the actual changes. From the beginning of the study we have defined the phenomenon under investigation by naming its various aspects that we would examine. Thus, the construct and internal validity of our study was built.

Usually the notion of external validity is also brought in discussions about the quality of a study and has to do with the possibility to generalize based on it. As we have stated in methodology's main section, our reasoning behind the choice of a qualitative and abductive single case study is not to come up with generalizations but rather to reflect on the problem and gain from the richness and particularity of the case. Making generalizations was not part of the goals and ambitions of this study.

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The issue of changes in supplier networks can be approached from various perspectives depending on the specific changes that a researcher tries to investigate. In this section we discuss the theories applied throughout our study. We provide explanation and arguments why we see these theories relevant to our case study and then adequate discussion of each of them is presented.

An important issue that has to be solved in the operations of any firm is the “make or buy” dilemma and the consequences of that decision. The answers and solutions that a firm finally adopts shape not only its organization form but also inter-organizational relations. In this sense there is a link between industrial relations, industrial organization, internalization and internationalization theories. An explanatory view on the configuration of the value and supply chain/network is the final objective.

First we start with various approaches to the inter-organizational relations in industrial systems, notably transaction cost, portfolio and finally the network approach. Having in mind that the industry in focus is a producer driven industry, explanatory value lies on the perspective of a customer firm managing its supplier base. Transaction cost and portfolio theory target issues regarding the boundaries of the firm and the relevant decision making. The advancement of purchasing in a corporate function of strategic importance provides with further insight on the available choices and the reasoning behind them. The network approach reveals the complexity of industrial relations and offers tools to help understand the general context.

When discussing issues as changes in an industrial context, internationalization is something unique for the development of a firm and its supplier network and needs to be included. The firm that internationalizes goes through many changes in inter- and intra-organizational aspects. The geographical dispersion of activities and the various potential configurations of production affect also suppliers from a point view they are involved in making these changes happen. For this reason after some elaboration of the network concept we include internationalization theories with special focus on networks.

3.1 Transaction cost approach

The transaction cost theory as it has been described by Williamson (Cox, 1996) set the foundations on some explanations about the way companies mark their boundaries. A firm as governance structure is more or less fluid and is adjusted in order to stay or become competitive. Internalization and outsourcing of activities are the two extremes between the various governance schemes that companies can choose from. The choice relies on the asset specificity of the activities and whether the costs of transacting over markets outweigh the internal costs of management (Levy, 1985). In Williamson's work there are various assumptions that have been severely criticized, for example the emphasis he puts in the opportunism as a behavior determinant (Ghoshal and Moran, 1996). The polemic is mainly about the prescriptive aspects or aspirations of transaction cost theory. From our point of view we see it valuable for our case mainly because of its descriptive merits.

Cox (1996), reflecting on his understanding about the current situation in research and practice of procurement, recognizes the existence of a general prescription or trend of cooperative over adversarial relationships. Starting from referring back to Williamson's work (1979) on transaction cost analysis he redefines the concept of asset specificity. Asset specificity is argued to be the degree that specific skills or knowledge of the organization contribute to a sustainable competitive position in the market. Cox (1996) bases this definition of asset specificity in terms of "fitness for purpose" (Cox, 1996:61). The characteristics of the transaction are those which lead to the specification of the efficient boundaries of the firm.

According to the level of asset specificity (high, medium or low) a typology of inter-firm relations –*external contractual relationships*– is formed (Cox, 1996:62) (see Figure 7 for details). This typology covers the spectrum from free market approach to partnership approach.

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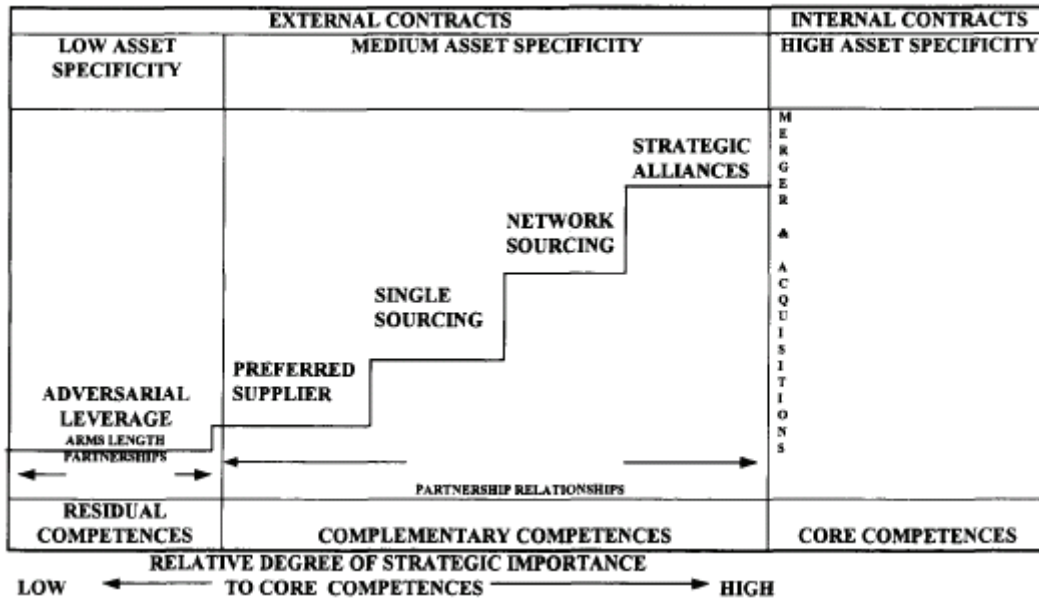


Figure 7 - External and Internal Contractual Relationships
(Source: Cox 1996:63)

3.2 Portfolio approach

The portfolio approach in business relationships has been developed as a tool for efficient and optimal purchasing decisions. It has its origins in the decision supporting models for resource allocation. There have been variations of the model but the main axons are the evaluation of the importance of the component (to be sourced) and the market. The portfolio approach tries to encapsulate and weight the determining factors for the sourcing decisions in one single framework. For the purpose of this study the interesting part is the explanation of sourcing decisions. These are factors connected to the product, supplier and the business context.

Sourcing decisions are usually based on criteria about product performance, supplier competitiveness (price, reliability) and logistics (Maxton and Wormald 2004). Olsen and Ellram (1997) come up with a list of factors that influence the relative supplier attractiveness: namely the financial background of the supplier, its technological capabilities, compatibility in terms of strategy and the strength of the bonds between supplier and client firm. The weight, however, of each factor is let to be determined by the decision makers inside the client firm.

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The strategic importance of the purchase decision depends on the impact that the purchased product will have on the knowledge base of the buying company, its technological capabilities, the volume of the purchase, the product's place in production procedure and the possibility of leveraging further purchasing from the same supplier (Olsen and Ellram, 1997). This brings into the foreground issues about the path dependency on some kind of decision making, by stressing the importance of some decision for future ones. In this way the impact of past decisions is recognized. The difficulty of the purchasing situation according to the same authors depends on the product characteristics, namely its complexity and innovative character, the supply market as defined by supplier power and their related technical and commercial competence. Finally, the environmental risk and uncertainty make the purchasing situation more difficult.

The portfolio approach casts light on some aspects of the sourcing decisions but it tends to disregard some other, notably those that increase complexity, for example the issue of product development (Dubois and Pedersen, 2002). Common product development changes the whole basis of analysis. The assumption of a "given" product that has to be sourced is simplifying the procedures leading to it. Industry reality is that there is collaboration between suppliers and OEMs/final assemblers (OEM-Original Equipment Manufacturer).

3.3 Network approach

In transaction cost economics, firms are facing only the interdependencies existing in the *traditional market model* (Johanson and Mattsson, 1987:34) ignoring the complex reality of industrial systems beyond the dyadic relationships. In the transaction cost approach the attitude of firms is characterized by bounded rationality and opportunistic behavior (Johanson and Mattsson, 1987).

On the issue of interdependence, the network approach developed by the IMP group provides a different view from that of transaction costs perspective. The network approach takes into account the complexity of industrial systems and the interaction between the firms. Networks are dynamic entities where interdependence and connectedness between actor bonds, activity links and resource ties are evident (Håkansson and Johanson, 1992; Håkansson and Snehota, 1995, cited in Healy et al, 1998). Interdependence of the actors in the network takes into account that every firm is dependent on resources controlled by other firms. An important

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extension of this is that companies cannot manage and control their network, but only cope with it (Harland, 1996).

The differences of the portfolio approach from the network approach are obvious. Focus on dyad and on single transactions can be criticized as simplistic. Business to business marketing and industrial purchasing have a timeframe that includes more than a single transaction, even for capital goods. In addition, incidents in one relationship between a supplier and the customer might influence also the other relationships and actors in the network.

The concept of business relationships is moving beyond dyadic relationships and it is stressed that a multitude of relationships directly and indirectly create an industrial network. Richardson has argued that “*firms are not islands and they are linked together in patterns of cooperation and affiliation*” (Richardson cited in Brusoni et al, 2001:598). This also affects the boundaries of the firm regarding the access to resources beyond its proprietary control. Single relationships between firms are embedded in a network context. That means that changes in relationships in the network have an impact on any other single relationship in the same network (Dubois and Pedersen 2002). The focal units of this approach are the inter-firm relationships and not the single firms (Håkansson, 1982; Axelsson and Easton, 1992, cited in Dubois and Pedersen, 2002). The structure of networks can be divided into three interrelated structures: activity cycles, actor and resource structures and can be described in terms of actors, resources and activities. These are the basic building blocks in the network approach (Lundgren, 1992). In the biggest part of the literature –and also in this paper– the actors are the participating (economic) organizations (Easton and Håkansson, 1996) and not the individuals in them. We do not disregard the influence of individuals but it is beyond the scope and the level of our analysis. However, interaction between firms is not only based on economic exchange but it also has a social dimension.

A specific type of network is supplier network. As described by Harland “*Supply networks can be defined as sets of supply chains, describing the flow of goods and services from original sources to end customers*” (Harland, 1996; cited in Lamming et al, 2000:676). Significant features of supplier networks are firstly the indirect relationships (Ford 2002:33). It means the focal company can be related to many suppliers through the few direct relationships that it has with the main suppliers (by that it can gain access to suppliers dealing

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with main suppliers- e.g. second and third tier suppliers in a hierarchically organized network as discussed later on).

Secondly, the issue of coordination in the network arises with the customer firms trying to coordinate and control the situation through linear supply chains. Third feature is that the size of a firm matters to its position in the network and in the role it can play in the development of it. The company's network position consists of its portfolio of relationships and the activity links, resource ties and actor bonds that arise from them (Ford et al, 1998). The division of labor between the firms in a network creates dependencies. In order to achieve a level of efficiency, coordination is necessary. This is the outcome of the interaction between the firms and not only of price, which is merely an attribute of this and not the main issue as in the market model's price mechanism (Johansson and Mattsson, 1987).

In this section we provided the description of the network from a static point of view. We discussed various views on networks in order to cover the complexity of the topic. With regard to the fact that our research focuses on historical changes in such networks we see necessary to include the change aspect in our theory section as well.

3.4 Networks and change

Networks are stable but not static. The existence of the network is connected to its history regarding the memories, investments in relationships, knowledge and routines (Easton, 1992). Industrial network descriptions can become more interesting with the inclusion of time as a key dimension. The question of change over time arouses especially with regard to the question "why" changes in existing patterns occur and why in some cases do not. The changes can be small in relation to the past, because they have to be accepted by large parts of the network. The changes in networks happen in an accumulative and incremental way in response to "changes" internal and external to them (Easton, 1992). Thus, it is clear that the changes in a network have to do with the individual actor's evolution. Changes in one part of the network will also affect the rest through the interdependencies that exists in each network. Networks and their actors evolve in parallel and in this way reality is formed (Lundgren 1992). This can also be seen from a strategy perspective, meaning that competition lies also on a network level, rather than simply on a firm level (Cunningham, 1990, cited in Lamming et al, 2000). The cooperation between distinct but related firms enables these firms to share

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mutual benefits and gain a competitive advantage over their competitors outside the network (Jarillo 1988 cited in Kandampully, 2003).

In Ford (2002), there are pinpointed two main changes that contemporarily are happening to the character of networks, notably globalization of networks and the increased complexity. Globalization of networks raises the amount of companies that share similar technologies and thus increases the competitive pressures. The other consequence is that the supply and value chain can derive from sourcing on a global basis. By the term network complexity are meant new developments that have risen and blurred the map of industry constituting by manufacturers, assemblers, wholesalers, retailers etc. Competitive collaboration, joint product development, virtual manufacturers are some of the novelties. There has been a shift from “generalist” organizations to “specialist” organizations (Kandampully, 2003). The trend of increased specialization in supply systems has as a consequence even the outsourcing of traditionally internal activities (Håkansson and Persson, 2004).

3.5 Purchasing

The exchanges and transactions among customer firms and their suppliers are coordinated by, and are the result of purchasing activities of customer firm. Despite the fact that “make or buy” has always been a fundamental issue, it has not been viewed as a strategic issue till recently (Gadde and Håkansson, 2001). The relations among suppliers and buyer firms have changed and that is seen in the developments in the purchasing functions of firms. Ten or twenty years ago purchasing was just a simple administrative function and was not considered to be something crucial for the success of the company. The discussion about strategy and the prescription to focus on core competences has led to increased outsourcing and the specialization. It also increased the dependence of firm on the resources of other firms (Gadde and Håkansson, 2001). As a consequence the importance of suppliers is increased.

Adopting the perspective of the customer firm we can find some of the reasoning that guides decisions about outsourcing, subcontracting, the management and organization of supplier base. The internal perspective of that firm is in many cases determinative for the role of suppliers. Rational choices are usually assessed on the basis of a cost/benefit analysis. The analysis itself is influenced by the approach that decision makers have. Previously the focus has been on dyad relationships, specific transactions and short-term orientation. The trend has

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changed and recently the strategic importance is stressed, the consequences on other relationships are taken into consideration and the focus is on long term competitiveness. Regardless the approach towards make or buy decisions, every move has certain pros and cons. The trade-off between control and flexibility is the main issue. There are however, various types of flexibility and control and this means that the criterion should be the preference on a specific type and not on a general level (Gadde and Håkansson, 2001).

With regard to outsourcing and subcontracting, there are some distinct choices that a company can make. Multiple, single or parallel sourcing has to do with the spread of the risk of relying on suppliers, with the associated costs, and with the assessment of suppliers etc. Centralized or decentralized sourcing depends on whether the company has given autonomy to each factory to deal on its own with suppliers or has restricted this activity on a centralized level. The implications of these preferences in outsourcing practices affect and shape the relationships that the customer firm has with each of the suppliers and the size of the supply base (Gadde and Håkansson, 2001). The extremes can vary from high involvement relationships and small supply base to arm's length relationships and a large supply base. During time the prescription in fashion seems to have moved from the first one to the latter but that does not mean that there is only one correct setup. There is a range of alternatives and picking the appropriate one is case specific.

Direct control of resources is based on ownership. Indirect control is based on relationships with other actors (Håkansson and Johanson, 1992). Network control is not evenly distributed over the actors in the network as it is related to the power that each actor has. In the past, ownership of resources has been considered to be the only way of having guaranteed access to those of strategic importance (Gadde and Håkansson, 2001). The idea of firms possessing core competences that are crucial for their competitive advantage and the subsequent focus on them is a main reason for outsourcing of other non-core activities (Gadde and Håkansson, 2001).

3.6 Internationalization theories

Another aspect influencing the composition and development of supplier networks is internationalization process both on the side of the customer firm as well on the suppliers' side. Internationalization of firms is a very well described area. There are a lot of scholars dealing with various aspects of internationalization. Some of them, as Dunning, Oviatt, Dougall, and many others, focused on the characteristics of the company and environment as prerequisites for the company to become international or global. Having transaction costs as their fundamentals they provided explanations on the issue of foreign direct investment. Other, as Johanson and Vahlne, Johanson and Wiedersheim-Paul, Yip, Chang and Rosenzweig, focused on the internationalization process itself and on the forms of entry mode or the stages in the internationalization of a firm. Building on a behaviorist approach to the firm, this strand of research offers a valuable insight into aspects of firm development and growth in an international context.

Parallel to these researchers, others as Zou and Cavusgil, Kim and Goshal, Kim and Mauborgne focused on global strategies and their success factors. Furthermore, the knowledge transfer and transfer of firms advantage as well innovation inside the global firm were the focus of Birkinshaw and Hood, Osterloh and Frey, Hu, Szulanski, just to mention few. These authors have stressed upon the issue of innovation and they also view internationalization as such (Andersen, 1993). Finally, there were researchers dealing with internationalization of networks or the role of an international firm in a network. Among few researchers out of this area we should mention Malnight, Johanson and Vahlne, Andersson, and Shi.

Another division of internationalization, done according to the Fletcher, is based on the approach to the internationalization process. It is on: "*stages approach*" (for example Bilkey&Tesar), "*learning approach*" (ex. Johanson and Vahlne), "*contingency approach* (ex. Reid) and "*network approach*" (Hakansson)" (Fletcher, cited in Andersson, 2002:368).

With regard to our research area the most important theories are those dealing with internationalization of a firm itself and with the internationalization of networks. Firstly, we decided to involve internationalization theories because the Volvo itself went during past fifteen years, on a continuous basis, through an internationalization process, and secondly

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because some of the suppliers as individual firms went through the same process as well. This is especially true for large multinational suppliers. While speaking about the network internationalization theories we see them especially important while assessing the role of a customer firm (Volvo) in such network and at the same time the role of the other actors (in our case suppliers) and internationalization of such network. The internationalization framework used in this paper is visualized below (Figure 8)

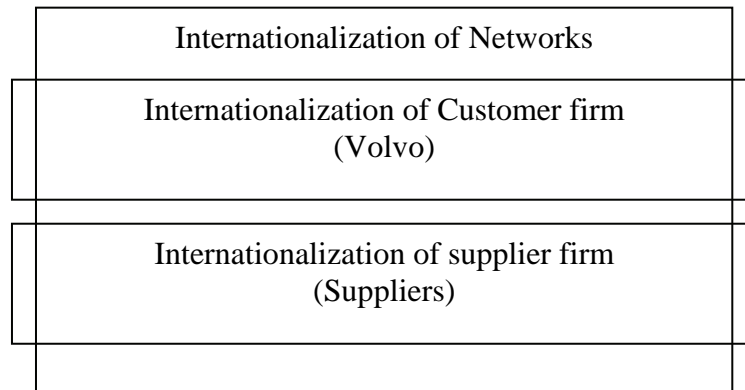


Figure 8 - Internationalization Theories Framework
(Source: Authors)

As our case study firm already internationalized long time ago and still continues with expansion it is meaningless to discuss here into the detail the prerequisites and characteristics of a company that wants to internationalize.

We would rather focus on internationalization process itself as it seems more relevant to our case study. According to the stage approach, internationalization encounters several stages. On the beginning, in the first stage, there is a firm purely serving local market. There are no or only rare and irregular exports to foreign countries. The second stage of the internationalization is when the company starts to export its products abroad via independent resellers. Later on when the company acquires more knowledge about that particular market, it may decide to increase its commitment to that market and establish there its own sales subsidiary. Final step of internationalization, according to the “stage approach” is the establishment of own production/manufacturing plant in new market. (Johanson and Vahlne, 1990; Andersen, 1993; Shi 2003). According to a different approach companies can also be born global and it is especially true for companies involved into state of the art technologies.

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In the first two stages of internationalization (no exports and exports via independent resellers) the company itself is not involved directly on foreign market nor its suppliers. Therefore these two stages have neither any major direct impact on the company's production operations nor on its structure and suppliers network. During the third and fourth stage of internationalization (establishment of own sales subsidiary and establishment of production/manufacturing), the company becomes directly involved in a new market. As a consequence, in these stages there is direct impact on company's structure as well on its suppliers.

As the large industrial companies are part of networks, the changes that occur through the internationalization process influence their networks and vice versa. By entering new markets firms come into contact with new environment, new culture and new factors. Highly internationalized firms are positioned within foreign networks and actively interact with other participants in that network. (Johanson and Mattsson, 1988).

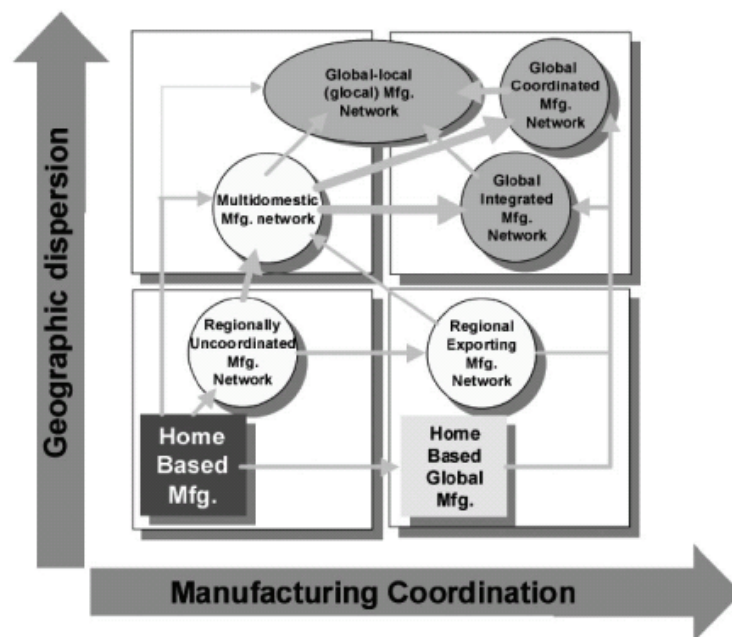


Figure 9 - International Manufacturing Network
(Source Shi, 2003:361)

As stressed by Shi (2003), today industrial MNCs are integrated parts of international manufacturing system. They are inseparable and mutually interdependent. Having developed this idea further, today *“networking characteristics of international manufacturing systems involve many new and wider perspectives, for example, a factory is “like a node of a manufacturing network, its geographic dispersion, horizontal coordination, and vertical*

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positioning and integration become more critical characteristic of the network” (Shi, 2003:358). The production of global or internationalized companies nowadays is on global level, they produce globally and they source globally. Manufacturing has transformed from the single place factory production to the international manufacturing network system (see Figure 9 and Table 2).

