

Impact of the 3rd Revolution in the automotive industry on the development processes of automotive suppliers

Marshall Plan Research

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Affidavit

State of Authorship

"I hereby declare on oath that this written assignment "Impact of the 3rd Revolution in the automotive industry on the development processes of automotive suppliers", which I am submitting as part of my research, is my own work. All sources have been properly acknowledged and the assignment contains no plagiarism."

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List of Abbreviations

ABS	Anti-lock Braking System
ACC	Adaptive Cruise Control
APPS	Applications
BMW	Bayerische Motoren Werke
BSD	Blind Spot Detection
CAN	Controller Area Network
EBIT	Earn before interest and taxes
ESC	Electronic Stability Control
ESP	Electronic Stability Program
FAST	Future Automotive Industry Structure
GM	General Motors
HMI	Human Machine Interaction
IT	Information Technology
LCD	Liquid Crystal Display
LIN	Local Interconnect Network
NAFTA	North American Free Trade Agreement
OEM	Original Equipment Manufacturer
RCTA	Rear Cross Traffic Alert
SME	Small and middle enterprises
TCS	Traction Control System
VDM	Vehicle Dynamics Management
VFD	Vacuum Fluorescent Display

1.Introduction

The influence of the consumer has grown so large that it determines the success or failure of an innovation and therefore represents its logical starting point. It is not only technical sophistication that makes an effective innovation, but adaptability to the individual settings of the user. The job of industries is to bring better harmony in the supposed opposites of efficiency and diversity with entirely new approaches. The industry needs to recognize the change and adapt accordingly. New approaches are a response to challenges such as low cost, individualization and globalization industry profitability required. The industry tried to find solutions for this problem and that was the start of the first revolution which was a big change in the automotive industry.

In retrospect, Ford classified steps towards mass production as the 1st revolution in the automotive industry. The 2nd Revolution happened in 1997 when Lean production was the Japanese secret weapon in the economic war and conquered the world. Ten years later the 3rd revolution shows that it is getting increasingly difficult for suppliers and automotive manufacturers to operate profitably in the market. In contrast to the first two revolutions, the third revolution is not only characterized by a specific OEM. Some companies are on the right path, but they are not as far ahead as "Toyota" in the second, and "Ford" in the first revolution. The third Revolution in the automobile industry has an impact on business models, the Original Equipment Manufacturers. Advanced globalization with raising concentration on core competencies, amplified outsourcing of critical parts of the value creation chain and increased focus on customers with ongoing product innovation and dynamic development of information- and communications technologies are the driving forces of this new big change. This change particularly hits the supplier. While manufacturers orient themselves more downstream, the production of complete modules is given to suppliers. OEM transfers more and more tasks to suppliers and focuses on their own value brand formative modules. Also, there is an increased takeover of immaterial value creation activities, especially Supply-Chain-Management and research and development tasks. The complexity of products and the cooperation between OEM and Supplier's are changing too. The balance between efficiency and diversity is a key factor for success in the automotive industry.¹

¹ Heigl, Rennhak (2008)

1.1 Relevance of the topic

The automotive industry is constantly changing. Competition and special consumer claims lead to steady improvements of effectiveness and efficiency. Efficiency is the ratio between the achieved results and the used resources. The point is to make the things right. In effectiveness, however, it is about doing the right things. This simple but impactful context shapes many industries. In the automotive industry, he led to revolutionary changes. This is unique in the Economics. In the 100 years of automotive Industry there were already two Revolutions and the 3rd is full in swing.

The topic of this paper should give an overview of changes appeared since the last revolution. New technologies and different ways of cooperation between OEM and suppliers are shown too. Also to find solutions for OEM and suppliers from different nations all over the world to work together as a team for better results. This fact is very important for our safety and for our well-being in the cars we are driving.

1.2 Research Objectives

To explore the impacts of the third revolution in the automotive industry on the relationship between OEMs and their suppliers particularly in a global context the following questions should be answered in this project

- I. What impact has had the third revolution in the automotive industry on the relationship between OEMs and suppliers?
- II. Are there differences concerning the impact of the third revolution in the automotive industry between the US- and German automotive supply industry
- III. Which managerial implications can be deducted for the automotive supply industry to persist under these changed conditions?

1.3 Structure of the paper

The paper is structured in an Introduction part in which the relevance of the topic is shown up.

Chapter two answers the first question and gives an overview about the third revolution of automotive industry, the history of the first two revolutions and the new supply chain. Chapter 3 shows differences between the Intercontinental industry between Germany and the US. And the fourth chapter answers the third question and lists up some strategic ways to survive in the market.

Efficiency and variety – according to Hüttenrauch und Baum's book, information technology and safety are the main topics of the third revolution in the automotive industry. This paper should show how industries or managers can handle the conflict between these two objectives. There are also new trends and inventions, new laws and difficulties to survive in the market.

2.The third revolution in the automotive industry

2.1 Historical Background

The time from when first car was invented until now is full of changes. There have already been two revolutions where car industries had to transform the structure of their business and management to survive on the market. A lot of OEM was founded and connected to many suppliers. The next two chapters will show the first two revolutions and their connecting changes.

2.1.1 First Revolution ²

The first revolution of automotive industry appeared in 1913 in the company “Ford”. Henry Ford the founder of “FORD” and inventor of the production line, introduced mass-production, which leads to cheaper production and higher quantity so cars were available to everyone.

Political environment

At this time, the military had large demand for vehicles. Ford had a good access to the potential labor force. The reason for this was the labor market at this time. The policy also offered the companies the opportunity to grow and become established.

Social environment

The idea that nearly every citizen uses a car was at this time realistic.

Compared to Mercedes, Ford was a lot cheaper and the reason for this was the mass production. You could buy a car, for example the Ford model T, for less than 300 dollars. This was considered a lot of money, but was still much cheaper than, for example, a car like a Mercedes. Henry Ford created highly paid and permanent workplaces for thousands of people to support the demand for his own product. And this was also revolutionary because he created this increase with his own employees.

Technological environment

Ford tried to rely on proven methods. Before the first Revolution, a car was like a tailored suit, made individually for each person. But there was no big space for changes considered to chassis or tires. Technically improvements in production were hardly possible, so they tried to reduce the individuality to reduce the complexity too. Cars became very similar.

Supplier

Suppliers were not important at this time and had a subordinated position. Ford produced nearly every part of his cars in his own company. The tractors, wood, mines and ships were operated and

² Hüttenrauch, Baum et al.(2008)

created by him. Ford managed it to avoid the action of suppliers. The suppliers were definitely inferior to Ford. The existing companies were taken over by Ford and were integrated into his own production.

2.1.2 Second Revolution ³

The Second Revolution leads back to E.Toyoda and T.Ohno of the company “Toyota,” who revolutionized “Lean Management”. Three scientists from MIT (Massachusetts Institute of Technology) examined the differences in development and production conditions in the automotive industry. At its core, lean production is an approach which apart less on technical production automation rather on principles of a lean production.

Political environment

Similar to Germany, trade unions played a big role in Japan. This led to efficient and effectiveness losses. Because of the last world war, the Japanese resources were very limited.

Japan was at a time of new beginnings. Although their financial resources were constrained, they had a lot of human resources they could use. The pressure from the trade unions was the reason Toyota gave every employee lifetime employment and a company profit based payment.

Social environment

The second revolution lead to the development of Toyota having to give lifetime employment guarantee to their employees. The industry was exposed to a very strong demand. After the Second World War, the global economy had a steady economic growth until the oil crisis. This fact however, leads to a positive demand of vehicles in Europe and also in America. There was just one problem; people were displeased with the low quality of their cars.

Technological environment

Suppliers gained growing importance to OEM, because they recognized the high potential of products and services. The cars became more sophisticated and more comprehensive and OEM lost intrinsic value. From a technological view OEM have to handle more complexity. To handle this complexity OEM had to establish platforms. They define platforms differently. In general, platforms define dimensions based on wheelbase, length and width.

Supplier

In principle, all methods of OEM are also shown on the supplier’s side. The added value was considered as a unit where different parties carry a part of it.

³ Womack, Jones, Roos (1992)

Supplier challenges got more and more difficult and they became a big part in the system and adopted a lot of responsibility. As higher the responsibility, the higher is the pressure on the supplier's side.

2.2 Supply chains in automotive industry

There were practically no supplier during the first revolution and the still existing supplier got tasks to be done without any own ideas. The OEM set all decisions for the supplier. The supplier had to carry out the tasks of Ford without contradiction. The changes of the supply chains during the second revolution were radically. The second revolution led to a completely new positioning of the supplier. There were new networks with the target of optimizing the value creation process. This was enabled by a global alignment of the supplier. There is just a small part of the classic value creation chain that takes place under the direct control of the OEM.⁴ It was originally part of each company to optimize the value creation process starting with procurement from warehousing to sale. OEM and the supplier have to answer one question: in which business field do we want to operate? A new definition of the business leads to quantum leaps in a company. The new value creation chain is very complex and extensive. In this context the new chain is not a simple line. Rather, it is a complex, parallel running single process of a couple of companies.⁵

2.2.1 Supply pyramid

The following diagram shows the levels of creating the final product. The automotive suppliers are differentiated by their value creation levels. Suppliers directly after the OEMs are called first level or Tier-1 suppliers and following suppliers, upstream suppliers or sub suppliers. There are further Tier-2 and Tier-3 suppliers who are named after their dependence to the supplier levels. People should know that suppliers could be in different positions at the same time. For example, a supplier who usually delivers shock absorbers as a part, supplier can be a system supplier for the development and production of the cockpit at the same time.⁶

