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Risk Management in the Selected Industry

Master Thesis

Study programme: N0413A050030 International Management
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Thesis Supervisors: Ing. Jan Öhm, Ph.D.
Departmens of economic Statistics

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Master Thesis Assignment Form

Risk Management in the Selected Industry

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- FOTR, Jiří and Jiří HNILICA, 2014. *Aplikovaná analýza rizika ve finančním managementu a investičním rozhodování*. 2nd ed. Praha: Grada Publishing. ISBN 978-80-247-5104-7.
- REJDA, George E. and Michael J. MCNAMARA, 2014. *Principles of risk management and insurance*. 12th ed. Boston: Pearson. ISBN 978-0-13-299291-6.
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- YOE, Charles E., 2019. *Principles of risk analysis: decision making under uncertainty*. 2nd ed. Boca Raton: Taylor and Francis, CRC Press. ISBN 978-1-138-47820-6.

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Annotation

This master thesis focuses on risk identification which is part of the risk management process. Specifically, it addresses the automotive industry in China. The main objective is to identify the risks facing the sector. In the literature review, the author describes the definition, classification and importance of risk in the business environment. Next, the entire risk management process is described, which consists of 4 parts. The reader is also introduced to the automotive industry and current trends. The practical part is devoted to risk identification, which is considered a key part of risk management. For a deeper analysis, the author focuses on the macroeconomic and microeconomic environment. PESTLE analysis was used to analyse the macro environment. Subsequently, the relationship between macroeconomic indicators and car sales in China was also statistically verified. In the case of the micro-environment analysis, the author examines the competitiveness of Chinese automotive parts suppliers with European firms to gain insight into other risks. For this purpose, internal sources and the author's personal experience at XY were used.

Key Words

Risk, risk managements, identification of risk, automotive industry, China, PESTLE analysis, SWOT analysis.

Anotace

Risk management ve vybraném odvětví

Tato diplomová práce se zaměřuje na identifikaci rizik, která je součástí risk managementu. Konkrétně se zabývá automobilovým průmyslem v Číně. Hlavním cílem je identifikovat rizika, kterým toto odvětví čelí. V teoretické části autor popisuje definici, klasifikaci a význam rizik v podnikatelském prostředí. Dále je popsán celý proces řízení rizik, který se skládá ze 4 částí. Čtenář je také seznámen s automobilovým průmyslem a současnými trendy. Praktická část je věnována identifikaci rizik, která je považována za klíčovou část risk managementu. Pro hlubší analýzu se autor zaměřuje na makroekonomické a mikroekonomické prostředí. K analýze makroprostředí byla použita analýza PESTLE. Následně byl také statisticky ověřen vztah mezi makroekonomickými ukazateli a prodejem automobilů v Číně. V případě analýzy mikroprostředí autor zkoumá konkurenceschopnost čínských dodavatelů automobilových dílů s evropskými firmami, aby získal přehled o dalších rizicích. K tomuto účelu byly využity interní zdroje a osobní zkušenosti autora ve společnosti XY.

Klíčová slova

Rizika, řízení rizik, identifikace rizik, automobilový průmysl, Čína, analýza PESTLE, analýza SWOT.

Content

Abbreviations

AI	Artificial Intelligence
EPI	Environmental Performance Index
EV	Electric Vehicle
GDP	Gross Domestic Product
GII	Global Innovation Index
IoT	Internet of Things
OEM	Original Equipment Manufacturer
PPAP	Production Part Approval Process

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Introduction

Risks are significant factors that affect not only the business environment but also most human activities. Some risks can be predicted, avoided, transferred and thus reduce their negative impact. The appropriate strategy is chosen by the firm based on the probability and magnitude of the negative impact of the risk. There are many ways and methods to achieve this. However, the core of risk management is the identification of the risks themselves. This stage is very important but also quite challenging. Therefore, the author decided to focus on this part of the risk management process in this master thesis.

The importance of risk management is also growing in the automotive industry. In recent decades, the sector has been changing rapidly due to current trends that are changing customer behaviour, requirements, technology and even the powertrain of traditional cars. Even the biggest players such as China have started to feel the impact. Based on all of the above, the author has decided **to identify the risks faced by the automotive industry in China** as the **main objective** of this thesis. In order to get a deeper picture, sub-objectives have also been set. The first partial aim is to **analyse the macroeconomic environment and identify the risks along with clarifying the relationship between macroeconomic indicators and automobile sales**. And secondly, to **evaluate the microeconomic environment and its risks**.

Before the actual risk identification, the literature review in the thesis provides a definition and meaning of risk. It also discusses risk management and all parts of the process along with their methods, which will also be used in the thesis. In addition, it deals with the meaning of risk and its management in the business environment. As the master thesis is focused on the automotive industry, part of the paper describes this industry, its importance and contribution, its links to other industries, automakers and also on the suppliers of automotive components. Subsequently, the current trends that are changing this industry are presented.

To get an overview of the evolution of the automotive industry, the period from 2000 to 2020 is described, focusing mainly on the significant changes in the number of produced cars and its reasons. The main players in the automotive industry are also introduced. However, the thesis then focuses only on a specific country, namely China. This state was

chosen because it has the largest automotive market in the world and produces the largest number of cars. Thus, the reader can get an overview of the automotive industry development in China, its car market, leading automotive brands, export of car parts, etc.

The thesis also focuses on the identification of risks. The PESTLE method is used to analyse the macroeconomic environment and the risks arising from it. Since the historical development of car production and sales suggested that there is a relationship between vehicles sold and macro indicators, the author decided to test this relation using statistics. A regression model will be used for this purpose. The dependent variable is the number of vehicles sold in China. The independent variable is GDP, inflation and unemployment rate. First, the author discusses with correlation analysis to find out the relationship of the selected variables. Then he deals with multicollinearity to analyse the correlation within the independent variables. Autocorrelation is also mentioned to see if patterns are repeated in the data. Finally, multiple regression to help explain the relationship between multiple independent variables relative to a single dependent variable.

For the analysis of the microeconomic environment, internal sources and the author's personal experience from the company in the automotive sector. As the company did not wish to be named, it is identified as XY. XY is headquartered in Munich but can be found all over the world. It specialises in truck braking systems, driveline-related systems and torsional vibration dampers for diesel engines in buses, trailers and even agricultural machinery. As this company also has Chinese suppliers of automotive parts, it is possible to compare the competitiveness of Chinese suppliers with European ones. Specifically, the writer focuses on the process of selecting an automotive parts supplier and all aspects that influence the selection or otherwise of a supplier from China. Finally, a SWOT analysis is created that provides a clear picture of the opportunities, threats, weaknesses and strengths of Chinese suppliers.

The source of the theoretical chapters was the professional literature. The practical part was based on both Chinese and European newspapers, reports, journals and academic papers, mainly from the scholar database. Statista, The World Bank and online data visualization and distribution platform OEC were a great help to collect numerical data. International trade statistics provided by UN Comtrade were also used. Other sources of information were the International Organization of Motor Vehicle, Corporate Finance Institute and much more.

1 Risk

Risk and uncertainty are an important attribute of most human activities, not only in business area. The definition of risk is not uniform, as it enters many sectors. Definitions vary according to the need to capture the aspects to which the risk relates. So, the concept differs for economists, theorists, scientists, etc. (Rejda E. George et al, 2014) Historically, risk has been associated with some danger with an undesirable outcome which could lead to losses, failure to achieve objectives or negative deviations of the organisation. (Fotr Jiří et al, 2014) Uncertainty is often confused with risk. However, in the economic and financial literature it is necessary to differentiate between these two concepts. Nevertheless, there are also authors who do not distinguish between these terms. (Rejda E. George et al, 2014)

Uncertainty refers to a situation where the outcome is unknow or not certain. It arises when the decision maker lack complete knowledge, information or full understanding of all factors and its possible consequences. (Gupta, P.K, 2016) For example, this unknown may relate to future trend of material prices, energy prices, exchange rates, future demand, etc. All of mentioned aspects could affect the results of future activities. (Yoe, Charles, 2019) The uncertainty is not only caused by a lack of information, but also by the limited reliability of the determination of future values of the factors. This is due, for example, to the use of unreliable data and inappropriate methods, etc. It follows that uncertainty can be reduced by avoiding the above. However, it is not possible to eliminate it completely. (Rejda E. George et al, 2014)

The **risk** is associated with an activity whose outcome is unknown. In other worlds, it is the consequence of an uncertain event. That may lead to some negative effect (for example a loss) or to something positive. So, risk not only represents a threat, but also presents various opportunities that can be used appropriately. (Fotr Jiří et al, 2014; Gupta, P.K, 2016)

1.1 Classification of risk

Risk can be classified from different perspectives. It depends on whether it comes from inside or outside the company. Accordingly, we can divide risks into **internal** and **external.** The first category is caused by human failure (poor employee performance), process failure, system failure or failure of controls and information technology within the company. On the other hand, external risks are based on the business environment in which the company operates. These can be microeconomic (competitors, customers) but also macroeconomic (technological risks, economic, environmental, etc.). (Popov, Georgi et al, 2016).

One of the most important classifications of risk is into **pure** and **speculative risk**. Pure risk represents a situation where a loss may or may not occur. Outcome, can be only negative or neutral, so any benefit can be gained from this type of risk. For example, there is a possibility that house will be destroyed by fire or flood. If this does not happen, the building owner will not gain anything additional. (Rejda E. George et al, 2014) However, the outcome of speculative risk is not only negative or neutral as in the case of pure risk. There is also the possibility of gain. A typical example is hazard or stock market investment. The player or investor can lose all the money invested or make a profit. (Gupta, P.K, 2016)

Risks can be further classified according to their subject matter. These include **technological** risks, which are associated with new innovative technologies (cost of acquisition of the best available technology, investment in research and development, etc.). Changing prices of materials, energy, inflation, exchange rates are **economic risks**. There are also risks associated with the **production process** or with **legislative** and **political systems**. Nowadays, **environmental** risk is also gaining importance. This type of risk can be associated, for example, with changing standards and the costs associated with remediation of environmental damage, etc. A company may also encounter **market risk**, which is the behaviour of competitiveness and the introduction of new products and pricing policies, changes in consumer preferences, etc. Risks associated with the method of financing, the ability to meet its obligations are called **financial**. Defaults on payments to customers include **credit risk**. Since risks occur in all areas of life, there are many more categories of risk. (Fotr Jíří et al, 2014; Treasury MH, 2004)

1.2 Risk management

As mentioned in the previous chapter, risk can negatively affect the performance of an organisation. The consequences of risk can have only minor impact in some cases. However, there are events that will have a major impact on the operation of the firm and its competitiveness. They may result in a large financial loss or even the closure of the business. Through risk management, the company is able to anticipate and prevent negative events and minimise their implications. (Hopkin Paul, 2013)

The aim of risk management is to analyse all risks specific to the organisation and respond to them in an appropriate and effective manner. According to Merna Tony, risk management can be defined as a set of actions which needs to be taken to alter risks (and their consequences) arising from the business activities. The process involves identifying, analysing and responding to risk events. Thanks to that, the company is able to identify its risks, predict how likely they are, the severity and implement the necessary actions and decisions. (Merna Tony et al., 2008)

The risk management process is divided into several parts. However, it varies depending on the author. For example, according to Yoe Charles there are 4 parts of this process which are identification of risk, assessing risk, risk treatment and monitoring risks in the industry. Each will be described in following subchapters.

1.2.1 Risk identification and its tools

The objective of risk identification is to identify potential risks that could affect the company and to indicate what the triggering events for potential problems are. It is considered to be the most important, challenging and time-consuming phase of the process. It seeks to answer the following questions: what are the potential problems, how can they arise in business operations, when how and why could the risks occur. (Fotr Jíří et al, 2014) The purpose of this phase is to obtain a list of risks that the company may encounter. Although the principle sounds simple, it is not always easy to find all the risks in a given company and industry. However, identification is the first step towards successful risk management.

There are many tools for identifying risks. The methods can be very simple or very complex and challenging. One of the simplest methods are checklists, which help to reduce the risk of overlooking certain problems. Also, mind maps can be used to graphically display individual risk factors and the links between them. (Fotr Jiří et al, 2014) The choice depends on the complexity and the required depth of analysis.

PESTLE

PESTLE analysis is a tool that helps to monitor the industry environment from a macro perspective. It can help in strategic decision making, understanding trends and market position. It is also used to identify risks and subsequently develop risk response strategies. (Dwyer & Tanner, 2022) There is a lot of competition and change in every industry, so analysing and understanding the market is essential for any business. It allows a company to predict or see risks and thus prepare for them, produce more relevant products and helps to adapt faster to current trends. (Thomas, 2007) Moreover, it can be also used for the evaluation of new market before entering and thus, company is able to see market conditions on market entry. (Cadle, et al., 2010) So, there is a lot of potential in this model for companies.