Difference of two types of manufacturing systems	
Factory manufacturing system^a	International manufacturing network system^b
1. Capacity: amount, timing, type	1. Factory's characteristics: (as whole left column)
2. Facilities: size, location, specialisation	2. Geographic dispersion: distributed factory condition
3. Technology: equipment, automation, linkage	3. Horizontal co-ordination: co-ordinated mechanism between factories in network
4. Vertical Integration: direction, extent, balance	4. Vertical co-ordination: integration in value-adding chain
5. Workforce: skill level, wage policies, employment security	5. Dynamic response mechanism: opportunity identity, and manufacturing mobility
6. Quality: defect prevention, monitoring, intervention	6. Product life cycle (PLC) and knowledge transfer in international manufacturing networks
7. Production planning/material control: sourcing policies, centralisation, decision rules	7. Operational mechanisms: network daily co-ordination, management information system
8. Organisation structure: structure, control/reward system, role of staff groups	8. Dynamic capability building and network evolution: learning by operations

Table 2 - Manufacturing Systems
(Source Shi, 2003:360)

According to Yip (1992; cited in Shi, 2003:362), there exist four forces that push company to establish the global network. These are the global markets, the cost pressure, government encouragements, and competitive game strategy. Furthermore Shi adds several additional complementary or parallel reasons for a manufacturing firm to transform from single location to international network production. Among the most important it is necessary to mention: strategic resource accessibility, thriftiness ability, manufacturing mobility and learning ability (Shi, Gregory, 1998 in Shi, 2003:362) or the combination of all or more of these. Shi (2003) goes even further and describes (based on the research of Cambridge Centre for International Manufacturing) a global manufacturing strategy being composed of four main modules influencing development of a network. These are: external requirements, internal capability, manufacturing mission and configuration, and network transformation tasks (Shi, 2003:362).

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A similar phenomenon in internationalization of networks, more precisely on the transition of MNCs from decentralized to network based structures, is the focus of Malnight's (1995) research. His conceptualization has the roots in the ethnocentric (centralized approach) and polycentric (decentralized approach) models and later on focuses on the process and stages of the transition from decentralized to network based MNC.

Behind such shift, the main driver is suggested to be the need of company to adjust its strategy from geographically oriented to the product or customer oriented strategy. This is not done immediately by simply switching the strategy but rather on a continuous basis or in several sequential steps. In a decentralized mode or during the first stage, MNC competes only within independent national markets and its focus is purely only on that market. During the second stage of transition, the company starts to support activities of individual national operations by basic regional activities but still, the influence or participation of individual market operation does not exceed the boundaries of the domestic market. It can be said that it is still much more one way process from region to national markets, but not vice versa. In third stage the MNC moves to the competition on the regional markets with the support of locally based operations. In this stage there is a visible shift from the regional support to individual or local markets to the support of local to regional activities. In the last stage the company competes in targeted regional products and customers and operates in an integrated network.

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	Decentralized Models	Network-Based Models
Market Orientation	Foreign operations as portfolio of independent businesses	Integrated worldwide strategy, with differentiated contributions by dispersed operations
Resource Configuration	Decentralized and nationally self-sufficient	Distributed, specialized, and interdependent resources and capabilities
Organization	Informal headquarters-subsidary relationships overlaid with simple financial controls	Complex process of coordination and cooperation in an environment of shared decision making

Table 3 - Decentralized and Network based MNC Models
(Source: Malnight 1995; p. 47)

The transformation of the MNC in each of these stages requires the adjustment in nature and distribution of resources within the MNC as well the creation of new relationships among individual parts of the MNC. It includes elimination of duplication of resources across national markets, rationalization of resources, and expansion and reallocation of specialized resources across the territory. With regard to the organizational linkages, there is a visible move from the collecting and communicating information on common challenges to individual national markets, to the coordination of the task and goals and eventually to the reallocation of the roles of individual national MNC functions to the specialized activities that focuses on larger geographical areas. (Malnight, 1995)

Furthermore, according to Ghoshal and Bartlett, the MNC should be viewed as a network of exchange relationships among different organizational units that includes both, headquarters as well the national subsidiaries and, what is important, all of them are collectively set in a structured system (Ghoshal and Barlett, 1990). Moreover such “internal” network is part of/influenced by its external network, which is composed of all its suppliers, customers, regulators, and competitors. They argue that the final configuration or the structure of the MNC itself and allocation of its resources is the result of the influence of the factors of the external network as the MNC is fully integrated into such network and is depended on it in order to survive.

Such an external network can be described based on the density of ties among all its components. In case of “within density” it includes all the ties on the individual national market and “across density” refers to the ties across total external network and across different organizational sets.

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Goshal and Barlett (1990) differentiate four types of inter-organizational relationships that may exist inside the MNC structure. These are: the unitary set-up, federative and coalitional set-up, and social choice. They describe the type and level of relationships that might occur inside the MNC, both between the headquarters and subsidiary as well among subsidiaries themselves.

With regard to the resources configuration (production equipment, marketing, finance, technology, etc.), Goshal and Barlet, refer to it as to the way in which MNC distributes the resources among its individual operations. The difference among the concentration of these resources in one place is described as the dispersal. It means the level to which the company resources are concentrated in one unit opposed to dispersal among more units. Such division refers to two main types, the “centralized hubs” and “decentralized federation”. The type of such configuration of the MNC is influenced by the distribution of power in such a network that influences flows of these resources (Ghoshal and Barlet, 1990).

3.7 Types of production and its Impact on Suppliers - Production vs. Assembly

Another very important factor while looking on the development of the supplier network is the type of production at the individual customer firm plant as it has tremendous impact on the type and amount of suppliers as well on their geographical location. There will be different flow of material and components to the production plant and assembly plant. We see necessary, on the first place to classify main types of operations in an automotive industry. Here we see as the best option to use the Dickens (2003) characterization of types of production of automobiles.

He identifies the several stages of development of country's' automotive industry based on the type of the production that takes place in that given country (see Figure 10). As visible from this figure this division is demonstrated on the type of production and the involvement of the company at the individual country's market, or in the served region. It is visible that in each stage or type of production a different sourcing strategy is used.

THEORETICAL FRAMEWORK

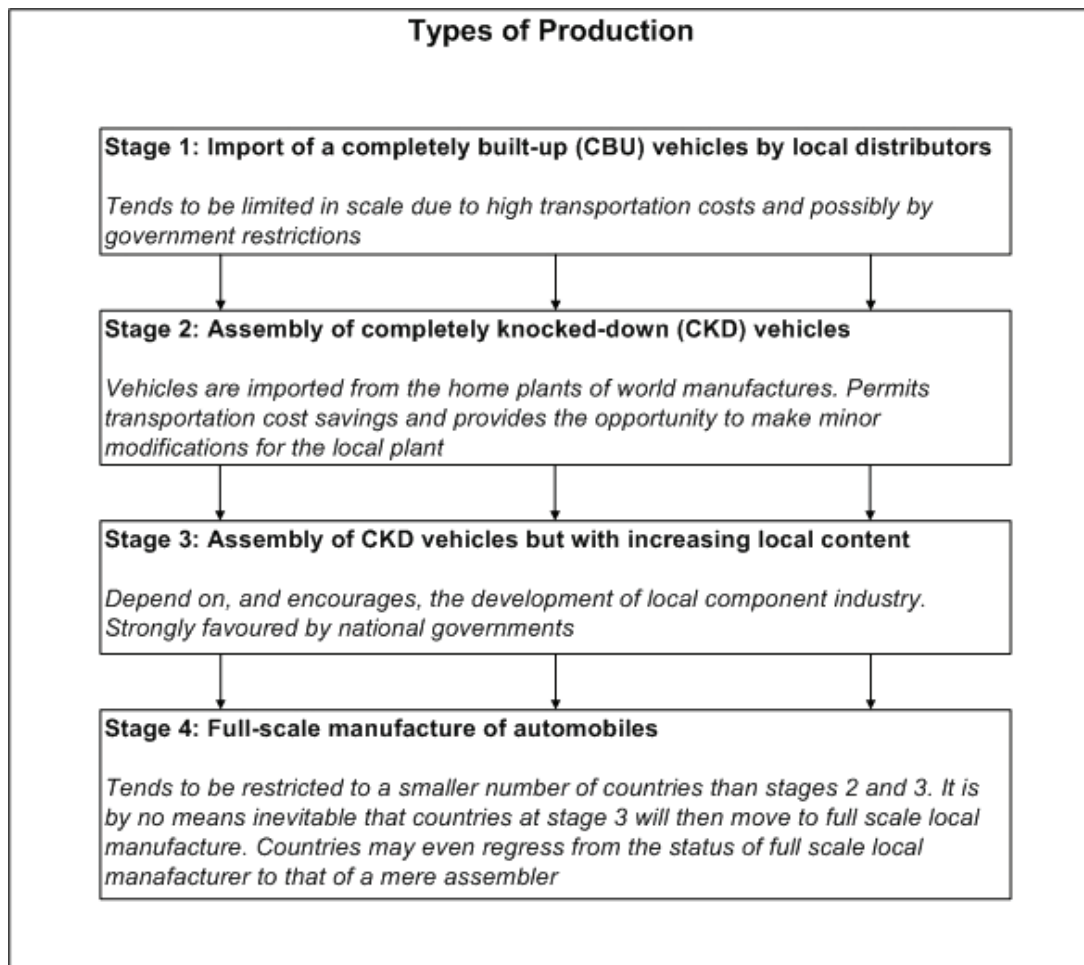


Figure 10 - Types of production
(Dickens, 2003:356)

The first stage is not relevant to our thesis topic as there is no sourcing going on and the product is completely imported. On the other hand the second level/type, assembly of completely knocked down vehicles (CKD) and third level assembly of CKD with substantial local content are much more relevant to our research. In these two activities company holds some operations in a country/region. In the extreme case of assembly of CKD the company is importing final parts or better to say complete modules to be assembled. It means there is no production going on in the new place, but rather only the assembly of main parts of the vehicle (usually complete chassis, cab and engine is imported and then assembled together in the new location).

Over the time, company usually starts source some activities and components from local suppliers and upgrades its operations by adding some production activities (eg. tires are sourced from the new location, Volvo Thailand). Decision to source locally is not often influenced only by the company itself but also by the local environment. We can say that

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there are not only economic/business reasons (costs of transportation, logistics, and quality) but quite often legal reasons. Today large number of countries requires company to have certain percentage of product sourced locally otherwise they will not allow them to build a plant (e.g. Volvo in Brazil, Volvo in China, Volvo in India).

Potentially, if the company sees its reasonable, an assembly plant can be upgraded to a production plant and carry whole production. Subsequently, it may start export whole modules (eg. Case of Volvo in Brazil exporting engine modules to other Volvo assembly and production plants) to other plants of the TNC and get involved in global production network. This process might go vice versa (from production to assembly of CKD or from CKD to import of CBU) and it quite often happens (closure of Volvo Pakistan CKD assembly plant and move to purely imports of CBU).

3.8 Conceptualization of Theoretical Framework

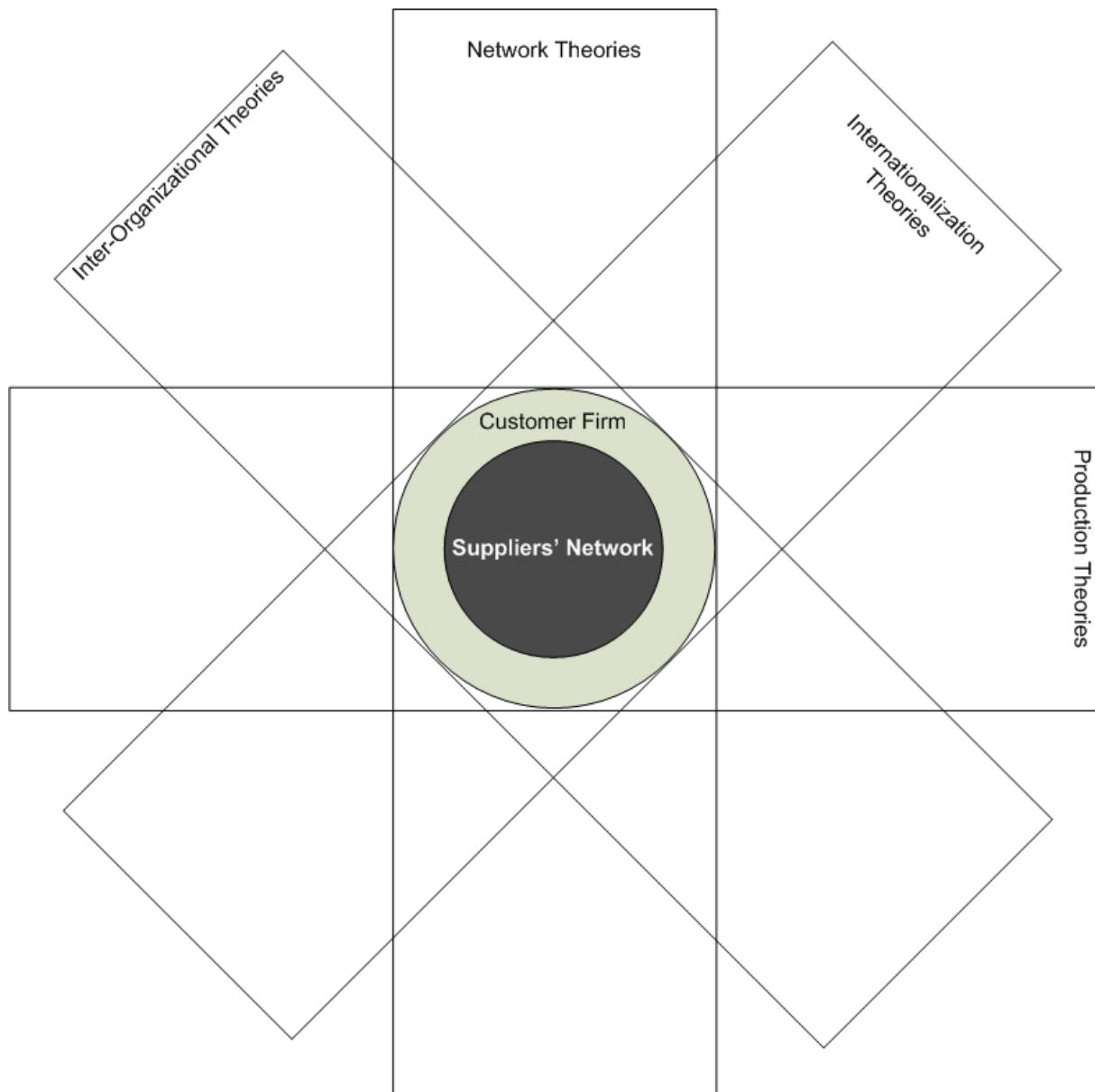
The preceding discussion was about the theories that in our perspective provide explanations on the phenomenon of changes in a supplier network and especially on its structure. From the problem formulation, where we initially defined the attributes of the structure to be studied, the issue is further elaborated based on the network approach on industrial relations.

The changes in an industrial network can be viewed as the outcome of many interacting factors. The evolution, development, and changes in the firms involved are having a major impact on the whole network. Since our focus is the supplier network, the role of the customer firm is expected to be crucial.

Apart from the firm specific factors of change we must include the influence of the external environment in general, as well as of the more specific industrial context. The aggregate level of examination of changes on the supplier firm specific level and the influence of the external environment overlap in the extent that industry particular characteristics and trends can be observed.

From the perspective of the customer firm, the changes of its supplier network can be explained as the outcome of its development, its internationalization, the configuration and type of production, and of its purchasing policies.

THEORETICAL FRAMEWORK



**Figure 11 - Theoretical Framework
(Source:Authors)**

As shown in Figure 11, our focus is mainly on the customer firm and the supplier network. Firstly there is the examination of the role of the customer firm. The individual firm can be seen as a self-determining actor causing changes to its configuration and organization but at the same time there is an interaction among the suppliers and the customer firm. The need for resources outside the proprietary control of the firm and the ways to gain access to them is changing the boundaries of the firm. Customer firm strategy is affecting not only the customer firm itself but also any other organization that interacts with it (suppliers in our case).

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Anything that makes the company as an organization getting bigger or smaller, change and move the geographical configuration of its operations affects in some extent the suppliers as well. From this point of view, we must be reminded of the existence of similar factors on the supply side. Taking the supplier perspective and realizing that as a distinct organization each supplier has its own strategic purposes and its own suppliers to manage, we can see the various moves that a supplier firm can make. Since our purpose is to examine changes on an aggregate level, the second perspective treats the suppliers as a group. As we said, it is not neglected that this group consists of individual entities, but there is need to level out the complexity.

Our conceptualization of approaching the changes that have happened in a supplier network is composed of complementary views on the process. The dual focus that is adopted is seen through theories that explain different aspects of changes happening in these two levels. They are overlapping in the sense that they describe and influence the interaction between customer firm and suppliers.

Thus we have decided to focus mainly on examining and finding suitable theories dealing with industrial networks, inter-organizational relations, customer firms types of production and its effect on networks and last but not least the internationalization theories.

Internationalization theories provide with the background of changes happening from a single firm perspective, which can be the customer firm but also the supplier. They also introduce us to the firm as an international production network. The importance of the production procedure in an industry specific view is added in the model. The network approach is seen to stand out from the various approaches of inter-organizational relations and be more valuable.

4 EMPIRICAL FINDINGS

In this section we will introduce the reader to the empirical data we collected during our study. First of all general trends in the automotive industry during the researched time period are presented. Then we move to the more specific area by introducing structure of Volvo purchasing and its global operations and changes over time. Last we provide reader with very specific description of changes in Volvo supplier network.

4.1 Trends in Automotive and Heavy Truck Suppliers Industry

When Ford and General Motors started in the beginning of the 20th century, vertical integration was the main strategy to control resources and achieve economies of scale. This approach to automotive production was the norm among the western vehicle manufacturers for long decades. The oil crisis of 1979 has been an important point in the history of automotive companies since issues of productivity and efficiency were brought up more intensively. The vis-à-vis competition between western and Japanese manufacturers played a crucial role in that (Volpato, 2004). The Japanese model of labor division between assembler and supplying firms has been influential for the operations and supply base organization of the western firms in the eighties. In the 1990s the big American corporations GM and Ford spun off their component manufacturing divisions, Delphi and Visteon respectively (Maxton and Wormald, 2004). The advent of theories about lean production and mostly the practices that have emerged in the 1980's had their impact on the supply base of automotive manufacturers. Just-in-time practices require timely deliveries and this can demand in some cases proximity of supplier production facilities. Definitely an increased level of co-operation between buying and selling firms is also necessary.

Technology has been always a driver for change in industry. The major developments that have shaped the automotive industry during the last 15 years is the increasing usage of electronics, the focus on safety, and the raising demands for environmental friendly transportations. In the passenger car industry the value of electronics in a new car was 10 percent in 1990 and 22 percent in 2000, with a projection to reach 40 percent of the car value in 2010 (Maxton and Wormald, 2004).

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The technological progress and the increased importance and value of electronic components, together with the need to remain flexible have marked a shift in the power distribution in assembler-supplier relations (Maxton and Wormald, 2004). Key suppliers have now increased importance. This change is partly due to the greater involvement in, and contribution of suppliers in design. Catalogue suppliers that had had standardized offerings have moved to more customized solutions. The vehicle manufacturers can just specify the interface that the parts or systems should have to fit with the rest of the vehicle and suppliers are free to use their own technology (Mackinovski, 2005). To sum up, a supplied component can be based on the drawing of the OEM, co-developed or based on design of the suppliers. In the latter case the order is based on a briefing about the functional specifications (in Volvo case they can be also developed in collaboration between supplier and Volvo) rather than detailed design (Volvo).

The supply side of the industry felt the increased challenge of bearing the main responsibility for the innovations. This was and still is an opportunity for small focused firms, but at the same time it was and can be a burden for the diversified suppliers that lacked the capabilities of innovating or keeping up the pace in their products portfolio.

Increased competition on a global scale leads the vehicle manufacturers to search for ways to reduce their costs. This can be achieved through different approaches in car design, assembly and production techniques. The individual firms trying to respond to competition following their own way, but still there are common patterns. In this way various interlinked trends are created in the automotive industry. These changes in the structure of automotive industry, the way of conducting business and production of vehicles have taken place, are still on-going and they affect all the actors involved, including the supply side. The number of suppliers was reduced by the trend of modules and systems sourcing on the one hand, and on the other hand positively by the expansion in new markets and the emergence of new technologies, which is proprietary knowledge of the developing firms (EIU, 1998).

The size of the impact that changes on the vehicles manufacturers' level have on the supply industry is also subject to the dependency of the suppliers on manufacturers. In Japan for example many suppliers have more than half of their turnover dependent on business with one single manufacturer (MIRA, 1997a). Some of these suppliers are reported to try breaking this situation of being tied to a manufacturer and there have been cases that they started supply

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companies outside the keiretsu they belong in. In the other triad economies the suppliers have been traditionally more independent (MIRA, 1997a).

