MASTER THESIS

“Business Process & Supply Chain Management – IB 3504”

“The Impact of TQM and Outsourcing on the Quality and Costs for OEMs in the Automotive Industry”

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ABSTRACT

MASTER THESIS – ADVANCED LEVEL, 15 ECTS CREDITS, VT 2008

SCHOOL OF MANAGEMENT AND ECONOMICS AT VÄXJÖ UNIVERSITY

BUSINESS PROCESS AND SUPPLY CHAIN MANAGEMENT – IB 3504

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TITLE

“The Impact of TQM and Outsourcing on the Quality and Costs for OEMs in the Automotive Industry”

BACKGROUND

The OEMs are facing fundamental changes. The importance of the quality of products in the automotive industry has changed to being exclusively dependent on the demand and sense of the customer. The OEMs have to react quickly on trends to fulfill the customer demands and be technically innovative. These innovations and intensity of their implication lead to a high cost pressure for the OEMs again. Therefore, the OEMs need to work together with their suppliers. Production strategies like TQM or outsourcing are known as the key to success. Although cost and quality management themselves are quite well-investigated in literature, and the use of both TQM and outsourcing are widely implemented in the OEMs’ strategies to improve quality and reduce costs, studies about the combination of TQM and outsourcing and their impact on quality and costs cannot be found. The wide spread opinion of managers is that quality and costs cannot support each other.

PURPOSE

In our Master Thesis we wanted to find out how quality and costs are related to each other to fulfill the given goals. The purpose was to examine the impact of the two common methods, TQM and outsourcing, on costs and quality for the OEMs. We
explored how the concepts interact and support costs and quality. Furthermore, the analysis states how these approaches are related within a supply chain and how automobile manufacturers can use both approaches to assure low costs and high quality at the same time.

**METHOD**

Our Master Thesis is a theoretical study based on a qualitative research method. We used scientific articles and literature for the theory and combined these in the analysis with the data and results from previous case studies as the empiric value. We combined this through the deductive approach. We not only used a positivistic view, but we also used a hermeneutic view due to the fact that analysis and conclusion incorporate both scientific articles and also personal interpretations.

**RESULTS AND CONCLUSION**

We concluded that precisely these two methods, outsourcing and TQM, supplement each other and fit together very well to assure the efficiency of the automobile OEMs with high quality and low costs at the same time. This is due to the fact that outsourcing is often used in companies and reduces the costs of OEMs; and TQM alone leads to quality improvements. Not only do they work well separately in companies, but outsourcing lays ideal foundations for an efficient TQM implementation.

**SUGGESTIONS ON CONTINUED RESEARCH**

We could not find any studies where these two approaches were researched in combination. Thus, one good future research could be to go on with empirical analyses about this theme in the automotive industry, for example by conducting surveys or interviews with OEMs. A case study about the combination of TQM and outsourcing could verify our mostly from the theory concluded results of the interrelation. A further deviation on the research could be that suppliers, instead of OEMs, could be the focus of the study.

**KEYWORDS**

Quality, and Quality Management; Costs, and Cost Management; Total Quality Management (TQM), and TQM in Automotive/Automobile Industry; Outsourcing, and Outsourcing in Automotive/Automobile Industry
ACKNOWLEDGEMENTS

First of all, we are grateful having Petra Andersson as our tutor and would like to thank her for the continuous consultation and guidance from the first day of our research. She had good advices and suggestions for us and came up with new ideas to improve our thesis more and more to provide the reader with an interesting and conclusive research work.

Furthermore, we would like to express thanks to our two opponents, Clémence Péry and Aurelia Chollet, as well as the other fellow students in our group, who gave us not only in the seminars support and reflections concerning our thesis. We appreciate their comments and are thankful for their suggestions and ideas which helped us a lot improving our thesis.

In the end, we would like to thank our examiner, Helena Forslund, who gave us extensive feedback and recommendations during the seminars, so that we were able to increase the precision of our research.

Thanks...

_Lorenz Heller_  _Tobias Quaing_  _Anna-Lena Zelfel_
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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ADAC</td>
<td>Allgemeiner Deutscher Automobilclub</td>
</tr>
<tr>
<td>AVSQ</td>
<td>Associazione nazionale dei Valutatori di Sistemi Qualità</td>
</tr>
<tr>
<td>COPQ</td>
<td>Costs of Poor Quality</td>
</tr>
<tr>
<td>COP3</td>
<td>Costs of Poorly Performing Processes</td>
</tr>
<tr>
<td>EAQF</td>
<td>Evaluation d'Aptitude à la Qualité pour les Fournisseurs</td>
</tr>
<tr>
<td>GM</td>
<td>General Motors</td>
</tr>
<tr>
<td>IATF</td>
<td>International Automotive Task Force</td>
</tr>
<tr>
<td>IQS</td>
<td>Initial Quality Study</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>JIT</td>
<td>Just in Time</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>QS</td>
<td>Quality Standard</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>SME</td>
<td>Small- and Medium-Sized Enterprises</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>Standard &amp; Poor’s 500 – Stock Market Index</td>
</tr>
<tr>
<td>TQM</td>
<td>Total Quality Management</td>
</tr>
<tr>
<td>TS</td>
<td>Technical Specification</td>
</tr>
<tr>
<td>VDA</td>
<td>Verband der Automobilindustrie</td>
</tr>
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1. INTRODUCTION

This chapter gives a general overview about our theme of the Master Thesis. First, the background presents information about the situation in the automotive industry and the importance of cost and quality management as well. We talked about the problem discussion which leaded to our research question. Finally, purpose and thesis disposition complete the introduction.

1.1 BACKGROUND

The automotive manufacturers called Original Equipment Manufacturers (OEM) are facing fundamental changes. The significance of quality has changed in the automotive industry over the past two decades. It is no longer just a statistical scorecard on freedom from defects or the measurement of fit and finish. The quality of a product is solely dependent on the demand and sense of the customer. (Juran, 2000) Quality management means the focused implementation of these customer needs into the technical language of the OEM’s production. The move from simple mass production to a more flexible customer orientated manufacturing strategy is the key to success. The OEMs have to react quickly to trends to fulfill the customer demands and be technically innovative. The numerous innovations and the intensity of their implication lead to a high cost pressure for the OEMs on the other hand. The manufacturers need to cooperate with their suppliers in the early phases of product planning and even in the R&D phase to handle these rising challenges of the market. The latest development shows that lean production is the key to success. That includes production strategies like Total Quality Management or Outsourcing.

An important tool, which is often understood as a main tool to cut cost, is outsourcing. But the latest development shows that outsourcing especially in the automotive industry has become mainly a strategic tool which should save costs, improve quality and make controlling the company much easier. Approximately only one third of a car’s value is created by the OEM itself on an average (Kleinhans & Dannenberg, 2004). And the trend will go on in the next decade. The impact of outsourcing on quality and costs is
therefore fundamental since two thirds of the cars are produced by 1st and 2nd tier suppliers.

The first largely dimensioned implementation of Total Quality Management was made by Toyota as a part of their lean production strategy. The concept of TQM is mainly used to improve the quality of the end product and to reduce deficiencies in the production which leads to cost reductions (Juran, 2000).

The use of both outsourcing and TQM are widely implemented in the OEMs’ strategies to improve quality and reduce costs. We wanted to find out how they are related to each other to fulfill the given goals.

1.2 Problem Discussion

Many scientists state that low costs and high quality are not compatible (Porter, 1990; Balachandran & Srinidhi, 1996; Nahmias, 2005). But there are also scientists like Juran or Deming who state that quality leads to lower costs. Although cost management and quality management themselves are quite well-investigated in theoretical literature, studies about the combination of TQM and Outsourcing for the interaction of cost and quality management cannot be found. The widely spread opinion of managers is that quality and costs cannot support each other. The reason for that is that quality is mainly understood as a customer related issue which raises the costs. (Deming, 2000) But according to Juran or Deming quality leads to lower costs. Juran argues that there are two critical meanings when it comes to the management of quality and costs. The first meaning refers to the “features of the product” which meet customer needs, and thereby provide customer satisfaction. A high level of quality in this sense usually leads to higher costs for the OEM. The second meaning is related to the “freedom from deficiencies” which means freedom from issues like errors that require doing work over again, customer dissatisfaction or customer claims. This kind of quality usually leads to lower costs and higher profitability. (Juran, 2000) Hence, there are two different approaches for the relation between costs and quality.

The relation between the two is certainly an important issue in the automotive industry. Several of the main OEMs like General Motors, Ford or Chrysler are facing quality and cost problems and struggle in a crisis which they can hardly solve, while other OEMs like Toyota or Honda operate highly profitable and provide a superior quality to the
customers. (Muller, 2006) There are several concepts to improve quality and cut costs. Outsourcing and Total Quality Management are two of them. But there are several pitfalls and the companies can make a lot of mistakes concerning these concepts. We wanted to find out how a company can find a way to balance a low cost production with a good quality simultaneously with the help of these two concepts. Outsourcing is widely understood as a cost saving concept, but it has also a great impact on the quality of the product (Quèlin & Duhamel, 2003) while TQM is known as a quality improving concept. But how does it affect the costs of the product? A typical attribute of the automotive industry is that OEMs with high quality products also have low costs because higher quality can mean lowering costs by reducing errors, rework and non-value added work (Juran, 2000). Poor quality leads to higher costs in general. The concept of TQM and Outsourcing should improve quality and save costs at the same time.

We chose the concepts of outsourcing and total quality management for three main reasons:

- First of all both are especially important in the automotive industry. TQM was first used a large dimension in the automotive industry and the outsourced value creation amount to 70% (Kleinhans & Dannenberg, 2002).
- The relation and interaction between these concepts is not well researched in literature, which gives us the possibility to find new approaches.
- The basics of these two concepts are very different. Outsourcing is not only part of a company strategy; it is also the well defined action of outsourcing processes to suppliers, while TQM is more or less a management philosophy concerning several issues inside the company.

The implementation of these two concepts should cut costs and improve quality. We wanted to find out if and how there is an interaction between outsourcing and TQM concerning the OEM’s cost and quality. Do they support each other or are they not compatible? Is there a connection at all? We wanted to analyze these problems with help of articles and data concerning the automotive industry and try to find the connection between TQM and outsourcing and their impact on costs and quality.
1.3 PROBLEM FORMULATION

Today’s firms have to consider and manage the whole supply chain to be competitive (Lee, 2001). Automobile OEMs outsource many parts of their manufacturing to gain cost and quality improvements. However, if something unforeseen happens to a supply chain partner the entire chain is affected by this problem. Moreover, the automotive industry, which we wanted to analyze, faces an outstanding tough competition. Nowadays, consumers expect lowest possible costs and highest possible quality at the same time. Today, this is the main challenge for automobile manufacturers. (Fawcett et al., 2000) Thus, the management needs to provide both high-quality and favorable vehicles, which is only achievable through quality improvements and cost reductions. The problem of handling costs and quality through TQM and outsourcing is presented in the next figure. At the same time, figure 1 presents the way we wanted to investigate this problem in our Master Thesis.

**Figure 1: Illustration of the Problem Formulation**

Our background and problem discussion led to our problem formulation.

“How is it possible for automotive companies to assure low costs and high quality at the same time by using Total Quality Management and Outsourcing?”

1.4 PURPOSE

By answering the research question this Master Thesis wanted to investigate the relations of costs and quality in the automotive industry, and how they interact. We
discussed two common methods in the automotive industry in detail – TQM and Outsourcing. We examined how these concepts support costs and quality, and how cost reductions and quality improvements can be achieved. Furthermore, the analysis states how these approaches are related within a supply chain and how automobile manufacturers can use both approaches to assure low costs and high quality at the same time. Moreover, besides our main goals we wanted to find questions for future empirical researches due to the fact that this is a theoretical master thesis.

1.5 Thesis Disposition

The figure below shows our disposition of all chapters we treated in the Master Thesis, and their influences on each other.

![Thesis Disposition Diagram](image)

**Figure 2: Thesis Disposition**

We started with the introduction to give a background and problem discussion for the thesis. Then we looked for an adequate way to find a theory for our thesis, which fitted our specific theme best. Searching for a suitable theory we read, understood and wrote the theory regarding our research question. Afterwards, we compared the theory with the case study theory to write the analysis. In the end, we came to our conclusion and gave some recommendations. This order of chapters and how we organized our thesis are represented by the black arrows. But the conclusion and recommendations were not only influenced by the analysis but also the introduction and the theoretical part. So, we wrote the conclusion based on the information we got from the first and the third part.
2. Methodology

This chapter constitutes an overview of the methodology we used for our Master Thesis. First, a discussion of the scientific and research approach is presented. Furthermore, we stated and explained the chosen data sources. Afterwards, the scientific credibility is described. The chapter ends with the timeframe for our Master Thesis.

2.1 Scientific and Research Approach

Ghauri and Gronhaug (2005) explain that research is fundamental for understanding even basic activities. Therefore, it is very important to know how to do research for gaining valuable results. It is essential to outline and give reasons for methodology used. A fundamental aim of methodology is the import and applicability of causal explanation as well as its relation to other forms of explanation and to understanding (Ekström, 1992). Hence, we stated the methods, paradigm and approaches of our Master Thesis in the subsequent paragraphs, starting with a comparison of the positivistic and the hermeneutic paradigm.

2.1.1 Positivistic vs. Hermeneutic Paradigm

The scientific paradigm was first discussed in detail by Thomas Samuel Kuhn in his book “The Structure of Scientific Revolutions” at the beginning of the 1960s. Gummesson (2000) defines the scientific paradigm as “the researcher’s perception of what one should be doing and how one should be doing it.”

Today, there are two main logical frameworks which are called the positivistic and the hermeneutic paradigm. Positivism is used by scientists who study a research question from an external point of view. The positivistic perspective only accepts knowledge if it is achieved by means of measurement and objective identification. (Gummesson, 2000)

The vantage point of the hermeneutics is the opposite of the positivism. Hermeneutic paradigm explains relationships through a more personal interpretative process. The table I compares and distinguishes between the positivistic and hermeneutic
perspective. Furthermore, table 1 presents our approach for the Master Thesis.

(Gummesson, 2000)

<table>
<thead>
<tr>
<th></th>
<th>Positivistic Paradigm</th>
<th>Hermeneutic Paradigm</th>
<th>Our characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research aim</strong></td>
<td>Research concentrates on description and explanation.</td>
<td>Research concentrates on understanding and interpretation.</td>
<td>Research focuses on description, understanding and interpretation.</td>
</tr>
<tr>
<td><strong>Scope</strong></td>
<td>Well-defined, narrow studies.</td>
<td>Narrow as well as total studies (holistic view).</td>
<td>Narrow and holistic study.</td>
</tr>
<tr>
<td><strong>Vantage point</strong></td>
<td>The vantage point is primarily deductive; thought is governed by explicitly stated theories and hypotheses.</td>
<td>The vantage point is primarily inductive; researcher's attention is less focused and is allowed to &quot;float&quot; more widely.</td>
<td>Primarily deductive research.</td>
</tr>
<tr>
<td><strong>Generalization or concretion</strong></td>
<td>Research concentrates on generalization and abstraction.</td>
<td>Research concentrates on the specific and concrete (&quot;local theory&quot;) but also attempts generalizations.</td>
<td>Concentration on specific (automotive industry) but also attempts generalization.</td>
</tr>
<tr>
<td><strong>Objectivity or subjectivity</strong></td>
<td>Researchers seek to maintain a clear distinction between facts and value judgments; search for objectivity.</td>
<td>Distinction between facts and value judgments is less clear, recognition of subjectivity.</td>
<td>We tried to maintain a clear distinction between facts and value judgment.</td>
</tr>
<tr>
<td><strong>Use of approaches and pre-understanding</strong></td>
<td>Researchers strive to use a consistently rational, verbal, and logical approach to their object of research.</td>
<td>Pre-understanding that often cannot be articulated in words or is not entirely conscious-tacit knowledge-takes on an important role.</td>
<td>We strived to use a consistently rational, verbal, and logical approach to our research object.</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>Statistical and mathematical techniques for quantitative processing of data are central.</td>
<td>Data are primarily non-quantitative.</td>
<td>We mainly used non-quantitative data.</td>
</tr>
<tr>
<td><strong>Researchers' position</strong></td>
<td>Researchers are detached – i.e. they maintain a distance between themselves and the object of research; take on the role of external observer.</td>
<td>Both distance and involvement; researchers are actors who also want to experience what they are studying from the inside.</td>
<td>We wanted to take on the role of external observers.</td>
</tr>
<tr>
<td><strong>Science or experience</strong></td>
<td>Distinction between science and personal experience.</td>
<td>Researchers accept influence from both science and personal experience; they use their personality as an instrument.</td>
<td>We wrote a scientific thesis; we tried to avoid the influence of personal experience.</td>
</tr>
<tr>
<td><strong>Emotionality</strong></td>
<td>Researchers try to be emotionally neutral and make a clear distinction between reason and feeling.</td>
<td>Researchers allow both feelings and reason to govern their action.</td>
<td>The thesis was written emotionally neutral; nevertheless, feelings might have an influence.</td>
</tr>
<tr>
<td><strong>Epistemology</strong></td>
<td>Researchers discover an object of research external to themselves rather than &quot;creating&quot; the actual object of study.</td>
<td>Researchers partially create what they study, for example, the meaning of a process or a document.</td>
<td>General approaches were used to study a specific object.</td>
</tr>
</tbody>
</table>

**Table 1**: Positivistic, hermeneutic and our paradigm (Gummesson, 2000)

The table illustrates not only a comparison of positivistic and hermeneutic research but also our procedural method. There you can see that our research has some congruencies with both approaches. Hence, it was very difficult to differentiate strictly between both research methods. We tried to investigate the research question from an external point
of view. Nevertheless, the analysis and conclusion were also characterized by personal interpretations. Furthermore, the knowledge was not achieved through measurement. However, we mainly used scientific articles to gather a theoretical basis. In conclusion we did not want to decide in favor of one or another paradigm due to the fact that we used parts of both approaches.