PESTLE is an acronym that stands for various factors used which are: political, economic, social, technological, legal and environmental**. Political factors** include political situation in the country, changes in political and national policies, government stability and support of the specific industry where company operates. Any foreign restrictions, exchange rate policy, supply-side policy, fiscal or monetary policy can have impact on any sector. (Perera, Rashain, 2017) **Economic factors** play a significant role in the success of an organization because the performance of the economy has a direct impact on the company's long-term prospects in the market. It focuses on the stability of the economy, employment rates, inflation rates, exchange rates, the structure of economic growth, ... (Perera, Rashain, 2017)

S stands for **social** or socio-cultural environment. This factor focuses on population size, age distribution, demographics, their lifestyles, etc. T represents **technological factors** in the selected industry. There are included all technological changes that may affect business. Foresight in technological development is an important precondition for the success of a company. In order not to be left behind, it is essential for a company to innovate its products. (Perera, Rashain, 2017; Holly Fosher, 2018)

Legal factors are laws regulations, rules, guidelines that apply to business. For example, it can be minimum wage, work health and safety, employment rights, consumer protection, industry specific regulation, etc. Last factor relates to the **environment**. These factors have become increasingly important in recent years due to the global warming, negative environmental impact and sustainability concerns. Nowadays, more eco-friendly methods of production or manufacturing are required. (Perera, Rashain, 2017; Holly Fosher, 2018)

SWOT analysis

SWOT analysis is one of the most commonly used tools. SWOT, which is an acronym, is used to determine and define company`s strengths, weaknesses, opportunities and threats. (Sarsby Alan, 2012) It is used by companies, organizations, departments or even by individuals. SWOT helps to increase awareness of factors which affect business, business decision and establishing a business strategy. Unlike PESTE, it focuses not only on the external environment but also on the internal factors. (Bigelow J. Stephen, 2022)

Internal factors are strengths and weaknesses of the company. Any competitive advantage of business which distinguishes from competitors is considered as a strength. It is something that the organization (or individual) does well. It can be for example strong business culture, way of employee motivation, strong brand, loyal customer base, low-cost resources etc. (Parsons Noah, 2021) Weaknesses, on the other hand, represents business areas within a company that needs to improve to remain competitive. In other world, it is something in which are competitors better, where resources or knowledge are lacking. Weakness can be lack of capital, high level of debt, not sufficient supply chain, etc. (Dough Leigh, 2009)

Opportunities and threats come from external environment. Opportunity is an event, situation or chance that can contribute to business success, give a competitive advantage to a firm or other potential future value. It can be new trend, change in costumer behaviour, new technologies, new regulation, lifestyle change etc. Last part of SWOT analysis are threats for a company which can negatively affect a business. It is any element that can be potential harm to the business or obstacle which prevent from achieving an organizational goal, mission or creating a value. Typical example is entering of new competitors, rising costs of materials, etc. (Parsons Noah, 2021)

Brainstorming

Brainstorming is a simple creative method that is created by generating ideas and sharing knowledge. It is a group technique that consists of two phases. In the first phase, all participants have the task of generating as many ideas as possible and, in the case of risk identification, as many potential risks as possible. Since the group participants are experts who have relevant insights, it is possible to find the problem from many perspectives. Then, in the second stage, all ideas are filtered with the agreement of the whole group. The basic rule of this method is not to criticize at this stage. Quantity is more important because it is believed that the greater the number of ideas, the more likely it is that some useful ones will emerge. (Martins Claudia Garrido et al., 2011)

Interview

Risks can also be identified through interviews with experts, stakeholders, project members, customers, etc. Like the brainstorming method, it seeks to gather potential risks through different perspectives and multiple opinions. Interviewees are asked prepared questions that need to be appropriately chosen. To achieve a better result, it is necessary to select the appropriate person for the interview. This person should have a high level of skill or knowledge and experience of the topic. In addition, the interviewer must be objective. (Martins Claudia Garrido et al., 2011; Morano et al., 2006)

1.2.2 Risk assessment

The second phase of risk management is risk assessment or, in some literature, risk analysis. This stage involves determining the probability of risk event occurring and the possible outcome of each risk. It also compares the importance and severity of each risk and ranks them in terms of significance and consequence. (Georgeta Panait Nicoleta, 2017) An important part of risk assessment is the identification of interdependencies between different risks and their sources. Risk assessment techniques vary. The essential point is that there is a qualitative or quantitative approach. (Altenbach J. Thomas, 1998)

Qualitative approach of risk assessment

The qualitative approach of risk analysis focuses not only on measuring the probability of a risk event but also on its impact. The main objective is to determine the severity of each factor. This approach is usually carried out first, in order to see the importance of the risks

and, if necessary, to focus only on the significant ones in more detail. However, it can be quite subjective, even when carried out by a subject matter expert. (Wood Richard, 2019)

A five-step scale is used to assess risk, from the lowest probability, intensity and negative impact to the highest. This is then recorded in the form of an intuitive graphical report. The most commonly used risk assessment matrix. The figure 1 shows how this method can look like. (Wood Richard, 2019) The higher the probability of its occurrence and the more negative the impact, the more significant the risk, of course. In the matrix, such risks are most often shown in the top right corner. The left-hand corner shows the less significant risks. (Fotr Jiří et al, 2014)

Figure 1 Risk assessment matrix

Source: Safran, 2019

Quantitative approach of risk assessment

Quantitative risk analysis uses verifiable data to analyse the impact of risks. This makes it more objective, which helps to improve understanding for all parties. Unlike the previous method, it focuses on the numerical values of the risks. This approach is usually used for those risks that have been classified as the most significant. The main objective is to calculate the expected cost of each potential risk. As it provides detailed information, it can help the company to make better decisions. (Indeed team, 2022) Several methods are used for quantitative risk analysis. The most common ones are: sensitivity analysis, decision tree analysis, Monte Carlo simulation etc. (Schlereth Thomas, 2020)

Sensitivity analysis determines how different values in specific model variable will affect the output of the model. It can calculate which factors have the greatest impact on the company performance. The assumption for this type of analysis is that there must be a functional relationship between the initial and final values that can be described mathematically. (Schlereth Thomas, 2020)

1.2.3 Risk treatment

Risk treatment, also called risk control or risk mitigation by some authors, is a process by which a company can mitigate risks by adopting the necessary strategies. It utilizes finding from previous stages of risk management (such as risk identification and risk assessment). (Srinivas K., 2019) By treating and moderating the risk effectively it is possible to use company`s resources properly and to define the steps to be followed when a specific risk arises. (Rejda E. George et al, 2014) There are five commonly accepted strategies used for risk addressing:

First strategy that will be mentioned is **risk avoidance**. The company seeks to eliminate risks by not engaging in activities that could lead to loss of assets or other negative impacts. The objective is therefore to eliminate the very source of the potential problem. With this approach, the chance of negative impacts is reduced to zero because the exposure to risk will (in theory) never occur. However, it is not possible to eliminate all risks. Avoiding risks may also not be feasible or practical in some cases. (Rejda E. George et al, 2014; Srinivas K., 2019)

Second strategy is **risk acceptance**. In this case, it is not possible to eliminate all risks or the potential loss from the risk is not large enough for the company to try to avoid it. Therefore, these are risks that are not too costly or their impact will not significantly threaten the performance of the company. This strategy can save budget for more important risks that already require a response from the firm. However, it is necessary for the company to strike a balance between the potential costs and the costs associated with risk prevention. This strategy does not require the company to take any preventive or mitigating measures. The company will simply deal with risks as they arise. (Potters Charles, 2021)

Another approach that will be mentioned is **risk reduction**. Through this strategy, company aims to reduce the probability and consequence of an adverse risk event. Sometimes it is possible to reduce the amount of damage that certain risks can cause to company processes. This can be done by modifying specific aspects of the overall project plan or organisational process or by reducing its scope. (Potters Charles, 2021)

Last mentioned strategy is **risk transfer**. This approach consists of the undertaking transferring the negative effects of the risk, in whole or in part, to a third party. Thus, if a situation with a bad outcome arises, the third party covers the loss in whole or in part. A typical example is the use of insurance companies. An insurance contract is essentially a transfer of risk from one party to another that obliges the insurance company to assume liability. (Srinivas K., 2019; Blackman Andrew, 2015)

1.2.4 Risk monitoring

However, risk management does not end with the implementation of risk measures alone. The process also requires an evaluation of the effectiveness of these strategies. This allows ineffective measures to be improved or changed completely. It includes recording what changes were made, what their costs were and how they affected previously identified risks. (Blackman Andrew, 2015) It takes into account how the risk strategies have impacted the organisation and what residual risks they have left behind. So, it may involve selecting alternative strategies, implementing a contingency plan, taking corrective action or re-planning activities. (Jeremy Fabbri, 2021) Phase of risk monitoring also includes continuous checking of business activities, which makes it possible to identify new risks.

Because, as already mentioned, the current market situation is changing along with government policy, the economic situation, etc. (Stephen D.Gantz, 2013)

1.3 Risk and risk management in the business environment

The presence of risks is everywhere. They can be found in the everyday life of ordinary people and, of course, in the business environment. Their nature is varied, some have financial character, others are the opposite. Some risks are manageable for a company, some unfortunately cannot be avoided. Risks do not only come from competitors, but also from the government, for example in the form of various restrictions or changes in the law. Risks can also be determined by the current stability of the economy in a given country because, as already mentioned, the economy has a long-term effect on every business. Moreover, in the current era of constant innovation, there is also a technological risk. New technologies can improve a company's performance and products, but on the other hand, not adapting to new trends early on can favour competitors. This leads to the other risk of changing customer behaviour as consumers start to demand these product innovations or even replace the product. With global warming comes environmental risks, and the list could continue. The risks are indeed many. Each sector may have its own specific ones, but negative events can, of course, be the same across sectors.

Of course, such risks can bring with them certain opportunities, but they can also have negative impacts on the company`s performance. Unfortunately, it is not possible to eliminate all risks. However, it is possible to reduce the consequences of these unpleasant events. This can be done through appropriate risk management. By putting in place an appropriate strategy at the moment the risk occurs, or even before it occurs, a company can avoid huge losses, weakening its competitiveness, etc. By applying appropriate methods in the risk assessment phase, the company can identify which risks are the most significant, and appropriately prioritise its business for the implementation of measures. For example, for risks with a lower probability of occurrence or with lesser consequences, the business may decide to accept the risk without any countermeasures and thus have more time and resources to focus on more important risks that could put the business at risk.

However, the process does not end with the implementation of strategies to eliminate or reduce the consequences of the risk. The business environment is constantly changing and it is therefore necessary for a business to continuously monitor its activities and environment to identify new potential risks or opportunities. In addition, it is also necessary to check

that the strategies implemented to address risk are effective and successful. If not, the company must consider establishing new strategies or adjusting existing ones.

However, the main core of any risk management is the actual identification of risks, which is a very important and challenging step. Without knowing what risks may arise, a company cannot take any steps to mitigate their consequences. Again, there are many methods of this identification, from simple to more complex. For this master thesis PESTLE and SWOT was chosen. Because as already mentioned, risks exist in many areas and can be classified in different ways. Therefore, according to the author, it is important to understand the industry and its risks from multiple from many areas. To do this, the author found the PESTLE method best suited for this purpose as it focuses on a wide range of factors. This will enable the firm to analyse the risks from the macroeconomic environment that affect the whole business sector. Once this picture is obtained, the firm will have a complete view from an economic, political, legal and environmental perspective. To identify additional risks the microeconomic environment was also analysed. In this way, it can then analyse all threats (or opportunities) for example, from competitors. In this case SWOT analysis was used which works together with the PESTLE.

2 Automotive industry

The automotive industry has become a key sector in all major countries of the world. It is a main driver of macroeconomic growth and stability, innovative technological advancement, comfort and more. Its importance is still rapidly growing. Over time, this engineering sector has become a pillar of the economy. However, it is not just the automotive industry itself, but also the interconnection with other sectors. (Ram Kidambi & Manish Mathur, 2022)

As shown in Figure 2, the core of the automotive industry is represented by the original equipment manufacturers (OEMs), which are both vehicle and component manufacturers. This core also supports a number of other business segments, both upstream and downstream. As a variety of materials such as steel, plastic, rubber, electronics, aluminium etc. are required to produce a vehicle, the automotive industry is highly dependent on other industries. On the other hand, a number of business segments are also connected to this industry. These may include insurance companies whose products are linked to the use of vehicles, the aftermarket associated with car repairs and the sale of spare parts for cars, parts storage, the used car market, advertising, transport and many others. (Investopedia, 2019; Ram Kidambi & Manish Mathur, 2022)