4.1.1 Specifics of heavy truck industry

Truck industry consists of three different segments, notably transporter vans, light trucks and heavy trucks (McNeill and Chanaron, 2005). The first two categories have the same characteristics as the passenger car industry and the same factors drive the developments. Heavy truck industry is quite different and has its own specifics. Trucks are not consumer goods, but tools necessary for trade. The fluctuations in private consumption do not affect their sales directly (McNeill and Chanaron, 2005). The volumes in truck industry are much lower than in passenger cars, but trucks as a final product have a very high value (McNeill and Chanaron, 2005).

More than in other markets, automotive is strongly state regulated, since it has been valued as significant engine of growth and employment and is also important for the current balance accounts (Maxton and Wormald, 2004). Still there are demands and regulations regarding the local content of products. In addition there are different styles and approaches in the truck business across the world. In mainland Europe there has been a tradition of vertical integration in the industry where the OEMs had a big proportion of the production in-house. The trucks are marketed as a full transport solution, with the services gaining more importance. In the US there has been more of a horizontal integration in the industry, component manufacturers were competing for business directly at the end customer level. This has given the customers the option of selecting various components for their trucks, namely the purchasers and fleet managers from the transport companies could ask for specific engines, breaks etc (EIU, 1998).

Another important aspect and truck industry specific is the length of the product life cycle. New models are not introduced so often, the development process takes longer and there is a long period of after market support and need for spare parts availability (Berglie, 2005). In a way, the length of contracts and business awarded to suppliers can compensate for the limited volumes.

4.1.2 Modularization

In the field of assembler-supplier relations major developments have been the introduction of modular supply and the creation of industrial condominiums. An industrial condominium or supplier villages are created when facilities of key suppliers are located in close proximity to the assembly plant (Humphrey and Salerno, 2001). This concept was first developed in Japan. Nowadays is often associated with modular supply, namely the supply of modules instead of individual parts. In this situation the assembler is buying systems rather than individual components. A hierarchical network with tiers is created in that way. The central customer is dealing with the first tier suppliers which are appointed to provide it with the outcome of a subcontracting procedure on lower levels. The first tier suppliers are getting more integrated in the product development of the vehicle manufacturers and this means also that they have the responsibility to fund research and development (PriceWaterhouseCoopers, 2000).

Module or system supply has implications on the geographical location of suppliers and the size of the supplier base. It favors production facility setups where (module) suppliers are located close to the final assembly operations site of the OEM. This however does not mean that there is necessity of a supplier village around the OEM (EIU, 1998). Most of the times, the privileged supplier has the module assembly activity nearby. On its own account, the supplier can do the sourcing for the system from distant tier two suppliers. Through system supply the OEMs reduce and manage more efficiently their supplier bases.

In this report we treat the notions of modules and systems as almost interchangeable, but we have to mention that there are differences between them that have implications regarding the status of the supplier, its technical expertise and the relationship with the OEM. As Paul Fleming from Delphi Automotive Systems notes “a module is delivered; a system is engineered” (Lewis and Wight, 2000). A system is about a group of functions, whereas module is a subassembly. Therefore, components of a system can be parts in various modules (Volpato, 2004)

Modularization is related with attempts to commonalize platforms and standardize designs at the global level based on the same first-tier suppliers at various locations around the world (Humphrey and Salerno, 2001). The introduction of common platforms and the increased commonality of components between different models and brands of the same company can

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also be seen as a response in the need to reduce costs in order to stay competitive. The expected positive results are also supposed to derive from the synergies of merging/rationalizing the supplier base of different brands. The appointment of suppliers responsible for modules leads to the hierarchical organization of supply base in tiers. The first tier suppliers have also the responsibility of dealing, organizing and managing the second tier and lower levels of suppliers.

Delivering assembled subsystems of the final product to the OEM means that the line between the operations of the two firms is also changing (Ford et al, 1998). Assembly operations are delegated to the suppliers responsible for delivering systems or subsystems. There is also the case of an OEM that has included module suppliers in its own assembly line, notably in the Volkswagen truck assembly plant in Resende, Brazil (EIU, 1998) Many authors conclude that new plants in emerging economies are used as experimentation and innovation platforms for new ideas by vehicle manufacturers (Humphrey and Salerno, 2001).

The benefits of modular supply for the assembler are cost reduction, increase of the low-scale assembly efficiency, and minimization of investment requirements in new plants (Humphrey and Salerno, 2001), as outsourcing allows the automotive manufacturer to allocate part of the investment to the suppliers who will be located near the assembly plant (Lung, 2001, Lewis and Wight, 2000). From their side, the suppliers can decrease the financial involvement in the new production location of the client by associating themselves with local partners. In this case they have to ensure that the international standards of competitiveness (productivity, quality, logistics etc) will be reached (Lung, 2001).

Modularization has also been a driver for consolidation in the supply industry. Suppliers need expertise from various sources in order to be able to deliver the solutions wanted from the vehicle manufacturers. The process of serving vehicle manufacturers' need for bigger and global suppliers has been a driver for consolidation in the supply industry. Small players are either driven out of the business or acquired and became part of bigger players. When a supplier is asked to deliver systems instead of simply components, it is also asked to enhance its knowledge base. In this rationale there can be a merge between cab and electric suppliers in order to deliver system such as dashboards etc (Mackinovski, 2005).

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4.1.3 Consolidation

Automotive industry in general has been the field of major consolidation activity. It can be assumed that some of the drivers behind this are globalization (regarding the investment possibilities) and increased competition on a global level. Globalization and the need for bigger volumes and economies of scale to balance the price pressures lead to consolidation in the vehicle manufacturers and the components manufacturers sector (PriceWaterhouseCoopers, 2000). The 1990s were characterized by a trend of consolidation in the industry. Mergers, acquisitions and strategic alliances (vertical and horizontal) were part of the weekly agenda (Volpato, 2004). It was reported that American companies were acquiring European counterparts in a pace of one per week (MIRA, 1997c) North American firms have expanded internationally mainly through mergers and acquisitions. Japanese supply firms on the other hand have been based more on technology transfers and joint ventures (MIRA, 1997a).

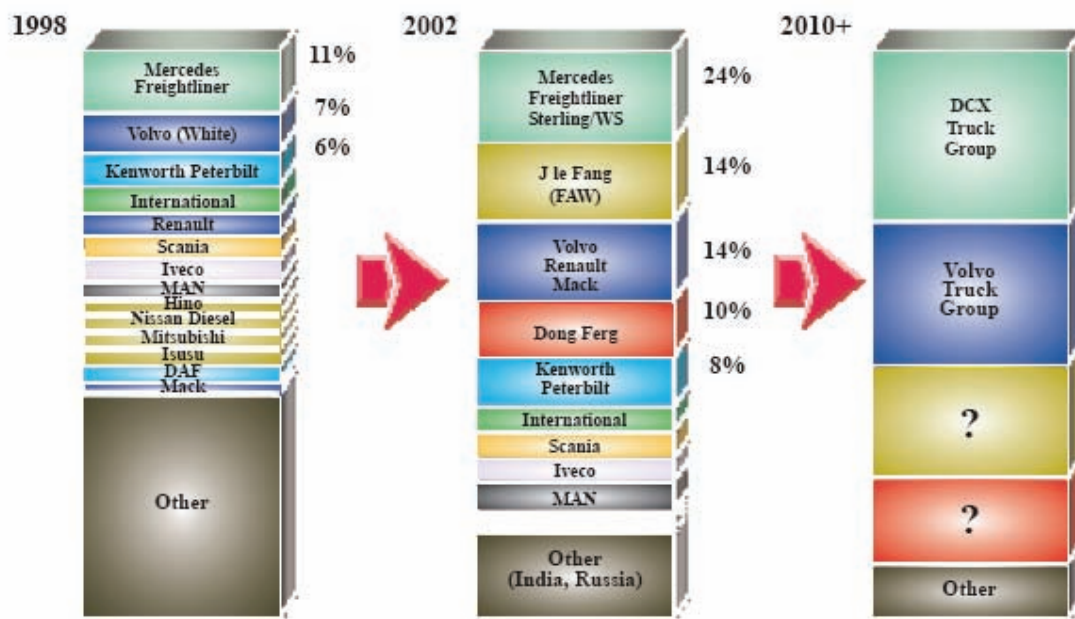


Figure 12 - Consolidation in the truck industry
(Source: Volvo cited in European Foundation for the Improvement of Living and Working Conditions, 2004)

The changes on each level of industrial organization (vehicle manufacturers, first tier suppliers, second tier and so on) affect and drive developments also in all levels. The consolidation in the field of the truck manufacturers has a strong influence in the supply industry since the independent decision makers for purchasing are decreasing (PriceWaterhouseCoopers, 2000). The effects of the reduction of the customer base (see

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Figure 12) on the supply side is there will be more centralized buying, more shared technology (EIU, 1998) and consequently the number of core suppliers is also expected to become smaller. Changes happening on the truck manufacturers and first tier supplier level affect the second and lower tiers because these companies have to adjust their marketing and engineering resources to provide the expected support upwards.

The total number of suppliers in the automotive industry has featured a remarkable decline. In 1988 there were reported to be around 30000 in 1988, and less than 8000 in 1999 (EUI, cited in Volpato, 2004). In another report (MIRA, 1997a) the first tier suppliers are said to have decreased from 3000 in 1990 to less than 1500 in 1996. At that time the predictions were that the industry restructuring would continue and that less than 375 top suppliers would remain by 2000. Much of the consolidation activity is concentrated on the elite of the industry, which have increased their size during that time. The 175 world top suppliers were responsible for delivering almost 80 percent of the business in value (MIRA, 1997a).

Apart from the need to enhance the knowledge base for building modules, there is also another driver for this kind of partnerships. Technological progress in vehicles manufacturing, especially in the form of increased application of electronics in the vehicles have led companies as Bosch and ZF to combine their skills (electronics and mechanical system) in transmission systems' building (EIU, 1998).

The consolidation in the supply industry raises concerns about concentration in the industry with negative effect on OEMs negotiating power. There are sectors in the supply industry that now only few players dominate. OEMs find themselves in the delicate situation where their business is better served by big suppliers but they also want to maintain the competition in the market and to have alternatives to choose from. Despite their wishes, there are parts of the supply chain in car industry, like seats, exhaust and shock absorbers, whose markets are oligopolies (MIRA, 1997b, Marchner, 2005).

4.1.4 Globalization and regionalization

The incorporation of more national economies in the global market has affected also the automotive business. Apart from the increased competition on a global level, the world has changed in the sense that new purchasing and outsourcing opportunities have emerged along with new markets and strong potential demand in the future. Having these issues in mind, automotive manufacturers and suppliers are expanding their operations in emerging economies and newly industrialized countries. The local market attractiveness is the main driver, but also the lower costs, especially combined with technical expertise as in the case of India.

With regard to the international expansion of production operations of the customer firm, there are sourcing strategies, which translate into reliance on the country of origin or preferred suppliers on a global level. Follow sourcing is the strategy where the same supplier is responsible for delivering the same part of system in different production locations of customer firm around the world (Humphrey and Salerno, 2001; Lung, 2001). Follow design means that the same design is used in as many as possible markets. These strategies are also connected with attempts to have common platforms for different brands (that belong to the same group) and standardized designs. The reason behind this is the cost advantages that the standardization process can offer.

When it comes to partner selection, especially in emerging countries, there seems to be a certain pattern (Humphrey and Salerno, 2001; Lung, 2001). There is a preference to have the globally preferred supplier, with which there is a close relationship, also in the new host country. Suppliers that have been appointed to design, manufacture and assemble a subsystem (suspension, seats, lighting etc) in the car maker's country of origin are often asked to follow their clients to the new locations (Lung, 2001). When this is not possible another transnational supplier is preferred over the locally owned companies. A local company that is using its own technology is the least preferred solution for sourcing in emerging countries. It is considered better when the locally owned supplier is using licensed technology from the global partner.

The planning of the production facilities by the final assembler reduce the freedom of the suppliers to formulate their strategies based on other motives as the location advantages for themselves and the motives offered by the policy makers of host country. This can be

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generalized in the issues driving the internationalization of supplier firms. Therefore, the reasons behind the geographical expansion of suppliers can be a mix of the power of the customer firm and the attractiveness of the local market (Lung, 2001).

4.2 Structure of Volvo purchasing (2005)

Based on the theories and preliminary research we decided to group suppliers into the groups based on the “typical” automobile supply chain as described by Peter Dickens (2003). Furthermore, we adapted this grouping to better fit truck industry and specifically Volvo 3P purchasing of parts and materials at the present time.

There were several reasons to base our division of data on the Volvo 3P purchasing structure. First of all, Volvo 3P is responsible for the purchasing of parts and materials for all Volvo trucks brand. As presented in section 1.7.2, Volvo 3P is a servicing unit to all Volvo truck brands. It is responsible for dealing with and coordinating all suppliers to Volvo trucks. Based on this fact we see very useful to use the same structure of categorizing/grouping suppliers as Volvo 3P does. This gives us very clear idea where to search, what to search and to whom to ask.

Secondly the data division based on the Volvo 3P purchasing structure provides us not only with a very good base for data collection on recent period (2001-2004) when was the Volvo 3P in charge of suppliers but also with possibility to divide and compare the data from the past periods (1990-2000) based on the same grouping.

Finally, the almost 100 percent authenticity of Volvo 3P purchasing structure with the general automobile production chain (describing the supplied materials to the chain) provide us with option to compare the development of Volvo trucks supplier network to the general trends in the automotive industry.

In following figure (Figure 13) you can see the comparison of automotive production chain according to Dickens on the left side of the diagram and structure of Volvo 3P purchasing on the right side.

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As described by Dickens (2003), the automobile industry is an assembly industry and one of the best examples of producer driven production chain. As an assembly industry it is based on the supply of enormous number of parts and components where majority of these is produced by third parties. Furthermore, Dickens divides supplied components or suppliers into three main categories based on the processes that precede the final assembly of vehicle: first it is manufacture of bodies, secondly of engines and transmissions and finally of components.

Manufacturing of bodies includes mainly manufacturing and stamping of body panels as well assembly and painting of these parts. Component parts include manufacturing of mechanical and electrical components (brakes, tires, steering components, etc.). Finally the manufacturing of engines and transmissions covers forging and casting of engine and transmission components and machining and assembly of engines and transmissions (Dickens, 2003).

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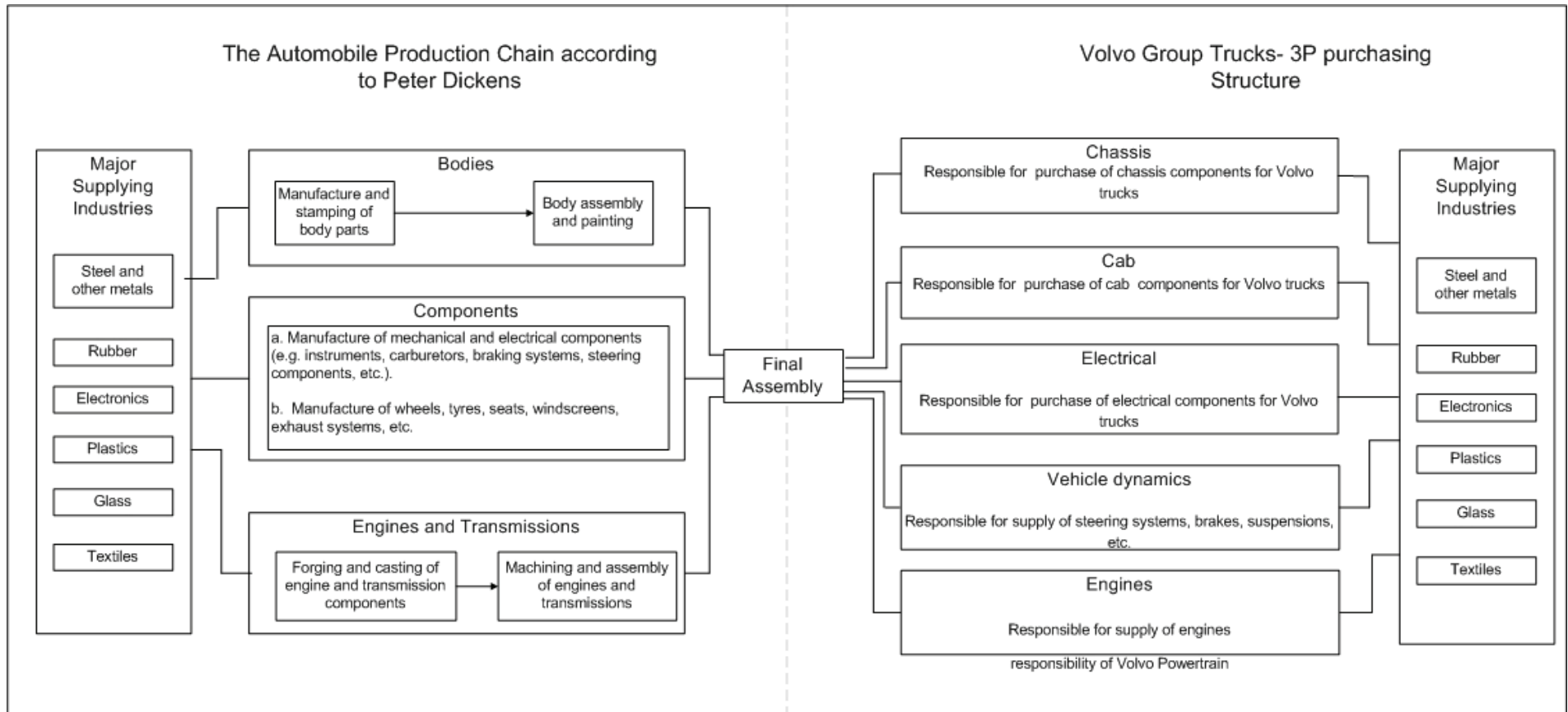


Figure 13 - Automobile production chain and Volvo 3P purchasing structure
 (Source: Authors; based on Dickens, 2003; p. 356 and Volvo 3P structure)

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Comparing Dickens model with Volvo purchasing we can see a very similar structure. Instead of having only three main groupings Volvo 3P has two additional or better to say more detailed or specific structure but the functionality remains same. The Bodies section is equal to the chassis section but with regard to the characteristics of truck vehicles, the Volvo logically has the cab section separately (in passenger cars chassis and cab are integrated into one compact module, on the other hand in case of trucks these consist of two separate parts). Comparing to Dickens model, the electrical together to some extent with cab section may be viewed as components.

Volvo 3P Vehicle dynamics and engines are identical with the Engines and Transmission. With regard to the supply of engines to Volvo trucks, it is done by another company of Volvo AB, namely by Powertrain. Volvo Powertrain has its own suppliers for individual parts and materials for engines, transmissions and axles. With regard to our topic and while looking on the suppliers of Volvo trucks it has to be stressed that we see Volvo Powertrain as the supplier rather than part of Volvo trucks (although it is also part of Volvo AB it is still separate company in the group). Our feeling from the interviews as well from the structure of Volvo AB was that it is also viewed as separate company inside one group.

Other specific with regard to the engines and what is later discussed in the section 4.3.1 is that Volvo in US also equips its trucks with engines of third parties (Cummins).

4.3 Volvo truck operations

Today Volvo trucks are operating eight factories and nine assembly plants globally. Its other brands are present on another 21 locations: Renault has 16 manufacturing operations and Mack is operating on another five locations (see Figure 14) (Volvo, 2005).

These operations are combination of fully scale manufacturers, CKD assemblies and CKD assemblies with substantial local content. In some cases CKD assembly plants are upgraded to have certain regional or even global function. This was for example case of Volvo plant in Brasil that was on the first place CKD factory with substantial local content (Brazilian law required to source to large extent from local suppliers) focusing on a assembly. Later on Volvo transformed this plant into the fully scale manufacturers with majority of local suppliers (80 percent in case of VH model).

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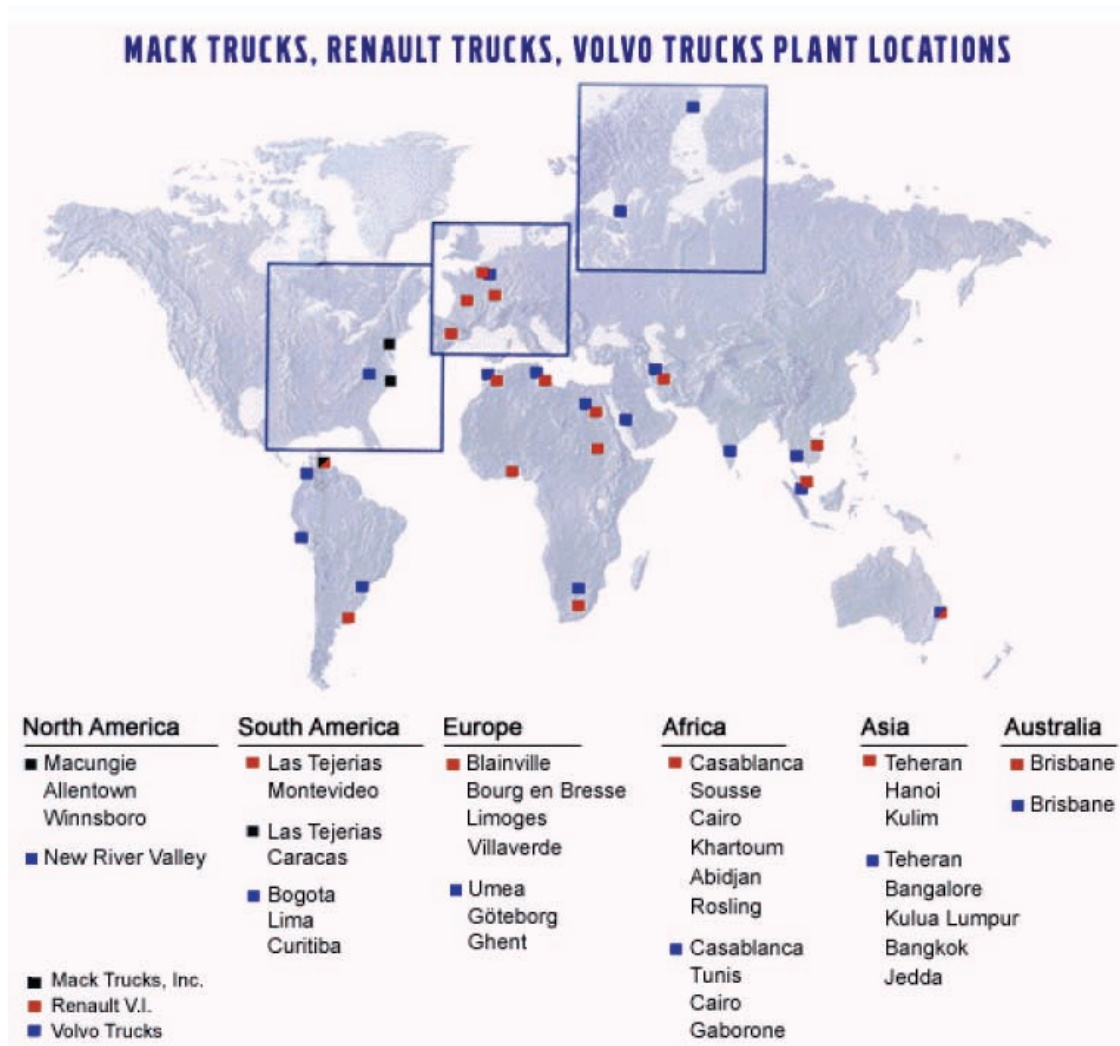


Figure 14 - Volvo Trucks Production Locations
(Source: Volvo, 2005)

Lately the Indian plant became fully manufacturing plant and the similar is expected from the newly opened Chinese assembly plant. In parallel to these Volvo is producing in the Australian plant. Nevertheless, Volvo's main global production sites in general are still Europe, US and Brazil, with increasing importance of India.