2.1.2 DEDUCTIVE AND INDUCTIVE APPROACHES

This Master Thesis relates theoretical knowledge and practical activities in real world with each other. Generally, two different research approaches are used. These are the deductive and inductive approach.

Gummesson (2000) defines the deductive approach as a process starting with existing theories and concepts to formulate suitable hypotheses which are tested. The vantage point of this research method is received theory. Thus, the deductive approach is mainly used for testing existing theories. Conclusions are drawn through logical reasoning. (Ghauri & Gronhaug, 2005)

On the other hand, the inductive approach starts with real-world data. From this empirical starting point researchers develop theories, models and concepts. Hence, this research primarily generates new theories. (Gummesson, 2000) Ghauri and Gronhaug (2005) state that the inductive approach draws general conclusions and these conclusions are the result of a process which starts with assumptions. The next figure visualizes the deductive and inductive procedure for an easy understanding.

![Diagram of Deductive and Inductive Approaches](image)

**Figure 3: Comparison of Deductive and Inductive Approach (Alvesson & Sköldberg, 2000; Ghauri & Gronhaug, 2005)**

Concerning this research we excluded the inductive approach due to the fact that this is a theoretical thesis. When we decided on our field of research we started to gather a
suitable theory and model for this theme. This theory was used to solve a problem which occurs in real business life. Our vantage point was the gathered theory. From this, we tested the relation between TQM and outsourcing in the automotive industry and how these approaches affect costs and quality. The results were achieved through logical reasoning. These features characterize the deductive method used for our Master Thesis.

2.1.3 Qualitative vs. Quantitative Approach

Researchers distinguish between two approaches to information gathering, namely qualitative and quantitative research. Generally, both methods can be used for data collection and researches. (Gummesson, 2000)

The qualitative research focuses on understanding social and human problems. This narrative-orientated approach is based on a complex and holistic picture which mainly gains information, feelings, thoughts and experiences through verbal communication. Primarily, qualitative research is a subjective analysis which does not focus on numbers and statistics. (Gummesson, 2000; Creswell, 1998)

Then again, the quantitative approach is also an investigation of social or human problems. But this research is mostly based on testing theories with the help of numbers and statistical methods. This mathematical procedure assesses whether the general hypotheses and theories are true or not. (Gummesson, 2000; Creswell, 1998)

Neuman (2003) presents a good comparison of qualitative and quantitative research which facilitates the understanding. The following table shows this comparison.
Qualitative Research | Quantitative Research
---|---
Capture and discover meaning once the researcher becomes immersed in the data. | Test hypothesis that the researcher begins with.
Concepts are in the form of themes, motifs, generalizations, and taxonomies. | Concepts are in the form of distinct variables.
Measures are created in ad hoc manner and are often specific to the individual setting or researcher. | Measures are systematically created before data collection and are standardized.
Data are in the form of words and images from documents, observations, and transcripts. | Data are in the form of numbers from precise measurement.
Theory can be causal or non-causal and is often inductive. | Theory is largely causal and is deductive.
Research procedures are particular, and replication is very rare. | Procedures are standard, and replication is assumed.
Analysis proceeds by extracting themes or generalizations from evidence and organizing data to present a coherent, consistent picture. | Analysis proceeds by using statistics, tables, or charts and discussing how what they show relates to hypotheses.

**Table 2: Comparison of Qualitative and Quantitative Research**
*(Neuman, 2003)*

We did not use statistical or mathematical methods for our Master Thesis. Furthermore, we used general theoretical methods and models to gain valuable information. We saw ourselves as external observers of a theoretical problem with a practical background and tried to create good solutions for this problem. Although we tried to stay objective, our research has subjective parts when it comes to the analysis and conclusion. Hence, we would rather say that our Master Thesis is a qualitative research.

**2.2 Data Sources**

It is important to use right and suitable data to write a well-structured and thoughtful thesis. We tried to search for and use the best possibilities for reaching the quality standards with our thesis. There are two different ways of collecting data for writing a thesis; the *primary* or as it is called the empirical data collection and the *secondary* or theoretical one.

Primary data collection is based on first-hand, original and new information that you get from an interview partner or answers of surveys, the empirical data. Secondary or theoretical literature only exists in books or articles which were collected by persons who investigated the theoretical solutions for their own purposes. Their purposes can be different from ours. *(Ghauri & Gronhaug, 2005)*
Many academics suggest starting all researches with secondary data sources (Ghauri & Gronhaug, 2005). We used books and scientific articles in journals. We found most of the books used in the library of the Växjö University, but we also used our German Universities in Osnabrück, Oldenburg and Berlin. Books are good sources for the relevant theory and for general information about logistics and supply chains, or in our case about quality, cost, TQM and outsourcing. We found some books in the Växjö library concerning the theme TQM, but we had some difficulties to find the suitable books for the theme outsourcing.

Another and more uncomplicated search of secondary data was to look for scientific articles or journals in different databases. It was very easy because we could go almost everywhere on the Internet for searching for English and German articles. We found most of the articles, all written in English, at databases such as ELIN or Ebrary. We searched for the following keywords: Quality and Quality Management, Costs and Cost Management, Total Quality Management, and TQM in the automotive/automobile industry, Outsourcing, and Outsourcing in the automotive/automobile industry. We also searched for TQM and Outsourcing in the automotive/automobile industry. But we had no success to find any suitable article. One more good secondary data source was the Internet. It was not only good for using databases, especially for latest articles; on the Internet we also found some useful and helpful websites which gave us some interesting and important information. The internet can also help to get more background information and knowledge of companies or for the problem research.

Sometimes secondary data already provide enough information to answer research problems and questions. In a case like that there is no need to search for primary data, such as in our case. We wrote a theoretical thesis; therefore, we did not use primary or empirical data as it is defined in the theory. We also used the secondary data and the Internet to illustrate our information in the analysis. We searched for and found previous journals, articles and case studies about TQM and Outsourcing in Automotive Industry. We used their data, outcomes and results with the theory and our ideas for the analysis.

2.3 Scientific Credibility

Scientific credibility is essential for the evaluation of relevant data within an academic work. It implies two basic perspectives, namely reliability and validity. According to
Yin’s theories a study should be tested according to four tests which will judge the quality of a study (Yin, 2003). Therefore the basic perspective validity is subdivided into construct, internal and external validity. The following paragraph explains how our thesis is related to the four tests.

2.3.1 RELIABILITY

Reliability aims at minimizing measurement failures as well as research prejudices in the course of a scientific study (Yin, 2003). The reliability of this Master Thesis was obtained due to the use of scientific books and articles in our theoretical chapter. The most of the sources we used for our thesis have been up-to-date but we also used classical theories, which were still topical.

2.3.2 CONSTRUCT VALIDITY

Construct validity deals with the operational measures of the concept being studied (Yin, 2003). We used different sources of evidence at different levels to make sure that our study’s construct is valid. According to Yin multiple sources of evidence should be used to ensure validity (Yin, 2003). Hence, we used different theoretical views from several authors. These theoretical approaches which are mainly based on literature and scientific articles were used to analyze the impact of TQM and outsourcing on the automotive industry.

2.3.3 INTERNAL VALIDITY

Internal validity deals with the inferences drawn from causal or explanatory case studies (Yin, 2003). Internal validity is a test for causal studies which try to determine whether event X led to event Y. As this Master Thesis was a descriptive and exploratory study, we did not use this test for our theoretical thesis.

2.3.4 EXTERNAL VALIDITY

External validity deals with the question whether a study can be generalized beyond the immediate case study (Yin, 2003). The aim therefore was to know if the findings of this research could be generalized. The thesis was based on theories and models which also had a generalizing character. Hence, the findings of the thesis concerning the approach
of outsourcing and TQM were significant for the automotive industry from the OEM’s point of view.

2.4 SUMMARY

To sum up, we gave an overview of the methodology used for our theoretical Master Thesis.

Study Method: Theoretical study
Scientific Paradigm: Mixture of positivistic and hermeneutic
Scientific Approach: Deductive
Research Method: Qualitative
Data Collection: Secondary
Scientific Credibility: Use of scientific articles and literature

2.5 TIMEFRAME

<table>
<thead>
<tr>
<th>Activity</th>
<th>Week 14</th>
<th>Week 15</th>
<th>Week 16</th>
<th>Week 17</th>
<th>Week 18</th>
<th>Week 19</th>
<th>Week 20</th>
<th>Week 21</th>
<th>Week 22</th>
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<td>Theory</td>
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<td>Conclusion</td>
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<td>Final Improvements</td>
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3. Quality and Costs

The third chapter of this Master Thesis is about the theoretical part “Quality and Costs”, where we created a uniform knowledge through definitions, explanations, and models relevant to our topic. This chapter is the basis for the further theoretical discussion of TQM (chapter 4) and Outsourcing (chapter 5).

3.1 Quality

Figure 4 illustrates the proceeding of the quality chapter. We defined the term quality and quality management. Thereby, we talked about the “Juran Trilogy” as a quality improvement process, which is similar in almost every company. Furthermore, this chapter includes a paragraph about quality in the automotive industry where we stated the importance of quality to meet customer expectations and quality standards as well.

Figure 4: Procedure of the Quality Chapter
3.1.1 Definition of Quality

Quality is a very spacious term which is used for several meanings. Hence, it was important to explain the expression we used in this Master Thesis. The expression costs are often used while talking about quality. A German phrase which is called “Quality has its price” is very often used. Many scientists and especially end-costumers think that quality is always expensive. (Balachandran & Srinidhi, 1996; Nahmias, 2005) However, everything depends on the point of view (Adam et al., 1997).

We would like to distinguish two types of quality. One quality term is more seen from the customers’ perspective and the other expression is the manufacturers’ point of view of quality. Juran (2000) presents two suitable definitions for our investigation.

“Quality means those features which meet customer needs and thereby provide customer satisfaction. […]” (Juran, 2000)

This quotation describes the customers’ point of view of quality. It is very subjective and every end-user might have a different understanding of quality. Nevertheless, it is very important for companies to know and fulfil customers’ quality expectations to stay profitable. Quality in this case concerns the product’s overall ability to perform required functions. This quality definition often means for companies to provide more expensive goods. (Juran, 2000)

The second definition must be seen from manufacturers’ perspective.

“Quality means freedom from deficiencies – freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, customer claims, and so on. […]” (Juran, 2000)

This perspective is rather objective. There are different methods to measure the quality, for example warranty charges or amount of rework. This definition tends to production and process quality which means that higher quality is usually linked with less costs. (Juran, 2000) It is important for automobile companies to achieve both quality definitions to be competitive in a very tough market.
### 3.1.2 Definition of Quality Management

The roots of quality management are in Japan during the 1950s. Since the 1990s this issue is very important for companies. Today, quality management is a main subject to be competitive in global markets. Quality management is a philosophy that encompasses many activities concerning the fulfillment of customer and organization expectations. An approach which is used by many automotive companies is “Total Quality Management” which we explained in detail in chapter 4 (Stashevsky & Elizur, 2002)

Almost every automobile company uses the guidelines of “International Organization for Standardization” to manage its quality issues. The ISO 9000 series from the year 2000 is responsible for quality concerns. It provides a collection of guidelines which are international accepted for good quality management practices. These standards define eight quality management principles to improve firms’ performance which are presented in table 3. (www.iso.org)

<table>
<thead>
<tr>
<th>Principle</th>
<th>Customer focus</th>
<th>Leadership</th>
<th>Involvement of people</th>
<th>Process approach</th>
<th>System approach to management</th>
<th>Continual improvement</th>
<th>Factual approach to decision making</th>
<th>Mutually beneficial supplier relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle 1</td>
<td>Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.</td>
<td>Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.</td>
<td>People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.</td>
<td>A desired result is achieved more efficiently when activities and related resources are managed as a process.</td>
<td>Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.</td>
<td>Continual improvement of the organization's overall performance should be a permanent objective of the organization.</td>
<td>Effective decisions are based on the analysis of data and information.</td>
<td>An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.</td>
</tr>
</tbody>
</table>

**Table 3**: ISO 9000:2000 Principles for Quality Management (www.iso.org)
The ISO verification stands for quality excellence and automobile companies expect that all their supply chain partners meet these standards. (www.quality.de/lexikon) Nowadays, the automotive OEMs are parts of big supply chains. A lot processes are done by partners and this trend will be going on in the next years like a Mercer Management Consulting study based on industry interviews, data analysis and economic modeling concludes. The OEMs will only produce that part of the car which is valuable for them. Hence, the supply chain management and especially quality issues become more and more important. Bandyopadhyay and Sprague (2003) present another adequate definition of quality management in a supply chain. “Supply chain quality management encompasses all activities associated with the flow and transformation of goods from raw material stage through the end users (finished product) stage along with flow of all information related to quality.” (Bandyopadhyay & Sprague, 2003)

A basic model for quality management and process improvement is devised by Joseph M. Juran who was a guru and co-founder in the area of quality management. This competent person is the eponym for “The Juran Trilogy”. (Godfrey & Kenett, 2007; Nahmias, 2005)

Juran’s Trilogy is a simple but notwithstanding complete model for managing quality. This management system should guarantee the production of ideal product features and minimum deficiencies at lowest possible costs (De Feo & Barnard, 2004). It has three major processes which are quality planning, control, and improvement. All three processes are interrelated like the next figure visualizes. (Godfrey & Kenett, 2007; Juran, 2000)

**Figure 5:** Interrelation of Juran’s Trilogy (www.6sigmatech.com)
The first component of “The Juran Trilogy” is quality planning. This structured process focuses on developing innovative products and meeting customer needs. For instance, this process requires automotive engineering and related activities for designing new cars. The quality planning process combines several steps. Automobile companies need to identify customers and target markets. They have to discover customer expectations and needs. In addition, these needs must be translated into product requirements, for example meeting standards. Furthermore, the developed automobile should exceed customers’ needs. The developed processes should create the car in the most economical way. Finally, these ideas and plans must be transferred into action. (Juran, 2008; De Feo & Barnard, 2004; Juran, 2000) Quality control is the second process of “The Juran Trilogy”. This universal managerial process meets objectives during operations. Main elements of this control process are the evaluation of actual performances, comparison of these performances to goals and standards, and then reaction on bad differences. (Godfrey & Kenett, 2007; Juran, 2008; De Feo & Barnard, 2004; Juran, 2000) The third trilogy element is the quality improvement process. A synonym for improvement is breakthrough which is also used by many authors (Juran, 2000). Here, the automotive company uncovers and identifies roots of existing problems. If the company knows the roots of the problem it can manage and change the causes. Furthermore, the manufacturer can install control systems to avoid these product and process problems for the future. (Juran, 2008; De Feo & Barnard, 2004; Juran, 2000) Table 4 summarizes the elements of “The Juran Trilogy”.