⁴ Rosengarten, Stürmer (2004) p.181

⁵ Heigl, Rennhak et al.(2008) p.28

⁶ Heigl, Rennhak et al.(2008) p.29

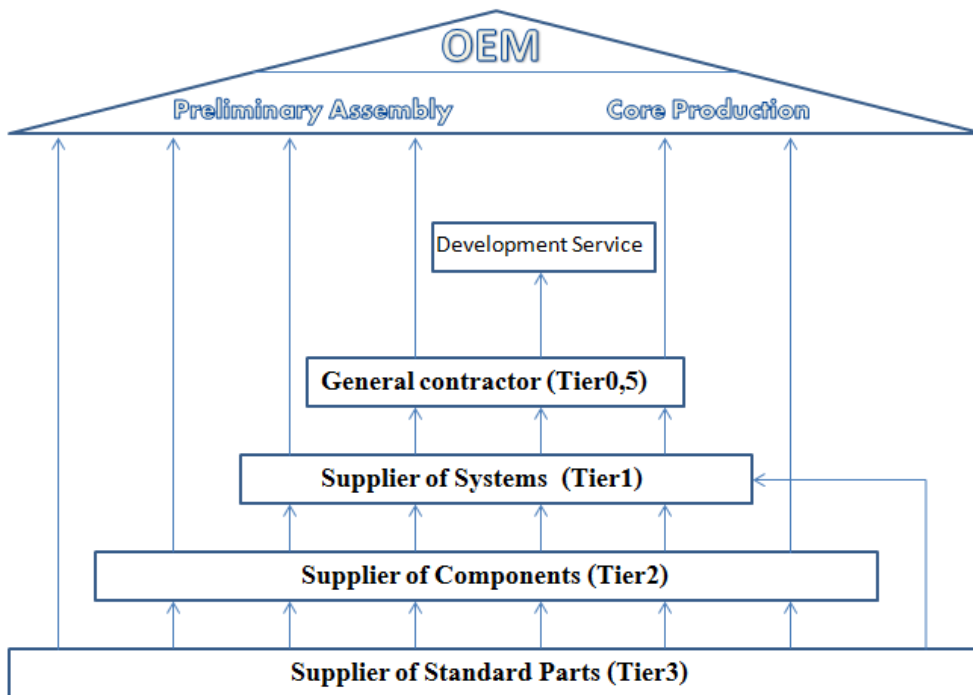


Figure 1: Structure between OEMs and Supplier (self generated)

The possible Future of the supply pyramid

The large shifts between OEM, Tier 1, Tier 2 and Tier 3 are over. In the development they are all working in teams and there is no difference between the different levels. The suppliers define exactly which required competitive core technologies and capabilities must be "in-house" and how they can make money. The result is that the majority of suppliers to Tier-1, 2 - and 3-level are active simultaneously. In consequence, this means that in future supply chains have more of a logistical importance. The position in the supply pyramid is not relevant for the success of a supplier. ⁷

2.2.2 OEM

An Original Equipment Manufacturer (OEM) manufactures parts and components that are delivered from outside suppliers to create their own product and sells this product under their own (OEM) name. We can split this market in two segments: automotive manufacturers (cars, commercials and utility vehicles) and motorcycles.⁸ The new method of automotive production is defined by a complete and an accurately fitting exchangeability of the parts and the simple way they are assembled. During the first revolution, nearly every task was part of the OEM, so suppliers did not have a special part in this chain because they had a loss of knowledge and professionalism to satisfy their requirements. The next table shows the top OEMs and their origin and that the most manufacturers are stationed in Germany (Europe), USA and Japan.

⁷ Dannenberg in an interview for Automobil-industrie.de (05.04.13)

⁸ Diehlmann, Häcker(2011) S.8

List of OEM

Country	Brand
Germany	Audi, BMW, Mercedes Benz, Opel, Porsche, VW, Smart
Japan	Honda, Mazda, Mitsubishi, Nissan, Subaru Toyota, Daihatsu, Suzuki
South Korea	Hyundai, Kia, Ssang Yong
USA	Ford, GM, Chevrolet, Chrysler, GM, Cadillac, Corvette, Hummer, Jeep
France	Citroen, Peugeot, Renault, Bugatti
Great Brittan	Jaguar, Land Rover, Lotus, Mini
Italy	Alfa Romeo, Lancia, Maserati, Ferrari, Fiat, Lamborghini
Spain	Seat
Czech Republic	Skoda
Sweden	Volvo, Saab

Figure 2: List of OEMs and their belonging countries

2.2.3 Suppliers

Suppliers deliver parts or groups of parts to manufacturers to create their own product. The supplier is part of a car supplier's chain. They are gaining more and more responsibility in terms of performance and development. Suppliers provide around 78% of the whole product and manufacturer assembles the rest. It is important to withstand the pressure that is coming from different sides and to carry out restructuring and adjustments.⁹ The supply industry is subjected to high-pressure from different sides. There are many influential factors, ranging from tougher global competition, costs, pricing pressures increasing of material prices, up to the behavior of banks and financial investors.¹⁰ The word supplier was originally a connection to the industrial division of labor. The typical feature of the supplier was the self-reliance of transaction partners. Suppliers are manufacturers of parts modules and components for customer companies. A final product is going to be created from the products that are produced by these suppliers. The supplier always creates a performance bundle and has direct contact to his customer. The automotive supplier is differentiated according to the value creation steps. The first level under the OEM is the Tier1 level and further sub suppliers.¹¹ The following table shows a ranking of the top suppliers in the world. It was approximately one year before the third revolution took place.

⁹ Becker (2010) p.172

¹⁰ Hüttenrauch, Baum et al. (2008) p.26

¹¹ Heigl, Rennhak (2008) p.8

List of suppliers

Position 2006	Company	Turnover in billion USD (\$)
1	Bosch	32,76
2	Denso	27,85
3	Delphi	25,02
4	Magna	22,81
5	Bridgestone	22,00
6	Johnson Controls	21,76
7	Michelin	19,02
8	Goodyear	18,93
9	Aisin Seiki	18,41
10	Lear	17,09
11	Visteon	16,47
12	Continental	16,28
13	Faurecia	13,67
14	ThyssenKrupp	13,61
15	Siemens	12,87
16	TRW Automotive	12,64
17	Valeo	12,37
18	ZF Group	11,85
19	Yazaki	9,02
20	ArvinMeritor	8,90

Figure 3: Top 20 global supplier (Automobil Produktion 2006)

2.2.4 Changing structures of automotive Industries and markets

OEMs are facing the task of managing the upcoming challenges. Positioning of the automotive brand, goal-oriented creation of downstream activities and brand-orientated modifications of the Upstream are some of these tasks. Especially the realignment of development and production value creation means an essential change of requirement.¹²

There are a couple of forecasts to the changing structure of industries. There is one forecast which is especially meaningful for this case. FAST 2015 describes in detail the changing of the values of creation chains of the automotive industry between 2004 to 2015. The impact of this change can be seen in the quantitative change of the value creation chain. The change that is described in the FAST study concerns mainly suppliers and offers them new changes and a higher responsibility and therefore a double of their value creation until 2015. OEMs have to shift their capacity because of expensive capital in order to get better assessments of their banks.¹³

¹² Gottschalk, Dannenberg (2006) p.29

¹³ Hüttenrauch, Baum (2008) p.172

2.3 Third revolution

People describe the “Third Revolution of Automotive Industry” as the new change and challenge for supplier and OEMs. The challenges of the market and the increasing complexity of the products change the interaction between OEM and supplier. The result is a strong structural change with impact on the whole value chain and the process architecture. Background is the since years conducting discussion of market imbalances between OEM and their suppliers who get under pressure.¹⁴ The main topics get set by the legislature, the competition and the drivers themselves. Emission reduction, improvement of active and passive safety and decreasing of total costs of ownership with focus on reduction of fuel consumption are just some of the main points. The main topics of this revolution are:

- **Information technology**

Information for the driver and for the car systems for a better and safer car control. Every electronic part is connected to the boardcomputer to keep control and get signals for broken components.

- **Safety**

New technologies and innovations to avoid crashes and get warned by intelligent systems.

- **Efficient variety**

It is necessary to offer raising individualization and convert it more efficient at the same time. Modularization is a solution to connect these two properties for a cheaper and faster production of the car.

- **Environment**

Supplier and OEM are still trying to find solutions for a better and lower emission to improve the environmental situation on the world. New regulations and standards for supplier and OEM have to be satisfied.

- **Applications and Infotainment**

Working- and spare time in your car with multimedia systems which are easy and save to handle during the drive. Music, movies and more technique in a car as an impression of personality. Traffic, weather and construction alerts are sent immediately to the car.

The above listed aspects have to be suffused to survive in this market. The biggest strengths of the suppliers are their creativity and their technological skills but they also show weaknesses in consistent design of their innovation strategies that means at the alignment of innovations to costumers benefits, the self R&D real net output ratio, the design of innovation networks and the business case for innovation portfolio. Also the innovation efficiency between OEM and supplier should be improved. The suppliers have to cover a higher proportion of the innovation value creation. Innovations continuously breath new life into the automotive brands. They improve functionality of

¹⁴ Hüttenrauch, Baum et al. (2008)

vehicles and they show ways to meet globalization challenges. One of the central success factors in the competition in the automotive industry is the innovations ability.¹⁵ The crisis of US supplier who has placed themselves under the protection of the US-American bankruptcy protection, takeover of supplier companies and the sale of the automotive department from Siemens AG to Continental AG are just examples for these dramatic changes in this business. The companies who emerge from this crisis will grow further, obtain more tasks from OEMs and will displace weaker competitors and take over their businesses. These suppliers can get a crucial key role and help the industry to new development.¹⁶

2.3.1 Drivers of the third revolution

The third revolution could not be avoided but this paper shows the special drivers of this revolution and their changes which led to this revolution.

2.3.1.1 Political Changes

In general, the world in 2007 was in a relatively stable but politically challenging position. There were three particularly stressful issues like Global Warming, the Emerging Market and Terrorism, which led to a big change in the Automotive Industry. A lot of regulations were placed to improve the environmental situation.

Global Warming and legal political conditions

With increasing gas prices and an increasing global warming problem, it is necessary to find alternative sources of energy. The politics reacted to these problems with standards and laws which are very complex and difficult for OEM and suppliers. Euro 5 or Californian environmental regulations are just two examples. Because of EURO-emission standards, diesel cars had a reduction of more than 90%. The development of EURO 5-standards will continue, so automotive manufacturers and suppliers are forced to observe legal framework conditions and create new innovations.¹⁷ The normal exhaust of a gas-driven car includes a couple of toxic gases which deteriorate the environmental situation.

- Nitrogen oxide NO
- Nitrogen dioxide NO₂
- Dinitrogen Tetroxid N₂O₄
- Carbon monoxide CO
- Sulfur dioxide SO₂
- unburned hydrocarbons CH
- aromatic hydrocarbons ArH
- Carbon dioxide CO₂ (which is main element of operating the greenhouse effect)

¹⁵ Wyman (2008) p.19

¹⁶ Heigl, Rennak et al. (2008) p.3

¹⁷ Hüttenrauch, Baum (2008) S.42

CO₂ or greenhouse gas is very dangerous because this gas is responsible for the greenhouse effect which leads to drastic climate change all over the world. Figure 4 shows a dramatically growth of the Carbon Dioxide emissions. A growing of the emissions is also connected with increasing temperatures all over the world which shows figure 5. Supplier and OEM are working on an intelligent engine control for better Emissions. A lot of changes happened in the past 100 years of automotive industry. Remember the time when Henry Ford built his first cars for the market. Practically no electricity in cars, windows and doors could just be opened manually, that means mechanically. Even the engines in cars were mostly controlled by a mechanic force, what led to high emissions. The new “Electronic Technology” in cars makes it possible to control the engine under best conditions. That means low toxic matters, low fuel consumption and a better air quality for everyone. It is too complex for OEM, so suppliers are working on high quality controls for this problem to get better air quality results and to calm the curve and stop a further growing of temperatures and CO₂-emissions.