Specific case in the assembly is Iran that is very interesting due to the volumes of trucks Volvo assembles and sells there. This plant might be very interesting from the point of view of local sourcing but its application is to a large extent limited by the uncertainty in the country and the political situation. With regard to this the shift to more extensive local sourcing is not expected.

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In the following table the reader can see a summary of Volvo operations on a global basis in the time period from 1990 to 2004. It indicates the type of operations (production, CKD, production of important module e.g. chassis, cab, vehicle dynamics), and the year the plant was open or closed.

ALL VOLVO TRUCK PRODUCTION OPERATIONS 1990-2004								
Plant Location	Country	Brand		Brand	Type	Opened	Closed	Upgraded
		Volvo Trucks	Renault V.I.	Mack				
Europe								
Umea	Sweden	x			Volvo Trucks	parts	1990<	-
Göteborg	Sweden	x			Volvo Trucks	production	1990<	-
Ghent	Belgium	x			Volvo Trucks	production	1990<	-
Blainville	France		x		Renault V.I.	production	2001	-
Bourg en Bresse	France		x		Renault V.I.	production	2001	-
Limoges	France		x		Renault V.I.	production	2001	-
Villaverde	Spain		x		Renault V.I.	production	2001	-
Moscow	Russia	x			Volvo Trucks	CKD	2003	-
Irvine	UK				Volvo Trucks	Production	/	2000
North America								
New River Valley	USA	x		x	Volvo Trucks	production	1990<	- 1996
Macungie	USA			x	Mack	production	2001	-
Winnsboro	USA			x	Mack	production	2001	2002
South America								
Bogota	Colombia	x			Volvo Trucks	CKD	/	/
Lima	Peru	x			Volvo Trucks	CKD	1990<	2001
Curitiba	Brazil	x			Volvo Trucks	production	1990<	- 1997 +1999
Las Tejerias	Venezuela		x	x	Renault V.I./Mack	CKD	2001	-
Montevideo	Uruguay		x		Renault V.I.	CKD	2001	-
Caracas	Venezuela			x	Mack	CKD	2001	-
Afrika								
Casablanca	Marocco	x	x		Volvo/Renault V.I.	CKD		
Tunis	Tunis	x			Volvo Trucks	CKD	/	-
Cairo	Egypt	x	x		Volvo/Renault V.I.	CKD	1999	2002
Gaborone	Botswana	x			Volvo Trucks	CKD	/	2005
Sousse	Tunisia		x		Renault V.I.	CKD	2001	-
Khartoum	Sudan		x		Renault V.I.	CKD	2001	-
Abidjan	Cote d'Ivoire		x		Renault V.I.	CKD	2001	-
Rosling	/		x		Renault V.I.	CKD	2001	/
Asia								
Teheran	Iran	x	x		Volvo/Renault V.I.	CKD	1990<	- 2001
Bangalore	India	x			Volvo Trucks	production	1998	-
Kuala Lumpur	Malaysia	x			Volvo Trucks	CKD	/	-
Bangkok	Thailand	x			Volvo Trucks	CKD	1999	-
Jedda	Saudi Arabia	x			Volvo Trucks	CKD	1999	-
Hanoi	Vietnam		x		Renault V.I.	CKD	2001	-
Kulim	Malaysia		x		Renault V.I.	CKD	2001	-
Jinan	China	x			Volvo Trucks	assembly	2004	-
Pakistan	Pakistan	x			Volvo Trucks	CKD	1997	2000
Australia								
Brisbane	Australia	x	x	x	Volvo/Renault V.I./Mack	production	/	-

Sources: Volvo, Mack, Renault V.I. websites, auto-asia.com, ae-plus.com, companies' annual reports, Volvo press releases, pressi.com, trailer-bodybuilders.com
 ("/" - means data not available)

Table 4 - Volvo operations 1990-2004 and their division

In case the plant was functioning before the researched time period, then “1990<” is indicated as opening year of the plant. The Table 4 clearly shows which brand/combination of brands is produced on an individual location and whether the plant is a production plant or rather focuses on assembly of CKD. In case the data were not available, symbol “/” is inserted.

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Table as well highlights all years when something important happened in individual locations. For example the upgrade of the manufacturing site by building new cab plant, etc.

4.4 Changes with regard to the Supplier Network of Volvo

We start this section by introducing market specifics with regard to Volvo presence and their influence on the supplier network of our case company. This is followed by the description of changes in supplier network over the researched time period. This section is divided on two main parts. First we introduce the changes in the supplier network of Volvo Trucks and Renault/Mack separately for the time period 1990-2000. The second time period, 2001-2004, deals with all brands together as Renault V.I and Mack were acquired by Volvo in 2001. We conclude our empirical section by the presentation of the development of the specific groups of component suppliers (cab, chassis, electrical and vehicle dynamics suppliers).

4.4.1 Truck Market Specifics and its influence on Supplier Network

The truck market in Europe and in the US is very different and these differences influence to a large extent the supplier base in both regions. In Europe Volvo takes the full control of the production and final assembly of the truck. In this region Volvo sells the complete FH truck or the complete Renault Premium truck. There is no option for the client to specify any third party components. All components are delivered by Volvo and are Volvo branded.

On the other hand in the USA the customer influences the configuration of the purchased truck to a much higher extent. The customer might specifically request to have instead of the Volvo engine Cummins engine, he/she might also chose Meritor gearbox and not the Volvo one, Meritor axles, Bendix brake system, Delco batteries, etc. Simply in US the customer decides more about the composition of the truck. Thus, to some extent the role of Volvo is just to assemble the components from different suppliers.

This has also the effect on the value added of the Volvo in the US that is much lower when the customer decides to have third party components in the truck. From this at least 50 percent of the value added in the truck is the powertrain. In the situation when approximately 60 percent of engines in Volvo trucks are Volvo branded and the rest 40 percent are Cummings

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(it used to be also other brands as Caterpillar) the Volvo margins are minimized (Hamnstedt, 2005).

Due to these reasons Volvo had problems in the beginning to make money on the US market as it was not generating enough margins due to the extensive usage of third party components. The partial solution to this was to move toward global sourcing. It enabled Volvo to increase the proprietary components in its trucks (components that cannot be sourced from third parties but only internally) and by that to increase the margin from each truck sold. It basically decreased the customers possibility to select third party components (for example in case of engines customer was able to chose from Caterpillar, Cummins, Detroit and Volvo but nowadays it is only Volvo and Cummins engines) (Hamnstedt, 2005). This trend was furthermore supported by the new US emission legislation that led to the need of higher integration of all truck parts and as that limited the third party components even further. Respectively we can say that the level of vertical integration had an increase in the case of Volvo trucks in North America (Hamnstedt, 2005).

Mack had always a special position with regard to the configuration of its parts by customers based on its strong tradition in the construction segment. Its customers always wanted a Mack truck with Mack components.

As visible from the text above a truck buyer can extremely influence the setup of his truck. In comparison to passenger cars where buyer can choose mainly the color of exterior and interior, type of radio, air-condition and few other things as ABS, airbags, stabilization system, etc., in case of trucks the variety of possibilities is much higher, starting by the setting up of interior, type of cabin, type of tires, axles configuration, he can choose from 500 different colors, etc. There exist a vast number of variables depending on the main function truck should perform (construction, long-haul, regional, etc.) as well other prerequisites of the buyer. The influence of the customer on the final purchased product is much higher in truck industry then in passenger cars industry (Hamnstedt, Mackinovski, 2005).

Due to this fact the usage of suppliers of complete modules or systems by the Volvo is to some extent limited as it will decrease the flexibility of delivering customer the desired configuration of the truck. In order to satisfy the demanding customers Volvo has to provide them with certain level of variety to choose from. On the other hand it has to deal with the

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decreased value added because of using third party components (Hamnstedt, 2005). This puts the company in some cases before the dilemma whether to increase its value added or to dissatisfy some of the potential customers.

4.4.2 Volvo Trucks Supplier Network before 2000/2001

In the beginning of the 1990's Volvo trucks sourced majority of its parts from suppliers located on the North of the Europe (Sweden and other Scandinavian countries) and Germany (approximately 60 percent of components were from this region). The remaining suppliers were spread around the rest of the Europe and only minimal portion of them was located in Asia (Hamnstedt, 2005).

The main milestone with regard to sourcing came in 1993 when new FH line was launched based on a new platform (2200 platform). This was the first visible shift toward the global sourcing and usage of the same platform in various trucks and in various regions. This was the first step toward the usage of global and common suppliers as this platform was supposed to be used in more Volvo models later on.

Preceding the launch of this new platform the number of parts of which the truck was composed have been counted in order to be minimized. The original FH line was initially produced in Europe and successively exported to other regions. In the meantime Volvo worked on the development of the new truck for the US market based on the same platform as the FH truck. In 1996 VN truck using the 2200 platform was launched in the US.

This led to the situation where Volvo was able to produce two types of trucks on two continents sharing same platform, having some commonalities and implementing common global sourcing for the FH and VN lines. This was possible mainly because Volvo started actively promoting global sourcing by setting up commonality targets, part number reduction targets and global sourcing targets (Hamnstedt, 2005).

Although some global sourcing was established in this time period, the majority of suppliers still prevailed to be local. First pioneers toward the global sourcing were European suppliers that were asked to export to US and some of them got established in the US mainly because it was not viable in some cases to ship their products from Europe. This happened in smaller

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extent as well vice versa as some US suppliers became interesting to Volvo's European operations (it were small scale exports at that time period).

In sum we can say that the period 1993 (FH series introduced) to 1996 (VN series introduced) was the beginning of Volvo global sourcing strategy and it was for the first time when Volvo started systematically focusing on global suppliers. It was the end of the time period when Volvo Europe and Volvo North America were managing their business separately and purchasing on their own. Before that, there was no cross-buying and no commonality between two branches.

At the same time Volvo started to source from the low cost countries (it was mainly case of electrical components sourced from Asia) (Hamnstedt, Mackinovski 2005).

In 1998 Volvo launched the NH model in Brazil based on the same platform as the FH and VN models. By the introduction of this model Volvo was building trucks on the same platform in its three main production plants. It allowed it to use to some extent same suppliers to these plants.

At the same time Brazil became interesting as a suppliers' base. Brazil was specific in the way that the government required companies producing there to have a certain percentage of the product being sourced locally. As a result Volvo had to and started to source a lot of components locally. Concurrently there was the NH model produced with the same platform as the trucks produced in Europe and US. It became very interesting to Volvo to start to source from Brazil for its other global operations especially with regard to the fact that Brazil as an emerging market had low production costs.

It is important to mention with regard to Brazil that Volvo was not purely dependent on domestic Brazilian suppliers. Another specific of Brazil with regard to the automotive suppliers was that it was very interesting country for the global suppliers. They were able to reach certain production volumes as other car manufactures as Volkswagen, GM, Ford had production there and suppliers were able to approach them. Some suppliers were interested in the low volumes of the Truck industry and some were not. Thus, Volvo's Brazilian supplier base was a mixture of purely local and global players. Furthermore, the other truck

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manufacturers as Scania and Volkswagen were there as well making Brazil even more interesting to global suppliers.

Brazil with its low labor costs became very interesting for the European Volvo plants. It was the start of the more extensive emerging markets sourcing. First it was Brazil to Europe and in a short time period Brazil to US making some of the suppliers located in Brazil the global ones (Hamnstedt, 2005).

In mid 1990's there was a visible shift toward sourcing from Eastern Europe that was able to provide low labor costs and possibility to source more locally in Europe (proximity to western European countries). This trend was driven not only by the end customers (Volvo and other automotive suppliers) but as well by the suppliers themselves. This was the case mainly of the Czech Republic, Hungary, Slovakia, Slovenia and Poland. First to move to these new regions were the suppliers of electrical components (1996) followed by the cab and vehicle dynamics and finally the chassis suppliers in 1998/1999.

4.4.3 Mack-Renault Supplier Networks before 2000/2001

Until year 2000 every brand (Volvo, Renault and Mack) was standing alone. Even before the acquisition of Renault and Mack by Volvo there was almost any purchasing coordination between Mack and Renault. They were managed moreover as independent companies/units with their own supplier networks. This resulted to the situation when, after the acquisition of these two in years 2000/2001, newly created Volvo Global Trucks group had to deal with three independent supplier networks with minimal or zero integration.

Until the late 1990's, when the way of purchasing and organizing of project development and cross-functional work was developed there was very little coordination between Mack and Renault. In this phase, coordination was including only processes, not global sourcing (it means same procedures and purchasing process were established in both companies). Common purchasing for both companies as well using of same components by both brands was almost non-existent (Hamnstedt, 2005).

This was partly due to the Renault's strategy as Mack was very successful on its market and with regard to this there was no need to change an organization/structure that was functioning

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well. There was also more focus on local sourcing by Renault as a result of long tradition. Renault had, and still has, very specific supplier structure composed mainly of French suppliers (up to 93 percent in the time of acquisition) (Berglie, 2005). It was another reason why Renault did not push for more global sharing of its suppliers.

Another hidden reason behind keeping these two supplier networks separate is that establishing global sourcing requires enormous effort, both financial and organizational. For every purchasing organization or every buyer it is much easier to take care of the local business and to orient on it than to take responsibility for the global business. As a result there was a tendency to focus more on the local suppliers.

At the end of 1990's there were the first visible attempts to move toward more global sourcing and to coordinate purchasing functions. This was mainly in the way of organizing of purchasing, project development and cross-functional work but not the purchasing itself (function teams, etc.). We can say that the processes became more common for both organizations, but the supplier networks themselves remained separate (Hamnstedt, 2005).

From the data discussed in this section it is visible that the driver for the global cooperation and sourcing came in 2001 after the acquisition of both companies by Volvo.

4.4.4 The Post-Acquisition Era (2001-2004)

The year 2001 was the most significant of the researched time period with regard to the implications on the supplier network itself but as well for Volvo trucks in general. Not only that Volvo acquired/merged with two new companies, Renault V.I. and its US affiliate Mack trucks, but also almost doubled its size, production, and sales. The number of production and assembly plants rose from 18 sites to 34 sites (Volvo, 2005; Renault VI 2005; Mack, 2005). Volvo got access to new countries and new markets. On the other hand it led to the situation where the company had two or three plants in one territory and logically parallel to this each of them with its own supplier network. There was no integration between Volvo on the one side and Renault V.I. and Mack on the other. As found during our interviews, the structure, characteristics and types of supplier in network of each company were different.

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The majority of Renault V.I. suppliers was of French origin (93 percent of all its suppliers) and located on the south of Europe (France, Spain). Additionally, Renault suppliers had on average only 15 percent of their sales with Renault V.I. This gave them to a large extent undependability on Renault V.I. (Berglie, 2005).

Mack as discussed in previous sections was focusing mainly on local suppliers as well and possessed quite large autonomy with regard to the sourcing.

There was very low commonality between Volvo supplier base, Renault supplier base and Mack supplier base. There were of course some common suppliers to both brands as for certain parts there is almost monopolistic or duopolistic market, but in general the supplier bases were overlapping minimally.

The Renault brand, as mentioned previously, sourced on the south of the Europe, while on the other hand Volvo focused on the north of the Europe. There were more commonalities between the Mack and Volvo in the US due to the market characteristics as there was the tradition of more customer specified components (discussed in section 4.4.1) and truck manufactures had to source from these suppliers (Delco batteries, Cummins engines, etc.) in order to satisfy customer needs.

The first push after the acquisition was to create a common supplier base. This was supposed to be done through the project called “Premium generation”. The result of this project was the recent launch of Mack Granite, Renault Premium and new Volvo FH range (2005). Moreover, Renault Premium and the new Volvo FH were launched on the same day. All these trucks are built on the same platform and some common global suppliers are used. We can say that by “Premium Generation” project Volvo successfully continued with the strategy started by FH, VN and NH models. This time was not only introducing the same platform in three different Volvo models, but also across three different brands (Hamnstedt, 2005).

After the acquisition Volvo became much bigger. Its production volumes increased and from that time Volvo is still expanding. A consequence of this was the shift toward bigger suppliers (global players). As the truck industry is a cyclical industry, Volvo needed economically strong suppliers able to deal with these cycles. It moved toward the suppliers that were able to help and expand with Volvo in upturn of the market but to stay stable when the industry was

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in the downturn. The result was that a lot of smaller suppliers become tier two suppliers and Volvo focused more on the strong first tier suppliers.

Another reason to move to large and strong suppliers was need for suppliers that are able to invest into the new technologies, new tools, new machinery, R&D, etc. This of course requires a lot of capital and only companies that are financially strong and interesting to financial markets are able to deal with it. Furthermore, the areas that are R&D intensive (electronic components, cab systems, vehicle dynamic systems, etc.) require a lot of investment on the beginning that repays after some time (quite often very long time periods). The small companies simply cannot afford such investments (Hamnstedt, Mackinovski, Marchner, 2005).

In the future there will be two main trends on the side of suppliers, especially in developed countries in order to keep the costs down. Majority of suppliers will have to decide either to maximally automate and specialize their production to stay in Western Europe or US or to move the production to the emerging countries (Hamnstedt, Mackinovski, 2005). This is already happening to some extent even today. As an example might be given the suppliers moving their production or part of the production to the Eastern Europe (Rieter Group having part of production in the Czech Republic) (Berglie, 2005) or to Asia and South America. With regard to the second variant, shipment costs and logistics costs have to be always taken into consideration as some components cannot be shipped from remote distances.

Between the years 2002 and 2004 India and China became very interesting as a supplier base. It was originally mainly tier two suppliers but just recently Volvo is introducing tier one suppliers. In the future their importance as supplier locations is expected to grow rapidly. An advantage of India and China specifically is that the majority of supplier factories is brand new and high capacity production facilities. Moreover, most of them are at the present time underutilized. This provides Volvo as a customer with the possibility to buy at very low prices.

In Europe (Western) it is very difficult to build completely new factories as the European suppliers are limited by existing infrastructure. The practice is rather to upgrade and extend existing ones. Improvement and maintenance in old factories can not be compared with completely new greenfield facilities as in China. Another advantage of China is that the influx

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of foreign capital is enormous and the interest rates are almost zero (Hamnstedt, 2005). This enables suppliers to build completely new plants equipped by latest technology. All these in combination with very low labor costs puts into this destination a lot of expectations not only with regard of suppliers but as well production itself.

What might slow down this trend are the increasing oil prices and with it closely connected transportation costs. If this trend continues the advantage of low labor cost might be deteriorated by high transportation costs (Mackinovski, Hamnstedt, 2005).

Another significant trend that was visible over the last few years was the movement toward the supply of complete systems. This topic is presented in more detail under the specific purchasing areas (sections 4.4.5 to 4.4.8), as each of them had different course of development and were affected in a different way.

On the other hand the extensive usage of complex systems or modules being supplied by large suppliers decreases Volvos possibility to get the value added as it then restricts Volvo to the role of assembler of big sub-assemblies (discussed in the section 4.4.1 when the US customer basically composes his truck with extensive usage of third party components) rather than producer. In certain areas car industry went too far with the usage of systems and is going already back (over usage of modules diminishes OEM's value added). Volvo is aware of this and tries to prevent it in certain areas in order to safeguard the margins and profitability that is created from inside production (for example: the case of Volvo US where Volvo in-sourced back the assembly of frame ladders) (Hamnstedt, 2005).

Another very specific thing with regard to the suppliers of modules (tier one suppliers) is that Volvo is outsourcing to them not only assembly of these modules but also purchasing responsibilities. As suppliers of complete modules they usually overtake those that were originally tier one suppliers and are moved to the tier two. In sum, through this, Volvo purchasing activity is transferred to the module supplier.

In some cases there are still today problems with giving these responsibilities to suppliers. It always takes time before they develop purchasing and quality assurance capabilities, etc., which Volvo had to build over the years. In general, module suppliers and first tier suppliers

have to develop and improve on both: engineering level but even more on the purchasing level in the future (Hamnstedt, 2005).