<table>
<thead>
<tr>
<th><strong>Quality Planning</strong></th>
<th><strong>Quality Control</strong></th>
<th><strong>Quality Improvement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish quality goals</td>
<td>Evaluate actual performance</td>
<td>Prove the need</td>
</tr>
<tr>
<td>Identify who the customers are</td>
<td>Compare actual performance with quality goals</td>
<td>Establish the infrastructure</td>
</tr>
<tr>
<td>Determine the needs of the customers</td>
<td>Act on the difference</td>
<td>Identify the improvement projects</td>
</tr>
<tr>
<td>Develop product features that respond to customers’ needs</td>
<td></td>
<td>Establish project teams</td>
</tr>
<tr>
<td>Develop processes able to produce the product features</td>
<td>Provide the teams with resources, training, and motivation to diagnose the cause and stimulate remedies</td>
<td></td>
</tr>
<tr>
<td>Establish process control; transfer the plans to the operating forces</td>
<td>Establish controls to hold the gains</td>
<td></td>
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</table>

**Table 4**: “THE JURAN TRILOGY” PROCESSES (JURAN, 2000)
3.1.3 Quality Standards in the Automotive Industry

The automotive industry has many quality standards, for example the principles of “International Organization for Standardization” which were briefly mentioned in chapter 3.2. Due to the fact that the people love their cars there are many organizations which pay attention to concerns of drivers. Moreover, the politics control many quality standards in automobile business. But the big organizations, for example the German “ADAC”, have much influence on political decisions. Juran (2000) states that external factors concerning quality in the automotive industry have increased in the last decades; for instance, growing customer activism, safety expectations, product liability, government regulation, and rising of environmental issues. (Juran, 2000)

Besides, many laws for the automobile business concerning environmental friendliness, safety issues and so on which we do not discuss in detail, there are the ISO-9000 quality standards which are principles for every company. For the automotive industry this standard were amplified and is called QS-9000/ISO-9000. These quality system requirements contain general standards of, for example, Ford and GM for their suppliers. This standard harmonization eases suppliers to work together with several automobile companies. Hence, the suppliers do not have to achieve different requirements of different companies. (Bandyopadhyay & Jenicke, 2007; www.quality.de/lexikon) Nevertheless, the standardization was not harmonized enough for the automotive industry. Therefore, there is a third approach which combines and replaces older ISO principles as well as QS-9000 and is accepted by all big automotive manufacturers. These standards are named ISO/TS-16949:2002 and are often referred to as TS-2. (Willem, 2004; Stundza, 2005; www.ts16949.com; www.quality.de/lexikon)

Since 2002, the TS-16949 conjoins all world-wide existing standards, for example QS in the US, VDA 6.1 in Germany, EAQF in France, AVSQ in Italy. The launch of TS-2 traces back to the “International Automotive Task Force” (IATF) which is a group of car manufacturers. Since 2007, TS-2 replaces previous standards and must be achieved by OEM suppliers worldwide. (Willem, 2004; Stundza, 2005; www.ts16949.com; www.quality.de/lexikon)

The TS-2 certificate of suppliers is the quality assurance for automobile OEMs. However, TS-2 is not only for direct suppliers but also for upstream supply chain partners. The standard consist of requirements for the strategic business-planning,
continuous improvements, stable process capability, less variance and waste in the
supply chain, and value chain optimization. Furthermore, the suppliers must implement
procedures for compliance with regulations and staff motivation. Compliance with these
standards is tested to guarantee expected quality levels. (Willem, 2004; Stundza, 2005;
www.ts16949.com; www.quality.de)

Suppliers have to invest a lot of time, energy and money to meet these standards. For
many suppliers it is a high burden to stay a supply chain partner for the big automobile
OEMs. But, from the OEM and supply chain point of view these standards guarantee
high quality for end-customers and favorable prices. For instance, OEMs do not have to
inspect receiving material in detail due to the fact that the quality is guaranteed.
However, what exactly are the benefits of TS-2? The “International Organization for
Standardization” expects several benefits of the harmonization of TS-2 requirements
which are presented below (Willem, 2004; Stundza, 2005; www.ts16949.com;
www.quality.de/lexikon):

- Increased confidence in global sourcing
- Increased confidence and value in the ISO registration process
- Improved product and process quality
- Reassignment of supplier resources to quality improvement
- Global quality system throughout the supply chain
- Consistent supplier/subcontractor quality development
- Reduction of multiple second- and third-party audits

3.1.4 Importance of Quality in the Automotive Industry

Quality is a very important issue for customers of the automotive industry to be satisfied
and only satisfied consumers are good customers. Thereby, satisfaction results through
cognitive comparison of perceived performance with pre-purchase expectations.
Satisfied consumer are very important due to the fact that satisfaction leads to increased
loyalty, reduced price elasticity, increased cross-buying, and especially positive word of
mouth. These results are major premises for a successful and profitable future. (Matzler
et al., 2004; Anderson & Mittal, 2000)

But how is satisfaction attainable through qualitative automobiles? First, we must
consider the term quality for customer in detail. In chapter 3.1 we defined to kinds of
quality. Here we talk about the quality, which meets customer needs and provide satisfaction (Juran, 2000).

If automobile OEMs meet or exceed the customer expectations the consumer would be satisfied. An even better result is if the customer is delighted which means that customers’ response is more positive and more emotional than simply excellent. (Berman, 2005) Until now, customer satisfaction has been seen as higher perceived car quality leads to higher customer satisfaction. However, it is not automatically the case that fulfillment of individual product requirements implies a high level of customer satisfaction. It is rather the case that the type of requirement defines the perceived product quality and therefore also customer satisfaction. (Matzler et al., 1996)

The first step to customer satisfaction or even delight is that OEMs must know customers’ expectations and needs to fulfill or exceed them. In figure 6 you see one possibility to investigate quality needs. If the automobile company knows what to ask it can investigate customer expectations through questionnaires and interviews. Equally important is afterwards the evaluation and interpretation of responses to understand and identify customer needs. (Matzler et al., 1996)

![Diagram](image)

**Figure 6: Identify Customer Expectations (Matzler et al., 1996)**

Quality attribute results are often categorized in three groups, which are basic factors, performance factors, and excitement factors. Every quality category has different impact on customer satisfaction. Thereby, customers presuppose basic factors. If basic requirements are not fulfilled customers are dissatisfied. Another characterization is that
the fulfillment does not lead to satisfaction because these features are basic requirements. Furthermore, the failure to perform has a greater negative impact on customer satisfaction than the positive effect of fulfillment. For instance, basic quality requirements could be stainless steel or on time delivery. However, requirements are different from customer to customer. (Matzler et al., 2004)

The second group, performance factors, is characterized by a linear and symmetric satisfaction relationship. High quality performance results in customer satisfaction and if the quality appearance is low customers are dissatisfied. (Matzler et al., 2004)

The third category is excitement factors which generates delight through unexpected and surprising quality. As a result, customers are satisfied while the impact of non-fulfillment does not lead to dissatisfaction. The positive performance has much more impacts on customer satisfaction. (Matzler et al., 2004)

To sum up, basic quality factors need to be fulfilled by automobile manufacturers. If basic requirements are performed excitement factors and performance factors can lead to satisfaction. Due to the fact that performance requirements directly lead to customer satisfaction it is important for the automotive industry to meet these needs. Excitement factors can be seen as extra benefit if both other categories are achieved. Consequently, if automobile companies are successful to satisfy customers they built up the basis for a profitable future. (Matzler et al., 2004; Anderson & Mittal, 2000)

3.2 Costs

Chapter 3.2 includes definitions and explanations of costs and cost management. We talked about two different cost meanings. First, there is a chapter we called permanent costs of quality, but then we also explained the “Costs of Poor Quality”, which even has a higher significance for automobile OEMs due to the fact that these costs are unnecessary. The following figure visualizes the procedure of the cost chapter.
3.2.1 Definition of Costs

The term cost is like quality a very spacious expression with several meanings. Hence, there are different definitions of costs. We wanted to specify two cost definitions. In 3.2.1.1 we wanted to talk about permanent costs of quality where we present a very common perspective of costs. The second cost definition deals with the subject of costs of poor quality, which is very important to talk about when talking about quality and costs.

3.2.1.1 Permanent Costs of Quality

This chapter is called “Permanent Costs of Quality” because we talked about a very common cost term, which is quite stable and used by many people for a long time. A cost definition of this overall perspective is:

Costs are “*something of value, usually an amount of money, given up in exchange for something else, usually goods or services. All expenses are costs, but not all costs are expenses. (An expense is the cost of resources used to produce revenue.*)” (www.investordictionary.com)
According to this definition, costs have a corresponding counter value. For instance, raw materials, salary and wages, depreciation and amortization of fixed assets, interests, and taxes are costs for an automobile manufacturer. If the price is higher these costs are often associated with better quality. It means that, for example, a raw material could be more expensive than another one because it is easier to work with (“better quality”) or an experienced employee gets more salary than an unskilled worker. Moreover, you can distinguish between direct costs (for example material costs) and overhead costs (for example lease costs). (www.lexikon.meyers.de; Nahmias, 2005)

3.2.1.2 Costs of Poor Quality

Costs of Poor Quality (COPQ) are costs that are unnecessary. Some scientists refer to quality deficiencies, quality costs (Juran, 2000) or Costs of Poorly Performing Processes (COP³) (De Feo & Barnard, 2004) while talking about COPQ. We stay using the expression COPQ. COPQ can be visible or hidden. Hence, quality related costs are much bigger than most companies expect. 15% – 40% of companies operating expenses are caused by these deficiencies (De Feo & Barnard, 2004; Juran, 2000). These costs raise the price for an automobile while quality does not increase. It is rather the case that if the quality can be increased the costs decrease. These with deficient manufactured products associated costs would disappear if everything were running perfect. (De Feo & Barnard, 2004; Juran, 2000)

Juran defines COPQ as “the costs of unplanned, unnecessary waste” (De Feo & Barnard, 2004). If these costs are identified it is possible for automobile companies to work against these theoretically unnecessary expenses. Hence, the companies can improve the quality through this procedure and save money at the same time.

In theory COPQ are categorized in three or four groups. For our Master Thesis we chose three subcategories, failure costs, appraisal costs, and prevention costs, which are discussed in the next chapters. (De Feo & Barnard, 2004; Juran, 2000) The following figure provides a very good overview of visible and hidden costs of poor quality. The explicit costs are presented and discussed in the next chapters. (De Feo & Barnard, 2004)
Figure 8: Costs of Poor Quality (De Feo & Bernard, 2004)

Failure Costs

The failure costs are divided in two parts, the internal and external failure costs.

Internal Failure Costs

Internal failure costs occur within the company before the customer receives the product (www.successthroughquality.com; Juran, 2000). These deficiencies take place because of non-fulfillment of explicit requirements or implicit needs of end-users. Furthermore, inefficiencies and avoidable process losses count to this group of costs. If no deficiencies occur these costs would not exist. Examples for the non-fulfillment of customer requirements and needs are scrap, rework, lost or missing information, failure analysis, redesign of hardware and software, downgrading and so on. For instance, unplanned downtime of equipment, inventory shrinkage, variation of product and process characteristics, and non-value-added activities are costs of inefficient internal processes. (Juran, 2000; Giakatis & Rooney, 2000)

External Failure Costs

External failure costs are costs associated with deficiencies, which occur after the product, or automobile is delivered to the customer (www.successthroughquality.com;
De Feo & Barnard, 2004; Juran, 2000). Lost opportunities for sales revenues also count to this group of failure costs. Like the internal failure costs all these costs would not occur if the automobile company produces without deficiencies. (Juran, 2000) This category is one of most important deficiencies when talking about COPQ (Miguel & Pontel, 2004) and the most expensive one to correct (De Feo & Barnard, 2004). The customers directly experience the poor quality and thus it is expensive and difficult to regain customers’ trust by OEMs. Warranty charges, complaint adjustment, returned material, allowances, and penalties due to poor quality are external failure examples of the non-fulfillment of customer expectations and needs. Examples for lost opportunities for sales revenues are customer defections, new customers lost due to poor quality and the lost of new customers due to lack of capability to meet consumer needs. (Juran, 2000; De Feo & Barnard, 2004; Giakatis & Rooney, 2000)

**Appraisal Costs**

Appraisal costs are costs for product quality audits through testing and inspection (www.successthroughquality.com). These costs occur if the degree of conformance to quality requirements is determined (Juran, 2000). On the one hand, these costs are spent to avoid higher costs through failure later on and thus seem to be necessary. Appraisal activities are involved because companies expect to find deficiencies. But, on the other hand, these costs are not necessary if the receiving products are free from defects. Therefore, these costs are unnecessary and can be reduced through quality standards like TS-2. (Juran, 2000; De Feo & Barnard, 2004) Examples of appraisal costs are incoming inspection and test, in-process inspection and test, document review, product quality audits, and evaluation of stocks. (Juran, 2000; Giakatis & Rooney, 2000)

**Prevention Costs**

Prevention costs do not necessarily count to COPQ. However, according to Juran (2000) we subdivide prevention costs under COPQ. These costs incurred to keep failure and appraisal cost to a minimum (www.successthroughquality.com; Juran, 2000). Prevention costs are raised for special planning, review, and analysis activities for quality. Although these expenses are a good investment to reduce subsequent costs the costs are unnecessary if products and processes are free from deficiencies. Examples for prevention costs are quality planning, new-products review, process planning and control quality audits as well as trainings. Activities like product and process design or
customer service do not count to prevention costs. (Juran, 2000; Giakatis & Rooney, 2000)

There is a theoretical optimal point of cost of poor quality due to the fact that COPQ cannot be avoided at all in practice. The following figure visualizes the relation of failure costs and appraisal and prevention costs. (Juran, 2000)

![Figure 9: Theoretical Optimal COPQ (Juran, 2000)](image)

**Figure 9: Theoretical Optimal COPQ (Juran, 2000)**

Figure 9 shows the theoretical optimal point of quality performance. If prevention and appraisal costs were higher the failure costs would be lower. The “Total Quality Costs”-graph combines all costs. The optimal quality performance would be at the bottom point of this graph. Furthermore, automobile companies should try to move this optimal point to the right and thus reduce the costs. This would be possible if on the one hand failure costs are reduced and on the other hand prevention and appraisal costs decrease due to better quality like it is explained in previous chapters. (Juran, 2000)

### 3.2.2 Definition of Cost Management

Cost management is still very important in today’s companies. The tough competition in the automotive industries causes a giant cost pressure for automobile OEMs. Hence, the manufacturer goal is still to “reduce costs” (Anklesaria, 2008) because revenues minus costs equal profit and profit is what OEMs want to increase. Nevertheless, cost management must be seen together with other managerial procedures, for example quality management. Nowadays, quality is as important as low costs and the definition of costs explains that quality can even cut costs. (Anklesaria, 2008)
Nowadays, the expression cost management is widely used although it is not a well-defined term. Cost management implies cost accounting and management accounting. The goal is to increase and maximize the company’s profit. Therefore, the cost management tries to control and improve products, processes, and activities. Cost management, like other management approaches, strives to increase customer value and decrease costs of products and services. It is closely related to quality management due to the fact that both methods want to reduce unnecessary costs, for example COPQ. One theoretical method to cut costs and increase quality is called outsourcing. Total quality management seems to focus on quality on the first view. But nevertheless, TQM also considers costs issues due to the fact that higher quality can reduce costs (Juran, 2000; Deming, 2000). (Agrawal et al., 1998)

3.3 Interaction of Quality and Costs

Quality and costs are closely related issues like the cost and quality definitions show. This Master Thesis discussed the relation of both terms and how automobile companies can assure both at the same time. Thereby, we focused on two dimensions of quality and cost interaction. On the one hand costs connected to higher quality, which concerns the features of a product to meet customer needs. Higher quality usually involves higher costs, and higher quality usually leads to more satisfied customers. On the other hand there is another comprehension of quality and costs. According to the quality gurus Juran and Deming quality leads to lower costs. These costs arise out of poor quality. Nevertheless, both dimensions focus on the end-user and quality is always connected to customer satisfaction, which is the main goal of every company, which wants to be profitable. For today’s automobile OEMs it is only possible to reach satisfied customers if they provide high quality at low price on both dimensions. Thus, outsourcing and TQM must be seen as methods which manage both quality and costs. (Juran, 2000; Deming, 2000; Fawcett et al., 2000)
4. Total Quality Management

The fourth chapter of this Master Thesis is about “Total Quality Management”. First, we started with the roots and then found a definition of TQM. In the definition we explained the benefits and reasons for failures of TQM. In the end, we regarded the TQM to the automotive industry.

Figure 10 illustrates our proceeding of the TQM chapter with its core aspects customer focus, continuous improvements and total participation (Boaden, 1997; Rao et al., 1996). This chapter also discusses theoretical benefits of TQM, which are mainly seen in a reduction of COPQ through quality improvements. In the end, we presented reasons why many companies fail implementing TQM.

4.1 The Roots of TQM

Total Quality Management was not investigated by a single person but a small group of individuals; the roots of TQM were explored, found and written by five different thinkers in the 1950s (Huggins, 1998). Deming, Juran and Crosby are the most well-known gurus for TQM but Feigenbaum as well as Ishikawa have been as important as...
the others regarding to define the scope of TQM (Rao et al., 1996). These authors did not really use the term of TQM on purpose; but retrospective, they wrote about it (Boaden, 1997). It is hard to say where the origin of TQM is, but it is assumed that TQM has its origin in Armand V. Feigenbaum’s book “Total Quality Control” from 1951. He was the first one who came up with this big theme. And the other authors who wrote about TQM acknowledged afterwards that his work were the first approaches for TQM. In 1979, Philip B. Crosby continued in “Quality is free” about the affecting of quality and quality management on business costs. He belongs also to one of the gurus of TQM. Kaoru Ishikawa amplified with his book “What is total quality control?” the concepts of quality management of Feigenbaum for almost all kinds of business management. Shortly after Ishikawa, W. Edwards Deming (1986) and Joseph M. Juran (1988) began to write about TQM. They are the latest specialists in TQM, and they concentrated on the statistic of quality control. (Huggins, 1998) Deming was the first American who introduced the quality principles to the Japanese on a large scale (Rao et al., 1996).