Carbon Dioxide Emissions

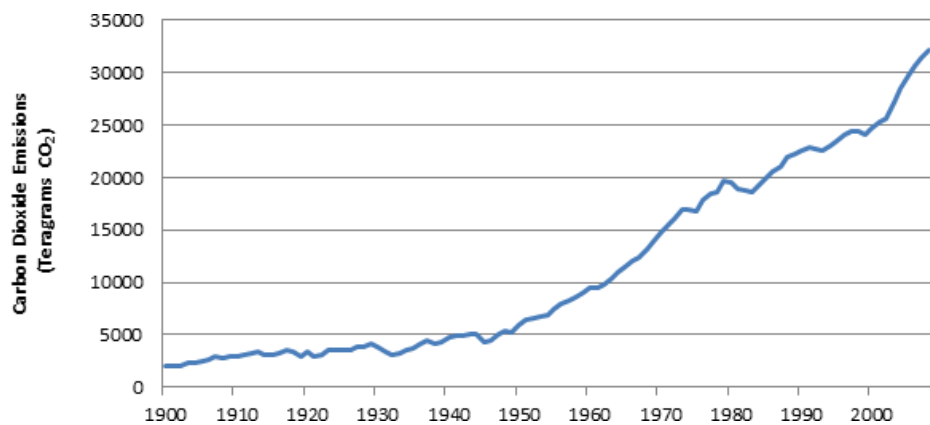


Figure 4: Carbon Dioxide Emissions

Temperature changing in C°

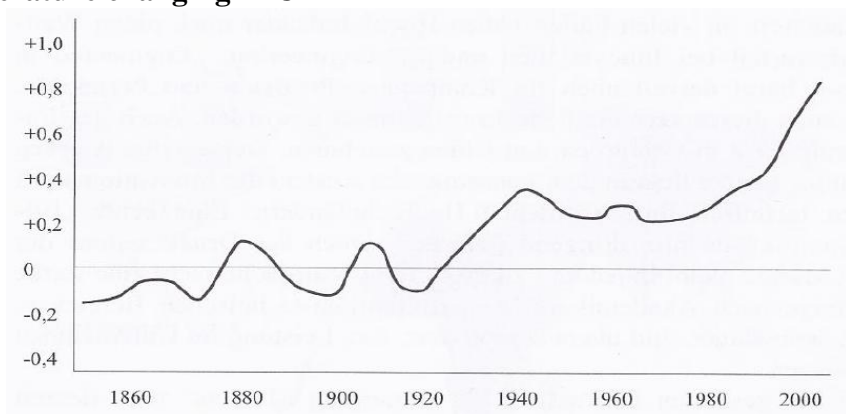


Figure 5: Temperature changing (Stern, 2006)

Emerging Markets

The market potential can be described by population and car density. These numbers show how many cars per 1000 people exist. You can split the market into triad and Non-triads and the next figure gives us an overview about some important countries.

Triads 2006	Car-density (cars/1000 people)	Population in Mio.
EU	501	381
USA+ Canada	690	319
Japan	520	127

Non-Triads 2006	Car-density (cars/1000 people)	Population in Mio.
Russia	152	145
Ukraine	112	45
Poland	285	39
Africa	18	823
Argentina	144	38
Brazil	97	176
Cuba	46	40
Mexico	128	101
China	5	1285
India	7	1045
Indonesia	16	208
Pakistani	5	145
Vietnam	6	80
Rumania	145	22

Figure 6: Triad and Non-triad market

The demand for cars in Non-triad countries will increase from the year 2005 to 2020 to 100% and in triad countries around 8%.¹⁸ It is important to differentiate each country and not to collect them together to find chances and risks or strengths and threats in the market.¹⁹

Terrorism and religion conflict

The fights and conflict between religions and the subsequent terrorism is one of the biggest political challenges of the future. Before September 11th, terrorism had a much smaller role than the present day. The difference between those days and now is that the conflicts are restricted locally. In the last decade, terrorism has had a much smaller impact on international politics and on the consumer market. People have recognized that terrorism is a real threat for everyone, so OEM and suppliers reacted to this situation and tried to find a solution to give the customers a safe feeling in their cars.

¹⁸ Becker (2010) p.129

¹⁹ Hüttenrauch, Baum (2008) S.33

Just for example: Volvo offers the option for interior monitoring. People see a flashlight on their key which symbolizes that someone foreign is sitting in their car.²⁰

2.3.1.2 Economic changes

Resource prices

From an economic view it is important to take a look at price development, especially the development of sale prices and resource prices. In the time between 1998 and 2004, crude oil prices increased over 170%. During that same time, polypropylene became more expensive by 28% and iron and steel by 38%. These price changes had a big impact to the industry. The impact affected not only us, the customers, but also the supplier. The impact is definitely stronger on the supplier because they have to take the higher costs, which could lead to higher getting pressure and finally to insolvency.²¹

Automobile prices

The decreasing cash willingness of consumers caused by higher getting loads like political interventions or tax increases or higher fuel costs. Petroleum taxes, fuel taxes and the switch to the euro were particularly influential in leading to cash explosions. Similar changes appeared in other countries, such as the USA, and this resulted in a big saving of the consumers in the area “Buying a new car”.

Automotive manufacturers

In the present day, just a little bit more than 10 groups of companies determine the value creation. The market is therefore much closer than the supplier market where 40 to 50 bigger suppliers are available. Not every company was able to manage the high start investments.

Thereupon a continuous company reduction occurs till now.

The market also is gaining new competitors, such as China. At this time China is not competitive but they are, as we all know, leaders in fast learning and they can become a threat for the market. China is trying to find partners to get a place in the US and European markets.



Figure 7: Connection of OEM

²⁰ Hüttenrauch, Baum (2008) S.44

²¹ Hüttenrauch, Baum (2008) S.45

2.3.1.3 Social changes²²

This chapter should give an overview about the trends and the impacts to the automotive industry. The following trends are bundled into 3 categories as social trends, cars as living area and cars as working area. The consumer is the focus of attention.

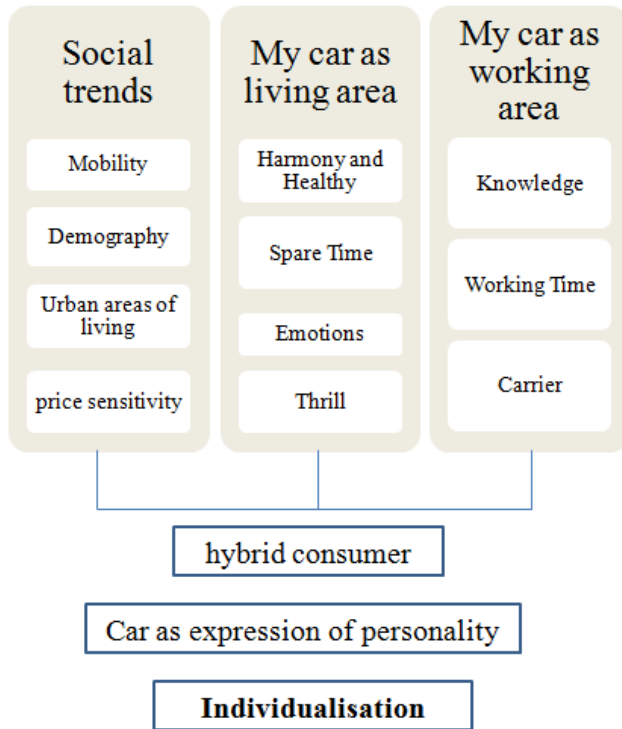


Figure 8: Social trends in automotive industry (self-generated: Hüttenrauch, Baum)²³

Social Trend - Mobility

Mobility is an essential factor for success in modern societies. People change their places of work more and more often, so they accept longer distances in advance and they spend a lot of time in their car. Whether it is for personal or work related use, people enjoy driving their cars, and as a result, traffic density is increasing. It is important for the OEMs and suppliers that cars can manage more and more challenges. Growing mobility leads to more functions in private and business life. But is it necessary to reinvent the mobility? The challenge is to restrict the auto mobility to the minimum essential.²⁴

Social Trend - Demography

To consider the change of the age pyramid you have to differentiate different economic regions, especially between industrial regions, Non- industrial regions and nations with strong economic growth. In regions like Germany for example, people in 2050 will live longer than ever, but the birth

²² Hüttenrauch, Baum et al.(2008) p.56

²³ Hüttenrauch, Baum et al.(2008) p.56

²⁴ König (2009) p.249

rate will decrease. The industry will react to this trend and find solutions that allow people of older ages to still be able to drive a car.

Social Trend - Urban areas of living

The growth of cities in the last years was strongly pronounced. The connected trend of urbanization will continue in the future. Classic metropolises as Tokyo and New York will increase their population but the growth will be not as high as before.

Social Trend - Price sensitivity

Products will just be bought in exceptional cases. Bargain hunters are increasing in quantity, whether it be for computers, cars, fashion or vacations. The loads of automotive industry are growing more and more and these are facts like higher insurance, value loss or fuels influence the mobility.

My car as living area ²⁵

Harmony and Healthy

The harmony of the body and nature is the center point of current lifestyle trends. OEMs and suppliers are creating special seats for the customer's health. Furthermore, air particle filters or hypoallergenic materials are in use to maintain the health of drivers.

Spare Time

People enjoy having spare time, and the automotive industry reacted to and capitalized on this trend. Cars are designed to have more space and features to connect people's spare time or hobbies with the car. For example, for people that go skiing, Kayaking or Mountain biking it is practical and conducive to their hobbies to have a car that has space to fit those things.

Emotions

Automotives have always been exposed to emotionality. It is on this idea that a competitive gap appeared and Toyota took the chance to take it. After setting a foundation stone in quality at Toyota, a strong technological differentiation and a stronger emotionalisation of brands took place as the implementation of the Prius has shown.

Thrill

People that enjoy extreme sports like surfing, jet skiing, and free climbing are always looking for a thrill. That's why they do those sports. A driver of a car is also looking for the thrill, but they connect the thrill with safety. There are high expectations for safety features for OEMs and suppliers. This is because many people who are not able to engage in thrill seeking behavior such as sports will seek

²⁵ Hüttenrauch, Baum (2008) p.60

this feeling in their cars. This behavior however, can lead to very dangerous situations in which it is necessary to have extremely reliable safety features.