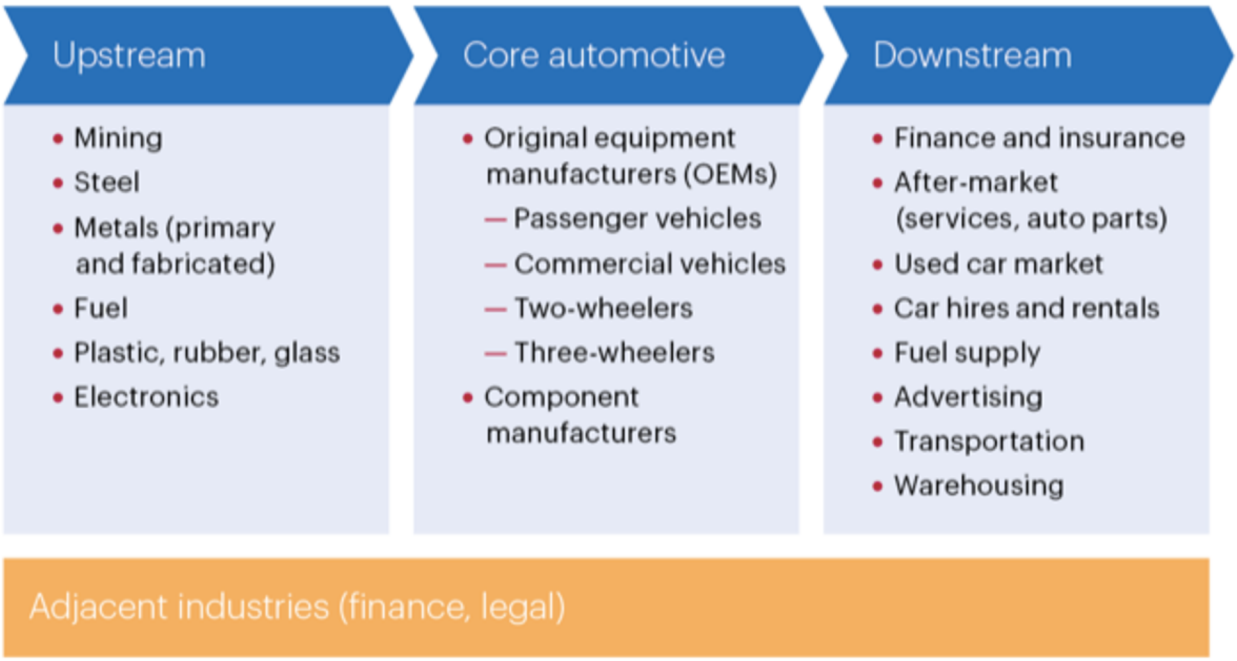

Figure 2 Interconnection between industries

Source: Kearney, 2022

There are therefore many links to the automotive industry and other sectors. However, this is not the only reason why this sector is important. It also generates government revenue through vehicle sales taxes, user fees, personal income and business taxes, service supply excise, value added and local taxes, import duties, ... In addition, through exports, automobile companies also generate foreign exchange earnings. (Accenture, 2020; Oica, 2022; Ram Kidambi & Manish Mathur, 2022)

The automotive industry also supports economic development. Based on data available in March 2020, the turnover of the auto industry exceeds 7% of EU GDP, 3-3.5% of total GDP in the US and 10% in China. In addition, the industry is a major employer. Almost 14 million people are employed in Europe, 8 million in the US and around 5 million in China. In parallel, every job in the core automotive industry creates more than 4 additional jobs in linked industries. So, the importance of this sector is huge from many aspects. (Accenture, 2020; Oica, 2022; Ram Kidambi & Manish Mathur, 2022)

2.1 Carmakers and its suppliers

The automotive industry is an engineering industry. It consists of many organizations and companies which focus on the development, design, marketing and manufacturing of motor vehicles. Their final products are than offered to customers in the form of passenger cars, motorcycles, light and heavy trucks, buses, etc. However, the automotive industry is not only made up of the manufacturers themselves. Parts suppliers are also an indispensable part of the industry. Cars have become increasingly complex over the years. This means that more parts are needed to produce a single vehicle, both simple and more technically demanding. This has encouraged an increase in the number of suppliers. Their main objective is to meet the demand of automotive manufacturers for plastic and rubber parts, special components, electronic components, etc.

However, carmakers have to be very careful when choosing a supplier of vehicle components. After all, the automotive industry is a very specific sector that cannot afford to make mistakes. Any error would significantly affect not only the customer experience, but more importantly the safety of vehicle owners and pedestrians. For this reason, vehicle brands as well as their suppliers must follow strict controls and certification. Core standards include IATF 16949, ISO standards, etc. Of course, individual car companies may require additional audits or standards. (Polly, 2021)

IATF 16949 is a global quality management system for automotive industry. It includes requirements for product safety and special characteristics and stresses the development of a process-oriented quality management system that ensures continuous improvement, prevention of defects and reduction of defects and waste in the supply chain. The main purpose is to meet customer requirements efficiently and effectively. This document is based on ISO 9001. The main difference between ISO 9001 and IATF is that ISO focuses on customers satisfaction but IATF goes further and requires compliance with specific company requirements outlined in the standard. (ABS Group, 2019; NQA, 2022; Smithers, 2022)

Safety and quality are important for every car company. Any mistake could damage the company's name. For this reason, every firm chooses its suppliers very carefully. It is therefore very likely that additional requirements will be added to the standards already

explained. Later on in this master thesis, internal sources of the company XY, which is located in Germany, will be used. And this corporation has high requirements for its suppliers and monitors other important information. These include VDA audit, PSA audit, standards for material specifications and many more. This example makes it clear that supplier requirements can of course vary from company to company.

2.2 Current trends in the automotive industry

Nowadays, the automotive industry is rapidly changing, driven by the accelerated rise of new technologies, sustainability policies and changing consumer preferences. Automakers are chasing the latest features with the vision of higher sales and differentiating themselves from the competition, speeding this transformation. Digital technologies continue to transform the mobility landscape. Artificial Intelligence and the Internet of Things have opened the door to new possibilities and features that can not only enhance the user experience but also rapidly improve safety. For example, several levels of automation can be found in modern cars, which can lead to fully self-driving, autonomous cars. In addition, the car can monitor the driver's vital signs to prevent dangerous situations or, thanks to predictive maintenance analysis, predict the failure of any part in the vehicle. Nowadays, the user can also benefit from a number of enhancements such as remote control, smart devices and apps, connected cars, adjustable equipment and much more.

However, changes in the automotive industry are also driven by strict environmental policies that force manufacturers to invest in alternative powertrains to reduce CO2 emissions. And it is precisely because of growing climate concerns that the automotive industry has started to electrify the sector. Thanks to government support and subsidies, the electric vehicle market is growing along with consumer interest. And it is these trends that are the focus of this chapter.

2.2.1 Rise of artificial intelligence

Artificial intelligence (AI) grows its importance across the sectors, automotive industry included. From basic elements like automatically adjusting of seats through smart driving assistance to completely autonomous cars and automatic production. AI is transforming automotive industry radically not only enhancing safety and comfort for customers but also enable manufacturers to enhance the efficiency and quality of their products` lifecycles.

To keep up with the competition, car manufacturers are investing into better equipment and adopting intelligent AI solutions. So, they can identify defects in-car components, improve quality control, decrease manufacturing costs and product safer and innovative products. AI technologies have advanced to the point where is possible to automate at least 30% in about 60% of occupations. Machine learning for example allows computers the ability to learn without explicit programming. Innovative systems can also diagnose problem and predict failure of equipment and through this increase equipment availability, lower inspection costs and lower total annual maintenance costs of equipment. Moreover, through robot-human collaboration can increase productivity by up to 20%. Artificial intelligence can also decrease quality problems as it constantly learns to improve its analysis based on feedback and thanks to this can detect defects up to 90% more accurately than humans. (Breunig Matthias et al., 2017; Nix 2021)

However, AI has a lot of advantage not only for manufacturers but also for the customer. To ensure greater security and driving experience car brands started to apply these innovative systems also to their product. Driver assistance is the typical example. Car nowadays can analyse can predict potential issue thanks to the ability to analyse driver`s history of driving. Moreover, with help of monitoring system and cameras it is possible to monitor driver`s vital, body position, current mood, eye openness, etc. the vehicle is able warn driver in case of emergency. Thanks this it that car itself can adjust airbags in accident, wake up driver from microsleep through vibrating steering wheel and so on. Adjustable temperature, seats, mirrors are basic equipment nowadays to enhance driver`s comfort. Another typical example of AI in car are sensor which monitor blind spots, alert the driver and even automatically react in dangerous situation (automatic braking in the event of an obstacle). For drivers comfort and safety are used basic features like automatically adjust the seat, mirrors, temperature. (Nix 2021)

2.2.2 Driving automation of vehicles

The rapid progress in artificial intelligence do not end with the above, but have also enabled automation driving of cars. Technological advances have allowed manufacturers to increase the capabilities of self-driving cars and move closer to fully autonomous vehicles than ever before. The expansion of self-driving cars has been driven not only by active research

and development activities, but also by increased investment in the autonomous market. Which has been valued at USD 20.97 billion in 2020 and is forecast to expand further. (Global News Swire, 2021)

There are 6 levels of automation, ranging from 0 to 5. For better clarity, all levels and their specifications are also described in the figure below. **Level 0** is **no automation** at all, so the car is fully dependent on a human driver in all respects. At level 1, the vehicle's driver assistance system is able to assist the driver with either steering, braking or accelerating, but not simultaneously. At **level 2**, called **partial automation**, there is one or more driver assistants that can control steering, braking and acceleration simultaneously. However, the driver must pay full attention and monitor the driving environment. (Bardt Hubertus, 2017)

Conditional automation, which is **level 3**, the automated driving system can perform all driving tasks. The driver does not have to pay attention because the car is also monitoring the driving environment, but the driver must be ready to take control of the vehicle at any time. A car at **level 4** has **high automation.** In this case, the human driver may still have the ability to control the vehicle, but the driver assistance system may also be able to intervene if the human driver does not respond appropriately to a request for intervention. When a vehicle reaches **level 5**, it is **fully automated**. It is therefore capable of performing all driving functions under all conditions. And it is these fully automated cars, also called autonomous cars, that are attracting carmakers and investors because they see great potential in them. (Bardt Hubertus, 2017; Synopsys, 2022)

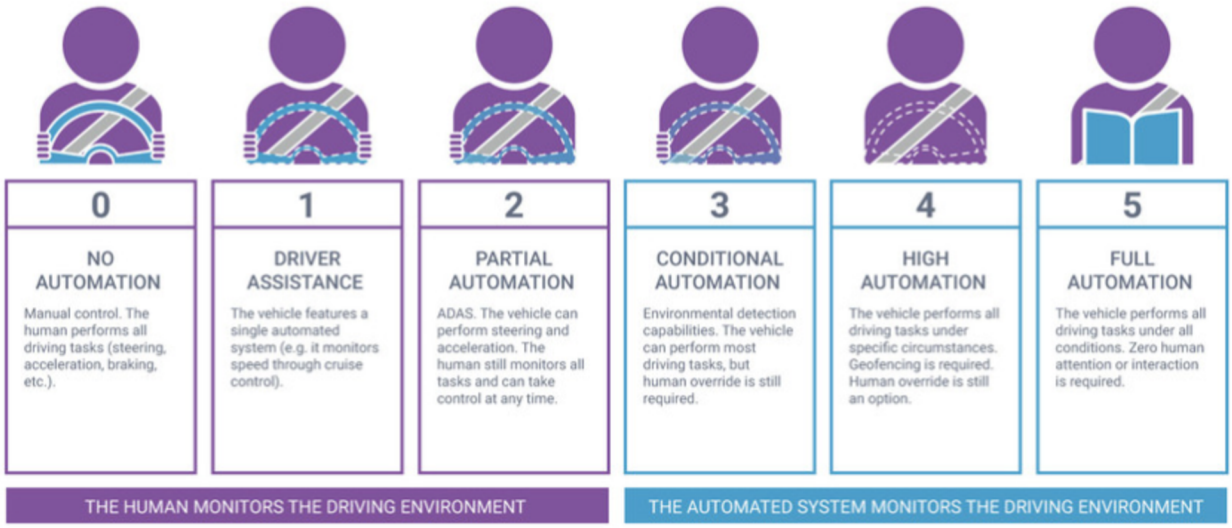

Figure 3 Levels of automated driving

Source: Synopsys, 2022

As explained above, to be considered fully autonomous, a car must pass through 6 levels of development of driver assistance technologies. Autonomous cars are currently at level 2. Level 2 and 3 are expected to grow rapidly by 2030. However, fully autonomous vehicles need further development and there are still many hurdles to overcome. The nature of the challenges is diverse, ranging from technological and legislative to environmental.

One of the most important obstacles, for example, is cyber-attacks. So before autonomous vehicles can be fully integrated into the transport system, the software must be completely secure against cybercrime. Another big unknown associated with fully automated cars is accident liability. If cars were not driven by a human driver, it is unclear who would be legally liable for an accident caused by an autonomous car. There are still many other unknowns, but if they are overcome, these innovative cars can bring many benefits. It can reduce CO2 emissions, save time, reduce congestion and, above all, improve safety. (Globe News Wire, 2021; Synopsys, 2022)

2.2.3 Electrification of automotive industry

Due to the growing climate concerns, sustainability trends and pollutant reduction, governments are setting increasingly stringent emissions regulations. And car manufacturers are responding to this pressure by replacing petrol and diesel engines with electric power. And with customers starting to embrace this trend, this market is getting bigger and bigger and this trend is becoming more important.

Today, there are several types of electric vehicles. One of them is a **battery electric vehicle**, also referred as pure-electric vehicles. This type of car operates only on stored electricity. The main components are high-voltage battery, one or more electric motors and a controller to manage the power electronic. There is no backup gasoline engine so its power source is a rechargeable battery. Thanks to this they do not produce any emissions.