4.2 DEFINITION OF TQM

Total Quality Management is a widespread and ample theme. Hence, there are found several definitions of TQM in the literature because of different aspects from the authors. Jack Hradesky (1995) gave a good and summarized overview about TQM in his “Total Quality Management Handbook”:

“Total Quality Management (TQM) is a philosophy, a set of tools, and a process whose output yields customer satisfaction and continuous improvement. [...] TQM combines cultural-changing tactics and structured technical techniques whose focus is on satisfying the needs of internal and external customers. TQM requires that the executives are involved and committed, not just interested, and that the focus is on implementation. Results of TQM include error-free processes which deliver products and services fit for use, on time, with competitive pricing and good value.

When properly carried out, TQM becomes integrated into all aspects of the corporate identity. TQM’s scope covers all functions within a company from sales and marketing through design, production, and service. The formula for success is one part ‘effective training’, two parts ‘effective implementation’, and three parts ‘executive involvement’.
The training is analogous to a football team’s practice; the implementation is the real ‘game action’.

Broadening the concept of quality is the aim of TQM, so that quality moves from a product appraisal function to a corporate imperative for excellence and the refusal to be satisfied with the status quo.”

The objective of TQM practices is to improve the performance of an organization. Over the years Deming summarized in 14 points his knowledge that a company needs for working with a successful quality management at all organizational levels. (Rao et al., 1996) Juran’s concept comprised the managerial dimensions of planning, organizing and controlling, and focused on trying to reach quality improvement. He established ten steps for quality improvement. The third guru Feigenbaum created four points which were indispensable for a good quality management. Today, it is known that these authors wrote about quality control in general, and not only specified on TQM. (Ross, 1993)

For this reason we would like to present Boaden’s list with his eleven points. In his article he investigated and specified on TQM. Hence, we decided to use his eleven statements for a successful TQM in a company. According to Boaden (1997) TQM involves:

1. Customer focus, with emphasis on the customer-supplier relationship, internally and externally.
2. The commitment of everyone to quality improvement, especially managers.
3. Training and education considered as an investment.
4. The involvement of everyone within the organization in quality improvement.
5. A focus on processes.
6. The use of teams and teamwork.
7. The use of appropriate tools and techniques, reviewed regularly.
8. Goal-setting, measurement and feedback for all aspects of the business.
9. Continuous improvement as a philosophy.
10. A change in the culture of the organization, for example the way people think and behave.
11. The inclusion of quality principles into product and service design.
Figure 11: Eleven Aspects which TQM Involves (Boaden, 1997)

So, this prior list of Boaden but also Deming’s 14 tools, Juran’s ten steps and Crosby’s four points can be assigned to three dominant broad categories. They want each employee to accept a way of life which comprises (Boaden, 1997; Rao et al., 1996):

- **Customer focus** (customer = any person affected by what you do)
  
  ➔ Prior importance of providing products and services that fulfill customer needs: demands organization-wide focus on customers

- **Continuous improvement** (lots of statistical tools)
  
  ➔ Consistent customer satisfaction can be achieved only through persistent improvement of processes that create products and services

- **Total participation** (which requires respecting others)
  
  ➔ Customer focus and continuous improvement are best attained by collaboration throughout an organization as well as with customers and suppliers

Summing up it is safe to say that all authors agree that TQM seeks to improve productivity by focusing on satisfying the customer and involving the employees in the
process. “TQM has the practical goal of improving the bottom line and at the same time raising the employee morale.” (Rao et al., 1996)

4.2.1 Benefits of TQM

Many scientists state that TQM results in a competitive edge for companies (Shin et al., 1998; Powell, 1995; Seetharaman et al., 2006; Tari, 2005). The implementation of TQM takes much time, effort, and is connected with costs in the beginning. Nevertheless, if the philosophy is implemented properly TQM has many benefits. (Ahire et al., 1996)

This chapter provides an overview of benefits arising from TQM.

The main result of TQM should be a profitable company. Hence, TQM wants to lead to a more efficient company. This is gained through satisfied customers which is the basis for profitability. TQM strongly focuses on customers to meet customer needs and expectations, and to achieve satisfied customers. Therefore, the company concentrates on quality as TQM suggests. This means the company wants to create value for customers, and all processes, which are not valuable, are unnecessary. (Powell, 1995; Seetharaman et al., 2006; Tari, 2005)

The way to an efficient and profitable company starts with the implementing of TQM characteristics. If the implementation is successful the company gains several benefits which lead to a better performance. Some main results of a successful TQM are improved quality through reduction of COPQ, easier problem solving, and improvement of products, processes and efficiency of employees. (Powell, 1995; Seetharaman et al., 2006; Tari, 2005)

TQM focuses on quality improvements and tries to cut valueless processes for customers. A main activity to quality improvements is the reduction of COPQ. Due to the fact that the whole company, this includes every worker, tries to reduce COPQ the productivity can be increased. COPQ contains internal and external failure costs as well as appraisal and prevention costs, and this is explained in detail in chapter 3.2.1.2 (De Feo & Barnard, 2004; Juran, 2000). (Seetharaman et al., 2006)

TQM strongly involves employees in its philosophy. Employees take part at the development. They need to understand what they are doing and should be able to react independently on occurring situations. TQM improves teamwork, creativity, innovation,
training, communication, trust and decision making (Karia & Asaari, 2006). Furthermore, employees become more motivated and encouraged to control, manage, and improve processes as well as solve problems within their responsibility. Moreover, TQM provides an atmosphere in which continuous improvements are very welcome. All these results of TQM lead to a competitive edge for an efficient and profitable company. (Powell, 1995; Seetharaman et al., 2006; Tari, 2005)

4.2.2 Reasons for Failures of TQM

If TQM is implemented properly the philosophy leads to quality improvements and excellence in business performance (Shin et al., 1998). However, the implementation is not as easy as some manager think. Many variables must be considered and if TQM were not implemented in a proper form the approach would lead to no progress. Furthermore, TQM is always connected to costs in the beginning, and if the system does not result in expected outcomes the implementation would be inefficient (Ahire et al., 1996). Many companies fail implementing a successful TQM. The failure quote presented in the literature is between 60% and 67% like Shin et al. (1998) state. This chapter states reasons for failure of TQM. (Seetharaman et al., 2006; Shin et al., 1998; Ahire et al., 1996)

Seetharaman et al. (2006) identified six major reasons for TQM failure:

- Lack of management commitment and management understanding on quality.
- Lack of awareness on the benefits of TQM implementation in the organization.
- Inadequate knowledge of TQM and improper understanding of the measurement techniques that are used to measure the effectiveness of TQM implementation.
- Lack of clarity in the guideline, implementation plan and implementation methods.
- Lack of understanding about positive results of continuous improvements.
- Ignoring the importance of customers.

TQM often fails due to the fact that there is a lack of knowledge about the proper implementation. The six major reasons for TQM failure are explained in detail in the next paragraphs. The first problem arises because of the lack of management commitment and understanding of quality. This means that TQM implementation is not successful if the top management does not play a special role in improving companies’
quality performance. The management needs to show commitment to TQM activities. This also results in increased employee awareness. Otherwise, if even the top management does not concentrate on TQM activities how should employees “live” TQM? For a successful TQM implementation the management must mainly support four areas, which are allocation of budgets and resources, control through visibility, monitoring progress and organizational change. (Seetharaman et al., 2006)

If the company is not aware of possible TQM benefits the implementation will fail. Employees must work towards improvements and must therefore know what the advantages and benefits of TQM are. Only then employees accept changes and concentrate on the philosophy. The benefits of TQM are explained in detail in chapter 4.2.1 (Seetharaman et al., 2006)

The third reason for TQM failure is the misunderstanding of TQM philosophy and its measurements. It is one problem not understanding TQM philosophy. If management and employees do not know what TQM is about they cannot implement and live the philosophy in a proper form. Another problem is if measurements are not done or done in a wrong way. Only if the changed activities and quality concentration is measured the company is able to assess whether the implementation is valuable or not. If statistical analyses and benchmarking are not done correctly the TQM implementation cannot be assessed and improved. (Seetharaman et al., 2006; Khanna et al., 2003; Shin et al., 1998; Ahire et al., 1996)

Lack of clarity in the guideline, implementation plan and implementation methods are also reasons for the failure of TQM. If the procedure of TQM implementation is not done accurately the systems fails. A proper strategy, capability, and control are necessary for TQM. Thereby, the implementation needs some time, and quality is a never ending process. Furthermore, the implementing employees should be skilled in TQM in order that the implementation does not fail. (Seetharaman et al., 2006)

Moreover, TQM fails if the importance of continuous improvement is misunderstood. If TQM is not understood as a system which improves all the time it could not work. Nowadays, the world and business live changes very quickly, and so must the TQM model. Furthermore, continuous improvements provide a very smooth changeover from one technology to another. (Seetharaman et al., 2006)
The customers are the center for every TQM philosophy. If the company does not focus on its customers it is not able to implement a successful TQM. The management and employees have to accept the importance of customers. (Seetharaman et al., 2006; Shin et al., 1998; Ahire et al., 1996) Today’s customers are more knowledgeable then ever before. They expect low prices and high quality at the same time. (Fawcett et al., 2000; Seetharaman et al., 2006) Hence, the customer focus is essential for companies to achieve customer satisfaction, and only satisfied customers are profitable for companies. Thus, organizations want to provide value to their customers, and this is only possible if the TQM focuses on its customers. (Seetharaman et al., 2006)

The following figure visualized the six discussed critical factors for a valuable TQM implementation.

**Figure 12: Critical Factors for a Successful TQM (Seetharaman et al., 2006)**
4.3 TQM IN THE AUTOMOTIVE INDUSTRY

Product quality in an automobile supply chain can be attained through TQM. Many OEMs use this philosophy to achieve customer satisfaction. However, the current market situation is characterized by an outstanding tough competition which means for the automobile OEM that it has to provide top-quality at low price. Nowadays, this is the main challenge for automobile manufacturers and TQM helps to handle low costs and high quality to meet the challenge. Hence, TQM is in connection with TS-2 the main approach of the automotive industry to treat the cost and quality pressure. (Fawcett et al., 2000; Bandyopadhyay, & Sprague, 2003)
5. Outsourcing

The fifth chapter of this Master Thesis is about “outsourcing”. We described the outsourcing process in general and outsourcing related to the automotive industry. Finally, we explained the concept of strategic outsourcing and the make-or-buy decision.

Figure 13 describes our theoretical approach of outsourcing. After explaining outsourcing in general, we focused on outsourcing in the automotive industry. Then we distinguished strategic outsourcing from non-strategic outsourcing. The make-or-buy decision itself is mainly dependent on if the components are strategic or non-strategic (Duhamel & Quelin, 2003).

Figure 13: Procedure of the Outsourcing Chapter
5.1 Outsourcing in General

Outsourcing is subcontracting a process, like product design or manufacturing, to a third-party company. It involves the transfer of the management and/or day-to-day execution of an entire business function to an external service provider. (Overby, 2007)

There are different forms of activity levels of outsourcing. Greaver disassociates the components manufacturing from individual, functional and process outsourcing. The component manufacturing belongs to an own field of outsourcing unlike the three others who are part of a hierarchy. Individual outsourcing affects single positions, functional outsourcing regards to whole divisions of companies and process outsourcing swaps out whole business processes like financials or IT. The extent of outsourcing is also important and can be differentiated between selective and total outsourcing. (Greaver & Maurice, 1998)

To get a closer look on the motives of managers, Kakabadse and Kakabadse (2005) show a current trend in the Cranfield study of 2002, where they researched the questionnaires of 700 managers from Europe and the USA in figure 14.

![Figure 14: Outsourcing Purposes of the Cranfield Study (Kakabadse & Kakabadse 2005)](source)

The goal of outsourcing is a maximal specialization on activities of high value with low risk and preferably low costs. The companies want to keep the overhead cost low and try to concentrate on their core business. The purposes for companies to outsource
where researched in literature and in surveys. Quélin and Duhamel highlighted the main motives of outsourcing in table 5.

<table>
<thead>
<tr>
<th>Main motives identified</th>
<th>Main references</th>
</tr>
</thead>
<tbody>
<tr>
<td>To reduce operational costs</td>
<td>Lacity and Hirschheim (1993b); McFarlan and Nolan (1995); Barthélémy and Geyer (2000); Kakabadse and Kakabadse (2002)</td>
</tr>
<tr>
<td>To focus on core competencies</td>
<td>Quinn and Hilmer (1994); Saunders et al. (1997); Alexander and Young (1996b); Kakabadse and Kakabadse (2002)</td>
</tr>
<tr>
<td>To reduce capital invested</td>
<td>McFarlan and Nolan (1995); Kakabadse and Kakabadse (2002)</td>
</tr>
<tr>
<td>To improve measurability of costs</td>
<td>Barthélémy and Geyer (2000)</td>
</tr>
<tr>
<td>To gain access to external competencies and to improve quality</td>
<td>Quinn and Hilmer (1994); McFarlan and Nolan (1995); Kakabadse and Kakabadse (2002)</td>
</tr>
<tr>
<td>To transform fixed costs into variable costs</td>
<td>Alexander and Young (1996a)</td>
</tr>
<tr>
<td>To regain control over internal departments</td>
<td>Lacity and Hirschheim (1995a); Alexander and Young (1996a)</td>
</tr>
</tbody>
</table>

**Table 5: Main Motives of Outsourcing in Literature (Duhamel & Quélin, 2003)**

The following chapters took a closer look on goals of outsourcing highlighted in literature.

### 5.1.1 Reduction of Operational Costs

The reduction of operational costs is still one of the main goals of outsourcing but the importance of this argument will decrease in the next years (Kakabadse & Kakabadse, 2002). Managers expect a cost reduction through the economies of scale the suppliers can offer. (Lacity & Hirschheim, 1993)

### 5.1.2 Focus on Core Competencies

Quinn and Hilmer (1994) explain the meaning of core competencies with a list of criteria. Core competencies are skill or knowledge sets and not single products or functions because single products can be duplicated or back-engineered and traditional functions like production or engineering were formed in the past. Competencies are sets of skills cutting across the functional borders. The managers should try to focus on areas where the company dominates, instead of spreading their efforts over the whole value chain. The competencies are also limited in number. At least one of these competencies should directly relate to understanding and serving the customer. (Quinn & Hilmer, 1994)
Honda, for example, does its entire engine R&D in-house and makes all the critical parts for its small motor design core competency in closely controlled facilities in Japan. It will consider outsourcing any other non-critical elements in its products, but builds a careful strategic block around this most essential element for all its businesses. (Mintzberg & Quinn, 1993)

5.1.3 IMPROVEMENT OF MEASURABILITY OF COSTS

The outsourcing of a department or just of a process improves the cost measurability. The OEM does not have several cost positions anymore, but a single position for the variable costs of the supplier payment. The negotiated contracts cut the risks of high cost fluctuation. (Barthelemy & Geyer, 2000)

5.1.4 ACCESS TO EXTERNAL COMPETENCIES AND IMPROVEMENT OF QUALITY

The suppliers are specialized on their products and are in a permanent competition with other suppliers to keep the OEMs as contract partners. These reasons can lead to higher quality and a higher competence level. The latest development showed that suppliers are already integrated in the early phase of R&D to harmonize the production. (Kakabadse & Kakabadse, 2005)

5.1.5 TRANSFORMATION OF FIXED COSTS INTO VARIABLE COSTS

The fixed costs of the OEM can be cut and transformed into variable costs through outsourcing. The fixed costs for employees and technical infrastructure disappear. The payments for the suppliers are variable costs in contrast. (Alexander & Young, 1996)

5.1.6 REGAINING CONTROL OF INTERNAL DEPARTMENTS

Outsourcing whole departments like IT or marketing are not only ways to streamline a company’s structure. Alexander and Young argue that it is easier to control the outside suppliers than the internal experts they replaced. The reasons are a clear contract, the desire to build a good client relationship and the reduction of internal political intrigue. (Alexander & Young, 1996)
5.2 Outsourcing in the Automotive Industry

The trend of strategic outsourcing has a sustainable impact on the relation of value creation between suppliers and OEMs in the automotive industry. After mass production in the 1920s and lean production in the 1980s, the global automotive industry is in the midst of another structural evolution, toward collaborative engineering and production. Outsourcing became more important since the Oil Crisis in the seventies due to several factors like globalization and new key competitive factors. Since then outsourcing became a central element of the automotive industry which reorganized the production and newly defined the core activities of OEMs. Component outsourcing was mainly the result of this change. Hence the OEM’s value creation decreased from 41% in 1989 to 35% in 2002 (see in figure 16). (Radtke et.al, 2004)

The OEMs outsourced labor intensive services like catering or cleaning, but also important strategic services like IT or logistics to concentrate more on the core competences. For example, Japanese auto manufacturers buy 70-80% by dollar volume, of his stamping requirement from contract metal stampers. In the US automotive industry it is the other way around. The Japanese manufacturers obviously assume that quality, delivery, inventories, and related costs can be better managed by the purchasing department when they are bought and not made by the OEM itself (Deming, 2000). Another example is the company of DaimlerChrysler which sourced out the whole supply management to Andersen consulting. (Chalos & Sung, 1998)