My car as working area

Knowledge, Working and Time Carrier

It's not unusual that people have to work in their cars, so OEM decided to fit cars with a small mobile office, where people can drive to their work. Driver are able to check or send E-mails, have conversations or have access to the web to book the next available flight or train to their final destinations.

Information Technology

The Automotive industry had two Revolutions and the third revolution is still in progress. The main topic definitely is IT because technique gets upgraded every minute. People can watch movies, news or listen to their favorite songs in their car. But it is common knowledge that a driver trying to work these applications can lead to accidents, and that is why the government does not allow calls during while driving. The OEM and supplier work close together to find a solution for this problem. Voice control is one of these solutions, which is a very complex technique, but is useful to not get distracted.

Apps

The new requirements of the automotive industry are now also requirements of suppliers. Nowadays nearly everybody uses a Smartphone with the possibility of using applications that can be downloaded onto them. OEM and suppliers had the idea to use these applications in their cars. Some OEM want to create their own shops, for example BMW has their own BMW shop which compares to iTunes (Apple). It's possible to download applications for your car like those on your mobile phone. You can use applications for navigation, entertainment, music or to find a cheap gas station or the nearest parking lot. In the coming years each OEM has the possibility of opening their own shop. Every car user can download these apps in his or her car to use to make life more simple. Smartphone's will play a big role for car users of the future. You, as a car user will be able to lock or unlock your car with your Smartphone. The car key was always a big challenge for designers but is a Smartphone a better solution? Continental is working on a new program to simplify the driving experience, where you just have to press a button on your mobile phone to open your car and to start the engine. Delphi, a different supplier, is also working on the same project but they are trying to find a completely different solution. The way leads in direction of key less controlling. Another important factor is the control of doors, windows, the query of mileage and tire pressure, the control of heating and cooling and the Check-Control-System.²⁶

²⁶ Car IT (2012) p.13

Network of Automotives with the Infrastructure

The automotive industry is trying to find a solution for all the network problems they have, along with and the combined infrastructure challenges. So for mobility it's very important to get real time data of each car to avoid traffic jams or receive warnings about dangers on the road. One solution could be car to car communication. It's possible to get facts about speed and ABS control intervention of vehicles ahead in time to create a response. For this plan, all OEM and suppliers of the biggest nations have to work together to find a mutual solution. Even infrastructure operators must be part of this big connection for the best results. Getting the information of each car on the road increases the quality and leads to a better outcome for this project. This program does not necessarily need direct support of all parties, but the cooperation of all companies would be very helpful. It's very helpful that OEM and suppliers use the same interface and technique standards. Targets of this idea are a consumption reduction, an improvement of light controlling on streets and increasing of speed limits within avoiding stops. The information of the light system gets directly transferred to the cars so that the driver gets speed suggestions to avoid a stop at a red light. Conversely to this a cars sends signals and facts to the light system which were converted to useful data - A forward-looking nature of driving²⁷

Software

Each new car generation brings more technique and this means in general more problems. Easy problems with power windows who does break down for example at cold temperatures or bigger problems like distance controls or antilock breaking system who does not work at a required time where u probably need it. It's is high tech invention and actually you cannot trust this technique a 100%. This can lead to accidents. That does not necessarily mean that you cannot trust this software at any time, it's just a sign that software in a car leads to problems. And suppliers who are programming this software for OEM are liable for such mistakes.²⁸

E-Mobility

Fuel is getting more and more expensive, and we all know that the reason for this is the lessening of the oil sources around the world. Experts affirm that it's possible to produce crude oil till 2050. And even the top 3 Oil Sources USA, Saudi Arab and Russia confirm the situation. OEM and supplier are working on alternative fuel sources like electro cars.

It already exist a couple of hybrid cars which are driven by fuel and electricity but companies want to switch to a method where cars are just driven by an electro engine and a high quality battery. The first advantage is the decreasing Co2 emission that leads to Ozone production and a substantially climate change. The second advantage is the cheaper way to drive his car. To fill his battery is much cheaper than filling the tank with fuel.

Renault is already working on electro driven cars and a lot of studies say that in 2015 every OEM is able to produce their own electro driven car for the market. But it's not that easy. The whole country

²⁷ Car IT (2010) p.21

²⁸ Car IT (2010) p.20

has to create a Huge electricity network to give the drivers the chance to charge their cars on every place At this point OEM and suppliers from Asia, USA and Europe have to work together as a team to develop a battery technology and get advanced technologies to create a uniform network of charging stations for a better Mobility all over the world. Electricity driven cars have a much lower range as fuel driven cars and this is at least one disadvantage for this development.^{29 30 31}

2.3.2 Conflict between efficiency and variety

The future problem of automotive industry is to offer raising individualization and to convert it more efficient at the same time. That is why efficient variety is one of the starting points of the third revolution of automotive industry. The development of cars in the automotive manufacturing industry is project orientated. The projects corresponds single vehicle types and there are a lot of people who are responsible for the car in different levels of development. The solution for this opposition between efficiency and variety will be crucial for the success of the companies.

2.3.2.1 The five variants of variety ³²

Variety as answer for the trend of individualization is not only a challenge for the automotive industry. In a lot of industries are rising product varieties. The high variety allows a costumer to find a product which fits perfect and satisfies the demands.

First type of variety – Brands

Clear brand messages are a central challenge in the variety discussion. Variety just becomes successful if it brings a lot of different options for the costumers. Some OEMs tend to define their brands un-clear. The current variety in the industry can be stated as bad managed. In most of the cases the brand message is beyond the understanding. But every manufacturer has its own brand core but they fail at the realization.

Second type of variety – Vehicle lines

The meaning of vehicle lines is that a car model can have more car body forms. The existing Brands have a variety of models in offer. Different car body forms in a vehicle line are not even mentioned. This trend will stop in the future. The limit between classic vehicle segments becomes increasingly blurred and new types are created which are again close to classic models.

Third type of variety – Derivative

Deviate are different car body forms of a vehicle line. Just to explain by the example Mercedes E-class or Audi A6 who has Kombi and Limousine in offer and these are the two deviates. It is obvious

²⁹ Car IT (2012) p.57

³⁰ Car IT (2010) p.22

³¹ KPMG's Global Automotive Executive Survey (2012) p.15

³² Hüttenrauch, Baum (2008) p.113

that it exists a large number of deviates in the automotive market. These trends will not break in. OEMs are trying to send clear messages to their costumers and not to offer as much cars as they can.

Fourth type of variety - Equipment options

Each single deviates offers a couple of different equipment options. The most of the OEMs are trying to increase their profitability of their cars and therefore offers a lot of selection possibilities. This is a big problem for OEM because in most of the cases they don't have the chance to proof and test the cars that are equipped with a special equipment option.

Fifth type of variety – flexible mobility

The industry tried to place crossover vehicles on the market. Most of these models were not successful. All attempts to implement such synthesis had a very small success possibility. The new mobility variety means that cars are not going to get leased or financed but a consumer specific mobility as a whole. The consumer has to pay a monthly amount and is allowed to change his car during the leasing time.

2.3.2.2 Modularization as a key factor for the third revolution

The car is not just a vehicle to drive it is more an impression of personality and OEM's have to offer a big variety of car modules which fits for every personality. But exactly this trend is very expensive. That is why suppliers are working on modules for OEM to reduce costs, create shorter development cycles and to get economies of scale in purchasing. With modularization it is possible to increase the number of produced parts because for example supplier don't have to create a big number of different parts which can be a normal windshield wiper but rather just one or two varieties which fits for every car. That leads to an easier assembling for OEM's because they don't produce parts for each OEM like Audi, Seat or Skoda but just sell one product for the whole VW Group and this leads to a higher unit number. The following figure shows the development of units per platform compared from 2010 to 2020. The numbers in the figure complies with million vehicles per platform.³³ In addition to the expansion of the product range a hugh number of vehicles are scored by modular transvers platforms and economies of scale through a variety.³⁴

³³ A.T. Kearney (2012)

³⁴ Willner (2008)

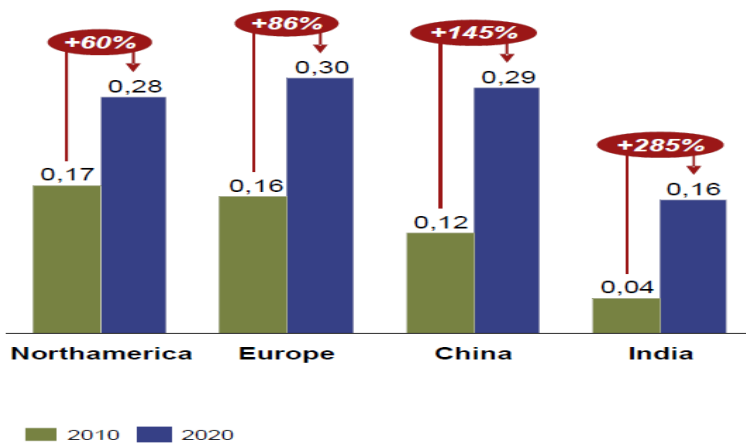


Figure 9: Modularization for growing of product numbers (Source: A.T.Kearney)

But there is a limit of maximal modularization because the driver should not see the module and that's why OEM's hide them. People who buy a premium car don't want to see that OEM uses the same parts they put in a low cost car. Think of parts which can be transverse control arms, in general hidden parts. But the reality corresponds exactly to this case. Modularity is described as product architecture. Modules are units which are strong connected among themselves and relatively weak connected to parts of other units. There are gradations of the units and the connections. Modularity is dependent on two design characteristics which are similarity of physical and functional architecture and minimization of interaction between physical components. Modularity allows companies managing a complex system by decomposing a unit into smaller pieces with limited dependence. Modular designs also allow the decoupling of components and systems and create an information structure which offers coordinating and a higher strategic flexibility which points out that these single components can be changed and updated quickly without affecting their environment.³⁵ Modularization is core sector of the third revolution of automotive industry. A module can be differenced in system, platform and components. A platform is a technical basis like a unit that has no impact to the shape of the car. It just defines the general dimensions of the craft as length, width or wheelbase. Today there is flexibility to these dimensions. A system consists of a functional integration of different products. It always serves a function, for example breaking or cooling. Systems are actually inflexible because they are not built-in to every vehicle line. They are limited to a unit use in different derivatives. A component is a part that is used in a higher leveled part.

³⁵ Pasche, Persson (2012) p.3

2.3.3 Impact of the third revolution on the relationship between OEMs and suppliers

The Relationship between OEM and supplier was not always the same as it was in the beginning of automotive industry. Back in time, when Henry Ford started his business, just a few suppliers were available because Henry Ford produced nearly every part in his own company. And that's why supplier did not have a chance to get involved in the automotive business. Years later when cars had more variety and models OEM were overtaxed and passes tasks to supplier who were responsible for the development. Today around 70% of OEM's work is done by suppliers. Supplier could focus on a specific segment and reach quality leadership for their parts. OEM passes their tasks, for example "programming or design" and other tasks, to different suppliers who fulfill their requirements.