However, because it is quite challenging with current battery technology to completely replace a fossil fuel car with a pure electric drive, there is also a combination of both drive systems. An example of this combination is **plug-in hybrid electric vehicle**. This electrified vehicle has an electric motor as well as internal combustion engine. The pure electric range is only up to 50 miles, but after the electric battery is almost depleted, the car automatically switches to using the fossil fuel engine. Another combination of both energy sources is the **hybrid electric vehicle**. In this case, however, the combustion engine supplies most of the energy. The electric propulsion system only serves to increase fuel efficiency. (Synopsys, 2022; Energy Saving Trust, 2022)

2.2.4 Internet of Things and connected cars

In an effort to stay ahead of the competition and increase sales, car manufacturers have started to apply the Internet of Things (IoT) to their products. IoT refers to a system of complex devices like electronics, sensors, platform hubs, etc which connect, interact with each other and exchange data through the internet connection without any intervention by humans. It can make vehicles more intelligent, efficient, safe and comfortable for the customer. The Advanced Driver System, which has already been introduced in subchapter entitled “driving automation of vehicles”, is one of an application of the

Internet of Things in the automotive industry. However, there are other ways to innovate cars through it. (Biz Intellia, 2022; Vakula Chetty, 2020)

Connected cars are a prime example of the use of IoT in this sector. This type of vehicle can be connected to other services or devices that are inside or outside the car. With its own internet connection, the car can transmit and process large amounts of data, download software updates, connect to other devices (such as a smartphone or smart home) and also provide internet connectivity to passengers via WiFi. The potential is huge. Any vehicle equipped with this smart technology can, for example, predict and prevent accidents by sharing location, speed and dynamics information with other devices and cars. It can also connect to other networks with data on traffic lights, accidents, weather forecasts warn the driver in case of some emergency. This could improve traffic flow and increase safety. (Acko, 2022; Burkhalter Max, 2021; Evans Claire, 2020)

Several **safety-critical features** can also be found in connected vehicles that can call for emergency in the event of an accident, assist in case of vehicle breakdown, track location and much more. Nowadays, it's even possible to park remotely using a smartphone app or smart key fob. The driver can also lock or unlock the doors, open the windows, start or stop the engine, control the air conditioning, turn off or on the headlights and much more at the touch of a button on their smartphone. There are many more features that connected cars can offer that can rapidly increase driver comfort and safety. (Acko, 2022; Burkhalter Max, 2021; Evans Claire, 2020)

The Internet of Things has brought an additional feature to the automotive industry in the form of **predictive maintenance system.** This feature collects data on the performance of vehicle components and can thus assess the risk of vehicle failure and alert the user to take the necessary steps to prevent the sudden failure of their vehicle components. With an automotive maintenance system, the driver can be informed of potential service and repairs before any collision occurs, which can save costs and time. (Biz Intellia, 2022; Burkhalter Max, 2021)

2.3 Automotive industry through times

The automotive industry has faced many challenges over the years that have significantly affected its development. Although the vehicle production curve shown in the figure below has a positive trend, several fluctuations can be observed. Each of these observable changes is due to different circumstances, which may also vary from one region to another. The aim of this chapter is to outline the evolution of the sector, its problems and the different approaches in each selected location. The course of development will also help to reveal the risks associated with this sector.

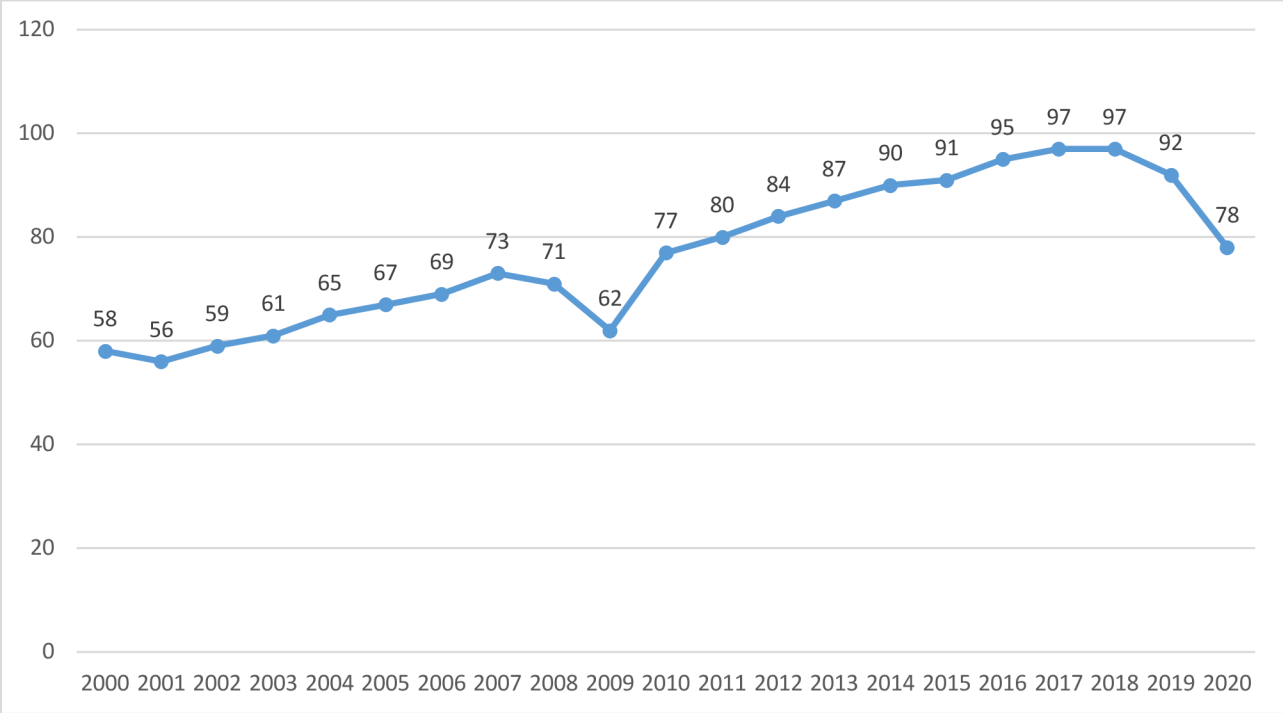

Figure 4 Vehicle production worldwide, 2000-2020

Source: own processing according to data from Statista, 2021

The fact that the development is influenced by location is also confirmed by Figures 4 and 5. While the curve representing production in Europe and the USA resembles the global production curve except for minor deviations, the curve in China is quite different. This suggests that each region has been affected by the same events to a different degree or faced completely different events. The next objective of this chapter is therefore to describe these events that have influenced the development of the industry, mainly focused on the biggest players like USA, China and Europe.

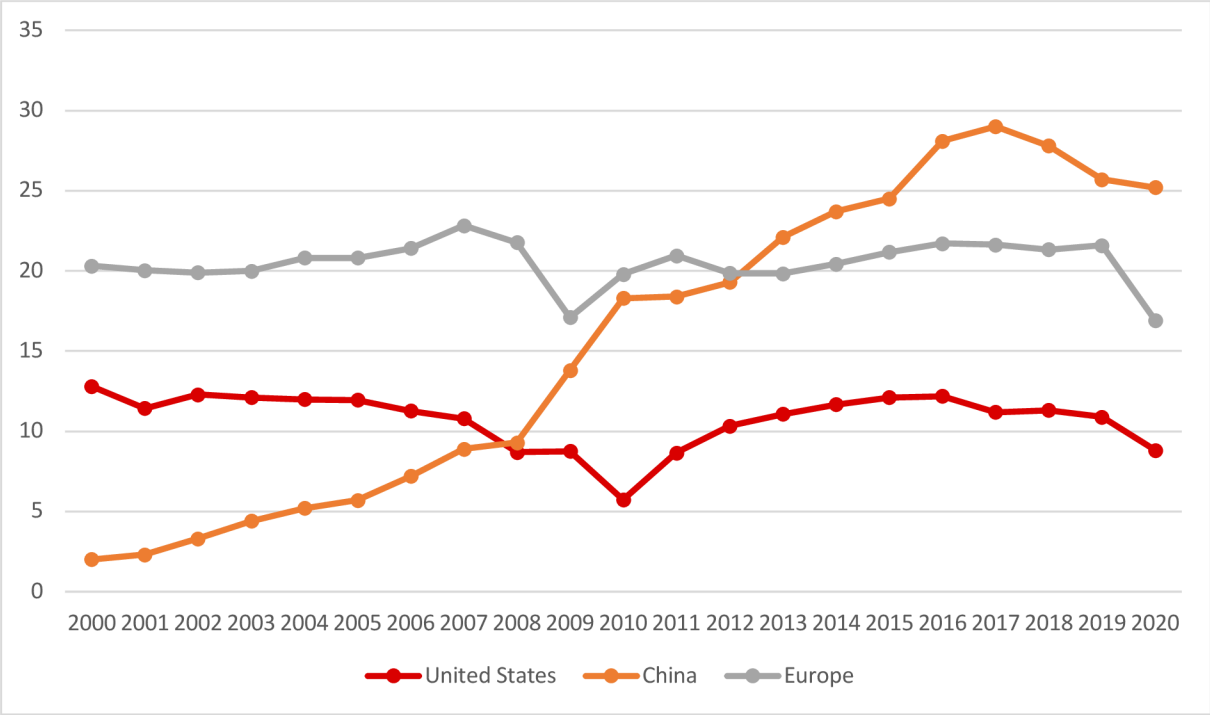

Figure 5 Vehicle production in selected areas, 2000-2020

Source: own processing based on data from Statista and OICA, 2022

2.3.1 Eight-month recession in US

In 2000, almost 58 million motor vehicles were produced all over the world. In 2001, The United States were facing several serious economic problems that year. The country had to deal with the consequences of the dotcom bubble, which was triggered by the rise and fall of technology stocks. As the internet developed, it attracted investors to put their money into technology start-ups (internet businesses). As a result, start-ups were able to raise large amounts of money, unfortunately without any long-term business plan. As a result, these companies ran out of money very quickly. This caused them to go bankrupt. Subsequently, in 2000, the stock market crashed as a result of the bursting of the dotcom bubble. (Investopedia, 2019; CFI, 2022)

In addition, the economic situation in US has also been worsened by an accounting scandal at companies like Enron and WorldCom (2002). Enron was using accounting loopholes to hide billions of dollars in bad debts while overstating its profits. (Year later another company named WorldCom inflated its assets by unbelievable USD 11billion.) The country was also significantly affected by the tragic event of the terrorist attacks on the World Trade Centre.

All of the above caused and eight-month recession. This had an impact not only on US vehicle production, but also on overall world production. (Investopedia, 2019; CFI, 2022)

2.3.2 The economic crisis 2007-2009

The United States and Europe had a big lead over China in number of produced cars. As it can be seen on Figure 5, each area produced more than three times as many vehicles as China. But since late 2007, the production of these two leaders has shrieked. In December 2007 the Great Recession, that was caused partly due to the bubble in the real estate market, began. It affected wide sectors in global market and is considered as one of the most serious one in the modern history. The automotive industry was one of those sectors that felt its impact the most.

The economic crisis of 2007-2009 negatively affected vehicle sales and production, import and export, market share of companies and also increased unemployment. The situation was exacerbated by deterioration in access to consumer credit, which finances a high proportion of new vehicles purchases (particularly in the United States). The automobile industry became very weak also due to the increase in the prices of fuel, which reached an all-time high of USD 145 per barrel on 3 July 2007. The impact has been felt particularly in the US manufacturers, whose sales have fallen 32% and two large companies, GM and Chrysler, have declared bankruptcy and restructured their operations. The US was so affected by the crisis that it was still dealing with the consequences in 2010. (Dupor Bill, 2019; Pavlínek Petr, 2015; Tang 2012)

Meanwhile, the Chinese car industry has shown strength and continued to expand. In 2008, China overtook the United States in total vehicle production for the first time. This meant that China became the world's second largest producer of motor vehicles. Thanks to the government's stimulus package, China was able to continue its rapid growth even in these difficult times. In 2009, China became the largest country in the world with 13.8 million units, overtaking Japan's production. This makes China the only country to show significant and continuous growth since 2000. (Dupor Bill, 2019; Pavlínek Petr, 2015; Tang 2012)

After the Great Recession, the automotive industry started to grow again. However, the leaders were no longer Japan or the USA. China became the largest producer of motor vehicles and its industry continued to grow. In 2012, China even overtook production in the whole of Europe to become the overall leader. In 2017, they reached a global peak of an incredible 29 million cars produced. In comparison, the US produced 11,19 million units and Europe 21,63 million units in the same year. However, in 2018, trade tensions between the US and China, a slowing economy, tighter vehicle emission standards and period of structural adjustment began to affect the development of China's automotive industry. (The Wall Street, 2019)

2.3.3 Covid-19 in 2019

A global pandemic has caused a huge upheaval not only in the automotive industry but in all sectors. It broke out first in China in 2019, then in Europe and then around the world. Covid-19 affected all aspects of daily life, societies and governments, international trade and industries. The pandemic has disrupted supply chains, changed customer behaviour, created new challenges and surrounded companies, including those in the automotive industry, with high uncertainty.