A recent Mercer Management Consulting study based on industry interviews, data analysis, and economic modeling concludes that by 2015, automotive suppliers will represent close to 80% of total value creation in light vehicle engineering and production, as the dozen automakers restrict their own share to those components and activities that are crucial to the success of their brands. (Kleinhans & Dannenberg, 2004)

The established hierarchy of OEMs and 1st and 2nd tier suppliers is still the dominant form of collaboration, but OEMs started to focus more on the downstream business (marketing, sales, and services) which will change the function of the automotive supply chain. The OEMs outsource their R&D and production departments increasingly to the suppliers industry, but the extent of outsourcing or own value creation is dependent on the position of the automobile brand as presented in figure 15.
Development of own value creation per car brand
2015 vs. 2002

Figure 15: Development of Own Value Creation per Car Brand (Kleinhans & Dannenberg, 2004)

The OEM’s own value creation is dependent on the brand and product differentiation. The non-premium brands will reduce their internal activity by approximately 30% and on the other hand premium brands will increase their internal activity by about 15%. But all brands will increase the external labor strongly. Figure 16 shows that the average share of the OEM’s value creation will decrease for all kind of brands. (Kleinhans & Dannenberg, 2004)
The main representative of this production system is the Japanese automotive industry. The precursor of lean production is Toyota. Ohno describes the “Toyota Production System” with its core elements Kaizen (continuous improvements), Muda (waste reduction) and Kanban (“JIT” production) which is described as the representative of lean production in the MIT – study “The second revolution in the automotive industry” of Womack, Jones and Roos. Japanese companies outsourced almost all components. The supplier network is a hierarchy with close relations between the OEMs and the suppliers. A low amount of suppliers, the pyramid hierarchy and the pre-negotiated contract conditions reduce the competition inside the supply system and focus it on the end product and therefore on the car manufacturers themselves. (Richardson, 1993)

5.3 Differentiation between Outsourcing and Strategic Outsourcing

Venkatesan says that strategic outsourcing is based on simple principles. In his opinion strategic outsourcing is prosecuted when the outsourced product subsystems and its activities have a marginal strategic relevance. Following characteristics should be considered to classify the subsystems:
- high influence on the customer value of product attributes
- the need of strongly specialized R&D and manufacturing abilities as well as specific
- engineering and construction technologies
- needed technology which could achieve a significant competitive edge in technology

So, Venkatesan relates directly to the potentials of a successful strategy which he tries to extract of the subsystems with help of his criteria to classify them as strategic factors of a company at the same time. (Venkatesan, 1992)

Figure 17 shows how Quélin and Duhamel summarized the five main elements characterizing strategic outsourcing.

**Five Elements Characterise Strategic Outsourcing:**
- A close link between outsourcing processes and the key success factors of a firm in an industry (Quinn and Hilmer, 1994).
- The transfer of ownership of a business function previously internalised, often including a transfer of personnel and physical assets to the service provider.
- A global contract, longer and denser than a classical subcontracting agreement.
- A long-term commitment between the client and the service provider. Previous research, based on more than one hundred major contracts, shows an average contract duration of 6–7 years (Lacity and Hirschheim, 1993b; Barthelemy, 2001).
- A contractual definition of service levels and of each partner's obligations (Doig et al., 2001).

**Figure 17: Five Elements characterise Strategic Outsourcing**

Quinn and Hilmer say that companies, which focus their own resources on a set of core competences to create a unique customer value and outsource non-strategic activities and activities which have no need of specific intern abilities, use strategic outsourcing. The strategic advances, which can be realized by strategic outsourcing, are related to key figures of a strategy. They cite examples like the maximization of income realized by own resources, the development of core competences to create barriers against competitors, the capitalization of investments, innovations and specialized abilities of extern suppliers as well as the lowering of risks and the reduction of life cycles with a increase of customer demand satisfaction at the same time. (Hilmer & Quinn, 1995) The concept of strategic outsourcing is mainly based on the Hilmer & Quinn model in this thesis.
5.4 The Make-or-Buy-Decision

In this chapter we explained the outsourcing-decision process of an OEM and its influencing factors. We used the decision model of Quinn and Hilmer to give a more detailed view.

The OEMs have to decide which processes and in which dimension they should be outsourced. Quinn & Hilmer argue that the decision is dependent on the attributes of the process to be outsourced. They link many parameters which form both advantages and disadvantages in collaborations. They develop two dimensions for classifying the many different activities (development/production of components or products, service or support activities) that a firm deals with, namely the potential for competitive edge and the degree of strategic vulnerability. (Quinn & Hilmer, 1995) The figure 18 shows that Quinn and Hilmer classify the different activities that require different types of relationships with the suppliers, into three groups.

![Figure 18: Competitive Advantage vs. Strategic Vulnerability (Quinn & Hilmer, 1995)](image)

Quinn and Hilmer talk about activities in general without making an explicit difference between parts and intangibles. They think that activities with a high competitive edge potential and a high degree of strategic vulnerability should be realized in house. Moderate strategic vulnerability and moderate potential for competitive edge represent activities that call for a range of relationships like short-term contracts, call options, long term contracts, retainer, joint development, partial ownership or full ownership in relation to the suppliers. Lastly, activities with low vulnerability and low potential for competitive edge call for arm's-length relationships with the suppliers. So they
concentrate on three aspects which are achievement of a high competitive edge potential, the strategic vulnerability and the form of collaboration between OEM and the suppliers.

But the model reveals that it considers only three possibilities out of a total of nine. This leads to the question as to whether there are no activities that are high in terms of strategic vulnerability and yet low on the competitive edge scale, or conversely, that are high on the competitive edge dimension and yet low in terms of strategic vulnerability? This question can be extended to all the six possibilities that Quinn and Hilmer have not considered. (Nellore & Söderquist, 2000)

Nellore and Söderquist improved the model of Quinn & Hilmer and extended the matrix fields (table 6 on the next page). The matrix explains every nine types of processes and classifies them in the matrix. The dimensions are much more detailed compared to the normal Quinn & Hilmer matrix. The “potential for competitive edge” axis shows the specification generator, the type of supplier, examples and the contract relationship, which gives a good understanding about the collaboration level between OEM and suppliers.
<table>
<thead>
<tr>
<th>Potential for competitive edge</th>
<th>High</th>
<th>Specification generator; type of supplier; examples; contract relationships</th>
<th>Medium</th>
<th>Specification generator; type of supplier; examples; contract relationships</th>
<th>Low</th>
<th>Specification generator; type of supplier; examples; contract relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEM; no supplier; styling; Not applicable</td>
<td>OEM-supplier generate specifications together; mature; engines; full or partial ownership</td>
<td>OEM generates rough Specifications which is then worked on by the supplier; mature; chassis; joint development, retainers</td>
<td>Supplier generates specification; partner; audio- system validation; joint development</td>
<td>Supplier generates rough Specification which is then worked on by the OEM; mature supplier; door knobs, glass mirrors; long-term contracts, retainers</td>
<td>Supplier generates the specification; contractual supplier; hand-held tools; short-term contracts, contract orders</td>
<td></td>
</tr>
<tr>
<td>Potential for competitive edge</td>
<td>High</td>
<td>Essentially qualitative specification n3 Degree of strategic vulnerability</td>
<td>Medium</td>
<td>Mix (qualitative and quantitative) specification</td>
<td>Low</td>
<td>Purely quantitative specification</td>
</tr>
</tbody>
</table>

**Table (Matrix) 6: The Procurement Matrix complemented by Contract Relationships** (Nellore & Söderquist, 2000)
6. Analysis

In the sixth chapter of this Master Thesis we talked about the analysis of TQM and outsourcing and their impact on quality and costs in the automotive industry. First, we started with the impact of TQM on quality and costs for OEMs. Then we explained the impact of outsourcing on quality and costs for OEMs. In the end, we showed how both TQM and outsourcing affect the OEMs of the automotive industry.

6.1 Impact of TQM on Quality and Costs for OEMs

In our theoretical framework we presented TQM as a management philosophy, which aims to improve quality and reduce costs of automobile OEMs. The analysis took a closer look on the impact of TQM on quality and costs. Therefore, we tried to find scientific articles about the current situation of TQM in the automotive industry.

Figure 19 shows the first treated step of the four main parts our analysis. We started with the impact of TQM on both quality improvements and cost reduction because theory mostly writes about both together. Especially Boaden does not distinguish quality and costs, while outsourcing differentiates them more.

Figure 19: First Step of the Analysis — Impact of TQM on Quality and Costs
According to Boaden (1997) there are eleven characteristics of TQM. On the basis of these points, the analysis proved the TQM impact on quality and costs for automotive OEMs.

6.1.1 Customer Focus

The customer is a main point of TQM, as almost every scientific study states-for example Seetharaman et al. (2006), Tari (2005), Juran (2000), Deming (2000) and Boaden (1997). Regarding to Rao et al. (1996), the major point of this customer focus is to meet customer needs, which results in satisfaction or even delight. According to Seetharaman et al. (2006), ignoring the importance of customers often leads to the failure of TQM. However, it is not easy to focus all the processes of a big automobile OEM on its customers. But it is obvious that if customer focus is achieved and customer expectations are met then this procedure leads to satisfied customers. The automotive industry implemented customer satisfaction programs as a survey of Stein and Bowen (2003) presents. The identified elements of these programs are comparable to the theoretical process of “The Juran Trilogy”. It is important for the automobile OEM to identify its customers and determine their needs as Matzler et al. (1996; 2004) emphasizes. Afterwards, the OEM is able to produce cars with these expected features, which means for the end-customer to manufacture qualitative automobiles. According to the Juran Trilogy, the OEMs always test and control whether their performance still meets customer demands and is therefore consistent with their quality goals. By means of these results the automobile OEMs adjust and improve their customer concentration.

Moreover, TQM and customer focus strive not only to improve quality but also reduce costs. Due to the fact that customer focus means concentrating on beneficial processes, it means that valueless processes for the customer are cut. That means that unnecessary costs – according to Juran (2000) COPQ – are reduced to improve quality and efficiency at the same time.

Evidence of an overall good customer focus is seen in the fact that automobile OEMs reached a score of 82% on the American Customer Satisfaction Index (ACSI) which according to Tsai (2008) is relatively high. Tsai (2008) also found that the Japanese car manufacturers achieve an even higher score than the American OEMs which leads to the assumption that TQM (customer focus in this case) is even better implemented in Japan where the roots of TQM are.
As we mentioned in chapter 4.2, customer focus is one of the three summarized categories of Boaden’s eleven points. Figure 20 presents a good overview of this customer focus. The customer focus tries to concentrate only on valuable processes for the customer, and thus cut valueless and reduce unnecessary costs (COPQ). Consequently, this improves the quality for the end-customers and leads to their satisfaction. Moreover, customer focus tries to meet customers’ demands by investigating their expectations and needs. If the automobile OEM succeeds in meeting demands this would also lead to satisfied customers.

Figure 20: Summary of the Customer Focus

6.1.2 Management Commitment

The commitment of every employee and especially of managers is often a critical point of TQM implementation, according to Seetharaman et al. (2006). Although there is no empirical study, which states a direct connection between management commitment and quality and costs, there is an indirect relation. Ahire and O’Shaughnessy (1998) present in their empirical analysis the importance of top management commitment. Although this study was done for the entire automotive industry and not only for OEMs the results are also valuable for our case. The article shows that companies with high top management commitment implemented the other characteristics of TQM in a proper way. Hence, the TQM was more efficient and the firms produced higher quality products. These results can also be translated into the automobile OEMs which means
in the end that management commitment leads to an efficient TQM with its positive effects on quality and costs.

6.1.3 TRAINING AND EDUCATION

In theory, Boaden (1997) considers training and education as investments. This shows that training and education is connected with costs. In fact, training and education are some of the main TQM cost drivers. Nevertheless, if TQM and training are properly implemented, they have a positive effect on the OEMs overall performance. Toyota, which is a role model for TQM usage, implemented several steps of training programs as Hirotsu (2001) presents. Toyota starts with courses for every employee and ends with special training programs for top management. Another statistical study by Karia and Asaari (2006) shows that training and education has a positive influence on job involvement, job satisfaction, and career satisfaction. Satisfied, motivated and qualified employees are good employees for OEMs. These characteristics are essential for continuous improvements.

Training and education takes time and costs money for the OEMs. However, today’s businesses change very fast and the automobile OEMs must often adjust their performance towards new standards and increased quality expectations of their customers. Therefore, training and education is necessary for every car manufacturer to make continuous improvements. According to Subedi and Maheshwari (2007) an example from Toyota shows that the management tried to avoid rework by encouraging its employees to concentrate on fixing the occurring defects as soon as possible. Thereby, workers were trained to identify and understand what went wrong in order to not repeat the mistakes. In the end the result can be improved quality with a reduction of COPQ. Hence, the investment in training and education is mostly profitable for an automobile OEM as the performance of Toyota reveals.

Moreover, according to the ISO TS-2 standards, training and education must be part of every channel member of the automobile supply chain, including OEMs. Hence, this emphasizes the importance of training and education for the automobile OEMs to meet customers’ quality expectations.
6.1.4 The Involvement of Everyone

The involvement of everyone within the organization in quality improvement goes one step further. According to Karia and Asaari (2006), employee empowerment like training and education leads to more job satisfaction. The motivation increases and the problems are solved where they occur. Furthermore, automobile OEMs can use the knowledge of their employees and improvements are done by people who really work with the processes; directly at the source. Powell (1995) studied the relation of increased employee involvement and autonomy in decision-making on the companies’ performance. He concluded that neither TQM tools nor techniques drive success but TQM features like open culture, employee empowerment, and executive commitment have a positive effect on quality and reduction of COPQ.

The automotive OEMs are big companies where employee empowerment is necessary and can have a big influence on overall performance. For instance, Toyota employees are assigned to have responsibility over machines. However, empowerment is also dangerous if management loses the overview and control. According to Kakuro (2004), it is important that the automotive OEMs’ vision and mission is clear and every employee works towards the right direction, which is customer satisfaction. Furthermore, it is important that everyone knows what their colleagues do and what the end result is. For instance, this means that every employee knows what the car-manufacturing process looks like.

6.1.5 Process Focus

A process orientation is mandatory when focusing on customers. With a process organization automobile OEMs are able to cross borders and serve customers more valued products, as Vanhaverbeke and Torremans (1999) state. However, the change from a functional organization to process orientation is always combined with problems. According to Knippenberg et al. (2006), employees must experience the new situation. They are often disapproving of something new and are not willing to change their behavior, and therefore they must be convinced that the process orientation is needed and useful.

TQM tries to cut valueless processes and thus reduce COPQ to improve end-customer outcome. By being process orientated the automotive OEMs are able to concentrate on
core process and integrate outsourced process partners in their customer focus. Every channel member concentrates on its core competencies and therefore is able to reduce COPQ in the supply chain and to provide excellent cars. This procedure is especially important in the automotive industry where the OEMs value creation is less than 35% as studies by Kleinhans and Dannenberg (2004) as well as Radtke et al. (2004) show.

6.1.6 Teams and Teamwork

Teamwork is like all TQM characteristics closely related to each other. For instance, teamwork goes hand in hand with employee involvement and commitment as well as training and education. According to Boaden (1997), teams and teamwork must be a part of the automobile OEMs. Cooney and Sohal (2004) found that the automotive industry uses teamwork for problem solving to gain continuous improvements. Hence, small groups directly at the source solve quality problems and deficiencies. For instance, Toyota with its successful TQM practices teamwork in a strong manner. They organize their employees in teams and train them. Furthermore, the workers get responsibility for special tasks. The team leader is one of them who also works on the line. (www.1000advices.com)

According to Kakuro (2004) team activities are developed to create creativity. Besides direct quality improvements, teamwork focuses on safety, efficiency and the work environment. The identified problems are solved by the employees on their own or are communicated to the management. Kakuro (2004) presents an example for the common usage of task team activities. Between 1988 and 2,000 he counted 15,000 employees and 5,000 managers who took part in 4,000 teams.

Teamwork is very successful for Toyota and it is an important part of TQM. However, Toyota knows that teamwork does not necessarily have a positive effect on quality and can also raise problems. According to Kakuro (2004), individuals can easily lose their objective through teamwork. Furthermore, teams might be mutually disassociated without being stimulated by others if they achieve a goal. Another problem that is known by Toyota is that the management can lose the overview and thus corporate activities do not work in the right direction.
6.1.7 Use of appropriate Tools and Techniques

According to Boaden (1997), Juran (2000) or Deming (2000), the use of appropriate tools and techniques and their regularly review is essential for quality management. Nevertheless, there are also studies which show the importance of tools and techniques from a different point of view, for example, Tari and Sabater (2004) or Powell (1995). In Tari and Sabater’s (2004) article, the authors analyze different tools and techniques. For instance, automobile OEMs often use benchmarking or quality audits which are required by ISO.