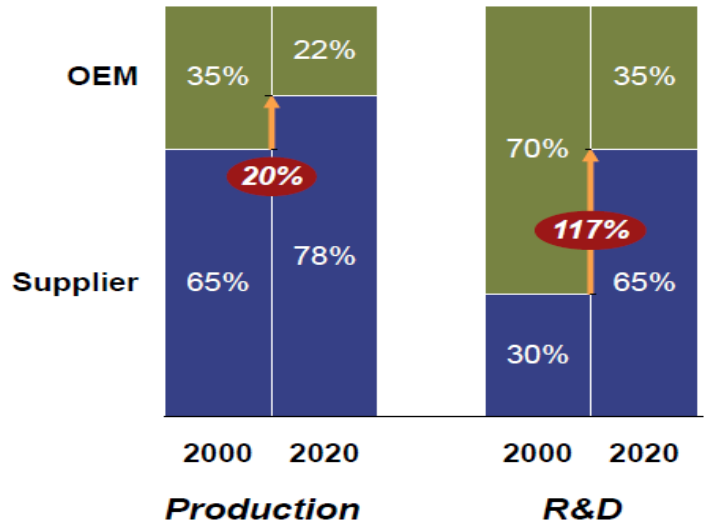


Figure 10: Task distribution between OEM and supplier (Source: A.T.Kearney)

OEM can save a lot of money by going this way because they don't have to pay the department that is usually responsible for the design or different jobs. Employees from extern companies who are working for these projects just get paid during the time of the project. When the project ends and no jobs or tasks are available the payment stops as well.

A big advantage of this method is the cost reduction caused by a not continuous payment to their departments. The market is full of suppliers who want to get a job of these big manufacturers so these companies called suppliers try to be cheaper than the others but that's not all. Just to be cheap does not necessarily mean they get every job. Competence is a very important fact for these OEM, because it's useless to get the job cheap done if quality is not sufficient. A big disadvantage is the loss of competence because the tasks are not done "In House" so People from OEM do not have the required knowledge to do these tasks on their own. If a new model appears and the OEM wants to change the supplier, no matter what reason, OEM'S have to teach the supplier from zero and this takes time and a lot of money. And to teach the supplier means that they have to show them each necessarily step which is required to start the production. Even the program or software they have to work with has to be explained to every employee who is working on this project. It is very important to know the people who are working for you.

3. Differences of the US and German automotive supply industry

3.1 Structure of the Industries

This chapter shall show the differences between the German/European and the U.S. automotive market concerning the impact of the 3rd revolution. The European market in the automotive industry is very vigorous. The situation in America got worse and had his culminating in Chrysler and General Motors who had bankruptcy and further impacts on the European market. While Fiat founded global presence by cooperating with Chrysler, European groups of General Motors found new investors obviously from Europe. One of the drivers of consolidation and new groups are linked to overcapacity and a price competitive markets which is possibly to lead to as much cost optimization as possible. A lot of manufacturers are already cooperating in production and Research and development. This could lead to a restructuring of a platform in the industry. Record numbers appeared in 2011 in the German supplier industry and this happened again in 2012 when the Germans set new sale levels. They affirm their top position close behind the Japanese and far ahead of the American market. The strongest sale growing's coming from the Korean suppliers. German automotive industries stay in spit their economic problems on course for success in Europe. Not only the big number of OEMs but also the big German supplier delivered perfect results. The number of vehicle product recalls that led to costumer uncertainty stayed in the normal limits. Also the euro crisis connected with the heavy sales slump in south Europe could not change the balance sheet of the companies. It shows that companies could in spite the crisis 2008/2009 increase their productivity and stability. The loss of market share and the competitiveness of American suppliers have increased. The only American supplier who could resist in this market in the top 10 is Johnson Controls on place 9. In 2000 6 of the top American suppliers were placed in the top 10 ranking. Also Groups with high and save aftermarket like Goodyear and technology leader BorgWarner disappointed in 2012 with decreasing sales. There are serious structural differences along the differences in development levels of the single markets. In general, the target of all countries is to build a strong automotive industry considered to economic development processes.³⁶ The growth of automotive supplier is dependent on external forces like sales of OEM, structural changes of the value chain and changes of the industrial dynamics.³⁷

3.2 Empirical research

3.2.1 Objective

The third revolution had different impacts on the world market and every country had to find ways to manage this aggravating circumstances. This paper takes a look at the European and the U.S. market to answer the following question.

³⁶ Diez (2012) p.22

³⁷ A.T. Kearney, Inc. (2008) p.1

Are there differences concerning the impact of the third revolution in the automotive industry between the US- and German automotive supply industry?

To give a short overview, four of the world leading suppliers Bosch and Continental which are representative for Germany, Johnson Control and Goodyear for the United States of America were compared with each other to find the differences between the aspects of the 3rd revolution.

3.2.2 Research Design

To get the needed information it was planned to do a primary research where it was necessary to get active information from companies. To get this information it is usual to do surveys, collections, testing or observations of the local audience. Expert interview were planned but every company excepted Goodyear could not answer the questions because of time which they don't have to answer questions for students. Forwarding to their homepage was a standard answer. Trying to get following questions answered was hardly with success.

- What are the impacts of the 3rd revolution for your company?
- In how far does efficiency and diversity play a role?
- Did your product range change since the 3rd revolution?
- What are the advantages of your company to the congruence?
- Which category brings the most sales?

This paper should compare Germany and America with each two companies who are kind of similar. All of them are under the top 10 automotive supplier but sometimes have different product ranges.

- Bosch (Germany)
- Johnson Controls (America)
- Continental (Germany)
- Goodyear (America)

Just one company could answer some of the questions which led me to start with a secondary research. To answer the second question it was necessary to get as much information as possible which was extern from statistics of authorities, brochures, catalogs, annual reports, directories, trade press, Internet. The secondary research is associated with relatively low cost. However, it has the major disadvantage that they must rely relatively old and no longer fully up to date. Another disadvantage is that the data you get is not secure and not accurate. An advantage is the inexpensiveness and sometimes it is just possible to get data by this way. So I decided to use a secondary research which was easier for me to handle. In a secondary research it is important to collect information, facts and data out of books, online sources and other researches which are public available. After collecting this information a selective summary is necessary to filter out the efficiency and report results to answer the required questions.

The extern sources for the secondary research are listed up in the following table.

Extern information
Annual reports
Brochures
Information from internet
Books
Internet databases
Press reports

Figure 11: List of collected information's

3.2.3 Results

3.2.3.1 Bosch

History

Robert Bosch, the founder of Bosch started his company in the year 1886. He got an order to invent a magneto ignition for cars. He developed his invention till he first fit out an automobile in 1897.

The Bosch Group comprises Robert Bosch GmbH and its roughly 360 subsidiaries and regional companies in around 50 countries. If its sales and service partners are included, then Bosch is represented in roughly 150 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. Bosch spent some 4.8 billion Euros for research and development in 2012, and applied for nearly 4,800 patents worldwide. The Bosch Group's products and services are designed to fascinate, and to improve the quality of life by providing solutions which are both innovative and beneficial. In this way, the company offers technology worldwide that is "Invented for life." The company was set up in Stuttgart in 1886 by Robert Bosch (1861–1942) as "Workshop for Precision Mechanics and Electrical Engineering." The special ownership structure of Robert Bosch GmbH guarantees the entrepreneurial freedom of the Bosch Group, making it possible for the company to plan over the long term and to undertake significant upfront investments in the safeguarding of its future. Ninety-two percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. The remaining shares are held by the Bosch family and by Robert Bosch GmbH.^{38 39}

Safety

Also IT in cars offers a couple of features for self protection. The best protection against crashes is to prevent them. Bosch has been developing active safety systems that significantly contribute to the reduction in the number of crashes, despite increasing traffic density. Active safety systems such as the Antilock Braking System (ABS), the Traction Control System (TCS) or the Electronic Stability

³⁸ Bosch.com (2013)

³⁹ Gottschalk, Dannenberg (2006) p.91

Program (ESP) intervene before a crash occurs. In the field of passive safety Bosch puts time to the best use. Bosch develops and manufactures advanced and reliable occupant and pedestrian protection electronics which precisely trigger passive safety systems such as airbags and seat-belt tensioners in the event of a crash or collision.

The central airbag control unit evaluates sensor signals to identify the force and direction of an impact and triggers the vehicle's restraint devices for optimal occupant protection and systems for active pedestrians protection respectively. Based on intelligent sensor technology, driver assistance systems constantly monitor the vehicle surroundings as well as the driving behavior to detect potentially dangerous situations at an early stage. In critical driving situations, these systems warn and actively support the driver and, if necessary, intervene automatically in an effort to avoid a collision or to mitigate the consequences of the accident. For Vehicle Dynamics Management (VDM) Bosch networks the Electronic Stability Program ESP with other active vehicle dynamics systems in the fields of steering, drive train and chassis to influence the handling of a vehicle and to better support the driver, especially in critical situations. Based on this networking, Bosch realizes software functions that further increase vehicle stability and thus improve driving safety and vehicle dynamics. The fact that the functions are implemented by means of software modules enable the vehicle manufacturers to differentiate with respect to vehicle make, and also within a given vehicle model. This ensures consistent system behavior and the economically efficient implementation of functions. By integrating individual safety components and systems, it is possible to create entirely new functions for improved safety. This means an increase in the number of installed control modules and sensors. Bosch thinks in terms of complete, end-to-end systems. This allows them to offer reliable, flexible and scalable solutions tailored to OEMs needs. This enables them to create innovative functions, and to reduce system complexity at the same time.⁴⁰

Apps and Infotainment

Bosch offers a variety of efficient apps for your safe drive. Apps like navigation or driving assistance furthermore, simple windshield wiper apps. The navigation app offers a 3Dimensional map with a good clarity and precise spoken instructions. It warns about dangerous curves and lets the driver save money by choosing the cheapest route. The windshield application is able to choose a suitable windshield wiper for your car. Bosch delivers intelligent solutions in the section entertainment, navigation, telematic and drive assistance. It is getting more important to display and process the information. The developed drive information's and assistance systems support the consumption and emission reduction.

⁴⁰ bosch-automotivetechnology.com

3.2.3.2 Johnson Controls

History

In 1883, the history of Johnson Controls started when Prof. Warren Johnson signed in his patent, the first electrical room thermostat and established the company Johnson Electric Service Company in Milwaukee/Wisconsin in the USA. Till the Mid 80's, even if he changed the name of his company into Johnson Controls Inc. the company was a name for building automation and building management.