The impact of the coronavirus on the automotive market can be seen, for example, in the number of newly registered passenger cars in 2020 compared to 2019 figures. As the figure below shows, there has been a large decline worldwide. The largest decline was recorded in Brazil, followed by the European Union (23,7% decline). According to the German Association of the Automotive Industry, new registrations fell by 19% in Germany, 25% in France, 28% in Italy, 29% in the United Kingdom and Spain lost almost a third of new passenger car registrations compared to 2019. The US lost 14,7% of registrations and China was the least affected, with a year-on-year difference of just 6,1%. (OECD,2021; Statista, 2021)

The consequences of Covid-19 are also being felt in the global production of motor vehicles. Global production fell by almost 14 million vehicles in 2020. Europe, for example, lost 4,66 million units in the same year. As a result of the production stoppage, 83 863 cars were not produced in the Czech Republic. This represents the largest loss in Europe for March 2020. In addition, measures to stop the spread of the virus, such as closing factories, closing

contracts, imposing restrictions, have also affected sales in the automotive industry. In the countries of Central and Eastern Europe, car sales fell by almost 32% in the first two quarters of 2020. (OECD,2021; Statista, 2021)

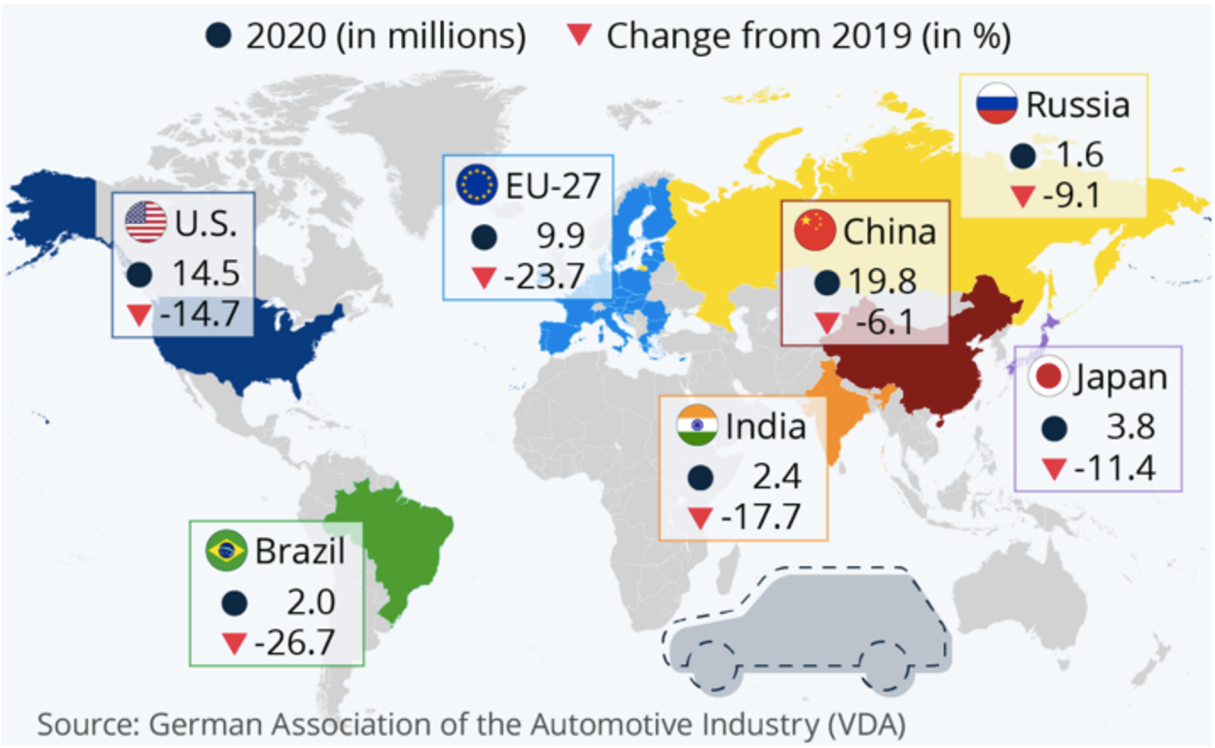

Figure 6 New passenger car registration in 2020 worldwide compared with 2019

Source: Statista, 2021

The first lockdown meant a significant crippling of production. Restrictive measures have disrupted production and demand of car manufacturer and their suppliers. Many companies, not only in this industry, have been forced to shut down all activities for a certain period of time. The lockdown in early 2020 halted car production, which quickly affected the entire supply chain, another issue associated with Covid-19. (Accenture, 2020)

Under the influence of globalisation and the drive to exploit cheap labour while striving for zero inventory to minimise working capital, global networks were created. But as countries around the world have had to implement legal and trade restrictions, they have been forced to close their borders and quarantine production lines or even shut down the entire company. For example, in China, which is the third largest importer of car parts in the world, almost two-thirds of car production was directly affected by the shutdown. This has also meant that shipping companies have been forced to cancel many of their routes,

which has also affected the sector. These facts have increased the shortage of needed parts, limited the distribution of suppliers, and co-created a worldwide chip shortage, which will be discussed in detail in the following chapter. (Accenture, 2020)

2.3.4 Global chip shortage 2021

As mentioned in the previous chapter, another major problem associated with Covid-19 was the worldwide chip shortage that halted automobile production. These chips, called semiconductor chips or microchips, are an important part of almost every product which require electric power. It is used not only in the devices which are used on the daily basis like fridge, washing machine, mobile phones, laptops, thermostats, electric toothbrush, cars, etc. but these chips are also important for the military, power grid, medical equipment and it even powers factories which are making the electronics and chips itself. (Popular Science, 2021)

In automotive industry, semiconductors chips can be found in many parts of car carrying out various functions. For example, they control air conditioning, monitor tire pressure, move seats, power steering or even ensure the proper functioning of the airbags. Cars with advanced technology safety systems, driver assistance features or with other electronic accessories may have over 100 chips in one car. It is not surprising that chips are very important for the automotive industry. The global chip shortage has had a major impact on the sector. (Statista, 2021a)

After the outbreak of the Covid-19, people were forced to stay at home. They had to start working from home and attending school remotely. This caused a massive spike in PCs, tablets and consumer electronics. Moreover, Zoom, Teams and other platforms became the meeting room, the schoolroom and the family reunion into one. These collaboration platforms and devices needed more chips. All of this, along with a rapidly expanding home office, would increase the already high demand for chips. (CNBC, 2021; Popular Science, 2021)

The closure of factories due to the pandemic meant that supplies for chip production were unavailable for several months. The previously mentioned increased demand for consumer electronics caused changes that spread throughout the supply chain and orders started to pile

up and backlogs began to increase. All these factors have contributed to the current global chip shortage. But in the automotive industry played another important factor. During the second quarter of 2020 automotive companies shut down. But not only that, they also cancelled orders from a lot of its microchip suppliers. That meant that these chip companies had to find other markets. And due to the rapidly high demand, the consumer electronics was suitable solution. But when automotive industry had opened again there was a shortage of cars chips because their previous suppliers have already retooled their plats to make chips for goods instead of cars. (CNBC, 2021; Popular Science, 2021)

To make matters worse, natural disasters struck the remaining factories. For example, a winter storm in Texas, a fire in Japan (this plant produces almost a third of the world's car chips) or a severe drought in Taiwan (a large amount of water is needed to produce microchips). Another possible threat on this topic may be the tense relations between China and Taiwan. Taiwan is a world leader in chip production. The theoretical possibility of a war between the two would have fatal consequences for many industries because the world would not be able to obtain the chips on which it depends. (Popular Science, 2021)

According to AlixPartners the chip shortage will cost auto industry about 210 billion dollars in revenue in 2021. In May the forecast was about 110 billion dollars which means that it almost doubled since then. The global chip shortage will probably negatively impact vehicle production in following year, leading to huge losses for the auto industry. In 2021 it is expected that 7,7 million units of production will be lost. Unfortunately, it is still unclear when this problem will be solved. (CNBC, 2021)

2.3.5 Magnesium deficiency 2021

Magnesium is raw material, very important for production of aluminium alloys which is essential for car production. Aluminium is ideal for parts which are light but still sturdy. It can be found in gearboxes, seat frames, fuel tank covers, steering columns, etc. In summary, without aluminium the production of the car cannot be completed. Due to the power crisis in China was is a risk of magnesium shortage. This would mean that the entire car industry could be forced to stop. More than 85% of the world`s magnesium production comes from China. (Financial Times, 2021; WV Metalle, 2021)

There used to be magnesium producing companies in Europe, however Europa could not compete with Chinese prices so they had to close or stop the production. Unfortunately, China was facing a power crisis. Due to this issue Chinese government ordered 35 (out of 50) magnesium smelters to close. Remaining ordered to cut their production by half. The supply of magnesium was thus in critical danger, the supply of this material was restricted and the automotive industry was again affected. (Financial Times, 2021; WV Metalle, 2021)

3 Automotive industry in China

China is currently considered the most important market for the automotive industry. Based on the number of new car registrations, the country is the largest automotive market in the world with more than 21.09 million registered cars. In addition, since 2009, China has also been a leader in car production. In 2020, over 25.2 million units were produced here and over 25.3 cars were sold. Which makes China the leading company in the world.

Although the People's Republic of China is currently the leader in the automotive industry, this has not always been the case. Compared to other countries, China has long lagged behind. And it wasn't until the 1980s that the industry really began to develop significantly. However, major milestones such as government policies, entry into the WTO, stimulus packages, etc., have enabled the rapid growth of this sector, putting China at the top of the world. (Statista a, 2021; Statista b, 2021)

China's share of global vehicle production has also positive trend. As the figure below shows, China accounted for approximately 32.5% of global vehicle production in 2020. This is almost two and a half times more than in 2008. There is therefore no doubt that the importance of this market is growing. Moreover, it is not only the production of the cars themselves that is essential, but also the parts and accessories of the vehicles that are manufactured in China and then exported to countries around the world. Due to the size of the country, there is also a large amount of raw that are also used in this sector. (Statista c, 2021).

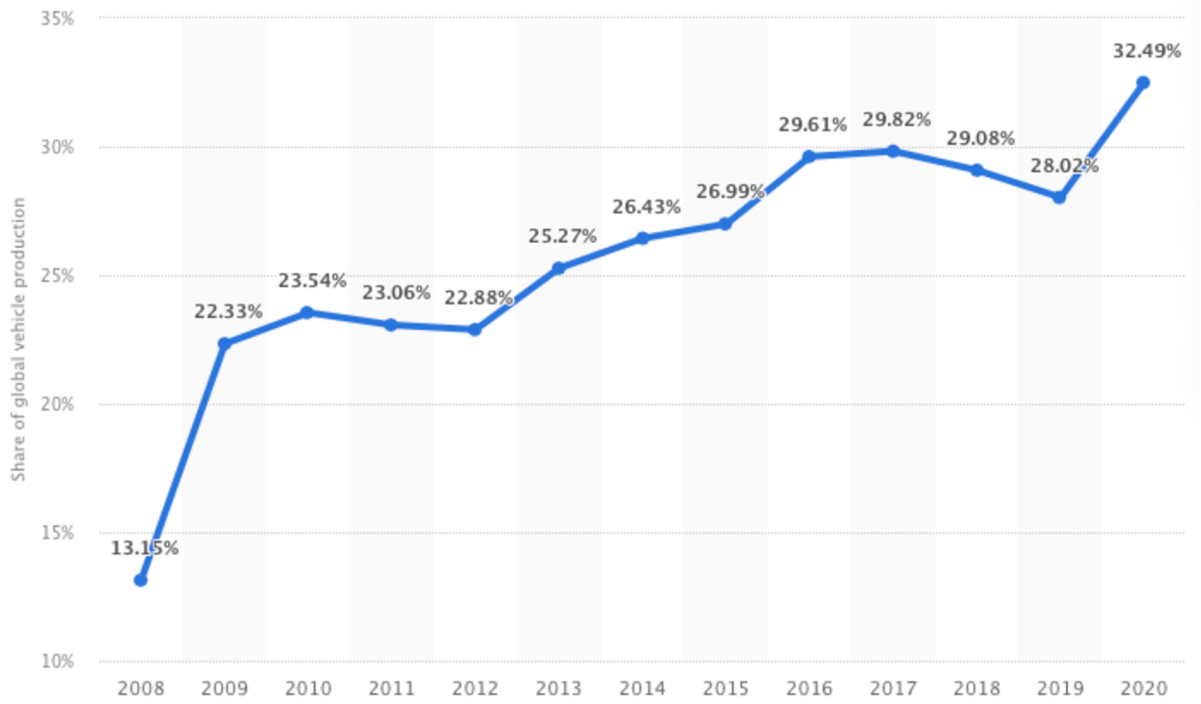

Figure 7 China's share in global vehicle production from 2008 to 2020

Source: Statista, 2021

3.1 Development of automotive industry in China

The history of the Chinese automotive industry started relatively late compared to the Western world, as the figure bellow shows. It was established in the 1950s, early after communist victory in China, with strong support from the Soviet Union. With this USSR assistant, for example, the First Automobile Works (FAW) was founded in 1953, which is now a major automobile manufacturer in China. In the early decades of the People's Republic of China, automobile production focused mainly on heavy trucks, commercial vehicles for industry and military purposes and did not develop significantly until the 1980s. (SHANJUN and Co., 2015; Tang 2012)

In the era 1980s, household incomes together with demand for passenger vehicles began to rise. This led to a rapid increase in imports as domestic manufacturers were not able to meet the demand. High duties of around 250% were imposed to protect domestic producers. In order to increase the competitiveness of domestic firms and strengthen technical capabilities, several state-owned manufacturers joined with foreign firm to form joint

ventures. However, for the same reason as the introduction of high tariffs, foreign ownership was limited to 50%. (SHANJUN and Co., 2015; Tang 2012)