The importance of TQM tools and techniques is not clear. For example, Powell (1995) states in his empirical study that tools and techniques drive success but soft characteristics are even more important to improve quality. On the other hand, Tari and Sabater (2004) highlight a statistically positive relation between TQM tools and techniques and a company’s performance. They conclude that tools and techniques are necessary for a successful TQM and for quality improvements.

These results emphasize the importance of tools and techniques in combination with other TQM characteristics and can also be transferred to the automotive industry. The TQM only works if all points are considered. For the big automobile OEMs it is important to use tools and techniques to implement a valuable TQM where the employees are empowered. In this industry it is especially important to review the tools and techniques which can be a reason for failure regarding Seetharaman et al. (2006).

The automobile OEMs and TQM especially try to improve quality and reduce costs through the reduction of COPQ, which is regarding to De Feo and Bernard (2004) a huge part of companies expenses. According to Tari and Sabater’s (2004) analysis, which was not only for the automotive industry, only 45% of the companies evaluated these costs. Although we believe that COPQ in the automotive industry is more properly calculated, this figure is astonishingly small. Unfortunately, we do not have statistics of the automobile OEMs but notwithstanding the OEMs should take care of this assessment to successfully cut these unnecessary costs due to the fact that OEMs must know where they have success with their tools and techniques and where not.
6.1.8 Goal-Setting, Measurement and Feedback

Goal-setting, measurement and feedback for all aspects of a business is an important part of TQM according to Boaden (1997). This is also seen in the earlier discussion which discussed goals and measures. Due to the fact that automobile OEMs are huge companies with many employees it is important to set goals and communicate them. Furthermore, the automakers must consider that they strongly empower and involve their employees in the improvement process. The employees have much responsibility. Hence, the OEMs have to communicate their vision and mission properly. But it is even more important to measure the success and give feedback to their employees. For the automotive industry it is especially important to measure the success of COPQ. According to Juran (2000) and Deming (2000), TQM mainly tries to reduce these unnecessary costs. When talking about tools and techniques we discussed a statistical figure of Tari and Sabater (2004) after which only 45% of the companies measure their deficiencies and only 8% subdivided into COPQ parts (Results are not specifically for the automotive industry). If the automobile OEMs do not consider the failure costs, appraisal costs and prevention costs, then the TQM would not have the desired effects on quality and costs. According to Seetharaman et al. (2006) and Shin et al., the TQM implementation would fail like it does at many companies because of improper implementation of TQM.

6.1.9 Continuous Improvement

According to Juran (2000) and Boaden (1997), continuous improvements have a direct and main influence on quality and costs. Thereby, continuous improvements must be seen as a philosophy. It is not a tool or technique it is more a result of other TQM characteristics. For instance, we presented earlier that customer and process focus as well as training, involvement and teamwork concentrate on continual quality improvements. Here you see again that TQM is a combination of many points, which must be implemented simultaneously.

Small improvement steps can have a big impact on the overall quality and cost performance; especially in the automotive industry where the OEMs have big lot sizes. Toyota is aware of this importance and presents figures, which partly explain its competitive edge concerning quality and costs. “Toyota Production System” strongly depends on its employees. Toyota receives more than 700,000 improvement suggestions.
by its workers. This means that on average every employee comes up with 10 suggestions to improve the processes involved in their work or products. Furthermore, according to this source (www.1000advices.com), 99% of these ideas are implemented.

These astonishing figures stand for Toyota’s employee empowerment, creativity and involvement and although not every suggestion must be an improvement this might explain Toyota’s high-quality appearance and its relative low prices. The high quality of Toyota cars is, for example, confirmed by the ADAC which yearly awards automobile OEMs. Toyota usually dominates the category “Quality” where breakdown statistics and customer’s quality appearance are used as criteria. For instance, in 2005 Toyota won with its Avensis. (www.adac.de)

In chapter 4.2 we talked about three broad categories; the second one is continuous improvement. Figure 21 shows how the different aspects of Boaden (1997) support the continuous improvement within the organization. There you can see that continuous improvements are in the center of TQM. They are supported by everyone’s commitment and involvement. Furthermore, trainings and education, teams and teamwork as well as goal setting, measurement and feedback boost continual improvements. In addition, the culture of an organization must be focused on continuous impotents. These procedures improve processes, products and the work itself and lead to quality improvements and the reduction of COPQ.
6.1.10 Change in Culture: Attitude and Behavior

When talking about continuous improvements and other points of TQM we already made it clear that the OEMs culture must be geared towards quality improvements and reduction of unnecessary costs. Hence, every employee as well as the management must be involved in this behavior; for instance, Boaden (1997) and Rao et al. (1996) talk about full or total participation. This means for an automobile OEM that its whole company must be focused on TQM with its goals to improve quality and reduce costs. Hence, it is very important for the automobile OEMs to communicate their TQM strategy and explain the principle to its employees. In accordance with Seetharaman et al. (2006) the TQM culture of quality focus and cooperation is crucial for the success of the automobile OEM. Furthermore, TQM culture tries to be proactive which is especially important in the automotive industry with its long development phase and tough competition. The suggestion figures of Toyota in chapter 6.1.9 show that Toyota’s workers and management understood TQM and that the change in the culture of Toyota took place.

**Figure 21**: Summary of Continuous Improvement
6.1.11 INCLUSION OF QUALITY PRINCIPLES

According to Boaden (1997), the inclusion of quality principles into product design is important. Seetharaman et al. (2006) states that if TQM is not implemented properly then the philosophy fails like it does in many companies. In doing so, it is especially important for automobile OEMs to include the quality principles into its product design. The automotive development phase takes several years and is very expensive. Hence, it is important for the automakers and their suppliers to implement quality issues in early stages of the product design. Due to the fact that the design of a car takes a great deal of time, automobile OEMs are not able to change their cars if they do not meet the customers’ expectations.

Moreover, R&D is not only an expensive part of car manufactures but also many costs are already here determined. Therefore, it is necessary that automobile OEMs already here cut COPQ and only focus on valuable process for customers. Furthermore, the OEMs must consider the identified customer expectations, according to Matzler et al. (1996), in the product design phase to meet end-users’ needs.

6.1.12 IMPACT OF THE COMBINATION OF THE ELEVEN TQM ASPECTS

The discussion of the impact of the eleven TQM characteristics showed that they are closely related and interact at several points. According to Seetharaman et al. (2006) an automobile OEM would fail with its TQM if all points are not implemented properly. But if the OEM does consider all these points, TQM might have many benefits according to the theoretical discussion of Benefits of TQM - especially quality improvements and COPQ reduction.

Empirically, many automobile OEMs implemented these TQM points in their quality management such as Toyota. Toyota is also the best example to see the results of TQM and its impact on quality and costs. Toyota is widely accepted as the leader in quality with comparable low prices and low production costs respectively. From the example of Toyota you can derive that a properly implemented TQM improves the quality for the end-customer and reduces COPQ. Hence, Toyota is able to provide excellent cars at low prices and still has a good profit margin. At the moment Toyota faces problems in the
difficult American and Japanese markets; however, its operational margin is still very good with 9.8% according to Boerse-online (www.boerse-online.de).

The detailed analysis before showed the impact of different TQM points on quality and costs. The overall impact of TQM can be tested through the overall performance of the OEMs due to the fact that according to Rao et al. (1996), TQM has the practical goal of improving the bottom line.

Toyota is often seen as the role model in the automotive industry and its success often refers to its quality management. For instance, many awards like the aforementioned ADAC award or JDPower’s Initial Quality Study (IQS) confirm this opinion. Another indication that TQM leads to better quality and lower costs at the same time is the overall performance of TQM companies compared to organizations which have not implemented a quality management strategy. From the next figure we can derive the importance of TQM for automobile OEMs.

![Graph showing stock price increase for TQM award winners and S&P 500 index](image)

**Figure 22: Comparison of Stock Price Increase (Hendricks & Singhal, 2000)**

In the year 2000, the professors Hendricks and Singhal compared the performance between TQM award winners, for example the Malcolm Baldrige National Quality Award, and the stock development of the S&P 500 index in the US. Although this survey did not focus exclusively on the automotive industry many TQM award winners are automakers, for example, Chrysler, Mazda, Ford, GM, Honda, Toyota, Nissan and is
therefore suitable for our investigation. The figure shows a five year stock price comparison between quality award winners and the S&P 500 on an annual basis. The five-year post implementation period starts one-year prior and four years after the date of TQM companies winning their first award. On the basis of the annual changes in performance you see that the winners have always beaten the S&P 500. Only the second year beyond the TQM implementation had the same stock price increase.

Moreover, according to Subedi and Maheshwari (2007) Hendricks and Singhal also found that the TQM award winners had profitability, growth and cost advantages compared to the other companies in their survey. Hence, we conclude that a properly implemented TQM improves the quality while COPQ are reduced and this ultimately results in an overall better performance of an efficient company. These results are especially important for the automotive industry where the OEMs compete in a tough market and the quality of the expensive good has an immense importance for the end-customers. Thus, the theoretical benefits that TQM can lead to a competitive edge for automobile manufacturers can be supported.

In the end, we wanted to present in figure 23 the last point of the three broad categories – total participation.

**Figure 23: Summary of Total Participation**
This figure explains what is meant by total participation according to Rao et al. (1996) and Boaden (1997) and what it means for the automotive industry. Quality improvements and cuts of COPQ are only possible if the automobile OEM collaborates with its suppliers and customers. The entire supply chain must focus on improvements for the end-customers. Therefore, it is essential to change the company culture towards a TQM, which allows progress. Furthermore, total participation involves everyone within the OEM. The managers and employees work in teams to improve the overall performance.

It would be interesting to investigate the implementation and impact of TQM in the automotive industry empirically. We thought that a case study could be the suitable method for this investigation. A suitable research question would be whether the automobile OEM has implemented Boaden’s (1997) eleven aspects of TQM in its quality management. The next step would be researching the impact of TQM and its aspects on quality and costs, which is done in a case study with the same automobile OEM best.

Moreover, the relation between the TQM implementation and COPQ could be investigated. A hypothesis such as a proper implemented TQM reduces COPQ could be tested. Significant results could support our theoretical assumptions.

6.2 Impact of Outsourcing on Quality and Costs for OEMs

In the following chapter we analyzed the impact of outsourcing on quality and costs. When we talk about outsourcing in the analysis we mainly define outsourcing from the production and logistics point of view. The commonly researched issues like IT or financial services outsourcing were not the objects of our analysis. We worked with several studies and articles concerning the automotive industry to investigate the progresses and effects of outsourcing for the OEMs and how they are related to each other. Unlike in the chapter 6.1, we first analyzed the impact of outsourcing on quality and costs separately. Then we combined it in an additional chapter, because the boundaries between costs and quality are clearer in the case of outsourcing.
6.2.1 Impact on Quality

In the second step of our analysis we wanted to investigate the impact of outsourcing on quality as it is shown in figure 24.

![Diagram showing the impact of outsourcing on quality](image)

**Figure 24:** Second Step of the Analysis — Impact of Outsourcing on Quality

According to Kakabadse and Kakabadse (2005) the main goals of outsourcing have changed from cost discipline and control to more strategic goals like focusing on core competencies or the access to external competencies and the improvement of quality. Looking at the advanced outsourcing development in the automotive industry we expect that these strategic goals mainly, concerning the quality and focusing the customer demands, are even more important for the automotive OEMs.

The focus on core competencies has a great impact on quality in the understanding of deficiency freedom and customer satisfaction. The strategic outsourcing of competencies which do not fit into the company’s orientation implicates several benefits for automotive OEMs. The core functions can be improved. Most OEMs focus on high-tech components or corporate identity components like styling or design which give them a competitive advantage and are therefore part of the brand management. (Nellore & Söderquist, 2000; Kleinhans & Dannenberg, 2004) For example, if a car producer focuses mainly on engineering and car styling and chassis, but outsources the non-strategic manufacturing and logistics, its engineering and styling can only get better because that is now the company’s main focus. Workers will not be spread too thin, managers will have time to focus more on styling processes and chassis, while leaders can concentrate on new engineering and design, as opposed to manufacturing and
distribution. The result is most likely to improve styling and chassis and in addition the customer will get an overall improved car because the outsourced manufactured parts are produced by companies whose sole purpose is to manufacture these components (Tomkins et. al., 2005).

Another outsourcing effect that improves quality is the access to new technologies and innovative components. For example, the world’s largest automotive supplier Robert Bosch GmbH invested 3,583 million € into R&D in 2007 which corresponds to a 7.8% share of the total revenue (www.bosch.com) while well known innovative car companies like Toyota (3.7%) or BMW (5.2%) spent a much smaller share of their revenue for R&D. Bosch developed 3,280 patents worldwide in 2007 (www.bosch.com). These patents will be implemented in several products of different car brands, which show the advantage of outsourcing compared to a situation where every car company had to develop their own technologies and innovations. These simple figures show the difference between suppliers & OEMs. A supplier like Bosch supplies several of the 13 major automotive OEM companies with high-tech and high quality components and subsystems. Natural high technology systems like the Anti-lock braking system (ABS) or the traction control system (TCS) are mainly developed and produced by 2nd and 1st tier suppliers, because they are specified for it. The impact on quality through the technological advantage is therefore fundamental.

The two main reasons we just highlighted also interact together. The R&D investment rate of the OEMs is comparatively low because they concentrate more on their core competencies. Kleinhans and Dannenberg (2004) call this brand management. The car producers need to create an image for their brand which builds up a competitive advantage. Therefore the OEMs invest more resources into marketing and the conception of innovations but less into the research and the development itself. The OEMs research the customer demands in order to create new conceptions which they develop in collaboration with their major suppliers. The suppliers provide the OEMs with the main technical implementation and the best quality.

A study of Generational Sequences in the U.S. Automotive Cockpit Industry from Fixson et al. (2004) highlights that the division of work concerning the quality and technology attributes of outsourcing in figure 25.
The study divides between three different cockpit generations. The first generation (termed generation 0) has rather integral product architecture that has been used for decades in which the automaker (customer) engineers the product, buys components, and then installs the components individually and sequentially while the automobile travels down the assembly line. In contrast, cockpits of generation 1 are designed to be assembled off the main assembly line. After assembly and test completion, they are attached to the automobile essentially in one piece. Internally, the cockpits are fairly similar in architecture. The internal structure of the cockpit is what is affected by changes between generation 1 and 2. Product architecture changes in generation 2 mostly affect the internal product architecture characteristics taking advantage of modular architecture to pursue cost reduction and increased functionality, while the external relationship between cockpit and vehicle are comparable for generations 1 and 2. Fixson et al. (2004) say that this three generation framework closely resembles how industry experts view the development of automotive cockpits. (Fixson et al., 2004)

The study shows the development of high-tech components concerning outsourcing. The new generation of cockpits is assembled by the 1st tier supplier and the parts are
produced by the 1st and 2nd tier supplier. The OEMs have a major share of value creation in the concept phase and a minor, but mentionable share in design, engineering and validation. The supplier’s share increases with the technological quality of the cockpits. The new generation of high-tech cockpits is mainly developed and manufactured by the suppliers, while the older less complex generations are mainly produced by the OEM itself. The OEMs outsource these specialized subsystems and components to benefit from the supplier’s technological and assembly experience and simply because it is not the core competency of the OEMs.

6.2.2 IMPACT ON COSTS

Figure 26 expresses the third step of the four main parts our analysis. We examined the impact of outsourcing on costs.

![Figure 26: Third Step of the Analysis – Impact of Outsourcing on Costs](image)

One of the main reasons for OEMs to outsource activities is the goal of cost reduction. But outsourcing is not only used to cut costs it is also a tool to improve cost controlling. (Quélin & Duhamel, 2003)

One challenge of OEMs in the automotive industry is the complexity of the product. Hence a reduction in cost of manufacturing and logistics services is an important outsourcing goal for the companies. When the OEM outsources manufacturing it can consolidate operations. Whole manufacturing or logistical processes and subsystems can be outsourced which leads to lower maintenance costs for factories or inventory (Tomkins et. al., 2005). The major manufacturing suppliers in the automotive industry
like Bosch, ThyssenKrupp, Siemens or Continental provide several OEMs with their products, so the company does not have to pay for under-utilized capacity, which would in turn lower inventory-carrying costs. As the number of suppliers will decrease (Kleinhans & Dannenberg, 2004) the capacity utilization and flexibility of the suppliers will increase even more in the coming years. The Mercer studies show which manufactured parts of the production are most likely to be outsourced in figure 27.

**Figure 27:** Value Creation in the Automotive Industry 2002 (Kleinhans & Dannenberg, 2004)

It shows that only the body structure and the related exterior body parts were mainly manufactured by the OEMs. But the outlook to 2015 shows that the OEM’s value creation will decrease for every manufacturing process and even their production share of body structure and exterior will drop below 50%. The number of suppliers in the automotive industry has decreased since 1980 from approximately 40,000 to 5,600 in the year 2000 and will decrease to around 2,600 in 2015. At the same time their total value creation will double between 2000 and 2015, which leads to a variety of powerful specified companies (Kleinhans & Dannenberg, 2004). Hence these suppliers can lower their costs through the economies of scale and scope. Therefore this development has a positive impact on the OEMs costs in two ways:
- The overhead costs decrease through the outsourcing of production capacity.
- The productivity of the suppliers increases which leads to lower variable cost for the outsourced processes.