The first step in automotive industry was in 1978 when stepped into the battery business by overtaking the company global Union Inc. 7 years later he overtook the British company Hoover Universal to get a start in seat components business. Johnson Controls is a global diversified technology and industrial leader serving customers in more than 150 countries.

Our 168,000 employees create quality products, services and solutions to optimize energy and operational efficiencies of buildings; lead-acid automotive batteries and advanced batteries for hybrid and electric vehicles; and interior systems for automobiles. Our commitment to sustainability dates back to our roots in 1885, with the invention of the first electric room thermostat. Through our growth strategies and by increasing market share we are committed to delivering value to shareholders and making our customers successful. In 2012, Corporate Responsibility Magazine recognized Johnson Controls as the #5 company in its annual "100 Best Corporate Citizens" list.^{41 42}

Safety

The Park-Distance Warning Displays ensure that drivers can perform tricky parking maneuvers without causing any damage. And their reliable Path Point Compass with automatic calibration, which can be integrated into an existing display, keeps them headed in the right direction.

As part of the global Industrial Design Team at Johnson Controls, their Human Machine Interaction (HMI) Design Group analyzes designs, evaluates, and implements interactive electronic systems in cars. Their research activities focus on the relationship between humans, technology, and driving tasks. The insights they gain help them to create tangible results that ultimately improve their products' usability. By reducing the drivers' workload, and consequently enhancing his driving experience. They also balance vehicle integration, customer themes, and product designs with interface and product behavior elements. Johnson Controls offers market-leading electronics solutions that not only facilitate smart integration but also take into account the need to accommodate ever-changing consumer electronics without sacrificing safety. To achieve this, they leverage their extensive Human Machine Interaction (HMI) expertise, using the results of our research to ensure that our systems display the right information to the user at the right time through the right connections and utilizing the appropriate medium. Body Control Modules perform a wide range of tasks, including controlling the interior lighting, door locking mechanisms, or windshield wipers. Their Research & Development activities focus not only on smart new functions, but also on

⁴¹ Johnsoncontrols.com (2013)

⁴² Gottschalk, Dannenberg (2006) P.133

incorporating greater functionality into increasingly compact modules. This allows our development engineers to achieve several objectives simultaneously.⁴³

Apps and Infotainment

They set the benchmark when it comes to meeting the need to present information in a configurable, flexible way while offering optimum readability, ergonomic design tailored for the interior and efficient space-saving assemblies. Their flexible solutions for presenting driver information fulfill these needs and more, delivering the ideal mechatronic combination of electronics, mechanics, and human factors. Their Human Machine Interaction (HMI) solutions are optimally tailored to driver requirements. Their intuitive products provide clear, concise information that facilitates everyday driving tasks. Some examples are their analog and digital instrument clusters, which keep the driver informed as well as visually enhancing the interior. The same applies to their high-quality clocks, which always display the correct time due to a CAN or LIN interface or radio control. Their monochrome and high-resolution LCD (Liquid Crystal Display) and VFD (Vacuum Fluorescent Display) displays leverage the latest technology to perform a wide range of information tasks.

3.2.3.3 Continental

History

Continental was founded in Hanover in 1871 as the stock corporation “Continental-Caoutchouc- und Gutta-Percha Compagnie”. Manufacturing at the main factory in Hanover included soft rubber products, rubberized fabrics, and solid tires for carriages and bicycles.

In 1898, initial successes in development and production were celebrated with the production of automobile pneumatic tires with a plain tread. At the turn of the century Continental balloon fabric was used to seal the gas cells of the first German airship. In 1904 Continental became the first company in the world to develop grooved tires for automobiles, in 1905 we commenced production of rivet anti-skid tires, similar to the later studded tires, and three years later we invented the detachable wheel rim for touring cars. In 1909, French aviator Louis Blériot was the first person to fly the English Channel. The flying surfaces of his monoplane were covered with Continental Aeroplan material. In the late 1920s, the company merged with major companies in the rubber industry to form “Continental Gummi-Werke AG”. In 1951 we commenced production of steel cord conveyor belts. In 1955, we were the first company to develop air springs for trucks and buses. Series production of belted tires began in 1960. Around 30 years later we brought the first environmentally friendly tires for passenger cars onto the market. In 1995 the Automotive Systems division was established to intensify the systems business with the automotive industry. We presented the key technology for hybrid drive systems back in 1997. Today, Continental ranks among the top 5 automotive suppliers worldwide. As a supplier of brake systems, systems and components for power trains and chassis, instrumentation, infotainment solutions, vehicle electronics, tires and technical elastomers, With around 170,000 employees (Status: December 31, 2012) in 46 countries, the

⁴³ johnsoncontrols.com

Continental Corporation is divided into the Automotive Group and the Rubber Group, and consists of five divisions:

Power train represents innovative and efficient system solutions for vehicle power trains. Interior combines all activities relating to the presentation and management of information in the vehicle.

Environment

Engine controls and intelligent sensor systems support the reduction of emissions and reduce the oil dependence. Optimization of fuel injection, efficiency and drivability, fuel economy and reduced emissions are the top targets for Continental to get better emission results.

Safety

Continental contributes to enhanced driving safety and global climate protection. Continental is also a competent partner in networked automobile communication. Chassis & Safety embraces the company's core competence in networked driving safety, brakes, driver assistance, passive safety and chassis components.

Apps and Infotainment

Continental produces a couple of applications for the car. "CarView" is an application which is easy and safely to handle, even at high speeds. This application is able to open mail or messages and reads them for the driver or to download listened songs in the radio and store it in the system. "MobileView" is connected with the driver's mobile phone. It is possible for him to check if the doors are locked, the windows are closed, the lights are out or to localize the position of the car. "HomeView" offers to check real time data like tire pressure, oil quality, loading status of the battery or to link the car with your personal computer at home to configure music or routes for the next drive. "PartnerView" is an all-round application to get restaurant suggestions, to find the next gas station.⁴⁴

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3.2.3.4 Goodyear

History

Looking back, the founding of The Goodyear Tire & Rubber Company in 1898 seems especially remarkable, for the beginning was anything but auspicious. The 38-year-old founder, Frank A. Seiberling, purchased the company's first plant with a \$3,500 down payment -- using money he borrowed from a brother-in-law Lucius C. Miles. The rubber and cotton that were the lifeblood of the industry had to be transported from halfway around the world, to a landlocked town that had only limited rail transportation. Even the man the company's name memorialized, Charles Goodyear, had died penniless 30 years earlier despite his discovery of vulcanization after a long and courageous

⁴⁴ continental-corporation.com (2013)

⁴⁵ Gottschalk, Dannenberg (2006) P.115

search. Yet the timing couldn't have been better. The bicycle craze of the 1890s was booming. The horseless carriage, some ventured to call it the automobile, was a wide-open challenge. Even the depression of 1893 was beginning to fade. So on August 29, 1898, Goodyear was incorporated with a capital stock of \$100,000. David E. Hill, who purchased \$30,000 of stock, became the first president. But it was the dynamic and visionary founder, hard-driving Seiberling, who chose the name and determined the distinctive trademark. The winged-foot trademark, inspired by a newel-post statuette of Mercury in the Seiberling home, has been altered over the years. Something else about these legendary early years lingers on through Goodyear's history. People like George M. Stadelman, a man who avoided crowds and never made a speech, yet had a gift of integrity and foresight that guided Goodyear's sales through a critical 20 years. People like Paul W. Litchfield, whose conviction and leadership helped inspire Goodyear's development for nearly six decades. With just 13 employees, Goodyear production began on November 21, 1898, with a product line of bicycle and carriage tires, horseshoe pads and -- fitting the gamble Seiberling was making -- poker chips. The first recorded payroll amounted to \$217.86 based on the prevailing wage of 13 to 25 cents an hour for a 10-hour day. After the first full month of business, sales amounted to \$8,246. Since the first bicycle tire in 1898, Goodyear pedaled its way toward becoming the world's largest tire company, a title it earned in 1916 when it adopted the slogan "More people ride on Goodyear tires than on any other kind," becoming the world's largest rubber company in 1926.

Economical challenges

Goodyear focuses on the new developments of their products to the EU legal requirements (in Europe) for tire manufacturers and automobile manufacturers. Especially the needs of the automotive industry will determine the direction of product development. As we are a big company it is possible to use a big amount of existing know how, our products are often test winner in various benchmark tests for winter and summer tires.

Apps and Safety

Goodyear offers apps for safety on the road like tire apps to find the right tire for your car or a highway helper. Some cars can load this application directly on their vehicles or for their mobile phones which can be connected to the car.

3.2.3.5 Comparisons

2013 is another record year for suppliers considering to sale numbers and operative results. The German automotive suppliers short the distance to their Japanese competitors and stay at the second place in front of the USA. The German automotive industry in 2012 was characterized by good business with high growing rates and high profits. The German suppliers out of the top 100 stayed at a 8,2% profit margin behind the Korean and could reach sale numbers around 160 billion Euros. The world market of the German supplier industry could grow the third year in a row. They profit by the strength of the German OEM's like BMW, Porsche and VW/Audi and also from the strong growing markets in east Europe, China and NAFTA. The German automotive industry is bursting with

strength especially with improvement of cost position, increasing of innovation force and the expanding of the global presents. They also could expand their sales and profits to the third placed supplier's, America. The loss of market share and competitiveness has been accelerated at the American suppliers. Today, the only remaining player among the top 10 global suppliers is Johnson Control who is ranked on the 9th place. There were still six of the largest suppliers coming from the USA who were ranked under the top 10. Self-supply companies with high and secure aftermarket business as Goodyear have disappointed in 2012, with revenue declines or stagnation.

The following matrix compares four of the top 10 automotive suppliers from the year 2012. All of them are either coming from Germany or from the USA. Each of them has their specific section of products and value creations. Just for example Bosch, who reached the second place in 2012 for best supplier, they offer drive technology, safety and comfort for cars, that's compared to the first place, which is continental, a completely different value creation. If you take a look at their years of founding you can see that they exist a very long time but all of them approximately founded their companies at the same time in consideration to their existence. They all spent a lot of money for "Research and Development" that led to an incredible knowledge and obviously to high sale numbers and a possible leadership. Out of company specific annual reports, numbers of their sales and their used money resources for development and research were taken out. Continental who just had sales of 14,9 billion euro in 2006 could more than double this number in just 6 years, these 6 years in which the third revolution took part. But all of these four compared suppliers finally could increase their sales. The EBIT of each company shows us the earnings before interest and taxes, which is a measure of a firm's profit that excludes interest and income tax expenses. If this number gets divided by the total sales we get the return on sales number which is a percentage of these two important numbers.