4.4.5 Specifics of Chassis Suppliers

In order to make the reader understand the specifics of the chassis suppliers and their role in the network we have to first briefly describe what the chassis is, as it has its unique specifics, in order to be able later to compare/match it with other modules (vehicle dynamics, electrical, and cab). In parallel to these, the changes that happened during the researched time period in the chassis supplier network are described.

The chassis is composed out of the main skeleton or so called main frame ladder and a large number of small parts attached to it. The frame ladder is composed of two main components: frame rails and cross members. The rest of chassis includes everything that is fixed to it as fuel tanks, tool boxes, mufflers, etc. and what is important it includes everything that is not part of moving mechanism of a truck (which is responsibility of the Vehicle Dynamics) (Hamnstedt, 2005).

Suppliers for chassis components are responsible for delivering small and large components. What is common to both of these suppliers is that they supply rather simple parts. Chassis is mainly composed from a lot of small simple parts. As the result there are more small suppliers.

Another common attribute of the chassis suppliers is that they are “Lego” oriented (Hamnstedt, 2005). In other words, the components they supply are built to print. It means, these parts are engineered/designed by the Volvo/Renault or Mack engineers. There is no shared R&D or design on the side of the supplier.

Chassis components are close to being a trade commodity as there are a lot of companies producing or able to produce given component. This is also visible from the form of purchasing of majority of them. That is by quoting, where Volvo informs for which part/component is looking for and companies compete (quote) to get the order.

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Closely related to this is the form of the relationship with the suppliers and the form of purchasing. Volvo develops given part, specifies it and then asks suppliers to quote for the production of such part. As a result there is high purchasing power on the side of the Volvo. It owns the drawing of the part and if one supplier is not able to fulfill requirements, Volvo can simply go to another supplier and quote again. In sum, the chassis parts are something that might be traded easily and there is no problem to switch suppliers when it is needed. (Hamnstedt, 2005)

What influences the selection of suppliers most are the prices of the supplied components. As we have seen so far, the R&D costs on the side of the suppliers are zero. Thus, the main influencer of the prices of components supplied is production costs of the suppliers.

Based on this, the trends of Volvo sourcing are very depended on the cost-development of the country where the supplier operates. This includes the cost of manufacturing, cost of material, cost of labor and last but not least the distance and logistics as some parts as fuel tanks is hard to ship because of their size.

These large parts have to be assembled locally or in proximate distance to the production plant. In this case the subcomponents are shipped from low cost countries to the supplier's assembly plant close to Volvo plant and then whole components are transported to Volvo from this assembly. These are mainly kiting and assembly operations (operated by first tier suppliers) that are located close to the Volvo.

With regard to the chassis suppliers and trends, discussed in sections 4.4.2 and 4.4.4, the first movement toward the global sourcing was with the introduction of common platform (2200 platform) in FH and VN series in 1993 and 1996. In case of chassis suppliers it was only to the limited extent as the large parts of the chassis had to be sourced locally due to the logistic problems. It was mainly the case of smaller components.

Referring to the movement of chassis suppliers to the low cost countries and emerging markets we can say that in this area chassis suppliers were slightly behind the other main truck modules (as electrical and vehicle dynamics). The more extensive sourcing from the regions of the Eastern Europe is visible from the years 1999/2000.

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With regard to Asia, the first chassis suppliers from China were introduced recently (Hamnstedt, 2005). It is expected, that especially the importance of suppliers from China and India will grow in the near future. This is given also by the fact that Volvo started production in India and assembly in China and will look for local suppliers that might eventually become global ones.

4.4.6 Specifics of Electrical Suppliers

Electrical components in trucks developed dramatically over the last 15 years; from the situation in the beginning of 1990's when the usage of electrical components in the truck was very low to the complex advanced electronic systems guiding today's trucks. The content of electrical and especially electronic components increased radically.

At the beginning of the 1990's there was a similar situation as in the chassis side. There were a lot of small suppliers mainly capable to build to print (Mackinovski, 2005). As mentioned above it means that Volvo did all the research and development and then provided supplier with the drawing and it just produced requested component.

We have to stress once more that in this time period (early 1990's) there was not so much electrical components in trucks. It was usually limited to some simple cassette player and radio on the side of electronics (no software, no GPS, no computers, no sensors) and mainly simple switches and wires on the side of electrical equipment. The value of electrical components with regard to the value of a whole truck was minimal.

In early 1990's Volvo focused mainly on local suppliers of electrical components and what is important it kept a lot of manufacturing internally. This was especially the case of labor intensive production as wiring, which counted for majority of the electrical components in a truck.

While speaking about the wiring it is a very specific part of the electrical components due to the labor intensity and sensitiveness. Even today some Volvo competitors keep the wiring production inside. Volvo was able to outsource some of the wiring production but still keeps some parts inside (Mackinovski, 2005).

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In the early 1990 the car industry started to look and outsource the electrical components on a more global scale. As discussed already earlier, the car manufactures were always setting trends and were ahead of truck manufactures. It took some time to the truck industry to follow the trend.

The first movement in the area of electrical suppliers was from the in-house production to local suppliers. Volvo started to outsource its electrical activities to suppliers located in the same region as the production plant. These were mainly small suppliers able to build to print parts that were relatively simple and were developed inside Volvo.

As the production of electrical parts was labor intensive, Volvo soon discovered that these parts could be made cheaper in low cost and emerging countries. Around 1996 Volvo started to look on possibilities to purchase from suppliers that were more global and that were more located in these low cost countries. The interesting locations were Eastern Europe, Northern Africa and Mexico. Volvo was basically in this sense following the footprint of the passenger cars manufacturers (Mackinovski, 2005).

In this time period Volvo took the decision to move all wire labor intensive production to the Central and Eastern Europe. There were two ways to do this. First of all to use existing suppliers and to push/force them to open up the production facilities in these regions. Second way was to completely re-outsource the components. In other words to switch from these local suppliers based in traditional locations (Sweden, Finland, Holland, Belgium) and resource their components to more global suppliers that had already production facilities in the low cost countries where they produced mainly for the automotive industry for many years.

It is also important to mention with regard to the global suppliers that in the middle of 1990's the volumes of Volvo production grew and Volvo became interesting to these global automotive suppliers as Delphi, Yasaki, etc. in terms of volumes. Volvo was looking also toward Asia as most of electronics originated and originate from this region (Mackinovski, 2005).

In this time period also more complex electronic systems emerged (black boxes, versatile computer units and equipment control units, etc.) that also required Volvo to move to bigger

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suppliers, with more knowledge and capability to bear the research and development on their own (e.g. move from local suppliers in Sweden and Germany and outsource their business to larger ones as Siemens Video, etc.). What is specific to the electronics components are usually high start up costs. This is mainly the case of the software operating these components but as well the more sophisticated and complex electronic systems/modules (not simple wiring and switches). The small suppliers are simply not able to cover such high initial costs.

Also the content of the software giving orders to the electronic components increased rapidly. The advantage of the software and data is that there is no problem with transportation. The trend was to source software from suppliers located in Eastern Europe and India. The expectation is that India will play central role in the future (Mackinovski, Hamnstedt 2005).

Today almost 80 percent of electrical and electronics components is sourced from eight to ten large global suppliers and the rest 20 percent is sourced from approximately 200 small suppliers. These small suppliers are usually highly specialized niche suppliers (focusing on data-link, wireless solutions, etc.).

The large number of small suppliers that used to form a major base of Volvo trucks till the middle of 1990's either got bought up by bigger suppliers or disappeared during the second half of 1990's. The majority of bankrupt ones was focused purely on the truck industry and was not able to deal with the upturns and downturns of the industry.

The aim of Volvo trucks is to narrow the main supplier base to four to five big suppliers and to buy more complete systems instead of simple components. A next step will be to follow the general trend in the automotive industry and move further to the east; to China, Thailand and Malaysia.

The advantage of the majority of electric and electronics components is that in comparison to other modules (Cab, Chassis and Vehicle dynamics components) there is no problem to ship them on long distances from remote locations (Mackinovski, Hamnstedt, 2005). These are usually small parts that might be easily packed and shipped in large volumes. On the other hand, especially at the present time, there is increasing need to have suppliers close to the company because of the need of close cooperation in the area of research and development.

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With regard to the purchasing power and power relations, it is hard and sometimes impossible, especially in electronics area, to change suppliers mainly due to the patents and the know-how that suppliers possess. On the side of the electrical suppliers and due to the higher simplicity of products it is much easier for Volvo to switch among various suppliers when necessary. This is expected to become more complicated in near future due to the higher usage of more complex systems.

One important factor that we want to mention on the end of this section and that limits the usage of common suppliers by Volvo on a global level is the different voltage regulation in the US and Europe. In Europe all electrical appliances in the truck use 24 V and in the US only 12 V. As a result in some occasions it is necessary to chose local suppliers instead of the global ones (Mackinovski, 2005).

4.4.7 Specifics of Cab Suppliers

In general, cab suppliers followed the patterns of the electrical suppliers with five to seven years delay. We can say that cab components characteristics stay somewhere between those of chassis and electrical components.

Complete cab is composed from a wide variety of parts and technologies. On the one side there are outside parts of the cab as the front grill, door handles, air spoilers etc., on the other side there is huge amount of smaller parts creating the interior of the cab. It covers various areas as plastics, air track units used for the heating and air-conditioning, seats, dashboards, etc. It is visible that it is not only the combination of various technologies and types of parts but as well of the various sizes of components (Marchner, 2005).

Due to the fact that some of these parts are quite bulky (e.g. air spoilers, hood, air intakes, grill, etc.), the transportation costs have to be taken into account. Although the production costs of some of these parts might be extremely low in low cost countries, due to the transportation costs it is still more effective to source them locally.

Cab suppliers are today in general still more locally than globally based. Even though there was a move of cab suppliers to Eastern Europe at the end of 1990's and Volvo used the same two strategies (pushed/forced suppliers to move there or looked for more global suppliers

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already located there), it had to keep certain amount of suppliers close to the production plants due to the transportation costs.

Another important driver (parallel to the labor costs) behind the movement on the east was the tooling costs. Cab stands for 80 to 90 percent of tooling budget of the whole truck (Marchner, 2005). Suppliers have to buy these tools that are often quite expensive. In order to keep the costs down, Volvo was promoting and pushing suppliers to buy tools from Eastern Europe and lately from Asia.

In the area of cab components Volvo is more dependent on its suppliers. The supplied components today are more complex and there is a high level of modularization. Suppliers are responsible for research and development. For example dashboards and steering systems are completely developed and produced by suppliers and then supplied to Volvo as complete modules. Volvo only specifies the functionality it expects from the component, but the component itself is developed and produced by the supplier.

With regard to this there was a movement to bigger module suppliers during the researched time period. For example ten years ago approximately 80 percent of cab components were supplied by 100 suppliers. Today the same amount is covered only by 40 suppliers.

There was a huge consolidation wave in the cab industry around year 2000 when a lot of small companies were bought by big players. In many cases it was a surprising situation even for Volvo itself as it sometimes got from newspapers that their local supplier was acquired by a global player.

It is expected that this trend will continue in the future. There will be more modules and system suppliers as well overlaps between the suppliers of individual truck parts. This trend is already visible in small amount in the cab and electrical suppliers while big cab suppliers and big electrical suppliers are looking for the know-how from each other in order to be able to provide the truck companies with complete system solutions. Respectively, this trend will move toward the area of chassis suppliers, where especially cab suppliers will try to integrate chassis components to their systems and by that move chassis suppliers to the tier two.

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With regard to the integration of the three Volvo brands and Cab suppliers the strategy is that all visible parts should not be common. It means they should not look same. This does not prohibit the usage of the same supplier. In other words everything what person can see, feel or smell in a cab should keep its brand identity (Mackinovski, 2005). All other parts that are not visible might be completely common.

4.4.8 Specifics of Vehicle Dynamics Suppliers

Before the merge in 2001 there were five different sourcing bases for the vehicle dynamics components. Each of them was located around the respective production plant in Northern Europe, France, US, and Brazil. These supplier bases were rather locally oriented than global.

From the time of the merge there was a push toward the usage of more global suppliers. Volvo started to coordinate the purchasing and to look for suppliers able to supply it on all three continents.

As discussed in previous section, after the merge Volvo's volumes almost doubled. As a result, the company became very attractive to the large global suppliers. This led to the situation when Volvo today is in the area of vehicle dynamics dealing only with global players. A lot of these are even common suppliers to the all three Volvo brands.

Another common characteristic of the vehicle dynamics suppliers is that the large majority of them is supplying complete modules or systems. There is not too much space in the area of vehicle dynamics for the suppliers of individual components and they exist today only as a tier two or tier three suppliers.

The main modules being supplied are the steering system, brakes and hubs, pneumatic structure, suspension modules, air production management systems and of course wheels and tires. In the case of tires, the supplier depends on the market where the truck is purchased and on the needs of the customer as the each market has different standards for tires. Tires are sourced moreover according to the customer needs and Volvo is purchasing tires from all major global tire producers (Michelin, Bridgestone, Continental. etc.) (Marchner, 2005).

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With regard to the purchasing power of Volvo in the segment of vehicle dynamics, the relationships are rather long term and last at least as long as the product lifecycle. A very specific thing in the vehicle dynamics suppliers industry is the very strong concentration of the suppliers. In some areas there is impossible to choose between more than one or two suppliers on the global level. There are quite visible duopolistic or monopolistic markets for certain components. This limits Volvo's purchasing power dramatically.

These duopolistic or monopolistic companies did not supply only Volvo trucks but as well all its competitors. This led to the situation where truck companies are competing to enter in to the mutual or exclusive partnership with some of the vehicle dynamics suppliers.

There is need of a lot of confidentiality, knowledge and development agreements between Volvo and its suppliers to protect innovation and competitive advantage gained through research and development. Otherwise, under the circumstances when the same supplier is supplying also competitors, it might lead to the situation (as it already happened several times in the past) when Volvo's new innovative feature developed together with a supplier is introduced within a short time period by its competitor, only because Volvo is using the same supplier.

Due to these reasons Volvo does some research and development on its own and then just delegates the production to the suppliers (they build to print). In some cases Volvo handles the research together with supplier and then further upgrades the technology or technology roadmap internally.

A market that is ruled by few global players limits also the competition and by that the variety of products offered. In the area of vehicle dynamics Volvo is looking on a continuous basis for new suppliers, for new possibilities to source, and also for the possibility to change the supplier and gain more purchasing power (Marchner, 2005). Today in some areas of vehicle dynamics Volvo is introducing alternative suppliers in order to increase the competition in the segment.

Due to the fact that the majority of vehicle dynamics suppliers is module and complete system suppliers, it is necessary to have them located close to the Volvo production plants. It means they usually supply complete systems that are hard to ship and transport. Based on this fact

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we can say that the first tier suppliers of Volvo are located in a proximate distance to its plants.

On the other hand these first tier suppliers source most of the components from their own production plants or second tier suppliers that are located in low cost and emerging markets. In case of vehicle dynamics these are again the Eastern European countries, the Baltic states, Turkey and of course as in case of other truck components India and China (Marchner, 2005).

In general the supplier base of vehicle dynamics is very mature. There exist few very large global suppliers. A lot of these suppliers are dedicated only or mainly to the truck business. In other segments as the electrical or cab, the suppliers are usually focused on both cars and trucks or mainly on passenger cars. In vehicle dynamics the situation is quite specific as the suppliers are focusing mainly on truck producers.

The truck business is very cyclic (five to seven year cycles) and suppliers that focus purely on the truck industry have to go through these cycles as well (Berglie, 2005; Marchner, 2005). During the last downturn in 2000/2001 the concentration of suppliers was even increased as a lot of smaller ones bankrupt.

Another characteristic of vehicle dynamics suppliers is the large level of automatization of their production. This leads to problems with the flexibility of their production as their reaction time on upturns is rather slow. This was the case of the wheel rims, steel wheels and bearings during last few years.

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In this section we will analyze the empirical data, match and compare them with theories as well against each other. Later on we will draw the outcomes and provide the reader with explanations of observed phenomena.

In sum we can say that some of our presumptions about the changes in the supplier network of the case company were confirmed. Notably issues as the increased importance of first tier suppliers, common architecture among models and globalization proved to be right. In other words these were the expected outcomes of our data collection. Already even in this area it was interesting to see the specific implications regarding the truck industry that were not typical and in some cases extended or modified proved general trends observed in automotive industry.

On the other hand, and what made our research even more interesting to us, were the unexpected outcomes we never went through before analyzing the empirical data. These were mainly in the area of the power relationships, suppliers following up the customer firm, influence of the internationalization of the customer firm and especially the importance of its production volumes.

5.1 Volumes

We have to start by analyzing the importance of production volumes to the development of the firm's supplier network. Volumes is a topic that is not specifically mentioned in theories dealing with the automotive industry and supplier networks or specifically in articles about the truck industry. It is usually only stated that the production volumes of truck industry are lower than in passenger car industry but hardly any more complete picture of production volumes influence is provided (especially with regard to the suppliers). On the other hand, it is a term that appeared in every interview and in every discussion about the suppliers to truck industry. Moreover, it affects the supplier network and its composition to enormous extent.

During our empirical data collection the production volumes of the case company were mentioned in all four researched types of Volvo suppliers (Chassis, Electrical, Cab and

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Vehicle Dynamics). The importance of volumes was always stressed at the point when the supplier network was in a transformation change from being focused purely on local suppliers to global ones and also in more general trends with regard to the globalization of Volvo itself. Another important fact with regard to the volumes is the purchasing power or better to say the power relations between Volvo and its suppliers that are closely connected to this variable.

We see the first main milestone with regard to the volumes and the impact on the sourcing and by that on the supplier network in the Volvo's strategy to use common platforms in its various models. This is visible in the introduction of the 2200 platform first in the European FH truck in 1993, later on the usage of the same module in a US VN truck line introduced in 1996 and finally in a NH model being produced in Brazil from 1998.

Introduction of the same platform (discussed in detail in a following section) allowed Volvo to share the same parts in more models. This led to the situation that, if we will simplify it, Volvo was able to sum common parts used in FH, VN and NH model and approach the larger global suppliers. Volvo was capable basically to offer them larger volumes of same parts to supply and make the company more interesting to them.

There is no discussion, and it was proved by all three Volvo managers during the interviews as well by Mr. Berglie, that in order to approach global big suppliers company has to offer certain volume otherwise they will not be interested to supply. In other words it will not be for them interesting to invest time and money to supply 300 parts a month. This is also supported by the fact that the majority of the global suppliers are primarily focused on the passenger car industry that is, in comparison to the truck one, large volume industry. The truck business is for them usually on the second place and only strong global truck producers with adequate volumes can approach them. We can say that there exists a volumes floor below which the global players will not consider the business with a truck manufacturer (see Figure 15).

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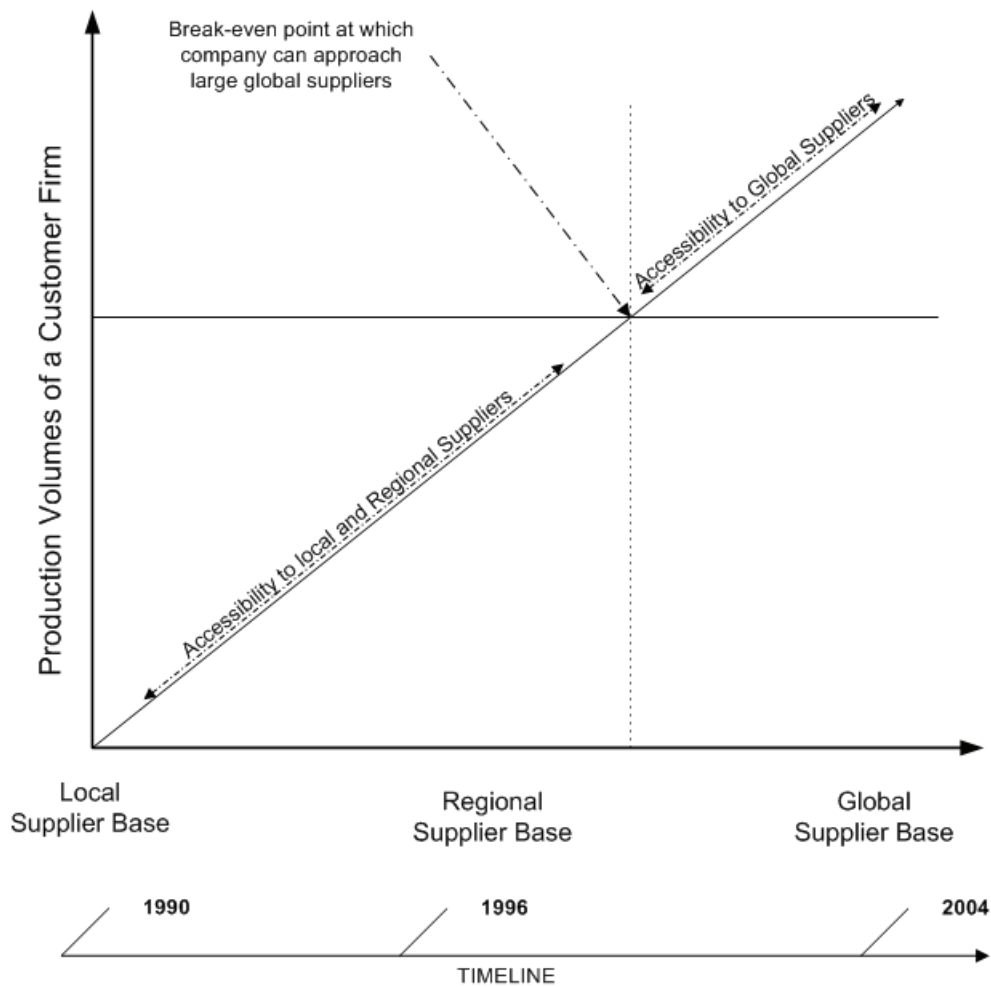


Figure 15 - Relationship model between Volumes and Globalisation of Supplier network
(Source: Authors)

Second important step with regard to the development of Volvo supplier network in terms of volumes was the acquisition of Renault V.I. and Mack and later on the establishment of Volvo Global Trucks and Volvo 3P respectively. As visible from the empirical data by this step Volvo almost doubled its production on a global level and became one of the top three global truck producers. The importance of this step with regard to the volumes was the increase of cross sharing of the same components among all three brands and its models.