Another important outcome of outsourcing is the reduction of staff. Outsourcing always leads to a downsizing of jobs, which is another positive impact on costs for the OEMs. The outsourcing of processes or whole departments is one of the most effective methods to reduce head count (Tomkins et. al, 2005).

The Mercer study shows the world wide impact of the employee reduction in figure 28.

**Figure 28: The Decrease of Jobs for the OEMs (Kleinhans & Dannenberg, 2004)**

Even though the total amount of jobs will increase in the automotive industry by 34% the OEMs will cut approximately 300,000 jobs while the suppliers will create about 3.3 million new jobs (Kleinhans & Dannenberg, 2004). However, the profitability and revenues is of the OEMs is expected to grow.

Kleinhans and Dannenberg (2004) expect that outsourcing will lead to a significant increase of profitability. The average EBIT margin of automakers has been 4.8% between 1992 and 2002. They estimated that the benefits of outsourcing in quality and
efficiency will lead to cost savings between 600€ and 1000€ per vehicle by 2015. The EBIT margin will increase by around 3 percentage points and the return on capital employed by 3 to 10 percentage points.

6.2.3 Interaction of Outsourcing Goals

The following figure should give an overview about the most important outsourcing goals stated by managers (Kakabadse & Kakabadse, 2005). We changed the exact terms to adjust these outsourcing goals to the specifics of our analysis and the automotive industry.

**Figure 29: Interaction of Outsourcing Goals**

The access to external technologies and competencies leads to a higher customer satisfaction. Technology and quality are the keys to a good brand image and high sales. The downfall of the Detroit3 (GM, Ford, Chrysler) is a good example of how failures in technology and quality can affect the company’s performance. The access to these specialized supplier skills also leads to a decrease of deficiencies, because the acquired high quality parts and the adopted production methods will improve the OEM’s own assembly. The reduction of deficiencies leads to a higher quality for the customer and saves costs at the same time (Juran, 2000; Deming, 2000). The access to external technologies and competencies and the focus on core competencies interact with each
other. Both the OEM and the suppliers focus on the processes they have the best competencies in, which leads to a kind of comparative advantage. The OEM focuses its R&D and other strategic resources on its core competencies, while the supplier is doing the same. Hence the OEM benefits from the suppliers focused technology and competence strategy.

The focus on core competencies leads of course to better brand image and customer quality. The OEM concentrates on marketing and strategy which leads to better car concepts concerning customer demands, while the supplier produces most of the new car’s “hardware”. The OEM also benefits from a more efficient production. We also see an interaction between that issue and the focus on core competencies. The OEM specializes and streamlines its own production focusing on its core processes, while the supplier is doing the same. It is similar to the technology factor, because the OEM not only benefits from its own increased productivity but also from the specialized streamlined production of the supplier. The more efficient production of both OEM and supplier leads naturally to a decrease of deficiencies and a direct reduction of mainly variable costs.

The achievement of a smaller head count and less maintenance costs is also one of the OEM’s main goals for outsourcing (Kakabadse & Kakabadse, 2005) and will cut the overhead costs. The focus on core competencies which we see as the most important driver of successful outsourcing affects this goal, too, because the strategic focus is besides simple cost reduction one main reason for outsourcing subsystems or whole departments. The smaller head count and maintenance costs leads to lower costs in general and to improved cost control. The allocation of overhead costs to processes is much more difficult than the variable cost allocation. The improved cost control is naturally a corner stone of a successful cost reduction.

Further researches could analyze the impact of outsourcing on the 1st or 2nd tier suppliers. Especially the larger 1st tier suppliers also outsource processes like the OEMs while the 2nd tier suppliers are do not have many possibilities to outsource processes or components because their products are mostly more basic. It would be interesting to compare the outsourcing impact between the three links. How does outsourcing influence the competition between the suppliers? How does it affect the supplier’s corporate strategy? What are the core competencies of the suppliers?
Questions like this could give a better total view on the supply chain of the automotive industry.

6.3 Interaction of TQM and Outsourcing on Quality and Costs

In this chapter we studied the last step of our analysis; the interaction of TQM and outsourcing and how this interaction supports and influences costs and quality of an automobile OEM (see figure 30).

![Diagram of TQM and Outsourcing Interaction]

**Figure 30:** Last Step of the Analysis – Impact of both TQM and Outsourcing on Quality and Costs and their Interaction

On the first view, there is no obvious relation of TQM and outsourcing. TQM is often seen as an internal philosophy to improve customer satisfaction. Outsourcing is often done to improve the OEMs’ costs situation. However, nowadays, TQM and outsourcing have increased, and there are definitely overlaps between the two. For instance, the earlier analysis showed that both TQM and outsourcing concentrate on quality improvements and cost reduction. Both approaches start with the same aim - they want to improve the efficiency of automobile OEMs. Furthermore, both techniques focus on the same issues we wanted to investigate, namely costs and quality. Hence, both approaches not only overlap but also interdigitate, due to the fact that TQM is often used internally and outsourcing mostly has an external perspective. However, according to Rao et al. (1996) and Boaden (1997), TQM also implies collaboration with customers and suppliers.
The figure 31 presents the connection between outsourcing and TQM like we analyzed in the following paragraphs. This figure shows that outsourcing leads to specialization and concentration on core competencies for OEMs and suppliers. The focus on core businesses improves the OEM’s TQM. But an efficient TQM is only possible if the automotive OEM collaborates closely with its suppliers and customers. Hence, quality standards such as TS-2 for the automotive industry have a big impact on a successful TQM and outsourcing. Furthermore, the customer focus must be transferred and communicated to the upstream supply chain partners. If outsourcing and TQM are implemented properly the combination of both would lead to quality improvements and cost reduction for the end-customers.

**Figure 31: Connection between Outsourcing and TQM**

According to Hendricks and Singhal (2000) the conventional wisdom of TQM is that it is less beneficial to smaller companies. The two authors negate this theory in their empirical study. We would like to use the results of Hendricks and Singhal’s research and transfer them to our case as we did in chapter 6.1.12. The results are presented in the next figure.
Figure 32: Comparison of Smaller and Larger “TQM - Companies” (Hendricks & Singhal, 2000)

The figure 32 compares the average percent change in performance of smaller and larger quality award winners. The performance of smaller companies, which implemented TQM, is obviously better than the results for larger companies with a quality management. For instance, small firms increased their operating income about 63% compared to 22% for larger firms. Furthermore, smaller winners experienced a 39% increase in sales (compared to 20% for larger companies) and a 17% improvement on sales while larger winners achieved 7% increase. These measures lead to the conclusion that TQM is more successful in smaller companies.

When we transferred Hendricks and Singhal’s (2000) results to the situation of the automobile OEMs we could come to several conclusions. First, the automobile OEMs must usually be seen as large companies. Hence, outsourcing helps the OEMs to concentrate on core businesses, which means that the OEMs become smaller. The depth of the organization decreases. According to Hendricks and Singhal’s (2000), this procedure should lead to a more efficient TQM. Thus, outsourcing is able to support an efficient TQM. The reasons for a better TQM lay in its key elements. It seems logical that teamwork, worker empowerment, everyone’s involvement and commitment perform better in smaller firms. In addition, the change to the TQM philosophy could be easier in smaller companies due to the fact that the resistance might be less compared to large companies.
In the further analysis we wanted to have a closer look on the interrelations presented in figure 31 and what the impact on quality and costs is. Hence, we started with Rao et al. (1996) and Boaden’s (1997) summarized core ideologies of TQM and analyzed their connection to outsourcing.

6.3.1 Customer Focus

A main TQM philosophy is to focus on its customers, which should lead to more valuable processes with an increased car-quality and a reduction of COPQ. In the end, the automotive OEMs can meet the customers’ needs and satisfy them with the help of TQM. This is explained in detail in part 6.1.1. In chapter 6.2 we discussed the very common and increasing outsourcing policy of the automobile OEMs. Outsourcing enables, according to Kakabadse and Kakabadse (2005), the OEM and the suppliers to focus on core competencies. This means for the OEM that the car manufacturer can concentrate on competencies such as brand value, investigating and meeting customers’ quality expectations, marketing, customer relationship management, customer dialogue program (for example the Porsche Card) and other valuable services. All these processes focus on customers and can lead to product diversification. Hence, you can say that outsourcing can enables an automotive OEM to better focus on its customers, and thus outsourcing supports TQM in doing so. This procedure influences the customer focus of the TQM in a positive way, and therefore supports the quality improvement and cost reduction. But outsourcing could also have a negative impact on customer focus, which is explained in the next paragraph.

On one hand, the OEM’s customer focus is supported by outsourcing, but on the other hand the production of some automotive parts moves back to the suppliers in the supply chain, whereby the direct customer contact and focus can get lost. Hence, it is important to communicate customers’ expectations throughout the supply chain, and therefore guarantee that the suppliers’ concentration on core competencies also leads to quality improvements and cost reductions for the end-user.

6.3.2 Continuous Improvement

According to the quality gurus Juran (2000) and Deming (2000) continuous improvements are crucial for an effective TQM with cutting of COPQ and product excellence. Kakabadse and Kakabadse (2005) emphasize that the outsourcing process
leads to a concentration on core competencies, which means that the automotive OEM and its suppliers specialize on their skills and can often gain economies of scale. Hence, outsourcing might lead to cost advantages because of specialization and economies of scale. The effects of specialization are learning effects and usually lower costs due to less rework and mistakes, which are unnecessary costs (COPQ). Furthermore, according to Quinn and Hilmer (1994) the automobile OEM gets access to suppliers’ technologies and skills through outsourcing. This itself is a quality improvement for the automobiles and also supports the further improvement process.

Moreover, the concentration on core competencies also enables the OEMs to only improve processes they are skilled in. Continuous improvements are concentrated on the main issues of the automobile OEM, and thus no resources are wasted for non-value adding activities. According to Kakabadse and Kakabadse (2005) the OEMs use the specification and concentration on core businesses to improve the quality for customers. However, this procedure can only be valuable if the OEMs collaborate closely with its suppliers. Permanent discussions, suggestions and inspiration for improvements are only gained if a close collaboration is given.

Quality and cost improvements are further achieved through more competition between suppliers. The suppliers are under considerable strain concerning quality, costs and innovations to stay an automobile OEM’s partner. The bottom line is that the end-customers are provided with excellence performance at low prices that companies like Toyota stand for.

6.3.3 Total Participation

Rao et al. (1996) and Boaden (1997) summarize several points under total participation as we stated in figure 23. This means for the TQM that it is only successful if there is a close collaboration and involvement of everyone within the OEM and at the suppliers. On one hand, it is difficult to combine outsourced parts with internal activities, but on the other hand, outsourcing gives the automotive OEMs the possibility for better participation within their company and thus a more efficient TQM. According to Richardson (1993) outsourcing flattens the hierarchy and depth of the organization. Thus, it is easier to involve everyone in teamwork and communicate the TQM philosophy. The communication within the company becomes much easier and leads to
more creativity and participation, which according to Kakuro (2004) is essential for progress.

Total participation means not only the inclusion of the suppliers in the automobile OEM’s quality management but also the customers. When we talked about customer focus, we stated that outsourcing enables the OEM to better concentrate on the end-users. This also includes the possibility for the OEMs to let customers participate in the development of cars. For example, the participation of customers through surveys or one-on-one interviews, leads to the identification of customer expectations according to Matzler et al. (2004). If the OEM can identify quality factors and communicate these with its suppliers, then this is the first step to meet customers’ needs or even delight the end-users through unexpected quality.

6.3.4 The Importance of Standards in the Connection of TQM and Outsourcing

The discussion in chapter 5 showed that outsourcing is very important in the automotive industry. According to the Mercer Management Consulting study, the importance of outsourcing will even increase in the next years. In 2015, OEM partners will produce about 75% of the value creation in accordance with Kleinhaus and Dannenberg (2004). This is a huge burden for the coordination between outsourced activities and processes done by OEMs. This problem especially occurs when it comes to the quality management. According to Boaden (1997) and other quality gurus like Juran or Deming TQM also encompasses customers and suppliers. The automobile OEMs try to guarantee high quality throughout the entire supply chain through quality standards. This means that the OEMs require their suppliers to achieve the quality standards of ISO; especially the TS-2 standards, which are discussed in chapter 3.1.3. Due to increased outsourcing and raised quality and cost expectations of customers these standards attain more and more importance for an efficient TQM.

TS-2 and TQM relieve the outsourcing process. Due to quality standards, supplier know exactly what they have to do and therefore can easily meet the requirements of automobile OEMs. According to Bandyopadhyay and Jenicke (2007) the standard harmonization is valuable for suppliers because they do not have to achieve different requirements of different automobile companies. Hence, the OEMs do not have much to negotiate with new suppliers concerning quality requirements. Furthermore, many
automotive suppliers deliver to several OEMs. If the standards are all the same required from the OEMs (like TS-2 for the whole automotive industry) and several OEMs receive the same products the suppliers can achieve economies of scale, which lowers the costs for end-customers. Hence, many automobile suppliers already achieve the requirements of OEMs and thus the integration of new suppliers is often valuable and easy for OEMs.

However, if we consider that TS-2 is integrated in today’s automobile TQM philosophies, which should be included according to Bandyopadhyay and Sprague’s (2003) quality management definition, what does outsourcing mean for the COPQ? According to Willem (2004) and Stundza (2005), TS-2 guarantees a certain quality level for automobile OEMs. Hence, many unnecessary costs can be cut. For instance, appraisal costs can be reduced to a minimum. Incoming goods do not have to be inspected and tested due to guaranteed quality, which saves much money and effort.

Outsourcing itself does not necessarily reduce prevention costs. Indeed, the quality and process planning could even become more difficult for the automobile OEM. But TQM in combination with TS-2 supports an easy planning process. According to Willem (2004) and Stundza (2005) TS-2 contains several requirements, which lead to a reduction of prevention costs. The specified regulations manage many issues in advance and therefore reduce the complexity of the planning process. Hence, the prevention costs can be reduced though the quality stays at the same level.

The third group of COPQ is the failure costs. What impact does outsourcing and TQM in combination with TS-2 have on internal and external failure costs? According to Seetharaman et al. (2006), TQM with its continuous improvements leads to a reduction of failure costs. Outsourcing even intensifies this cost cutting due to the fact that both suppliers and automobile OEMs concentrate on core businesses where they are skilled. This means that deficiencies such as scrap, rework or warranty charges can be reduced. Hence, the OEM reduces costs with the help of TQM and outsourcing. At the same time the customer recognized quality improvements due to less external failure costs. TS-2 is important in this case because the automotive OEM is only able to reduce failure costs if the receiving goods are free from deficiencies, which is guaranteed through quality standards.
Our theoretical assumption was that outsourcing supports TQM. This supposition could be empirically investigated through hypothesis testing. A suitable hypothesis to test would be that a high outsourcing level comes along with a better TQM implementation.

6.4 The new BMW Plant in Leipzig — Outsourcing and TQM in One Factory

To take a closer look on how outsourcing and TQM interact and improve quality and costs inside a company we analyzed the 2005 built BMW plant in Leipzig, Germany which mainly produces the 3series. As the plant is one of the most innovative and efficient in the world we wanted to use it as an example for the new generation of highly innovative plants. We want to show how the factory is organized concerning the integration of suppliers and the implementation of TQM concepts and how both approaches interact in the automotive production processes. The analysis is mainly based on the case studies of Anna Kochan (2006) and Ludger Pries (2006), on an article in the Siemens journal “Move up” from Thomas Hildebrand (2005) and BMW websites as well.

6.4.1 Outsourcing and Supplier Collaboration in Leipzig

Olsen (2006) stated that outsourcing generally increases productivity, saves labor costs and improves quality in the manufacturing industries. A closer look at a case study from Anna Kochan (2006) about the newest BMW plant in Leipzig, Germany shows why. The plant itself was built in a very close collaboration with Siemens, which is one of BMW’s major suppliers. Siemens not only played a big role in building the plant, it also provided the IT-systems and the whole automation software (Hildebrand, 2004). The high automation grade (97%) is provided through the robots of the supplier KUKA AG which BMW selected to collaborate for the 3series production. Several other suppliers like FFT, Edag or Emil Bucher are involved in the welding lines production for assembling the underbody of the car (Kochan, 2006). But the most innovative attribute of the plant is the integration of the suppliers into the production itself. BMW built a supply center which has a direct link to the assembly hall. Internal and external suppliers pre-assemble modules in the center in order of the needed supplement for the assembly line. The parts from the different suppliers move full automatically on the shortest route to the assembly line, “just in sequence”.