There are a couple of facts why the German industry will count to the winners. The development of the world automotive industry had a lot of structural shifts and that's why the American industry decreased his proportion of the world automotive production from 87,7% in the year 1950 to 13,8% in the year 2010. They are confronted with a continuous meaning growth of emerging markets. The strength of the German automotive industry in the international environment is especially shown if you compare them with the triad markets. That's why the proportion of the US market is strongly decreasing.⁴⁶ The Germans have a strong position considered to premium segments which is an above-average trend. In nearly every counties and regions are German brands the premium champions. The high proportion of premium vehicles in the sales structure is an important stability factor for the German industry and their suppliers. Measured to the world production the Germans could strongly increase the amount of produced cars. Around 8,9% were produced in Germany in 2010. The abroad production was a useful way to show a successful globalization strategy.⁴⁷ They also have strength in sales position in North America, Asia and the fast growing emerging markets. But there is a disadvantage like the employment development is long term considered declined. That is not a reason for the competition ability.⁴⁸ The US-market is weakening and Europe stagnates. The

⁴⁶ Wyman (2008) p. 19

⁴⁷ Dannenberg-Interview for Berylls Strategy advisor

⁴⁸ Diez (2012) p.50

automotive market develops extremely different. The innovation offers have to customize themselves stronger to regional demands. That means there are regional specific innovations which are not in use to other countries. Just for example, satellite radios are a must have in America but does not play a role in Europe. Television in cars does not make sense in America but there is a big demand in Japan, Korea and China. Accordingly, innovation main topics are different. But there is a multitude of innovations which are similar in each country, for example emissions controls or active safety.⁴⁹ Germany the innovations leader with their premium brands have to focus on the limit but not constantly. Often this leads to solutions which are too expensive or passes the costumer wishes. Drivers also have to be introduced to specific innovations. The time of market launch is also important for the subsequent success. Different national brand images require nationally different recoverable Prices. Despite all the efforts of automobile manufacturers to worldwide unified prices, there is a big difference in the reality. Traditionally, new car prices are in North America, for example, clearly lower than in Germany. Striking differences are particularly apparent in Luxury brands. "The fact that the cars from Germany are so cheap in America is the ruinous price structure across the Atlantic."⁵⁰ The differences between suppliers of different markets are decreasing continuously. The American past shows a close supplier connection between outsourced component plants and the big three. The Japanese automotive suppliers were strongly influenced by Keiretsu and the German player always stood for SME's and variety. These structural differences have completely been changed. The suppliers are forced to be present in the core regions with own value creation in the production and the development because of the globalization. In the meantime there are the same requirements whether USA, Korea or Europe. The business models and structures are always getting closer. A direct comparison between these suppliers is therefore possible and brings to light that the performance of the key success factors, cost position, innovation and the network management makes the difference.⁵¹

Pos	Dimensions	Bosch Automotive	Johnson Controls Automotive	Continental	Good Year
1	Country	Germany	USA	Germany	USA
2	Founding year	1886	1885	1871	1898
3	Value creation and products	Drive technology Safety Comfort	Seating Interior Electronic, Battery, Safety	Chassis Safety Interior Power train Spare parts Tires	Tires, Air springs, Hydraulics, Power transmission
4	IT	Electronic systems, Vehicle dynamic management	Body electronics, Home link	Driver assistance, Electronic break systems	

⁴⁹ Wyman (2008) p. 19

⁵⁰ Thiemer, Schiff (2010) p.5

⁵¹ Dannenberg-Interview for Berylls Strategy advisor

5	Safety	Driver assistance, Active safety, Passive safety,	Human machine interaction	Passive safety	Grip
6	Apps and Infotainment	Navigation system, drive assistance, windshield wiper app	Driver information, Navigation system	Car View, Mobile View, Home View, Partner View	Highway helper, Tire finder
7	Environment	Growing of energy efficiency, low energy demand for production		Intelligent sensors, Engine controls	Safety according to international safety standards
8	sales 2006 [billion €]	29,7	19,5	14,9	15,3
9	sales 2010 [billion €]	28,1	No specification.	26	14,2
10	sales 2012 [billion €]	30,9	20,6	32,7	15,8
11	Employees worldwide 2013	306.000	168.000	173.000	69.000
12	Countries	150	150	46	22
13	Research and Development [million €] 2012	4.787	79	1.766	370
14	Patents 2012	4 784	197	435	No specification.
15	EBIT 2012 [billion €]	1,4	1,73	3	0,79
16	Return on sales [%]	4,5	8,39	9,17	5

Figure 12: Matrix to compare four of the top supplier (numbers out of annual reports)

4. Managerial implications

It is part of the strategic business management to find competitive advantages and to initiate the right steps to use advantages. Competitive advantages usually arise out of the value which a business creates for a customer as far as this value does not exceed the value creation costs of the business. In this case, the value is what a customer is ready to pay for a product. To choose the right strategy it is useful to use the five forces of Porter or even to consider the customer perspectives. The word competitor strategy in the industrial economy is the target medium combination which is customized to the competitive surroundings.⁵² Supplier has to find the right strategy to lead the market and survive under this big variety of competitors considering the third revolution. The next two chapters 4.1 and 4.2 are going to summarize the strategy recommendations for the supplier industry. Chapter

⁵² Heigl, Rennhak (2008) p.39

4.1 lists the competition strategies based on Porter and chapter 4.2 shows ten theses which are summarized and confirmed by automotive experts.

4.1 Different strategies for supplier⁵³

These strategies are an industrial-economical target-medium combination which is reasonable to the environment. The main point is focused on the competitors. Target is a strong sector position. According to Porter's approaches some success promised strategies for the automotive industry. Considering to the supplier industry, the following 5 forces of Porter can foresee the extent of the present competitive displacement in the triad market during this revolution. The negotiation strength of the customers on the basis of a concentration process leads to increasing competition along the whole value creation chain. To survive under these circumstances as a supplier, the business strategies have to be matched to the future requirements and expectations of the OEMs. The selection of the right competition strategy and an adequately business model are crucial for surviving in the automotive industry after or during this revolution.

4.1.1 Technology Leadership

The innovations of each supplier are one of the most important features to settle a vehicle manufacturer from the competition. They differentiate between product and process innovation. It is just possible to save a technological market advantage by creating new innovations. The supplier has the chance to escape of the price challenge and to achieve *First-Mover-Wins*. Manufacturer has to differentiate their product offers from other competitors to raise the willingness to buy. OEMs need help of their suppliers, so they are going to get involved in the product creation process, because OEMs need their innovations competency.

Innovations in cooperation between OEM and supplier can arise in two ways. The manufacturers require innovation from their suppliers, because their own resources are limited and they are convinced of their abilities. But it is important not to wait for demands coming from OEMs; they should offer their innovations to them. Supplier can use a couple of strategic options, as: Innovative new products, improvements of existing products or process innovations. They call it knowledge-based value creation.⁵⁴

4.1.2 Cost Leadership

For each supplier cost optimization is a very important point and an essential task. No company is allowed not to use the existing cost saving potential. Therefore a new way of cost management has to be pursued as well as a optimization of the internal and external value chain has to be proofed. The convenient ways of cost saving are not enough. They need a creative cost management which is based on success factors: permanently production growth and exhaustion of each possible process technology updating which lead to a cost optimally production and a better quality. Just volume

⁵³ Porter (1999) p.33

⁵⁴ Heigl, Rennhak (2008) p.44

manufacturer will win the race, because they completely use the scale effect and also use each possible action to reduce the costs. Labor costs decrease as further you go to east but on the other side logistic and transport costs increases with growing distance.

4.1.3 Specialization

Another strategy is to specialize to a special area or part to obtain the customer demands through good management. The automotive manufacturers try to enter into special wishes of customers to generate extra growth. As a result of model diversity and market segmenting not all companies can exist out of the same equal components or platforms. A certain percentage has to be special solutions. Crucial for a niche provider is it to have a close connection to their OEMs. The company has to specialize into special customer demands and be under permanent information exchange. Demands to niche provider are very high leveled, that means that they have to be innovation leaders in his area and be flexible to special customer wishes. The niche provider has a special status because it is difficult to change him like other suppliers. And this leads to better price negotiations.

4.1.4 Quality Leadership

Basic condition for a good business development is to deliver good quality goodness accordingly to the specifications of the OEMs. The zero mistake strategy coming from Japan led to dramatic tightening of quality norms. These very less mistake percentage presuppose a new strategy in the advance the delivery. The cooperation with supplier already in the development process is very important for a high quality. Stress and tight schedule planning can lead to a lower quality.

4.1.5 Outpacing

Outpacing, invented by Xavier Gilbert and Paul Strebel is a functional strategy as a part of the corporate strategy. Target is it to increase the profitability by maximizing quality and minimizing prices. The following chart shows 4 quadrants.

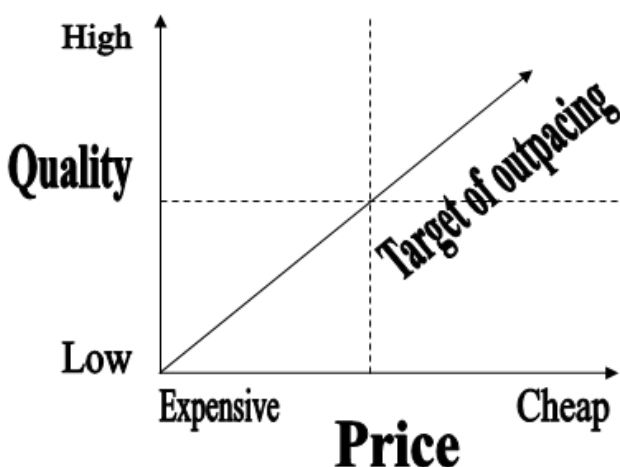


Figure 13: Outpacing strategy (self generated)

The quadrant upper left and the quadrant lower right correspond to the generic strategies of Michael E. Porter. Companies who are stationed in the upper left are on the basis of quality competency and a missing cost efficiency quality leader. Companies who are located in the lower right are cost leader. And businesses that are located in the lower left have no quality leadership and no cost leadership that means they have to find another strategy like customer loyalty management.⁵⁵ The growth of the number of provider on the market or the levy of an attractive and price conscious customer segment can lead to a price reduction in a company. Such a price decline should not compromise the quality. But in high-priced premium goods there is always the risk of an image loss. The implementation of a multi-brand strategy can remedy the situation. Conversely cost leaders have the chance because of large production margins at stable prices to grow their sales or to generate a new customer segment.