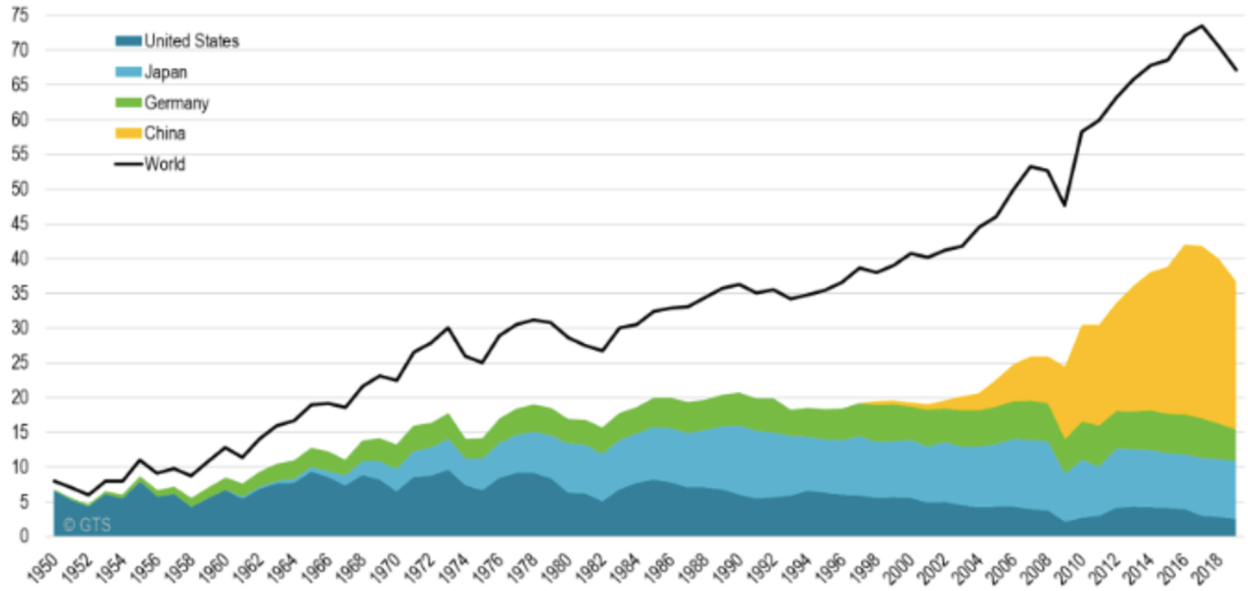

Figure 8 Automobile production in selected countries, 1950-2018

Source: The Geography of Transport Systems, 2022

An important stimulus for the automotive industry in China was the 1994 Automotive Industry Policy which aimed to attract large internationally established manufacturers to operate in China under a joint venture, and which also promoted consolidation in the automotive sector and helped to restructure China's state-owned enterprises and encouraged individual car ownership. This policy increased domestic capacity which, together with the high tariff and import quota, reduced the market share of imported vehicles from 90% in the late 1980s to 28% in 1995 and then to 5.8% in 2001. (OICA, 2022; SHANJUN and Co, 2015)

Another important milestone for the automotive industry was China's entry into the WTO in 2002. This led to market opening, a reduction in tariffs from 100% to 25% (during a five-year transition period) and the removal of local content requirements. However, despite this change, imports continued to decline. From 6% in 2001 it fell to 3% in 2006. This was due to the fact that by 2005 many foreign car manufacturers had entered the Chinese market in the form of joint ventures. On the other hand, after China's entry into the WTO, the automotive industry began to grow faster than ever before. Rapid growth is captured

on the figure bellow. In 2001, more than 2.3 million vehicles were produced in China, and this number more than doubled in 2004. (OICA, 2022; SHANJUN and Co, 2015)

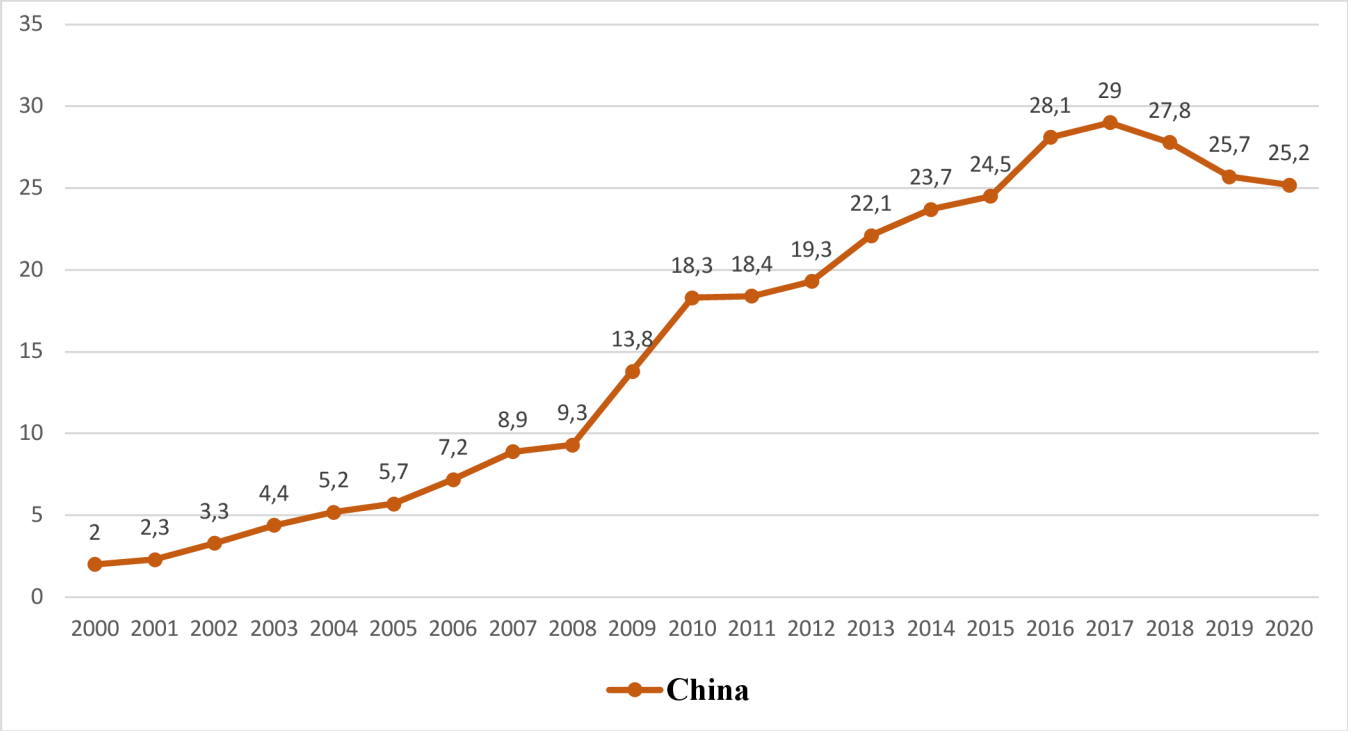

Figure 9 Motor vehicle production in China, 2000 – 2020

Source: own processing based on data from OICA, 2022

China overtook South Korea in 2002 and France in 2003 in number of produced cars. In 2005, with more than 5,7 million units, China approached the production level of Germany which was world`s top three producer at that time. Eventually, in 2006, China overtook even German production. As the figure shows, the production curve continued to rise during the economic crisis of 2007-2009. The reason for this constant expansion was an economic stimulus package by Chinese government. As a result, People's Republic of China produced more than 9,3 million units in 2008, 13,8 million in 2009 and even 18,3 million units in 2010. This enabled China to overtake first North America and then Japan to become the world's largest producer in 2009. And it has stayed that way ever since. (The Wall Street Journal, 2020; OICA, 2022)

The first decline in vehicle production started in January 2018. This decline began with rising trade tensions between the US and China. It was exacerbated by a slowing economy, government policies, up to a 75% reduction in subsidies, and stricter vehicle emission

standards that have been implemented in many areas in 2019. Since January 2018, the availability of new credit has also decreased, which has also affected vehicle demand. China`s automotive industry was also shaken by the energy crisis in china, Covid-19 and the risks associated with it such as chip shortage and so on which will be discussed later on in this diploma thesis. Despite this, China is still currently the leading country in terms of car production, with a whopping 25,22 million units produced in 2020, sold and registered. (The Wall Street Journal, 2020; OICA, 2022)

3.2 Car Market in China

If the Chinese market is divided by brand of origin, it is clear that domestic companies have the largest share. As following figure shows, second biggest share had Germany in 2020. However, compared to the previous year, its market share has shrunk and Japan has caught up. US brand of origin is on fourth place, with much smaller market share. South Korea follows with 3,5% and France has only 0,3% of market share. In China can be found both pure indigenous-brand manufactures and also joint ventures between local manufactures and foreign car makers. (Statista d, 2021)

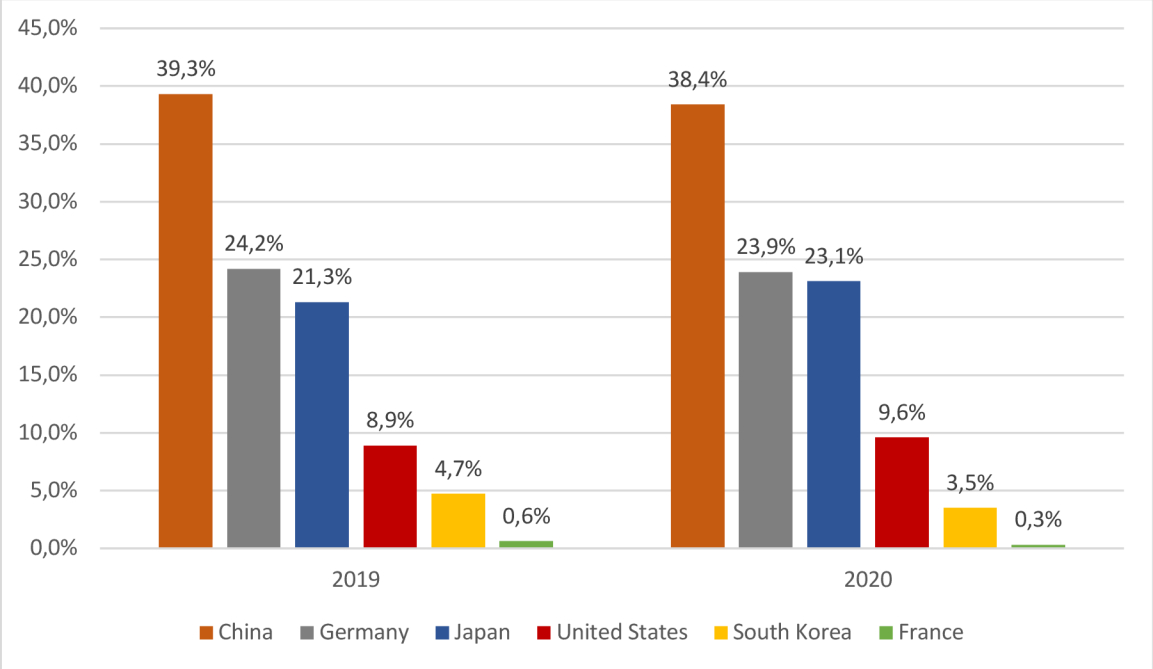

Figure 10 China market share of passenger automobile sales by origin of brand

Source: own processing based on data from Statista, 2021

In 2020, FAW, in partnership with Volkswagen, was the leading company by number of vehicles sold. This group sold more than 2.1 million passenger cars. Shanghai, a domestic manufacturer, came second and third. This is because this company works with two different foreign companies, which are Volkswagen (1.6 million cars sold) and General Motors (1.4 million cars). The purely domestic company Geely International Corporation is in fourth place and Dongfeng, with Nissan as a partner, is fifth. The following figure shows the ranking of the leading Chinese companies in more detail. (Statista e, 2021)

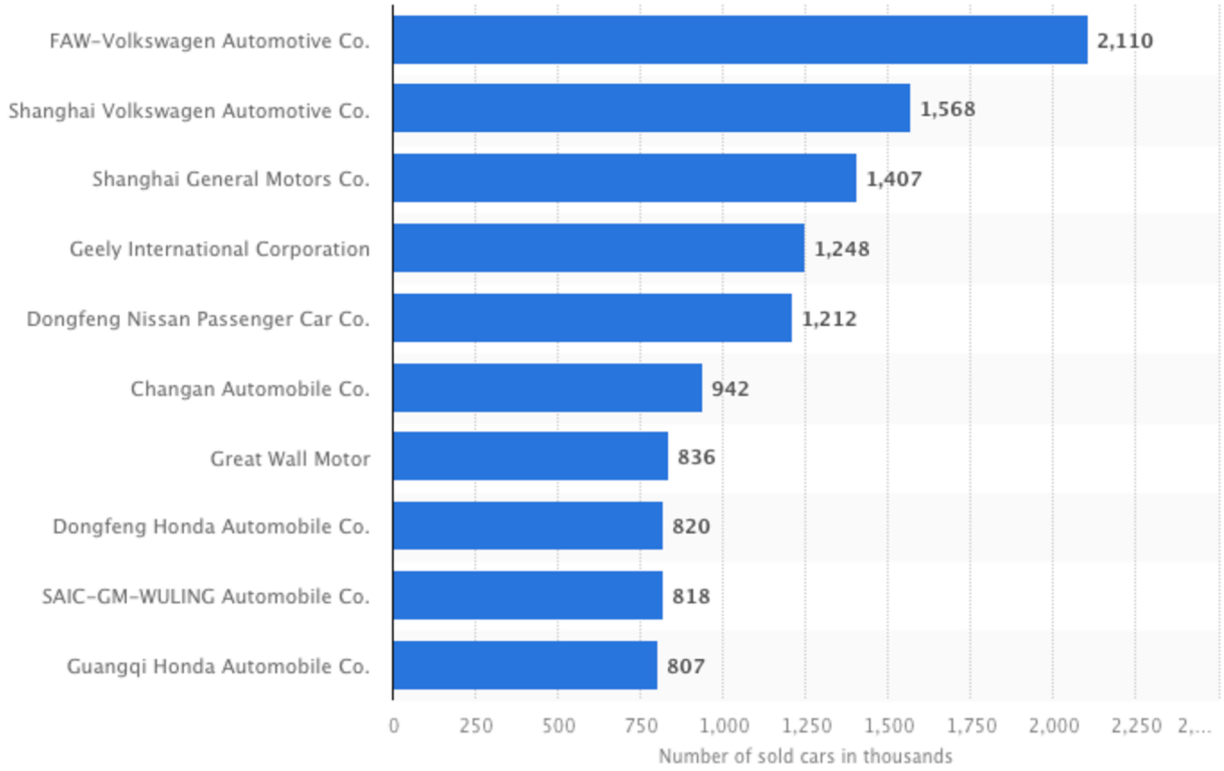

Figure 11 Leading passenger car manufacturers based on number of cars sold in China in 2020
Source: Statista, 2021