For this purpose Volvo Global Trucks organization was established originally (for the transition time period) and later on Volvo 3P as its successor. The main goal of Volvo 3P is to coordinate the product planning, research and development, purchasing, and product range management for all three brands and all their truck lines. What we have to stress is that the goal of Volvo 3P is in other words to increase the commonality among three brands and the

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usage of the same components and platforms. As in the previous case (2200 platform) this makes the Volvo even more interesting in terms of volumes in the eyes of the big global suppliers.

This was very well demonstrated by the “Premium project” that led to the introduction of new Volvo FH line, Renault Premium line and Mack Granite line earlier this year. All of these lines are based on the same platform. This allows using the same supplier for all three lines and by that provides necessary volumes. In other words, as mentioned by Mr. Mackinowski, everything that person cannot feel, smell or touch might be completely same in a cab of all three trucks.

Another important fact with regard to the production volumes and the changes in supplier network is the power relations between the customer company (Volvo) and its suppliers. With regard to the small suppliers that remained in Volvo suppliers network the purchasing power of Volvo rapidly increased due to the larger volumes of Volvo orders and the higher dependability of suppliers on the orders from Volvo.

On the other hand by the movement to the global suppliers the purchasing power of the Volvo decreased as their main business was to supply the car industry and they were not dependable on Volvo. The second fact was the increased sharing of research and development that made Volvo more depended on them (discussed more in the modularization section and consolidation section).

In summary we can say that the truck producer, in order to switch its supplier base from the local one to the global one, needs on a first place to reach a certain amount of volumes to attract global suppliers. The second important fact is that these global suppliers are necessary for the implementation of global strategies of truck producers, especially in the area of global coverage of supply of more complicated modules as well in order to share the research and development costs. As visible from the empirical data the important movements toward the global suppliers happened in the second half of 1990's (introduction of 2200 platform and common parts) and in the time period after the acquisition in 2001 (integration and coordination of purchasing for all three brands). These were two main milestones when Volvo reached the certain level of production and was able to approach global suppliers with interesting offers. We have to also stress that these two “Volvo” milestones were not 100

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percent facilitators of the increase of volumes in these time periods. To some extent the increase in production volumes was caused also by the upturn in the truck industry (as the truck industry goes in cycles). By that, the production in these two time periods grew in a natural way as well.

In summary the production volumes influenced the supplier network in these terms:

- Increased production volumes allows company access global suppliers and implement its global strategies
- Low production volumes forces company to focus more on the small local suppliers
- Production volumes have direct impact on power relations between the customer firm and its suppliers
 - In general higher production volumes increase the negotiating position toward its suppliers as the supplier is more dependent on the customer firm
 - On the other hand in our case the shift toward the global suppliers caused the increase of dependability of Volvo on global supplier (in other words the purchasing power of Volvo is lower with global supplier in comparison to the power it had toward local supplier)
- The term “production volumes” was mentioned by every interviewee several times stressing its importance

5.2 Modularization

One of the approaches in automotive manufacturing that have led to major changes in the industry structure was the trend of modularization. It was stated from most of the interviewees that there is a delay in the heavy truck industry in comparison to passenger cars regarding most of the trends. In addition we have found that there is difference between different components of the vehicle in the time or intensity that these trends appear.

Modularization has been applied to a great extent in car industry (for example Smart being composed out of only four main modules (Hamnsted, 2005)) (Larsson, 2000). At the same time involvement of suppliers as sub-assemblers in supplier parks of the OEM production is a practice that appeared also in the truck industry (e.g. Volkswagen’s Resende plant discussed

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in Section 4.1.2). Volvo has not reached full level of modularization and supplier integration in final assembly. When referring to modularization as a trend we should not forget that it does not equal with a road that every OEM has to follow. Learning from other firms can lead to better suited and customized approach for Volvo.

In Volvo the shift to systems and components sourcing started in 1993 with the platform 2200. These were the first steps to cut down the number of parts and increased the commonality between different models and production sites. As a consequence of modularization and with that connected component commonality in Volvo's production, we can see that there has been a move from individual parts suppliers to module suppliers. This in turn led to the restructuring of the hierarchical organization of supplier tiers and the reduction of direct suppliers. System and module sourcing is increasingly taking the place of the traditional component sourcing or in house production. This is also supported by the trend of OEMs to focus on the core business and outsource all non-core activities to suppliers.

The extent of modularization in each segment of the vehicle purchasing commodities (cab, chassis, electrical, and vehicle dynamics) is dependent on the special characteristics of it. Most purchasing areas are still moving toward modularization. Vehicle dynamics were the first to move into this and now the majority of business in this area is awarded to few suppliers. In cab and electrical the process started around the mid 1990s and is still ongoing with open prospects for the future. Systems engineering in this area is complicated as it requires expertise in electrical and mechanical parts to be combined. In chassis, the supply base is more fragmented and with regard to the characteristics of the chassis components (simple, build to print components) they are regarded as trade commodities (which translates to arms length transactions).

Modularization does not mean that there is less assembly work required for manufacturing a truck. It simply means that there is reorganization in regard to who is doing what in the value and supply chain, with more sub-assembly work done by the suppliers. There is trend from complete assembly done by OEM to important sub-assemblies to be outsourced. This might not be irreversible, as assembly firms try to find the most beneficial approach for them that will be accepted by suppliers. A big part of the added value comes from the assembly operations. In cases of diminishing value added for OEM producer (in case of high margins of suppliers) this may lead to the situation of back in-sourcing in certain segments. This is only

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hypothesis that has to be proved or disapproved in the future. With regard to this, there was already one case of in-sourcing that we have observed (frame ladder assembly in-sourced back by Volvo US). The nature of the product was such that control advantages of internal production were not the drivers for this decision. A move back to internal production, in this case, was dictated by the desire to increase margins. However at the present time we cannot set whether in-sourcing will become trend or not.

Systems and modules procurement relates to a transfer of costs (R&D and management costs, etc.) from the OEM to suppliers, but also to reallocation of power. This happens because first tier suppliers are becoming responsible for managing the second tier and additionally they are more involved in research and development, to the extent that they are the main source of innovations. As technology development is dependent more on the suppliers and the boundaries among suppliers and OEM are changing the power of suppliers is increasing.

The reliance on suppliers for innovation is increasing and at the same time there is an increased need for cooperation between supplier and buyer with the supplier having a stronger position. As we have seen the suppliers that can play the role of a system supplier are generally big and global companies or alliances that combine their strengths in different areas of expertise in order to deliver increasingly complex and complete systems for Volvo (e.g. Siemens Video, Delphi, etc.). Bigger and global suppliers are those who can bare the cost of developing complex systems, and smaller suppliers base their success on niche technology. In either case Volvo is dependant on the suppliers and especially in the vehicle dynamics where there is a high degree of concentration in the market. The limited number of them leads to oligopoly situation in the market, changing thus the power relations in the network.

Briefly the consequences of modularization in Volvo's supplier network are the following:

- Hierarchical structure of tiers is changed and reinforced
- First tier suppliers are becoming more important, taking over some responsibilities of Volvo (as R&D, purchasing)
- Relationships with suppliers as means of access to their resources are increasing in importance
- It had impact on redistribution of negotiating power in the network
- Bigger and global suppliers are getting a bigger proportion of business

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- Cooperation in supplier-supplier level is increased (driver for alliances and consolidation)
- Cooperation in suppliers-OEM level is increased

5.3 Geographical reallocation

During the last 15 years the geographical location of Volvo supply base has changed in various dimensions. We were able to observe a shift from being oriented to local suppliers to regional ones and later on to global suppliers. The other observation made is the shift of supplier base from western developed countries to the east, more specifically to low cost and emerging markets. This was firstly to Eastern European countries and lately to Asia. We should not as well forget on the increasing role of Brazil during the researched time period.

As we can see from the empirical section on the beginning of 1990's Volvo was oriented on local suppliers. The majority of the chassis suppliers for Europe was located in northern European countries (Sweden and other Scandinavian countries) and in Germany. The US factory was mainly supplied by the North American suppliers (majority of them being located in US and minority in Canada). The Brazilian plant was supplied by the suppliers located in Brazil and to some extent some parts were imported from Europe as CKD units. The situation in the cab, electrical and vehicle dynamics supplier segment was identical.

The beginning of 1990's can be regarded as level zero concerning the globalization of Volvo supplier network. Its supplier base was locally oriented in all segments. There were not so many differences among the cab, chassis, electrical and vehicle dynamics suppliers.

We were able to identify several reasons for the focus on local supplier base. First of all there were not so many alternatives than to source in developed countries that were moreover on the same cost level (so the distance was decisive). East and Central European countries as well Asian were still waiting for their chance that came a little bit later but not on in the early 1990's. It was too early after the fall of iron curtain. Post-communist countries had to first stabilize themselves, transform their markets from central oriented toward market oriented and to build the necessary infrastructure. Furthermore they had to update their technology and solve quality problems.

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The situation of Asia (coupled with large distance from all three main Volvo production plants) was similar. Its time, to become supplier base location to truck industry, came later and in some segments it is happening at the present time or it is expect to happen in the near future.

The second reason behind staying more local was that at that time period suppliers were delivering simple parts that were build to print and modularization was non-existent. From this point of view there was no need from the side of Volvo to switch to the bigger or global suppliers as the local ones were able to carry the production. Furthermore, Volvo did not have sufficient production volumes to approach the global suppliers that were focusing on the passenger car industry with its higher production volumes.

The shift toward the more regional suppliers started in the middle of the 1990's (depending on the type of the supplier) and continued till the first years of the new century. We have to stress that this movement toward the regional or continental suppliers was case only of the suppliers to the Volvo's European production plants as the Volvo US was always focusing mainly on the North American suppliers (with regard to the US due to the strong automotive industry majority of the suppliers were present on the US market anyway, so imports were not necessary). The Brazilian plant had to source locally due to the strict Brazilian legislation.

In this time period it was the shift to the Central and Eastern European countries (namely Czech Republic, Hungary, Slovakia, Poland and Slovenia). These countries were able to provide low labor costs, quality products and proximity to the Volvo's production plants (only for illustration according to maporama.com, the driving distance from Prague to Gent is 967 Km, Prague to Gothenburg is 1076 Km, Warsaw to Ghent 1338 Km and Budapest to Ghent 1412 Km, on the other hand the distance between two European Volvo production plants, Gothenburg and Gent, is 1206 Km). As a result a lot of local suppliers were asked to source or to move their production to these countries or they were substituted by suppliers established in these countries.

This movement as basically all others was cost driven. These countries as mentioned above were able to provide very low labor costs in comparison to original local suppliers. Furthermore, with regard to the logistic costs that were not deteriorating the advantages of low cost production, Central and Eastern Europe was a logical choice. In addition to this,

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some of the suppliers, especially cab suppliers, started to purchase tooling from these countries. They did it either automatically by themselves or were requested by the Volvo in order to decrease costs.

The other fact that played in favor of these countries was that all of them were expected to join the European Union in near future. It was anticipated that it would make business with suppliers as well the transport of components even easier in the future. All of these countries are members of the EU from 2004.

The first pioneers in this area were the suppliers of the electrical components that started to move their production or were substituted by suppliers located in East and Central European countries in 1996. As we mentioned in the empirical section electrical and electronic components were labor intensive and the shift to the low cost locations was enviable. They were followed by the vehicle dynamics and cab suppliers in a second half of 1990's and finally by chassis suppliers on the end of the century (from 1998/1999).

This trend, the orientation toward supplier base in Central and Eastern European countries, has not ended yet. There are still a lot of new suppliers entering this region, especially automotive suppliers that might become or plan to be suppliers to the truck industry. We cannot ignore the fact that in this region the car manufacturers still build their factories at the present time (Toyota-Peugeot-Citroen opened its production in Czech Republic in 2005, Kia Motors is building factory just now in Slovak Republic and Hyundai is planning to build production plant in this region). These companies are strong enough to force their suppliers to follow them to this region and it is also happening. These suppliers once established might be then approached by truck producers. Thus, we expect that eastern and central Europe will be still interesting for the Volvo and its suppliers in the future.

Another development that followed the regionalization and movement on the east in general, and which we can retrieve from our empirical data was the shift toward the global suppliers. There were already some global suppliers before 2000/2001. They appeared in limited degree with the introduction of the platform 2200 and especially around 1996 when the VN model based on the same platform was introduced in the US.

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However, the real shift toward global suppliers came with the acquisition of Renault V.I. and Mack and with the creation of Volvo 3P and the launch of the “Premium project”. This was the time when Volvo started to look for the global suppliers or common suppliers for all three brands. The movement toward the global suppliers was also closely connected with the increased usage of complex modules in Volvo trucks. In case of modules there were and are only few suppliers that are able to deliver them. For example in case of vehicle dynamics for certain components and modules the market is duopolistic or monopolistic. It is clearly visible that these modules have to be supplied by global suppliers as it will be hard or impossible to find local or regional suppliers for individual Volvo production plants. In certain cases the importance of the global suppliers has grown rapidly and they became the major suppliers to Volvo. In the case of cab suppliers 80 percent of components is covered by 40 suppliers and in electrical 80 percent of components is covered by eight to ten suppliers majority of them being global ones. This clearly demonstrates the increasing importance of the suppliers with global coverage.

On the beginning of the new century suppliers from Asia became interesting to the Volvo trucks. Exception to this trend were the suppliers of electronics, which moved to this area in large advance (mid 1990’s) before the vehicle dynamics, chassis and cab suppliers. In the case of electronics we see it as natural way as the Asia was the main source base for the electronics parts on the world. The shift toward the more global, Asian, suppliers was possible because of the characteristics of the electronic components that are small and easy to transport globally. The other thing that spoke for Asia was the extensive R&D in the area of electronics (especially Japan and today also India in software). With regard to the other parts as the cab or chassis suppliers the main problem were the logistics as these are usually larger and heavier components.

What is also important, before 1998 (when production in India was opened) Volvo did not had any production in Asia but only assembly plants (CKD units). From this point of view, if there were any suppliers in Asia (as in case of electronics), they would have to ship almost all its production to the Europe, Brazil or US. In case of larger components logistic costs will cannibalize the advantages of low cost production.

As described in the empirical data section from the beginning of this century the importance of Asia is growing. This is especially the case of China and India as both are able to provide

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very low labor costs as well enormous markets for the both Volvo and its suppliers. We think that in the future and with the transformation of Chinese Volvo plant from mainly assembly to a fully production one, the importance of this region will even increase. The question is to which extent these suppliers will become global or stay regional (e.g. will supply only Chinese and Indian production plant).

A special case was the supplier network of Volvo Brazilian production plant. It stayed to a large extent locally focused and still is. This is caused by the Brazilian legislation that requires foreign producers to source high proportion of the components locally in order to be allowed to produce in the country.

In summary there were observed two parallel trends. First of them was the transformation of type of suppliers from the local ones to the regional ones and later on to the global ones. Second trend was the movement of supplier production and allocation to the east. First to the Central and Eastern Europe and later on, and at the present time this trend continues, to Asia and China. These two mentioned trends are interlinked together. We see the movement to the regional supplier base closely connected with the movement to the Eastern Europe as well the establishment of production of the global suppliers' production in this region due to cost reasons. Lately, there was the observable movement, mainly of the global suppliers, toward Asia (China and India). Nevertheless we think that the time of China and India will come in near future as the importance of these two countries as a supplier base will grow.

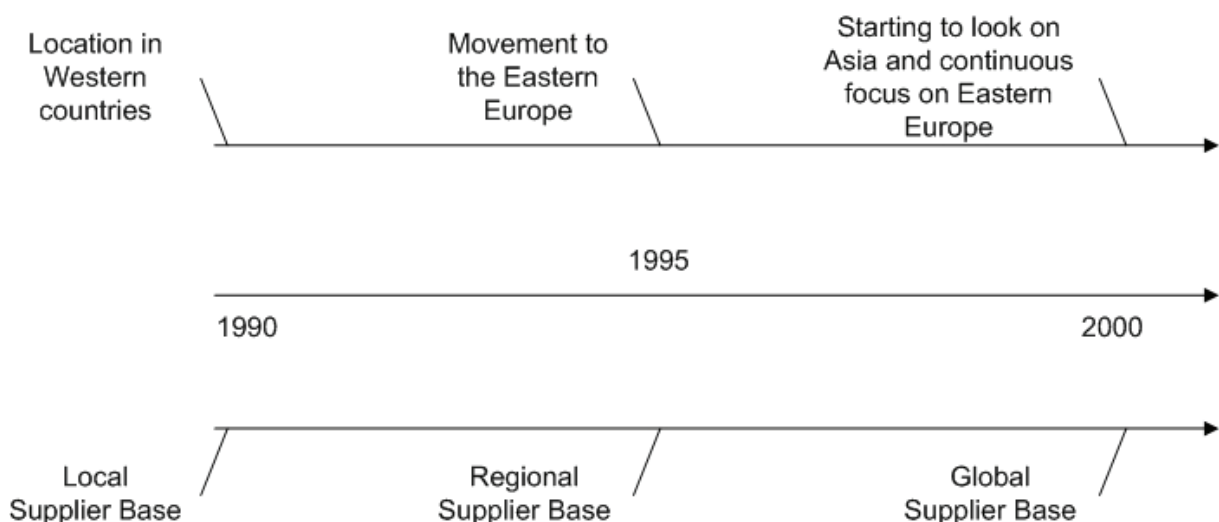


Figure 16 - Geographical reallocation
(Source: Authors)

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In summary the geographical changes influenced the supplier network in these terms:

- Till the mid 1990's Volvos supplier network was locally oriented
- Starting by 1996 and continuing till now, there was a shift from local orientation toward the regional one
- Starting in a larger extent by the year 2000, there was a visible orientation toward global suppliers
- In parallel to these, starting by 1996, there was a visible shift of suppliers to the east. This was especially case of Europe where the large proportion of suppliers production was moved to the Eastern and Central Europe
- Lately, starting mainly by 2000, some of the suppliers production is moving further to the east - to Asia, especially to China and India

5.4 Consolidation

As visible from our empirical data the supplier industry has been the field of extensive consolidation almost in all segments. The number of players in the market is being decreased, not only on the supply side but as well there were mergers and acquisitions on the side of OEMs. These two parallel moves, the shrinkage of suppliers number and of independent buyers is affecting the relationships in the industry. Fewer buyers and fewer sellers means that both sides had to deal with the situation.

As a result the fewer and bigger buyers have reached a level of volumes to attract global suppliers and increased their negotiating power when dealing with smaller suppliers, as in the case of Volvo joining forces with Renault V.I. and Mack. The other side of synergies or benefits reaped from the merger between Volvo and Renault was the rationalization of the supply base that was triggered. The extended use of common architecture in the new models (e.g. Premium project) that were launched contributed to the reduced number of suppliers used.

Even before this merge took place there had been the attempt to create alliance between Volvo and Renault that ended in failure in the beginning of 1990s. Except the mergers there has been also an extensive usage of strategic alliances for certain markets and product

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development. The consequences on the suppliers depend on the extent and depth of this cooperation.

At the same time the oligopoly situation in certain areas as vehicle dynamics is not regarded as the ideal situation for the Volvo as it limits the competition between suppliers and by that the availability to choose from more alternatives. Limited options create extreme dependence on the supplier. For this reason smaller players are sometimes promoted in order to increase the competition in certain segments.

Another aspect of the consolidation activity in supply industry was the fact that small companies that had contracts with Volvo were acquired by bigger ones. We can see that in this way a significant change has taken place in Volvo supplier network, notably the linkage with other networks through the new actors that replaced or became part of the new suppliers. These changes have been not the result of actions of the focal actor in the network but came from the periphery or outside of the network and shaken the relationships and power distribution in it.

Through mergers and acquisitions suppliers succeed in gaining access to the networks of OEMs and furthermore they improved their geographical reach and their knowledge base. Consequently they had improved their position in terms as they were able to offer more to the OEM concerning the production and also the geographical reach (able to deliver into more locations).

In summary there was enormous consolidation happening on the both sides of the industry. The smaller and local suppliers became targets of the global players and were integrated to their networks. There was also consolidation on the side of truck manufacturers that led to the few players (customer firms) remaining on the market. This had effect mainly on the power relations between the suppliers and customer firm (discussed in Section 5.6) as OEMs became more dependent on the global suppliers.

To sum up, consolidation in the industry had the following effects on Volvo's supplier network:

- OEM level merge

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- unification with Renault supplier base
- improved negotiating position of Volvo purchasing organization
- Supplier mergers and acquisitions
 - entering of new bigger (global) suppliers to the network structure
 - oligopoly situations – increased power of suppliers
 - active support to smaller players to maintain competition and have more alternatives
 - suppliers with advanced technical capabilities and shared R&D with OEM
 - increased complexity due to overlapping supplier networks with competing firms

5.5 Internationalization of customers' firm production

As reader can see from Table 4 Volvo trucks opened as well closed several operations on the global level in the researched time period. It is clearly visible that throughout the researched period the production was concentrated in three main global areas. These were production plants in Europe (Sweden, Belgium and from 2001 Renault's production plants in France and Spain), in USA (New River Valley and from 2001 production plants of Mack trucks) and finally in Brazil. Looking on the rest of the Volvo truck operations it is visible that it were mainly the assembly plants. It means to these locations the CKD units were imported from production plants (Europe, USA, and Brazil).