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Another highly innovative feature of the new plant is the number of key roles that BMW has entrusted to outside suppliers. The entire logistics function has been outsourced. Three main third-party service providers share the task: Rudolf logistics for body shop logistics, Schenker logistics for assembly, and Hoechst subsidiary Infraserve handles non-series production logistics, including spare parts, both for offices and for the plant, such as light bulbs, printer cartridges, conveyor motors etc. The 160 Schenker employees work next to the BMW workers on the same assembly line and also in two module assembly areas where five different suppliers rent space and prepare modules according to the assembly sequence, only noticeable through the different color of their working clothes. (Kochan, 2006) 80% of the daily material is supplied “Just in Time” or “Just in Sequence” by the logistic service providers (Pries, 2006). Figure 33 shows the ground plan of the plant.

**Figure 33**: Ground Plan of the BMW Plant, Leipzig (Kochan, 2006)

Indeed BMW never implemented suppliers as deeply into their production as in Leipzig. The collaboration with the suppliers is closer than in every other BMW plant. There are no communication barriers between the integrated partners and BMW. But it is also an example for the right choice of outsourced components. According to the procurement matrix of Nellore and Söderquist (2005) BMW produced strategically important components like the chassis or the painting mainly itself, but also integrated their suppliers in-house by having a high level of collaboration, while the suppliers of basic components and materials are not integrated in the plant organization.

6.4.2 Use of TQM Concepts in Leipzig

Boaden’s (1997) eleven points of TQM are the basis for our analysis of the BMW plant. We analyzed the use of these eleven aspects to find out in which dimension TQM is
implemented in Leipzig. The boundaries between these points are not always clear in terms of their practical approach, but we wanted to find examples for every aspect of Boaden’s TQM concept.

The use of the points

- the involvement of everyone within the organization in quality improvement (4),
- the use of teams and teamwork (6),
- and the change in the culture of the organization, for example the way people think and behave (10)

are visible through the following organizational attributes of the plant: New work structures have been adopted especially prevalent in the highly automated areas of the Leipzig body shop where the investment is particularly high. In all other BMW plants, multi-disciplinary teams manage individual sections of the production line. A team could, for example, be comprised of ten production operators, three quality specialists, three for logistics tasks and six for maintenance jobs. Taking a completely different approach, the teams operating at Leipzig are made up of personnel who are all trained to an equal level in each discipline. Each one can, for example, teach, operate and maintain a robot. (Kochan, 2006) Team work and a change in the whole team organization structure are used in one of the most important processes of BMW’s production. The new-style teams in the Leipzig body shop also organize themselves and decide which member takes responsibility for which functions each day.

BMW also considers education and training as an investment (3), because they trained these multi-disciplined body shop staff in its various factories across Germany and invested remarkable resources into their education. That lead to a much more efficient level of working, but BMW does not have to pay higher wages despite the higher skill levels. (Kochan, 2006)

The customer focus with emphasis on the customer-supplier relationship (1) is also evident in the Leipzig Plant. One of the goals when BMW planned the construction of the plant was the creation of a perfect work atmosphere without boundaries between BMW staff, the suppliers and also customer visiting the factory. (www.bmw-werk-leipzig.de) The construction of the plant allows managers, engineers and assembly workers to work with each other and to communicate directly to improve processes. As proof of the innovative character of the plant, the central administration building at
Leipzig, designed by the renowned London architect Zaha Hadid, was a finalist for the 2005 Stirling prize. The car bodies are being transported several times between the different production processes. That leads to a transparent production for employees and visitors (Hildebrand, 2004). BMW provides several guided tours and other offers for visitors.

The TQM points:

- the commitment of everyone to quality improvement, especially managers (2),
- the involvement of everyone within the organization in quality improvement (4),
- and goal-setting, measurement and feedback for all aspects of the business (8)

are also a part of the BMW philosophy in Leipzig. The bonus payment system of BMW is a good example for these points of the TQM concept. The new output-oriented salary schemes were introduced in certain areas, with a basic salary and bonus payments of up to 21% of the basic salary if production targets are reached. There are also individual bonuses according to performance and goal attainment (with 3% of the basic salary as a general target step, and 6% and 9% as additional steps). The annual bonus payment is oriented around plant seniority – from 25% (less than a year working at BMW) up to 100% (three or more years of BMW service), with the start of production in 2005 as the starting date. (Pries, 2006) Employees and managers also get bonuses for improvements which is an incentive to make the production more efficient and improve quality.

The focus on processes (5) is fundamental in the automotive industry and naturally in the BMW plant, too. The outsourcing of the logistic processes to three main suppliers and the high rate of outsourced processes in total are evidence for that TQM point. BMW clearly focused on its core processes in the plant, which are the body shop, the paint shop and final assembly of the components with an individual customization of the cars to fulfill the customer demands.

The use of appropriate tools and techniques (7) is widely implemented in the BMW production system. One example is the assembly shop of the Leipzig plant which is a mainly manual area. However, the insertion of the windscreen is a sophisticated station involving more than 50 cameras to ascertain the exact position of the vehicle in the station and the best fit of the windscreen in each vehicle coming down the line. The station was supplied by German systems integrator IBG. As well as working structures, the equipment at the Leipzig plant is also very flexible. A universal pallet, with
common location points below and model-specific positioning points above will enable a new model to be accommodated on the assembly line with the minimum of adjustment. (Kochan, 2006) Guenther Benz, the director of the body shop, explained: “Change this tool and you can immediately build a new model on the same line.”. Other innovative technologies and tools are implemented in the outsourced logistic department. When the new supply of parts arrives, it is the line runner’s job to transfer them to the appropriate station. But in Leipzig the Schenker personnel ride on electric scooters, because the 20 stations cover a length of about 120m and the employees might have to walk that distance 100 times a day. (Kochan, 2006)

The philosophy of continuous improvements (9) is a fundamental core of BMW production system in Leipzig. The plant itself is a result of several improvements the engineers developed in the other BMW factories. The construction attributes of the plant allow to the implementation of new components and to make improvements in a short time. But also in the short history of the plant itself BMW made several improvements to optimize the production processes. Problems can be quickly investigated and solutions implemented, having the technology on site. For example acoustic testing is now done regularly during a launch, when component changes occur. Gerhard Schlager, the director of quality management, stated: “We’ve already eliminated sources of noise. And, because we can create far more extreme conditions than the average customer will encounter, we can improve the whole system step by step” (Kochan, 2006).

The inclusion of quality principles into product and service design (11) is implemented in every OEMs production process. To underline the importance of quality principles in the BMW production in general, we want to highlight the BMW’s philosophy of core quality control procedures (www.bmweducation.co.uk):

- Quality is of key importance in every stage of the manufacturing process form product conception to customer feedback.
- Principles applied are consistency and complete coverage of all requirements throughout the development and production process.
- Quality control is achieved through a system of quality audits at every stage of the manufacturing process: the production of parts, components and in the assembly plants.
The same quality control principles also apply to suppliers of materials and components. All BMW suppliers agree to work to specifications of quality.

Every member of staff is fully responsible for the quality of their work.

The BMW management structure allows for the team to react quickly if a fault is found and groups comprising of employees from all levels are pulled together to work immediately on a problem should one occur.

We think that the eleven points of Boaden (1997) are well implemented in the BMW plant Leipzig. It was not always possible to make clear cuts between the different points. But the overall picture of the plant and the company BMW itself shows the importance of quality in their philosophy.

6.4.3 Interaction of Outsourcing and TQM in Leipzig

The positive impact on quality and costs of this plant’s organization with its high outsourcing rate and its focus on quality can be proven by several figures. Gerhard Schlager, the director of quality management, stated: “Compared with other launches, we have achieved 50% fewer faults per vehicle, and we are recording far better process capability measures than we had in the past” (Kochan, 2006). That decrease of deficiencies is a big step ahead in terms of quality improvement and cost reduction. The level of productivity is 20% higher than in other BMW plants (Kochan, 2006). The quality in terms of customer satisfaction of the BMW 3series improved too, since the production in Leipzig started. According to the ADAC Pannenstatistik, which measured car break downs of 87 different models, the BMW 3series (built in 2006) had the best performance of all middle class cars, far ahead of competitors like Toyota, Ford and Volvo (www.adac.de).

The plant in Leipzig is an example for a good interaction of outsourcing and TQM. The whole construction plan of the factory is based on supplier integration and the interaction of BMW personnel and supplier personnel, but also the use of innovations and technology lead it to be one of the most efficient plants worldwide. We think that outsourcing can be seen as a precondition for the successful implementation of TQM concepts in the Leipzig plant. The focus on the processes assembly, body shop and design processes gives BMW the opportunity to focus their resources on these few processes, while 500 trucks supplies the plant with 10,000m³ material day per day.
(Pries, 2006). The workers know their crafts and are trained to work in different areas of the plant. Hence the focus on these core activities allows a much more flexible production with more specialized staff. In addition the focused partners like Schenker who are responsible for the in-house logistics support the production with their experience, but they are part of the BMW quality control, too. Another positive impact on costs is seen in the employment situation. In December 2007 BMW announced it would cut 7,500 jobs in Germany (www.neurope.eu), but BMW makes an extensive use of workers lent from different temp agencies and hired by their suppliers in the Leipzig plant. When there is a crisis, BMW does not have to cut the jobs of the unionized BMW employees, but instead the more flexible and less paid outsourced jobs without mentionable complications. This leads to another cost advantage for the OEM, but to a controversial work ethics discussion on the other hand. Workers with different wages but comparable educations work side by side. Jens Köhler, a member of the workers’ council said that this leads to a conflict within personnel. Especially after payment day the employees working in the same teams have discussion about the unequal salaries for the same kind of Job. (www.mdr.de)

**Figure 34:** Supply Chain of the BMW Plant Leipzig, Germany
Figure 34 shows a simplified model of the plant’s supply chain of the BMW plant. The left arrow shows the direct influence BMW’s quality control, while the right file explains the outsourcing and integration level in terms of value creation share and communication quality. It shows how BMW focused on its three core components concerning production, but also closely integrated the most important suppliers, while the less important 1<sup>st</sup> tier suppliers and the 2<sup>nd</sup> tier suppliers are loosely or not integrated in the production. The quality of these less integrated suppliers is mainly controlled and guaranteed through the quality standards like ISO or TS-2, while the closely integrated suppliers are direct part of the BMW quality control. They are in permanent mutual communication with BMW workers, engineers and managers. Hence BMW has found an effective solution in integrating suppliers directly into the Leipzig plant. The figures of BMW show that this kind of plant organization with its

- high degree of outsourcing,
- its close integration of important suppliers,
- its focus on the main production core competencies,
- and its strongly implementation of TQM

leads to highly efficient production with high quality, less deficiencies and lower costs.

The example of the BMW plant in Leipzig shows how a well planned integration of suppliers, a high level of outsourcing and TQM concepts can interact together and improve the production in terms of quality, efficiency and costs. The factory is also a benchmark for the organizational structure of future automotive plants because the success of the plant will most likely inspire and influence other OEMs.

*Several questions arise concerning the BMW case. Further analyses would be necessary to find out in which dimension outsourcing and the close collaboration influence the staff motivation. In which do the different contracts with different wages have negative impact on staff loyalty and working morale? Which barriers do rise up? Is there an influence on the productivity? Is the communication between contractors really honest when it is about admitting mistakes to make improvements? These questions could be answered in company internal survey studies.*
7. Conclusion

This last chapter concludes our Master Thesis. We focused on answering the research question and discussing the findings of this thesis. Moreover, we gave reflections and a critical review. Finally, we presented suggestions for future researches.

7.1 Answer to the Problem Formulation

Today’s automobile manufacturers are confronted with a big challenge because consumers expect the highest possible quality at the lowest possible price. Our research question was “How is it possible for automotive companies to assure low costs and high quality at the same time by using TQM and Outsourcing?” In the analysis, we examined the relation between TQM and outsourcing. Their connection is that both methods try to improve the efficiency of automobile OEMs and concentrate on quality improvement and cost reduction.

The customer focus is the most important aspect of TQM. By regarding the customers’ demands and needs the quality improves automatically because the customers will be satisfied with the help of TQM, which leads again to a reduction of COPQ. Outsourcing enables the OEM (and supplier) to focus on its core competencies such as investigating and meeting customers’ quality expectations. Thus, outsourcing concentrates on the customers, too. This improves the OEMs’ TQM at the same time. But only an accurate implementation of both and a close cooperation of the OEM with its suppliers and customers leads to an efficient TQM and finally to quality improvement and cost reduction.

Today, Toyota is the largest automotive company worldwide. It implemented TQM, and is the best example for having high quality and low prices/costs at the same time. But as we analyzed TQM is more successful in SMEs. Automobile OEMs are large companies, but with outsourcing and its focus on core competencies different parts arise within the OEMs. These parts can also be seen as “small” OEMs. The employees have smaller task and therefore they are more involved and skilled in their area. It is rational that the TQM philosophy of more teamwork, worker empowerment, involvement and
commitment to perform, will be implemented more easily and with greater success in smaller firms because everything is clearly arranged and on a more personable scale. In addition, the change to the TQM philosophy could be easier in smaller companies due to the fact that the resistance might be less compared to large companies.

It is known that outsourcing is often used in companies and reduces the costs of OEMs. We have also highlighted how TQM alone leads to quality improvements. But they work not only separated very well in companies. Outsourcing lays good foundations for an efficient TQM implementation. Therefore we conclude that precisely these two methods, outsourcing and TQM, supplement each other and fit together very well to assure the efficiency of the automobile OEMs with high quality and low costs at the same time.

7.2 Reflections and Criticism

Our Master Thesis was a theoretical investigation of a real world problem in the automotive industry. Outsourcing and TQM are two very common methods to handle cost and quality challenges of automobile OEMs. However, the relation of the two methods had not yet been analyzed. Hence, it was interesting to combine two quite well investigated approaches in the automotive industry, which is also an exciting business. Due to the fact that this is a theoretical study we only used empirical information of scientific articles and web pages. It would have been interesting to get access to primary data of automobile OEMs. Nevertheless, we thought that a theoretical thesis is valuable as starting point for this spacious theme.

Moreover, TQM was presented as a uniform method, which a company can implement, or not. However, as we mentioned in our TQM chapter the quality gurus such as Juran, Deming, Crosby or Feigenbaum did not use the term TQM for their quality management discussion. Nowadays, almost all quality aspects are combined under TQM. Thereby, every automobile OEM uses quality management (TQM) in some way in its company. However, due to the fact that there is not a uniform TQM theory, every quality management looks different and thus is also called differently. Every automotive OEM must experience and adapt quality management that is suitable for its firm. Hence, different “TQMs” are hardly comparable and it is thus difficult to assess or benchmark the success of quality managements.
A typical problem concerning our research is the rate of unsuccessful outsourcing decisions especially concerning international outsourcing (off-shoring). A representative survey concerning the outsourcing of German companies from 2002 showed that 30% of outsourcing is less successful (27%) or not successful (3%) at all (www.aus-innovativ.de). The rate is quite low but still some companies regret their outsourcing decision and decide to integrate the outsourced processes into the company organization again. Still, most companies do not give information about these problems in surveys or case studies concerning the impact of outsourcing. Decision models like the procurement matrix from Nellore and Söderquist (2000) should keep this rate low.

The use of quantitative survey figures also causes several problems for a study. For example, a component whose supplier value creation share is 90%, could still be mainly affected by the OEMs in terms of conceptions and research and development. Therefore deficiencies or poor quality and high costs could be mainly caused by the OEM, even if its value creation share is only 10%. This detailed view on every single process would be necessary to find out how much “real” value creation is made by the OEM.

7.3 Suggestions for Future Researches

This thesis was a theoretical analysis about the impact of TQM and outsourcing on quality and costs in the automotive industry. We already stated emerging ideas for future researches immediately after each analyses chapter (6.1, 6.2, 6.3 and 6.4). Nevertheless, we thought that there are a lot more possibilities to go on after this master thesis. Due to the fact that it was a theoretically based there are many possibilities for future researches. A good idea would be to go on with empirical analyses about this theme in the automotive industry. First of all, a case study of big automobile OEMs could lead to a more detailed empirical foundation of our results. Furthermore, the results could be supported by surveys among automobile OEMs. For instance, the OEMs’ overall performance could be analyzed and connected to their quality and costs situation and compared to other companies. Another possibility could be to measure the COPQ (as far as it is possible) and compare these between the OEMs.

Another opportunity would be a survey study which combines the outsourcing grade in terms of value creation share with the level OEMs or supplier’s level of quality. The quality could be measured with help of several clusters like callbacks, customer satisfaction or deficiencies in production. We think that the outcome could probably
show a statistical relation between the outsourcing grade and the quality and therefore could provide evidence for the impact of outsourcing on quality and the concepts of TQM itself.

This Master Thesis tried to combine two very common methods of the automotive industry; namely TQM and Outsourcing. Due to the fact that we could not find any studies where these two approaches were researched in combination it would be very interesting to follow up this interrelation. For instance, a case study about the combination of TQM and outsourcing could verify our mostly theory-based conclusions.

Moreover, this Master Thesis focused on automobile OEMs. However, the cost and quality pressure is also high for the OEMs’ suppliers. Hence, this study could also be done for suppliers within the automotive industry. It would be interesting to see whether the suppliers handle the challenge of providing high quality at low prices in the same way OEMs do.
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