The number of cars imported into China has been declining in recent years. The highest number was reached in 2014, when more than 1.4 million cars were imported. But in 2020, it was much lower, at 933,000 cars, the second lowest number since 2010. According to OEC, the main importers in 2021 were Germany, US, Slovakia, Japan and United Kingdom. On the other hand, exports have fewer cars compared to imports. In 2020, imports exceeded imports for the first time, with 995,000 cars and commercial vehicles exported from China. The main export destinations in 2021 were Belgium, the United Kingdom, Slovenia,

the United States and Chile. The following chart shows imports and exports in 1000 units of cars over the period 2010-2020. (Statista f, 2021; G Statista, 2021; OEC, 2022)

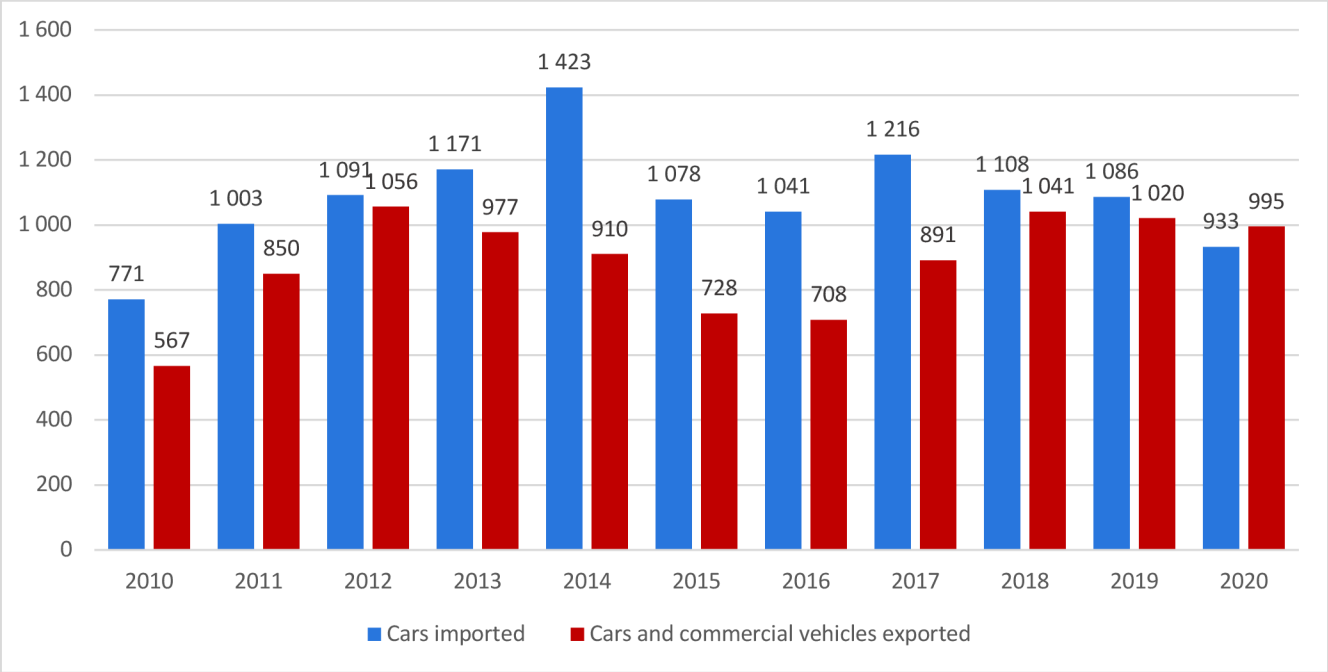

Figure 12 Number of cars imported and cars and commercial vehicles exported to China, 2010 – 2020, in 1000 units

Source: own processing based on data from Statista, 2021

3.3 Auto parts in China

China is very important for the automotive industry not only for the production of vehicles, but also for the production of automotive parts that are exported all over the world. In 2020 China exported motor vehicle parts and accessories worth approximately 32,9 billion USD which made China the 3rd biggest exporters of these commodities in 2020. China is particularly important to the US. As the following chart shows, the US automotive industry is heavily dependent on parts sourced from China, as approximately 26,4% of Chinese exports of this commodity went to this country. From the second perspective, that of importing parts into China, US$25,77 billion worth of goods were imported into China in 2020. The most important country is Germany (US$8.38 billion), followed by Japan (US$6,14 billion) and the US (US$2,17 billion). (UN Comtrade, 2022)

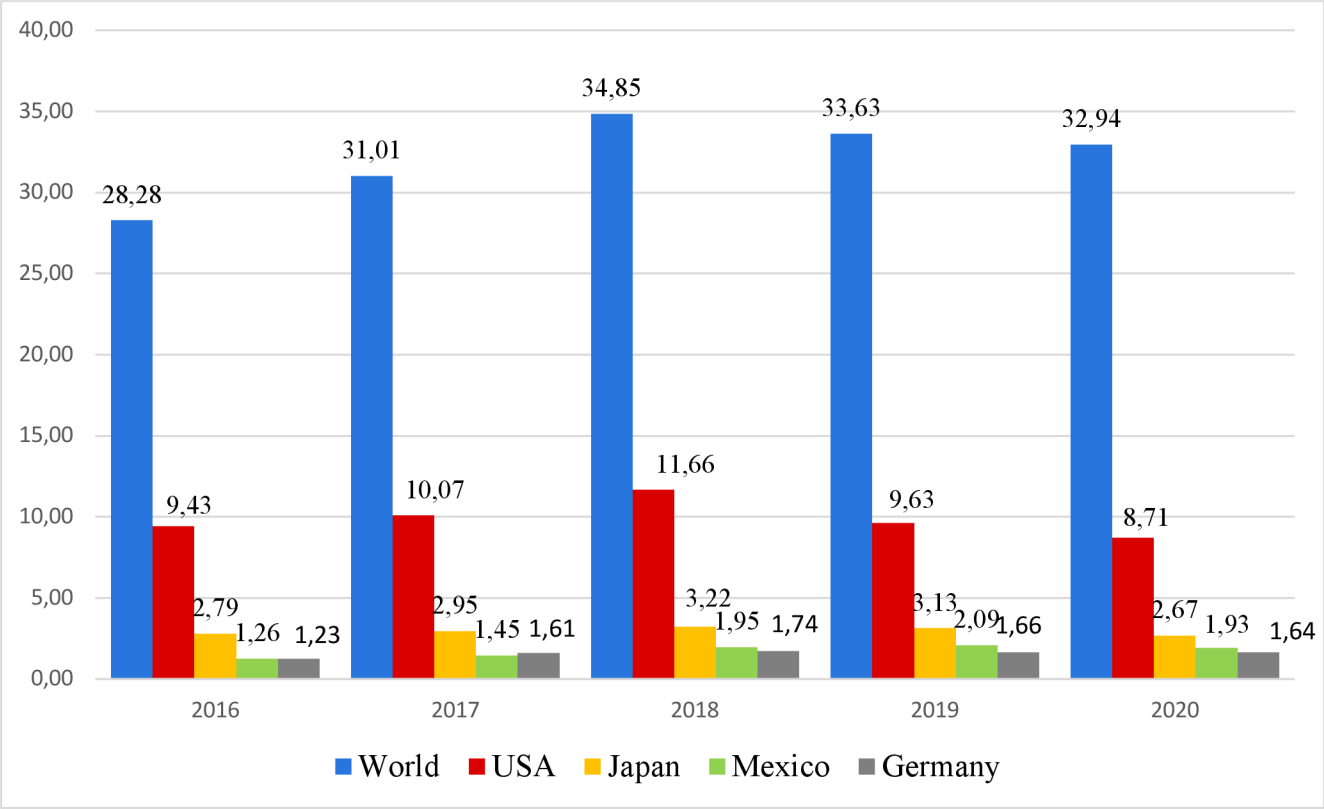

Figure 13 Chinese export by country, 2016-2020

Source: Own processing based on data from UN Comtrade, 2022

4 Risks from macroeconomic environment

Section 2.3 showed that the macroeconomic environment significantly affects the cars produced and sold. In fact, the most significant declines have been caused by economic crises. It is therefore very important for the automotive industry to understand this environment and the associated risks. In the case of China, PESTLE analysis was used to do this. Subsequently, the relationship between the number of cars sold and selected macroeconomic indicators was statistically tested.

4.1 PESTLE analysis of current Chinese car market

This subchapter focuses on the PESTE analysis of the current market in the selected area. It mainly deals with aspects that significantly affect the automotive industry and the companies operating in it. Thus, policy factors such as government financial support, taxes or restrictions will be described. Economic indicators will be used to determine the current economic environment in China in order to get an overall view of the economic factors that affect the automotive industry. Population issues, technological skills will also be discussed in this chapter. Finally, the environmental factors that are currently receiving increasing emphasis will be described. This analysis will help to uncover the challenges facing the automotive industry.

4.1.1 Political factors

At the beginning it is important to mention that Chinese political system is very different from that of the Czech Republic, Germany or even the European Union. For these countries, the democratic system is the most familiar, but China is ruled by a communist regime that recognises different principles and is generally much stricter. In 1949, the Communist Party of China came to power by winning the civil war against the Chiang Kai-shek Nationalists. The Communists named their new regime the People's Republic of China after this victory and have been in power ever since. (Transparency International, 2022; Susan V. Lawrence, 2013)

The Party is intolerant of opponents of the Communist regime and seeks to maintain a permanent monopoly on power. Although corruption in china is improving according to Transparency International it is still quite high. In 2021, the perception index was 45 out of 100 (0 represent highly corrupted countries, 100 the cleanest) which puts China in 66th place. (Transparency International, 2022; Susan V. Lawrence, 2013)

China has always been very protective of its domestic market, and this does not only apply to the automotive industry. For this reason, the entry of foreign car manufacturers into China has been limited. Outside car makers could only enter the Chinese market through a joint venture with a local car manufacturer, with foreign ownership limited to 50 %. This meant that brands from different countries shared profits and technology within the People's Republic, allowing local brands to expand more significantly and rapidly than on their own. (Fraser Tom, 2021)

However, this restriction changed in 2017. In this year Chinese government increased the maximum limit to 70% which attract even BMW. In January this rule changed again. This time China have completely lifted restrictions on foreign ownership of its automotive conglomerates. Thanks to this foreign manufacture can have full ownership of vehicle brand in China. The move will attract more foreign companies, even smaller start-ups such as Lucid and Rivian, to enter the world's largest car market without the obligation to form a joint venture but on the other hand it also can threaten local brand. (Fraser Tom, 2021)

As mentioned earlier in this master thesis, pandemic restrictions have had a major impact on the automotive industry, the supply chain and the overall economy. Over time, people in China have returned to their pre-Covid-19 lives. The Chinese government has set many incentives for the automotive industry to increase its sales again. For example, in 2020, Beijing announced that subsidies and tax breaks for new energy vehicles would be extended for another two years. This is despite the fact that China has begun to dramatically reduce these subsidies and tax breaks in 2019 to eliminate underperforming companies.

Moreover, VAT of secondhanded-vehicle sales will be cut to 0,5% from 2% till the end of 2023. As the electrified-vehicles sales were hit harder than fuel-vehicle many Chinese provinces are also providing cash subsidies of up to $1 400 per new vehicle in an effort to encourage residents to purchase new cars. In addition, electrified vehicles will also continue to be exempt from a 10% sales tax. (iDnes, 2020; Yang Jian, 2020)

Because of the Omicron variant, China has recently introduced new pandemic restrictions. Cities such as Shanghai, Changchun, Shenzhen and many others have been closed, although the number of Covid cases is relatively small. The Chinese government is pursuing a so-called "zero Covid" strategy, which uses widespread closures and aggressive restrictions to suppress any outbreak. This could be very worrisome for automakers. Automotive brands such as Toyota and Volkswagen have already had to suspend operations because of these restrictions. The Chinese government has also announced the largest citywide closures since the outbreak of the Covid epidemic this April. Shanghai will be closed while authorities conduct testing for Covid-19, meaning that companies based in the area must halt their operations and work only remotely. (BBC, 2022)

4.1.2 Economic Factors

The analysis of the economic environment consists mainly in the impact of macroeconomic factors on the automotive industry in the selected region. China began to open its market and reform its economy in 1978. Since then, the Chinese economy has experienced astonishing growth. In the last decades, China has built up many foreign partners, becoming a major export country and an important manufacturer which catapulted the country to become the world`s second largest economy.