What is important with regard to these changes and development of suppliers network is that the suppliers were mainly supplying or delivering the components to the same location throughout the research time period as the "real production" was hold on the same places in 1990's and still in 2004 (with except of Indian plant that became new production plant). We can see that even though the type of suppliers has changed (to global and module suppliers), the delivery locations remained same. The same situation is with the introduction of the new truck models that are mainly produced on the same places as their predecessors 15 year ago.

What has changed was not the geographical areas of the production but processes and functionality of these individual locations. Volvo's three main production plants became more interconnected and interdependent on each other. Here we can see especially increase in

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importance of Brazil plant in global network as the new cab and engine plants were opened in 1997 and 1999 respectively.

It means that different main modules of one truck model might be produced on one of these three main locations (e.g. Chassis and cab in Sweden and engine in Brazil and vice versa). What is important with regard to the supplier network is that the production centers remained same throughout the researched time period. We can see that the impact of the internationalization of the customer firms on the supplier network itself was not as enormous as we expected. Volvo produces more trucks today than before and of course it sells in more markets than in 1990, but these products are produced on the same locations as in 1990 and then distributed as completely build units or as a completely knocked-down units to the final sale or assembly locations (in some cases with minor components being supplied by local suppliers).

The implication on suppliers network with regard to the expansion of a customers firm on new markets as well the increase of units sold globally is that the supplier firm has to supply more of its components to the global production hubs of a customer firm but, and what we want to stress, not to the new markets of the customer firm nor to the assembly plants of the customer firm.

In other words supplier delivers its components to European, US or Brazilian plant of Volvo trucks where the main modules (cab, chassis, electrical components and vehicle dynamics) are produced. It is then on the customer firm to distribute these modules to the new markets and to its assembly plants, not on the supplier of individual components.

In summary the internationalization of Volvo's production influenced the structure of its supplier network in these terms:

- With regard to the changes in supplier network the internationalization of production is crucial as it changes the setup and geographical allocation of suppliers
- Internationalization of firm itself influences the volumes of production but the internationalization of a production has higher impact on the structure of the supplier network

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- The type of activity held in customer firm's plants has distinctive effect on setup of supplier network.
 - The effect of a CKD assembly on a supplier network is minimal
 - Setup of production facility influences structure of the network to a large extent, firstly bringing new local and regional suppliers to the network and later on global ones

5.6 Power Relations

Between 1990 and 2004 a remarkable shift took place in Volvo's supplier network in term of the relations among Volvo and its suppliers. All the changes in the network's structure and mainly the change concerning its composition and the main actors (direct suppliers of Volvo) had a crucial impact. It is connected with the reallocation of responsibilities and the resources ties between suppliers and Volvo.

In 1990 it can be said that the general picture was the one usually expected of a big customer firm and its suppliers. The role of the focal company, was giving to Volvo a dominant position in its network. At that time, Volvo was dealing with small and local suppliers, the majority of product development was kept internal and the procurement was based on the engineering design provided by Volvo (suppliers produced built to print components). The size of firms involved, their high number, the scattered nature of OEMs' networks and the leading position of Volvo in R&D meant that Volvo had the upper hand and was able to shape the developments.

In other words Volvo on the beginning of 1990's had very strong purchasing power over its suppliers. We can say that suppliers were more dependent on Volvo and Volvo had the decisive power while dealing with them.

During the last 15 years the domination of Volvo over its suppliers has decreased. The number of components that are ordered in a built to print form is decreased. Furthermore, the suppliers now are cooperating with Volvo in product development and more importantly a lot of the innovations derive from them and are patented by suppliers.

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Another reinforcing factor for the shift of the power distribution over the network actors is that the suppliers now are big global companies that are mainly responsible for delivering complete modules and systems. They are suppliers that have relationships with many vehicle manufacturers. As a consequence the negotiating power of Volvo is moderated. This is visible in some areas as vehicle dynamics where the monopolies or duopolies on the side of the suppliers exist. Volvo has no chance than to source from these suppliers. As a consequence the negotiation power of the Volvo is very low today.

The stronger position of the suppliers is further supported by the monopolistic and duopolistic nature of markets of certain components. In such a situation, all truck producers compete for the same suppliers in order to become their exclusive partner. It means there is competition between customer firms for the supplier and as a consequence it decreases the negotiation power of Volvo.

We see also appropriate to mention in this section of the analysis the increasing importance of shared R&D that has enormous impact on the power relations between Volvo as a customer firm and supplier of the components, modules or complete systems. By shifting part/full responsibility for R&D on the supplier, Volvo can focus more on marketing and brand management and reduce the effort in developing innovations for all the areas of production. On the other hand, as a consequence, becomes dependable on its supplier to enormous extent.

One of the main reasons for the shift in R&D responsibility allocation is the changing technology. The cost to keep up competing by using only internal resources is unbearable in the current competitive conditions. Focus on core competences is then the next step to make. This leads to outsourcing of previously internal operations. The change in the type of direct suppliers is facilitating this change. As we move in the timeline to current situation, suppliers are bigger and global companies, as the result of the consolidation and modularization in the industry. Furthermore, some areas of technology are the field where also small specialized companies can compete successfully (especially software). These two facts combined give the ground for the changes to happen. Outsourcing of research and development is possible when there are specific competences in this field outside the firm. The high asset specificity of innovations can explain the closer relationships with the suppliers.

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We can see a shift from built to print components, where Volvo was the exclusive provider of engineering design to a greater involvement of suppliers in product development. This can have the form of common R&D or reliance on proprietary technology provider by the supplier. The increased dependence of Volvo on supplier resources and their subsequent upgraded role in the network changes the structure of power relations between the truck manufacturer and its suppliers.

Based on our empirical data we can see a changing mode in the relationships between OEM (Volvo) and suppliers. Volvo is becoming more dependent on suppliers for the next innovations in their trucks, and needs suppliers to be able to deliver their offerings in a variety of places around the world. As a result purchasing activities are concentrated to fewer and bigger suppliers, which have the capacity, financial resources and technical capabilities to follow and support Volvo in its strategy.

In sum the changes in power relations influenced supplier network in terms:

- There was visible decrease of power on the side of Volvo and the increase of importance on the side of suppliers. This was caused mainly by:
 - Increased dependence on suppliers technology and knowledge
 - Shared R&D
 - More large global suppliers with strong position on the market (sometimes duopolies or monopolies)
- This influenced the structure mainly in terms of stronger position of suppliers and the need of the customer company to cooperate with them and stay closer

6 CONCLUSIONS

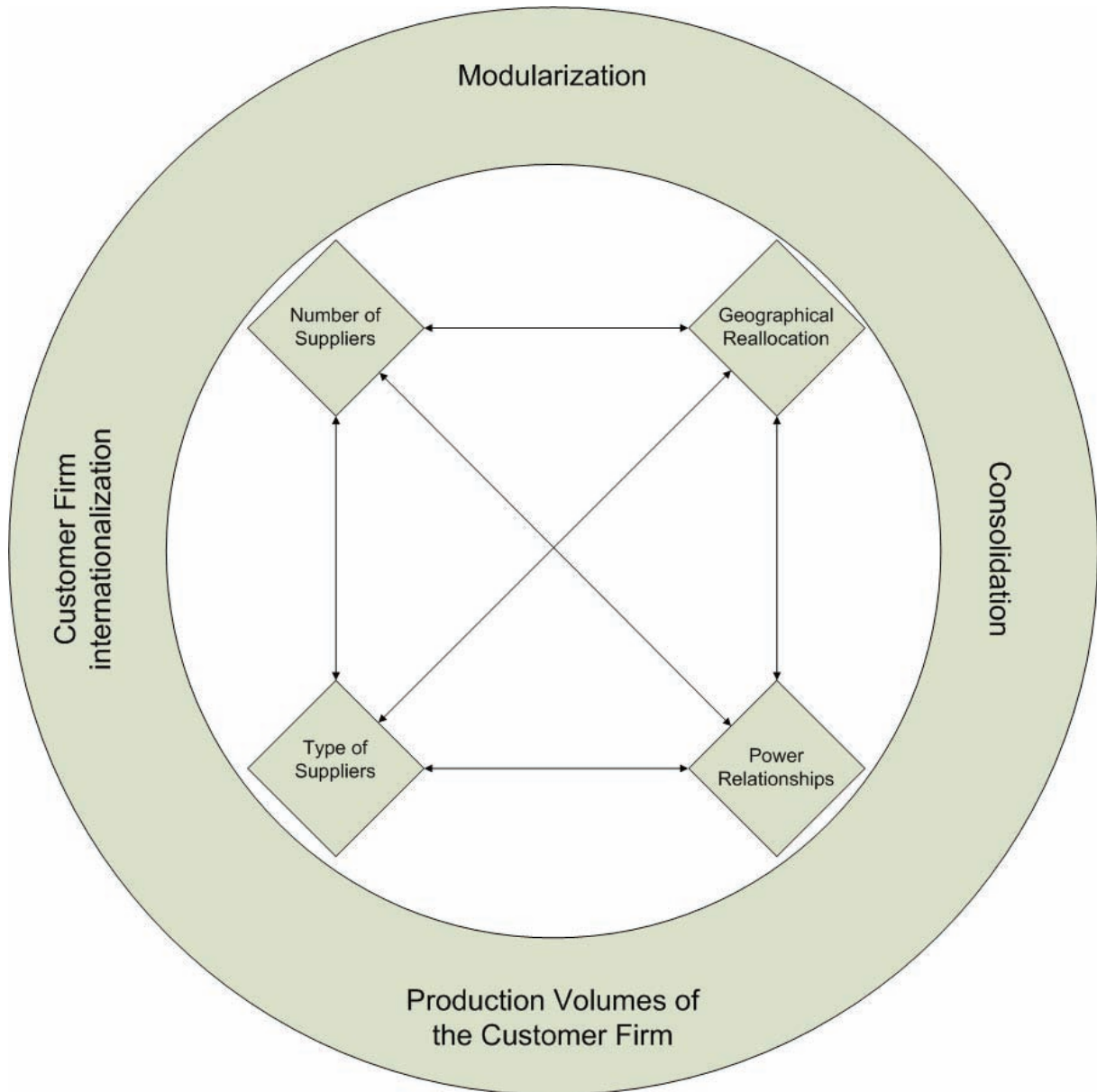


Figure 17 - Supplier Network Development Model
(Source: Authors)

In this section the conclusions of our research are presented. We provide answers for the questions and problems formulated in section 1.3 “Problem formulation”. All information presented in this section is based on our case study, more precisely on the empirical data collected and the outcomes of the analysis.

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First we will describe “*How has the structure of a supplier network changed?*” in other words we will answer the first of two questions we defined in our problem formulation section. Secondly the answer for the question “*What have been the reasons behind these changes?*” is provided. These two questions might be seen as the outcome of descriptive approach (how it changed) and the explanatory approach (the reasons behind) as we stated in the methodology part.

The current picture of Volvo’s supplier network is quite different from how it used to be in 1990. During this period there has been lot of changes going on that have influenced the structure of the network.

In sum, we have identified a shift from local to global suppliers, from small to bigger suppliers, from parts to systems and module sourcing and reliance on suppliers for research and development. The number of suppliers has been reduced, their role has been upgraded, and the geographical dispersion has changed, since there has been a move to the east and emerging economies. The reasons or contributing factors to these changes are the modularization of production, the consolidation in the industry, the changing/expanding geographic configuration of the customer firm operations, the increased production volumes of Volvo, changes in the power relations, and the changing world economy and political situation.

6.1 The Changes in the Structure of a Supplier Network

In order to answer the first of our problem questions we have to focus firstly on answering the sub-questions that will later help us to describe the total picture of the changes. For better illustration of the changes in the supplier network of our case company we designed the figure below (Figure 18), which summarizes all main observed changes and shows their interconnectedness. The underlying factors for these changes have reinforcing effect on each other.

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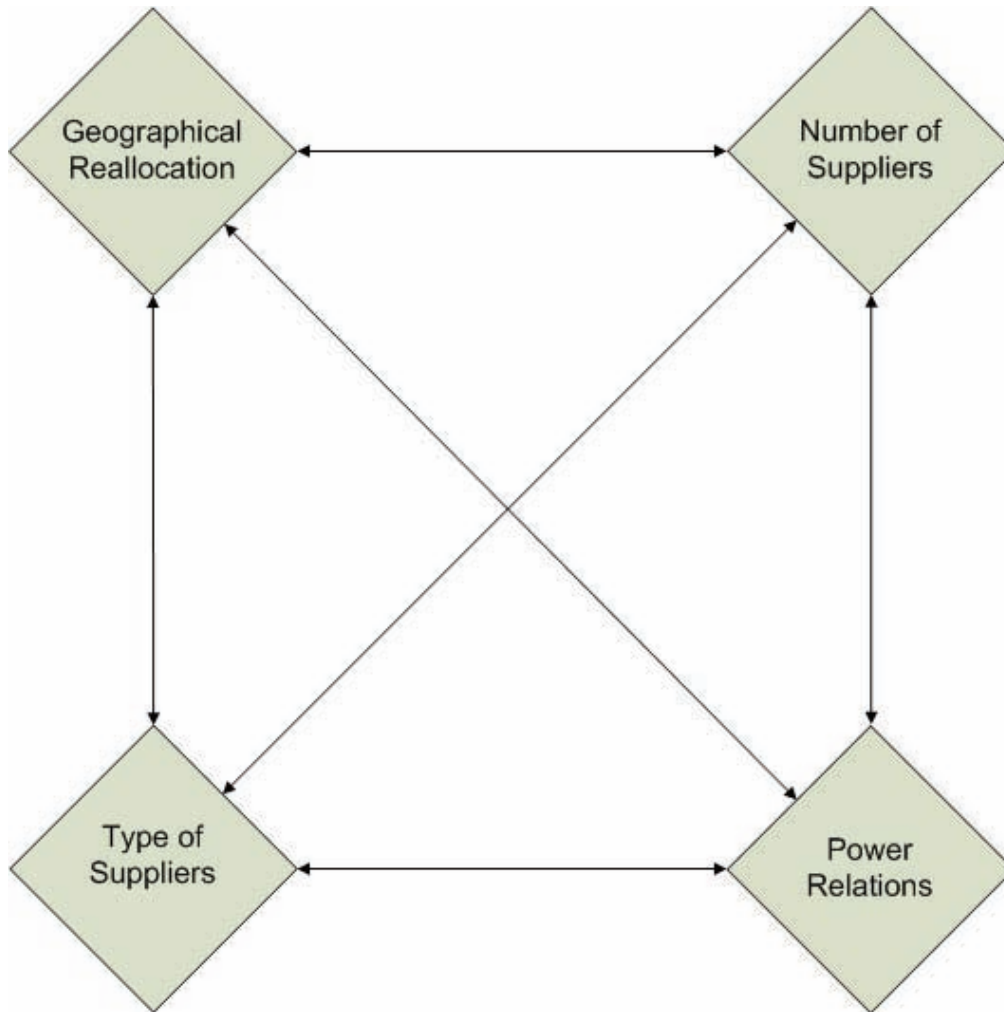


Figure 18 - Changes in the Structure of Supplier Network
(Source: Authors)

The sub-questions are:

How has the structure of a firm's supplier network changed in terms of geographical reallocation?

As visible from our analysis section there was a visible shift of the supplier network from the west ("developed countries") toward the east; first toward Central and Eastern Europe starting by mid 1990's and later on, on the beginning of the new century, toward Asia, especially China and India.

We can say that the supplier shift in the case of Central and Eastern Europe was motivated by cost reasons. This region was able to provide low labor costs and more importantly the proximity to the Volvo European plants. This trend is not finished yet and it might be expected that this region will remain interesting for the suppliers as their production base.

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The second observable shift was toward the Asia. In this case the costs at the present time where one of the main reasons as well. Especially in China and India the labor costs are low. Moreover, both of these countries are able to provide the large scale brand new factories. The second reason for China and India is their strategic position with regard to Volvo production network. In 1998 Volvo opened a production plant in India and just recently an assembly plant in China. It is logical that these new factories require having suppliers from the region. With regard to Asia we have to mention that the prices of oil and logistics costs will play important role and will determine whether it will become more important location for the global suppliers in the future.

In summary, based on our analysis, there was a visible shift mainly toward the Central and Eastern Europe starting by the mid 1990's and we expect this trend to continue. Later on and parallel to the shift of supplier production to the Central and Eastern Europe there was the initial shift toward China and India. However, based on our empirical data as well our analysis, we feel that the importance of Asia will grow in a near future.

How has the structure of a firm's supplier network changed in terms of number of suppliers?

In this area we were able to observe visible decrease in the number of suppliers. This was mainly caused by two parallel trends. First of them was the move from local suppliers, to regional ones and later on toward global ones. The second trend was the growing importance of the first tier suppliers that caused the decrease in total number.

With regard to the first phenomenon, in certain areas the supplier base was decreased from several hundreds suppliers to tens. The decrease in number of suppliers was caused by the growing importance of first tier complete system or modules suppliers. Majority of small suppliers were moved to the tier two or lower.

In summary there was a shift toward the first tier module and system suppliers that in a result led to the enormous decrease in total number of direct suppliers to Volvo.

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How has the structure of a firm's supplier network changed in terms of type of suppliers?

With regard to the type of suppliers we were able to observe the change from local suppliers, to regional ones and finally global ones. In parallel to this trend there was shift from suppliers of individual parts to the suppliers of more complex systems; mainly module suppliers and system suppliers. Also, as briefly discussed above, there was a visible move of suppliers from tier one to the tier two and the change of type of suppliers in tier one to module and system suppliers.

There was a visible shift from suppliers being located locally, in the same country as the production plant toward the regional suppliers (e.g. European suppliers being able to supply both European plants) and later toward the global suppliers supplying all Volvo production plants.

The second observable trend was the movement from suppliers of individual parts toward the suppliers of complex modules and systems, notably toward the bigger suppliers that are able to hold R&D and deliver the customer firm (Volvo) with complete modules and subsystems. These suppliers took over the small suppliers and suppliers of individual parts and moved them to the tier two or lower.

As mentioned in the previous section and the paragraph above, the majority of small suppliers and suppliers of individual components were moved from the tier one to the tier two or lower. In other words new big global suppliers overtook or moved smaller suppliers to supply directly them, not Volvo. From this point of view, the importance and dependability on tier one suppliers grew enormously.

In summary there was visible shift toward the global suppliers of modules and complete systems. These suppliers moved majority of small suppliers of individual components under them.

How has the structure of a firm's supplier network changed in terms of power relationships?

When we observe the power distribution among Volvo and its suppliers in the beginning and the end of the researched time period, we can see increasing importance of suppliers and the

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upgrade of their role in Volvo's value chain. As a result, they have achieved a better position through the researched time period. From the point where Volvo was the dominant actor with unquestioned power over its network it moved to a bigger dependence of Volvo on its suppliers.

As the amount of resources needed for competing on a global level lies outside the narrow organization of Volvo, the dependence on the extended Volvo (its suppliers) increased.

How has the structure of a supplier network changed?

Based on our sub-questions we can draw a complete picture of the changes in the supplier network in the time period 1990-2004 and answer our first problem question:

On a first place we have to stress that all trends described in our sub-questions are interlinked and influence each other (it is demonstrated in Figure 18). Any of them appeared in vacuum and many of them are interlinked.

The emergence of global suppliers goes hand in hand with the rising importance of the first tier suppliers. At the same time the global suppliers were becoming suppliers of module and complete system rather than of the individual parts. All of these had as an effect the decrease in total number of suppliers. These global first tier suppliers moved the other small local suppliers under them, to the tier two or lower.

The other visible movement happening in the supplier network was the movement of the supplier production first to the Central and Eastern Europe and later on to Asia. The trend toward Central and Eastern Europe still continues and will in the near future. On the other hand the importance of Asia as a supplier base will grow mainly in the future, especially with regard to the fact customer firm is establishing production in the region.

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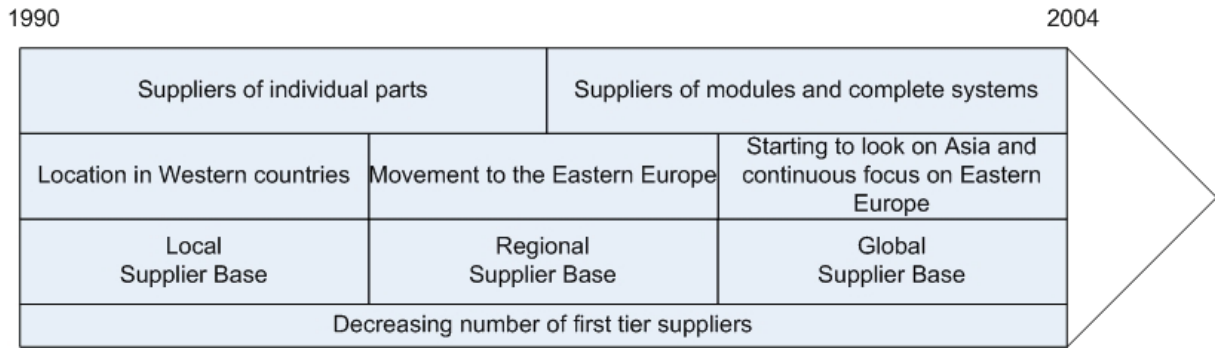


Figure 19 - Changes in Supplier Network in Time
(Source: Authors)

6.2 The Reasons behind these Changes

As these changes in the structure of suppliers network did not happened by themselves (see Figure 17) in following section we will describe the causes or catalysts of them. In this case we again decided to create a summarizing figure (Figure 20) in order to better illustrate the complexity of the changes and to describe the individual factors, before drawing a complete picture.