4.2 Recommendations for the supplier industry

The new revolution is still in progress and the huge amount of supplier will become smaller and smaller. A look into the future will show that only the best and biggest supplier companies will survive. Some businesses are on the right way but nobody really knows who is able to withstand this revolution and the connected hard business of the market. These recommendations shall give an overview about the future. The automotive industry is in the middle of a big change and it is very important to react to all these trends.⁵⁶

4.2.1 Cost reduction

The automotive industry is going to shift all their value chain steps into other regions. In our altercation with political and economical drivers it has shown that the pressure on OEM and supplier will continue to rise. Innovations have to be placed in the market faster and with more probability to success. There is a competitor situation on the supplier side, which acts ruinous and leads to a consolidation process. The pressure of OEM is nearly as high as the pressure of supplier's even though a big market cleanup took place. The future growing of the automotive industry in new regions enables new low cost approaches. These are initially standing against the requirement of a variety, which is not required from consumers in low cost markets, where standardization is critical to success. The consumer in this markets do need a "rationally mobility" and do not orientate themselves in specific markets. In a globalized market inevitably occurs Indian or Chinese supplier in Europe. This sets the Additional pressure on suppliers. Therefore all automotive suppliers have to deal with the development of Low cost modules. Low cost becomes another standard in the automotive industry.⁵⁷ Long term considered, this strategy can bring the risk to get suspended in the cost. But not only in the low price segment, also the whole automotive creation.⁵⁸ The automotive

⁵⁵ Gilbert, Strebel (1987) p.28

⁵⁶ Hüttenrauch, Baum (2008) p.271

⁵⁷ Dannenberg (2008) p.19

⁵⁸ Heiss (2008) p. 31

industry experienced a revolution with low price cars. The innovations usually came from expensive premium models and sat down step by step as low cost cars.⁵⁹

4.2.2 Interdisciplinary engineers

We have seen that consumers want to bring their personality in expression more than ever. This individuality includes various sections as mobility, urbanity, emotions and knowledge. All this facts just show that the car of the future brings the own personality stronger to expression. The basis of costumers is more differentiated as before and needs personality solutions. The customers of the future are standing in the foreground to get a success probability of innovations which are high and long-term saved. This individuality needs engineers to fulfill those demands of Development. Milberg is talking about a big loss of quality engineers and suppliers have to change this situation. Maybe by making it attractive for students, which can probably lead to a change in around 6 years, the average duration of studies in this direction.⁶⁰

4.2.3 Open and cross industry innovation

Nanotechnology, bionic and information technology deliver special potential for the automotive industry. The use of new technologies will be marked by interdisciplinarity. Automotive innovations are not going to restrict to one area, but they will limit themselves increasingly cross-sectored. Focus on innovation is the driving force behind the continuous improvement of the automobile. Suppliers have to keep innovation and withstand the cost pressure. They solve market promises with Sheer Driving Pleasure and this is an economic success for their businesses because just an attractive substance of products saves their long term sale success.⁶¹ Innovation offers have to be customized more regional. One of the key success factors in competency in automotive business is the innovation ability. Supporting an open organization and culture is necessary for the automotive industry to open itself. They should adopt more trends of other industries, for example from entertainment electronics or the tele-communication. OEM and supplier have to build innovation networks to improve their competencies and to reduce costs. The management has to create an open culture which supports the cooperation, and strengthens the competency level of the employees.⁶² The success of German supplier is the challenging market environment is defined by a two pillar strategy. It consists of a strong focus on foreign production and a strong export. It leads to shorter transport ways and fitted models for growing markets.⁶³

⁵⁹ Stolz (2008) p. 31

⁶⁰ Milberg (2008) p.8

⁶¹ Draeger (2008) p.10

⁶² Dannenberg (2008) p.19

⁶³ VDA(2013) p.30

4.2.4 Modul supplier

An added value depth product and service portfolio is a key growth gearing. It is important for suppliers to reduce the complexity and the variants in the product range and to ensure a long-term technological leading, if necessary by external complementary purchases. Our findings suggest that many auto-parts companies have carried out several waves of initiatives to reduce complexity, most still have an extremely heterogeneous product portfolio.⁶⁴ The consumers want to have individuality and variety. But compared to now, the variety has to grow clearly. The problem is that the required variety cannot be implemented efficiently. The necessary growing of the variety can just be reached by revolutionary efficiency improvements. Variety strains the efficiency. OEM and suppliers have to handle a lot of challenges, especially in the product development process. The strong product focus, they have today has to be expanded by market- or customer perspectives. In this case, globalism and regionalism is playing a big role. There will be a lot of development cooperation's between OEMs and between OEMs and suppliers. Modularization is a medium to solve the contradiction between efficiency and variety. The industry is in front of the problem to provide more variety efficient. Modularization of products is a possible way to solve this problem. A very important task for automotive industry is to define which modules have an impact on the brand and on the final vehicle. As part of the third revolution, the value creation depth will sink more and more. In the future, niche vehicles will rather be the rule and note the exception. That means a growing value creation for suppliers. Uniform modules as a technical basis for completely different car models as well as standard modules for important components like gearbox, air conditioning or axes should reduce the production and developing costs.⁶⁵ Costumers no longer overlook the variety and also get insufficiently informed about the advantages.⁶⁶ The quantity of value creation on the OEM side will decrease in the next years. Therefore suppliers take over more tasks which where managed by OEMs before. The complexity of modules requires an efficient development by special companies. Supplier matches the OEM with their modules out. There are of course differences in the value creation between electronic, interior and power trains but the direction is the same. System connectors combine various existing components and Modules into a functional system with improved customer benefits.⁶⁷

4.2.5 Core competences

The pressure on the hard side of value proportion will increase essentially, so that focus on competitive core competencies will be the only solution. This growing business specific consolidation leads to changing relations between OEM and supplier. In opposite to today, fewer suppliers will stand in front of OEM considering the module specialization. Products which do not support the core of the OEM brand will be covered by the commodity model. The interaction

⁶⁴ A.T. Kearney (2008) p.3

⁶⁵ Wimmer, Schneider, Blum (2010) p.22

⁶⁶ Wyman (2008) p.32

⁶⁷ Wyman (2007) p.26

between OEM and supplier is strongly restricted by buying and selling. Companies who are in the commodity model have to try to get their organizations to reach cost and process leader.⁶⁸

4.2.6 Relationship Management

Emotional factors put the customers in the foreground. The customer has to get the feeling that the provider try's everything to satisfy the customer. Sympathy and mutual trust are important sectors. The costumer should not be worried about provider's product promises. But this is a point where suppliers have to work on. An open communication between businesses is important to reduce uncertainties and build up trust. New supplier business relations are necessary to reach efficient levels which are much higher than the today's level. The interest of car buyers of innovation is much lower than some OEM would like to believe. In addition, he is rather unwilling to invest money in innovations. Just 17% of the supplier innovations get paid by costumers.⁶⁹ To use the internet for electric coordinate with extern partners, manufacturer and a couple of first tier supplier created a portal for their suppliers and this is growing more and more. These supplier portals like BMW group partner portal or VWgroupsupply.com develop themselves to mighty platforms which get build up during the buy in.⁷⁰

4.2.7 Multi level marketing and innovation

The today's existing variety is going to be stretched. Modular concepts give the possibility that this variety is getting more efficient than ever. During the vehicle creation cycle module updates set up new possibilities of variety. There is a big potential next to these module updates. The automotive supplier industry will grow together because of these concepts. They also have to integrate the customers into their development processes and this leads to a growing innovation force of the businesses and to a reduction of the risk in the product development.⁷¹ Innovation is the, for humans affordable and to the demands accorded mobility in agreement to environment and safety.⁷² Dr. Jan Dannenberg recommends Focus on costumers and marketing. Innovations are just successful if megatrends, legislation, competition or to address the costumer. A big part of today's vehicle innovations are based on the ideas and the dreams of engineers. To less people accept costumer wishes. Manufacturer and supplier have to orientate their innovation management stronger to the demand of the costumers and the Future market development. Starting points for an improvement of the costumer- and market orientation of R&D get found in the product portfolio, in the innovation marketing, in the price politics and in the market research and nearby to R&D centrals and also at innovations for special costumer segments.⁷³

⁶⁸ Burgard, Dannenberg (2008) p.25

⁶⁹ Wyman (2008) p.25

⁷⁰ Legner (2009) p.16

⁷¹ Lang (2006)

⁷² Menne (2008) p.12

⁷³ Dannenberg (2008) p.18

4.2.8 Coordinated innovation strategies

OEM's are working un-efficient in terms of the relation to supplier. The efficiency is increasing by growing consolidation of the supplier market. A clear business model is inevitable. It is part of the companies to go the right ways and to handle the challenges of the third revolution at the implementation of efficient variety. Prof. Dr.-Ing. Joachim Milberg, the president of the German academy of technical science wishes more courage for innovations and a closer network system between economic and science, because the prosperity of tomorrow can only come from the ideas of today.⁷⁴ Also active realignment for the innovation portfolio according to Dannenberg's paper shows that an unbalanced R&D program leads to future growing gaps. Manufacturer and supplier should analyze and realign their innovation portfolio continuously to reach a balance of the market potential versus market meaning, innovations rate versus risks, extern versus intern development and functions versus cost reductions. The compliance of the timetable, the recoverability and the sales strengths of innovations and also the cover of most important customer segments have to be proved. The innovation portfolio has to offer short-term perspectives and also long-term value promises for the business of the Future.⁷⁵ More than 40% of all investigation flow into innovations which never make into the car creation.⁷⁶ The automotive industry invested 68 billion Euros in 2005 in Research and development. Until 2015, the Total industry will spend around 800 billion euro's for R & D.⁷⁷ According to Dannenberg's paper "big chance for suppliers" an improvement of economy and risk management for R&D in supplier companies will lead to successful results. To stay competitive at the cost, manufacturer and supplier have to raise their economy of their innovations. Improvement of the efficiency at R&D organizations, process cost reduction and productivity improvement are three fields of action. OEM's and supplier continuously check the actuality and rightness of their innovation strategies. The central targets of each innovation strategy are short- middle- and long-term improvements of competitor position and sales strength.⁷⁸ Many innovation archetypes of suppliers are strongly aligned to the advantages of networks and cooperation's.⁷⁹ Increasing model and variants at the same time, shorter product life cycles, extensive modularization and modular strategies and high dynamics in use of new technologies in the car, new development areas around the electric mobility and strong cost pressure and high capital intensity have modified the cooperation between OEMs and suppliers.⁸⁰

⁷⁴ Milberg (2008) p.3

⁷⁵ Dannenberg (2008) p.19

⁷⁶ Wyman (2008) p.21

⁷⁷ Wyman (2007) p.4

⁷⁸ Dannenberg – Interview (2008)

⁷⁹ Wyman (2007) p.26

⁸⁰ VDA (2013) p.38

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