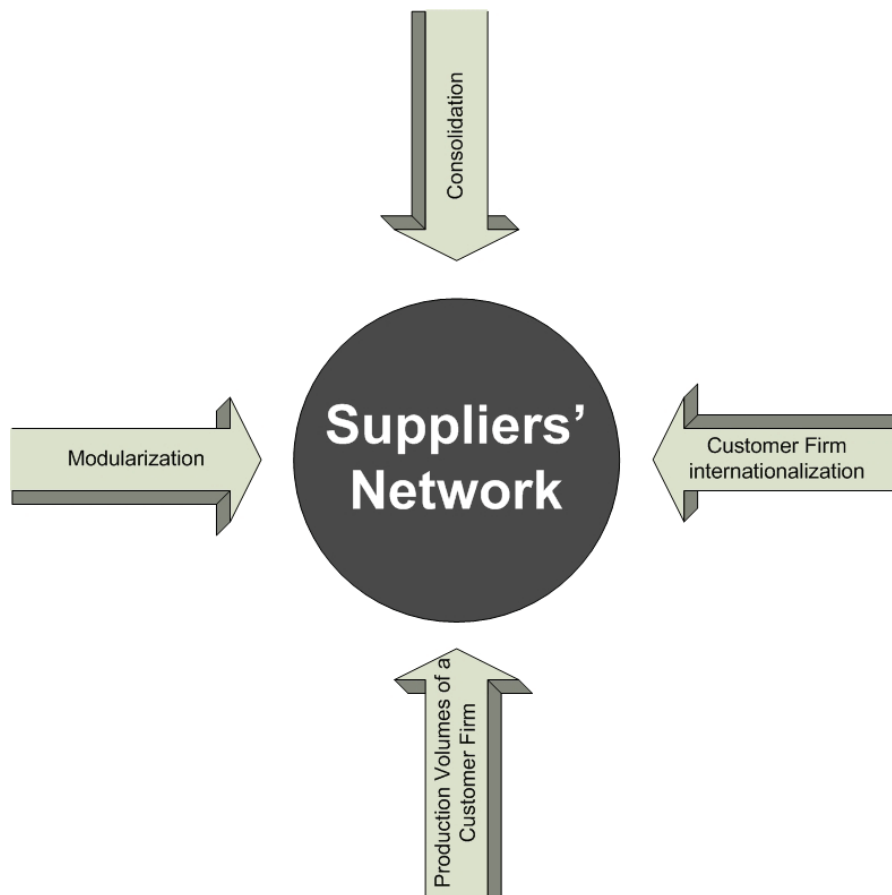


Figure 20 - Forces and Trends Influencing Supplier Network
(Source: Authors)

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The trends observed are:

Consolidation

As visible from the empirical data and analysis there was an extensive consolidation happening in the industry (both on the side of the suppliers as well on the side of OEMs). This led to the decrease of number of the suppliers as well to the emergence of large global suppliers.

Mainly in the second half of the 1990's and in the beginning of the new millennium a large number of small, simple parts suppliers disappeared. They were either acquired by the larger suppliers (global module suppliers) or have bankrupt. Majority of the suppliers that disappeared were focused mainly on the truck industry and in general were not able to deal with the cycles of the truck industry.

The other characteristic of the consolidation, as discussed in previous sections, was the movement of the smaller simple parts suppliers to the tier two or lower below the suppliers of modules and systems, which form the majority of first tier suppliers today. A lot of these small suppliers were also vertically integrated by module and system suppliers.

The consolidation on the side of the truck manufacturers (through acquisitions, merges and takeovers) has led to the decrease of their number. One of the examples is as well our case when the Volvo acquired Renault V.I. and Mack during the researched time period. Another example is the acquisition of Sterling by Mercedes-Freightliner.

In summary there was a visible decrease of the direct (first tier) suppliers as well of the total number of the truck manufacturers. In the first case this was mainly result of acquisitions or bankruptcies of suppliers. In the second one it was the outcome of the major merges and acquisitions. In both cases this lead to the increase of the concentration on the market.

Modularization

The current situation is that Volvo is cooperating with a small number of big and global suppliers. The direct small suppliers of components are specialized companies in niche technologies. Purchasing is conducted on a central level, and the suppliers are expected to be

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able to deliver to all Volvo production plants. System and modules procurement is now the norm that replaced the individual parts and components sourcing.

This shift from supply of components to supply of systems is linked with the consolidation in automotive supply industry and the changing relationships between truck manufacturer and suppliers. Modularization is mainly changing the responsibility allocation of the various assembly activities. It does not translate to less assembly work in total, but only less assembly by the final assembler, the truck manufacturer, and as a consequence more assembly work by the supplier. Moreover, the system assembler is having a big part of the responsibility for the relevant R&D. Modularization is a manifestation of the interdependence among customer firm and suppliers and the changing boundaries between them through outsourcing and cooperation. This is visible not only in terms of production (assembly labor division), but it also concerns knowledge creation.

Beside the description of the changes supported by modularization in production we can also see changes in the field of knowledge and innovation. An important factor in the changing network is the shifting responsibility for research and development. Apart from an outcome and reinforcing factor of modularization, it is also linked with the relationships among the actors, their role and the resources ties between them. As the product becomes more complicated, suppliers are increasing their part of the responsibility for new technology creation. The R&D costs and the capability to deliver modules worldwide is also pushing for partnership with large global firms, which have the necessary resources to fulfill the demands of being a tier one supplier. As a result, Volvo Trucks can focus more on its core activities and reduce the effort in developing innovations for all the areas of production.

Increase in Production Volumes of Customer Firm

A very important factor allowing the customer firm to move toward the global and module suppliers was its increasing production volumes. As we find out in our analysis part, only with adequate volumes Volvo was able to approach large global suppliers and to ask them to cooperate.

Unless Volvo was able to provide these large suppliers with adequate volumes to supply they would not be interested to supply. It was not worth for them to invest and to develop the relationship only to deliver small volumes of components. Due to the low production

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volumes, Volvo had to focus on smaller local or regional suppliers on the beginning of the 1990's.

The first breakthrough came in the middle of 1990's when there was an upturn of the whole industry. At the same time Volvo was implementing the common platform 2200. In this sense, Volvo became more interesting to the larger suppliers as the common parts can be supplied to more models of Volvo trucks.

Second important event with regard to the volumes was year 2001 when Volvo acquired Renault V.I. and Mack. Its size as well volumes almost doubled. It made the company very interesting to large global suppliers. Hand in hand with this Volvo started "Premium project", which goal was to develop common platform for all three brands and to increase the number of common parts used.

In summary the increasing production volumes and increasing usage of common products allowed Volvo to approach large global suppliers. Without these volumes Volvo will not be able to move from local/regional suppliers toward the global ones.

Internationalization

This trend is slightly different from the previous ones as it showed not to have such an influence as we expected. As we found from the empirical data the internationalization of the customer firm itself, in our case, had minimal impact on the supplier network. Of course as the company grown international its sales grown as well and it had indirect impact in terms of volumes produced.

What we found important and what has the impact on the supplier network in to higher extent was internationalization of the production of the customer firm. By that we mean the establishment of a new production plant or the upgrade of an assembly plant to the production one. This unfluenced the structure of the supplier network, as either the old suppliers had to start supply this new location or new suppliers (mainly local and regional suppliers) entered to the network. Some of these new suppliers were later upgraded to global suppliers.

In sum, the internationalization of production had large impacts on the supplier network as the new suppliers have to be selected and the some of the old suppliers have to supply new

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locations. The internationalization of the production also brings quite often new global suppliers into the network.

What have been the reasons behind these changes?

As visible already from the description of individual trends there were not happening in isolation from each other. They were influencing each other and in certain aspects dependent and closely connected to each other. Some of these factors were coming from the external environment and on the other hand some were linked with changes happening on Volvo's side.

The consolidation and modularization were going hand in hand as modules cannot be produced by small firms and need high level of expertise from different areas. In order to access these large global suppliers and be able to switch to the modules produced by them, the customer firm has to reach certain production volumes to become interesting to them. The emergence of the global suppliers was to great extent supported by the consolidation in the industry as the smaller suppliers became part of major suppliers. The consolidation on the side of the truck manufactures, on the other hand, led apart from the concentration in the market to the larger production volumes of each of the few global players. In parallel to these the internationalization of production of Volvo required large global suppliers being able to supply all of its production plants.

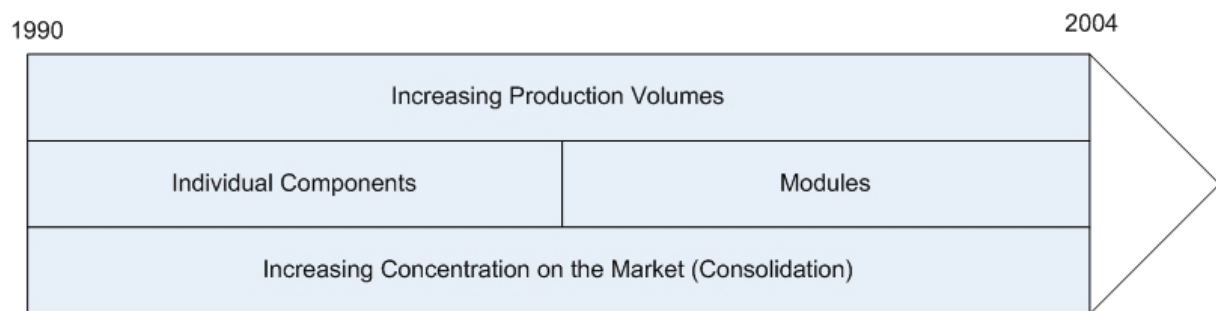


Figure 21 - Forces and Trends Influencing Supplier Network in Time
(Source:Authors)

7 CONTRIBUTIONS AND RECOMMENDATIONS

This study provides a detailed insight to the changes that have happened in the supplier network of case company - Volvo trucks. The contribution concerning the prospect of generalizations deriving from this thesis is limited, because of its partial character, the examination and better understanding of a particular case. It can be treated however as an input for further research, which will have this kind of ambitions. The implications of our study lie mainly in the deep understanding of researched phenomena. We were able to discuss observed phenomena into the detail and find the reasons for them.

From another point of view a contribution of this study is that it provides a complete picture of a complex phenomenon on an aggregate level. In our case, we have chosen to target on the aggregate level by getting information from the purchasing department of the customer firm and the suppliers associations. Their role suggests that they have adequate knowledge of details and the whole picture of their supplier network.

This thesis contributes not only in the area of empirical research but as well on the methodological part of thesis creation by extending the research conducted by abductive approach.

The research process was bounded by the limitations we have set in order to produce a complete report under the given conditions of time and data availability. Looking retrospectively on our thesis, we can see that what could have been done in a different way can be also a part of further research. The limitations of our study as well the findings can be a source of inspiration for future research in this field.

The extension of the researched period and the greater detail depend on the availability of data. Access to archival records and senior management of earlier periods would allow a quantitative study that would lead to discussion on the aggregate level, as we have done, or move to detailed investigation of specific issues.

In view of that, it would be extremely interesting to focus more on the data collection on the side of the suppliers and to conduct interviews with the supplier representatives. It will

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require conducting a lot of interviews in order to get a balanced picture. In the truck industry that we had in focus it would mean, there will be need to deal with the various types of suppliers starting by the local ones and going through regional to the global ones. At the same time the need to cover the cab, chassis, electrical, and vehicle dynamics suppliers will be necessary as their development is different.

Issues that were discussed in our thesis and can be the basis of research in the future are the degree of influence of firm specific and environment specific factors of change on its network and the interaction between them. Further elaboration in the change factors and their role, as well as the adoption of a firm specific perspective could possibly reveal aspects that were not conceived with our approach.

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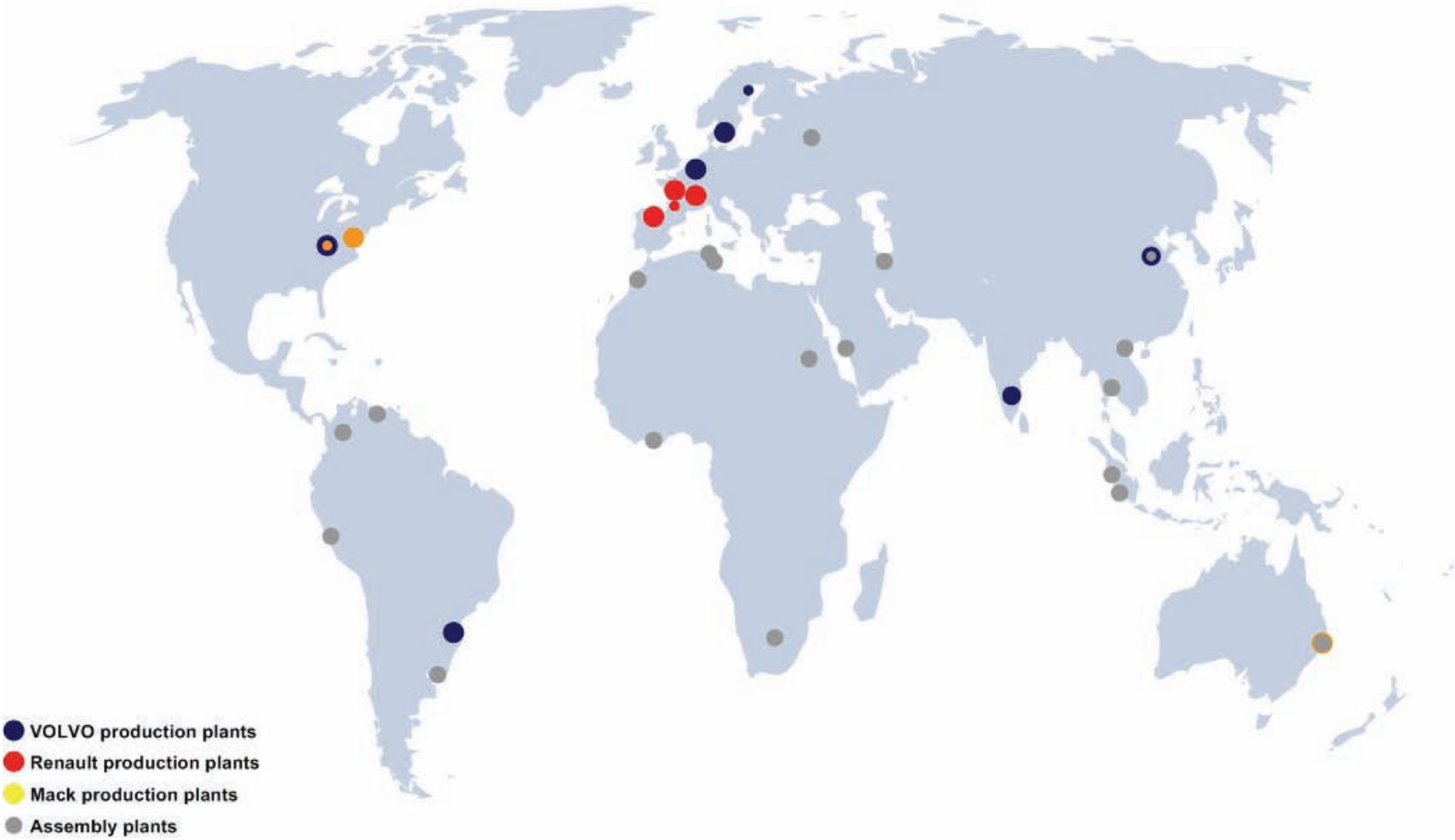
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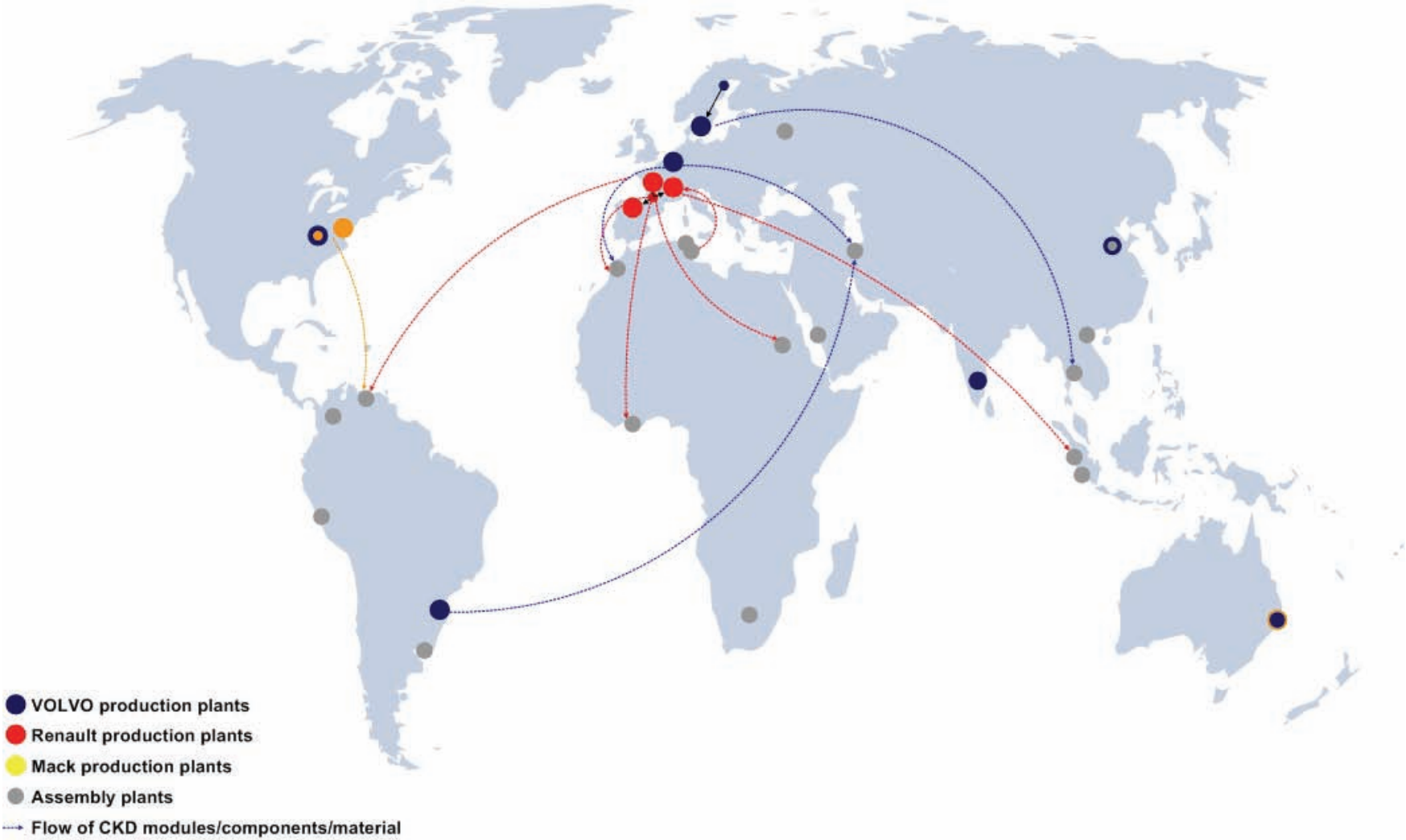
APPENDICES

Volvo operations 2004



Flow of CKD units from production plants to assembly plants for selected locations

Volvo operations 2004



VOLVO TRUCKS WORLD VEHICLE PRODUCTION- VOLVO HEAVY TRUCKS															
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	-	-	-	-	-	-	-	21 212	26 904	25 350	30 486	26 228	27 100	26 097	29 819
Brazil	-	-	-	-	-	-	-	5 082	4 793	3 361	4 555	4 590	4 833	5 600	8 382
Others	-	-	-	-	-	-	-	-	-	-	5 709	4 928	4 942	9 057	14 498
Sweden and others	-	-	-	-	-	-	-	13 661	15 147	15 438	17 861	16 850	17 438	17 606	18 964
USA/Volvo	-	-	-	-	-	-	-	20 765	29 022	35 429	23 395	12 857	14 299	17 079	25 637
USA/MAC	/	/	/	/	/	/	/	/	/	/	/	21 831	22541	18581	25 289
France ¹	/	/	/	/	/	/	/	/	/	/	/	39 680	38 577	36 384	40 153
Spain ¹	/	/	/	/	/	/	/	/	/	/	/	9 203	9145	9209	12 093
UK	-	-	-	-	-	-	-	2268	2930	2090	/	/	/	/	/
Others															
Russia	/	/	/	/	/	/	/	/	/	/	/	/	/	80	208
Asia												1 826	3231	6633	11825
Iran	-	-	-	-	-	-	-	898	664	415	-	850	2316	5660	9949
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	196	148	280	322
China	/	/	/	/	/	/	/	/	/	/	/	/	/	60	430
India	/	/	/	/	/	/	/	/	68	-	-	460	347	87	500
Malaysia								515	/	-	-	210	125	98	206
Thailand	/	/	/	/	/	/	/	/	/	/	-	110	195	448	418
Australia	-	-	-	-	-	-	-	665	643	696	-	-	782	1344	1221
Africa								871	725	370		1 091	925	1000	1244
Morocco	-	-	-	-	-	-	-	305	430	170	-	72	97	148	248
Tunisia	-	-	-	-	-	-	-	96	60	96	-	292	50	-	84
Botswana	-	-	-	-	-	-	-	470	235	76	-	554	620	852	912
South Afrika	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Egypt	-	-	-	-	-	-	-	/	/	28	-	173	158	/	/
Bogota	-	-	-	-	-	-	-	1660	1030	12	-	-	-	-	-
Pakistan	-	-	-	-	-	-	-	110	80	-	-	-	-	-	-

Based on Volvo AB Annual Reports, Volvo Trucks Annual Reports and Quaterly Reports