Among the most typical indicators of economic strength is the gross domestic product indicator. At the time of the start of China's economic reforms, China's GDP stood at 149,541 billion. Since then, China's GDP has grown by an average of almost 10% a year. In 2020, after 42 years, their GDP was $14,723 trillion. Only the United States had a higher GDP than this region ($20,953 trillion). However, China's economic growth began to decline in the second half of 2021, despite a strong recovery (after pandemic) in the first half of 2021. According to the World Bank, this economic slowdown is expected to continue in 2022. The pandemic and subsequent recovery have played a role in exacerbating domestic

and external imbalances. However, the Chinese government recently set a GDP growth target of 5.5% for 2022, hinting at further stimulus measures to come. (Focus Economics, 2022, The World Bank, 2022)

Next important indicator is inflation in selected country. Inflation can be expressed as an increase in the average consumer price index (CPI). CPI in 2020 was 2,419% this number marks a decrease compared to previous year. China's producer price index (PPI) rose by 8.8% year on year in February 2022, compared with 9.1% y/y growth in the previous month. However, the war conflict between Russia and Ukraine has led to higher global commodity prices, which could feed through into domestic inflation. (The World Bank, 2022; CEIC Data, 2022)

According to the World Bank, unemployment in China started to rise again in 2019 after four years of successful decline. The main reason for this was the COVID-19 pandemic. It climbed to its all-time high of 5% in 2020. In February 2022 the unemployment raised to 5,5%. The Chinese government shared its five-year plan, announcing that its goal is to keep the unemployment rate below 5.5%. (iDnes, 2021; Statista, 2022; The World Bank Data)

Another important data point to get an overall picture of Chinese economy is the amount of their debt. China's debt has increased dramatically over the past decade, but the exact numbers vary depending on the source used. As a result of looser fiscal policy aimed at helping to revive the coronavirus-hit economy, China's national debt level increased significantly in 2020. To measure country ability to make future payments on its debt it is used government debt as a percent of GDP. According Trading Economics, national debt in relation on gross domestic product in China in 2020 was 66,8% which is by almost 10 % more than in 2019. Local government debt was 25,7 yean in the end of 2020 which is around 3,97 trillion. However, experts believe not only that the number is much higher but also that there is a massive hidden debt. This hidden debt comes from local governments standing as guarantors for other entities that borrowed money. (Graceffo Antonio, 2021; Trading Economics, 2022)

An important factor for any exporting country is the exchange rate. China is a major world exporter. Their important export partners are the US, Japan, Germany, the Netherlands, the UK, etc., which should mean that there is an exchange rate risk for exporters and foreign investors. However, China's current policy is very different. The basis of China's economic policy is to manage the exchange rate of the yuan in favour of exports. For several years, the Chinese yuan has been largely pegged to the US dollar. This means that the Chinese central bank announces a central parity rate between the yuan and other currencies and buys and sells as much currency as is needed to achieve a target exchange rate within a certain band. (UN Comtrade Database, 2022; Wayne M. Morrison, 2019)

Due to pressure from foreign partners, the yuan was permitted to appreciate by 2.1% against a basket of major currencies (not just the US dollar) in 2005. As the world was hit by the financial crisis and demand for Chinese products declined rapidly, China stopped the appreciation of the yuan. In 2010, China resumed its policy of appreciating the yuan. Although the central bank announced in 2015 that the parity rate would become more market-oriented, the yuan depreciated by 4.4% in the following days and continued to fall for the rest of 2015 and 2016. As of 2018, the RMB's value against the U.S. has generally trended downward. However, this could also be due to the slowing Chinese economy and tensions between the US and China (especially after Donald Trump's election victory).

After some countries increased tariffs, China intervened in the currency markets to offset the impact of these tariffs. At present, it is very difficult to ascertain the true value of the Chinese currency, but many studies and experts believe that it is significantly undervalued. (UN Comtrade Database, 2022; Wayne M. Morrison, 2019)

4.1.3 Social factors

China, which had a population of 1,411 billion in 2020, is the world's most populous country. However due to the due to the one-child policy, which was changed to a two-child rule in 2016, China is facing a demographic crisis. China's fertility rate is very low at 1,3, which is below the 2,1 level where the population is accurately replaced from generation to generation. In 2020, the government in China allowed each couple to have up to three children. This was in response to the lowest number of births in that year since 1949.

Despite this fact, many partners do not want a third child. (World Bank, 2022; The New York Times, 2022; John Xie, 2022)

This is because of the high cost of raising a child, the rising cost of housing, the ridiculous prices of goods, etc. A family also has to spend a lot of money on their child's education, as this is still seen as the main route to a better life. All of the above is linked to another problem: while few newborns are being added to the population, many workers are nearing retirement. For decades, China has had the advantage of a huge and rapidly urbanizing population, which meant cheap labour. But as many residents retire, the workforce is shrinking. In addition, the government will have to spend more money on pensions as healthcare increases life expectancy. (World Bank, 2022; The New York Times, 2022; John Xie, 2022)

4.1.4 Technological factors

Through joint ventures with foreign automobile brands, China was able to acquire technological know-how and thus accelerate the development of this field. Nowadays, Chinese manufacturers no longer rely on Western innovation, but invest heavily in research and development themselves. Government spending on research and development is the biggest contributor to technological maturity. (WIPO, 2022; Xinhua, 2022)

In 2021, China spent a new high of 2,44% of its GDP on R&D, 0.03% more than in the previous year. Total spending was about 2.79 trillion yuan, which is about $441,13 billion. China is also one of the 20 most innovative economies in the world. Based on the Global Innovation Index (GII), which measures the performance of innovation ecosystems in economies around the world, China ranked 12th (out of 180 economies) with a score of 55,8. China has thus shown steady progress, rising from 14th place in 2020 to 12th place, and has also demonstrated the resilience of investment in innovation during COVID-19. (WIPO, 2022; Xinhua, 2022)

For environmental reasons, which will be discussed later in this thesis, China is focusing on new energy vehicles (NEVs), not fossil fuel vehicles anymore. This transition to greener vehicles requires huge investments in changes in production, skilled workers and reorganisation of production technologies. In this area, China faces enormous

competitiveness from the US, thanks to Tesla, which is considered the biggest pioneer in this field. In the European Union there is also a strong focus on this type of propulsion due to the so-called "Green Deal", which represents further competition. However, China's big advantage is the huge support and subsidies from the government. In addition, China's strategy is to become a world leader in science and innovation by 2050, with the largest number of high-tech industries such as robotics, aerospace, healthcare, appliances and many others. (Briefing, 2021; European Commission, 2022)

As the number of EVs in China grows, so does the number of charging points. Currently, China has the largest network of charging stations for alternative fuel vehicles, which mainly include electric vehicles. According to the China Vehicle Charging Infrastructure Promotion Alliance, there were 2 223 million charging points available in September 2021. The number of charging stations for electric vehicles has therefore doubled from the previous year and is still expanding. (Scooter Doll, 2021; Mark Kane, 2021)

4.1.5 Legal factors

An important aspect from a legal point of view is the minimum wage. In China, it is set by the provincial governments, which of course has to consider a large number of factors when setting the wage, such as the minimum cost of living for local employees, the consumer price index, economic development, etc. However, China also includes in this amount contributions to funds, insurance and social insurance, etc. This means that the actual wage is much lower. As mentioned minimum wages vary from region to region. In January 2022, the highest minimum hourly wage was 25.3 yuan (3.64). On the other hand, the lowest was 13 yuan (€1.87) Which is much less compared to Europe. In Germany, for example, the hourly wage will increase to €12 in October 2022. (Statista 2022; Euro news, 2022; Qian Zhou and Zoey Zhang 2022)

China is considered a low-cost country because of this cheap labour. This is another advantage for China, as lower costs attract foreign companies. They are able to save their production costs. However, as the economy, prices and cost of living rise, China is moving and the wage of workers. So over time, the wage gap could start to narrow, and China could lose its advantage in this area. (Statista 2022)

4.1.6 Environmental factors

As already mentioned, the automotive industry is becoming an increasingly important sector for China and also a major contributor to GDP. However, with China's growing population, emissions have become a major concern. As China's 2017 Annual Environmental Management Report showed, emissions from motor vehicles are a major source of air pollution. Moreover, in some cities, they have even surpassed other contamination sources. Due to the high consumption of fossil fuels, most Chinese cities are heavily polluted. In addition, it is also a major source of greenhouse gas emissions. (Wang Jin et al, 2019)

To better understand the environmental performance of the country, the Environmental Performance Index (EPI) will be mentioned. The EPI scores and ranks countries based on current data and calculates changes over the years. According to this source, China achieved an EPI score of 37,7 (out of 100), ranking it 120th out of 180 countries. Unfortunately, this ranking is very low, which indicates serious environmental problems. To combat these problems, the Chinese government has started to introduce emission reduction policies affecting the automotive industry. (Environmental Performance Index, 2022)

President Xi Jinping has announced that China wants to reach peak CO2 emissions before 2030 and achieve zero net emissions by 2060. This mean cutting as much of carbon dioxide emissions as possible. To help achieve carbon neutrality and reduce pollution in China's cities, China has decided to move in the direction of electric vehicles. And so, the Chinese government has started to support this market by subsidies. Moreover, they also published a plan that will require all new cars sold in 2035 to be hybrid or new energy vehicles (NEVs). It also aims to reduce pollutant emissions by 40% to 50% by 2023. These standards are stricter than the Euro VI standard in force in Europe. (Yep Eric, 2020)

Government support has made the Chinese EV market the largest in the world. And so, the Chinese government has begun to support this market with subsidies. In addition, they have also published a plan that will require all new cars sold in 2035 to be hybrid or new energy vehicles (NEVs) and also aims to reduce pollutant emissions by 40% to 50% by 2023. These standards are stricter than the Euro VI standard in force in Europe. (Yep Eric, 2020)

Thanks to government support, China's EV market is growing, but on the other hand, fossil-fuel vehicles face severe restrictions. For example, The Auto Industry Investment Rules prohibit to establish any new separate fossil-fuelled carmaker, to build fossil-fuelled car production, relocate outside the province where existing fossil-fuelled car market is located. Not only that the capacity for fossil-fuelled cars has been strictly controlled but China plans to require that all cars sold and manufactured after 2035 have to be either electric, fuel cell vehicles, plug-in hybrid or hybrid. Also Chinese government require from car manufacturer to use renewable energy and plant trees. (Dow Jameson, 2020; Mark Schaub and Atticus Zhao, 2020)

4.2 Risks arising from PESTLE analysis

All aspects are under the strong control and influence of the Chinese government, which of course can affect any sector, including the automotive industry. In addition, there is still a high level of corruption in the country, which can lead to further potential risks. The most current risks relate to the continuing restrictions on Covid-19. Although the number of infections is low, the Chinese government is still quite cautious.

Many manufacturers are being forced to shut down operations for short or longer periods, which could significantly disrupt production, cause losses for companies and interrupt chain supply. This risk can be avoided by expanding your production to other locations. Indeed, if a producer were to depend on a single location where restrictions were imposed, the impact would be much greater than for a producer with branches in multiple regions or even countries. Moreover, covid-related restrictions also increasing production costs.

The removal of foreign ownership restrictions opened up the local market to new competitors from abroad. This can attract also experience brand in automotive industry with powerful and deep R&D capability, access to leading technologies and global footprints. Moreover, this policy can also threaten already built joint ventures in China. Foreign car brand can separate their operations from local partners. Companies from abroad could for example can decide to buy-out the Chinese partner and therefore the joint venture would be converted into a wholly foreign owned enterprise. Another possibility for foreign automaker to exit joint venture and set up its own manufacturing company without a Chinese partner.

So, the removal of foreign ownership will rapidly increase competition on Chinese market as the local market will attract foreign car brands.

A significant risk arising from the social sphere is aging population. The declining number of people of working age will make the workforce more expensive. This may deprive China of a major advantage that attracts many companies, namely readily available and cheap labour. AI-based automation could help with this problem, enabling the productivity gains needed to achieve GDP targets. However, the initial investment is significantly higher. Another problem is rising unemployment in China. The high unemployment rate in the country means lower purchasing power and also lower demand for cars.

The current economic situation of Chinese households is also an undeniable problem. Due to rising housing prices, people have less money left and buying a new car is being put on the back burner. Manufacturers who make vehicles that are affordable for the middle class are the most affected. This is because the middle class has been disappearing in recent years due to the growing disparity between social classes. (iDnes, 2020)

The electrification of the automotive industry in China brings many environmental benefits, but the impact on car manufacturers is less optimistic. Companies have to invest huge resources in electric vehicles, internal changes are necessary as investment in electrified vehicles forces companies to change the proportion of their budgets spent on research and development activities. In addition, many new partnerships need to be created in the supply chain as the technology is different from standard fossil fuel cars. Manufacturers of exhaust systems, fuel systems and transmissions will have to adapt to this new technology as it is not used in electric vehicles. On the other hand, suppliers developing components for electric motors will see demand rise. So, these new technologies, changing consumer preferences and increasing regulation will rapidly reshape the automotive industry in the following years.

Strong government support for electric vehicles could also deepen unemployment in China. The process of manufacturing a standard engine is the most labour-intensive part of making a car. An internal combustion engine has more moving parts, plus a gearbox that requires more workers to adjust. However, the production of an electric car requires approximately 30% less labour. So as more electric cars are produced, more jobs will be lost. This would,

of course, have an impact on unemployment in China, because the automotive industry is a major employer. (Isidore Chris, 2019)

4.3 Impact of macroeconomic indicators

As is evident from the development of the automotive industry, this sector has already faced many challenges that have caused a reduction in production and sales. Most of these events had an economic nature (in the form of an economic crisis). This suggests that there is a relationship between macroeconomic indicators and the number of cars sold and produced. To verify this fact, the author decided to use statistical data to test the relationship between GDP, unemployment rate, inflation and the number of cars sold in China. All the data are shown in the following figure. Due to the lack of data availability, the period between 2005 and 2020 was chosen.

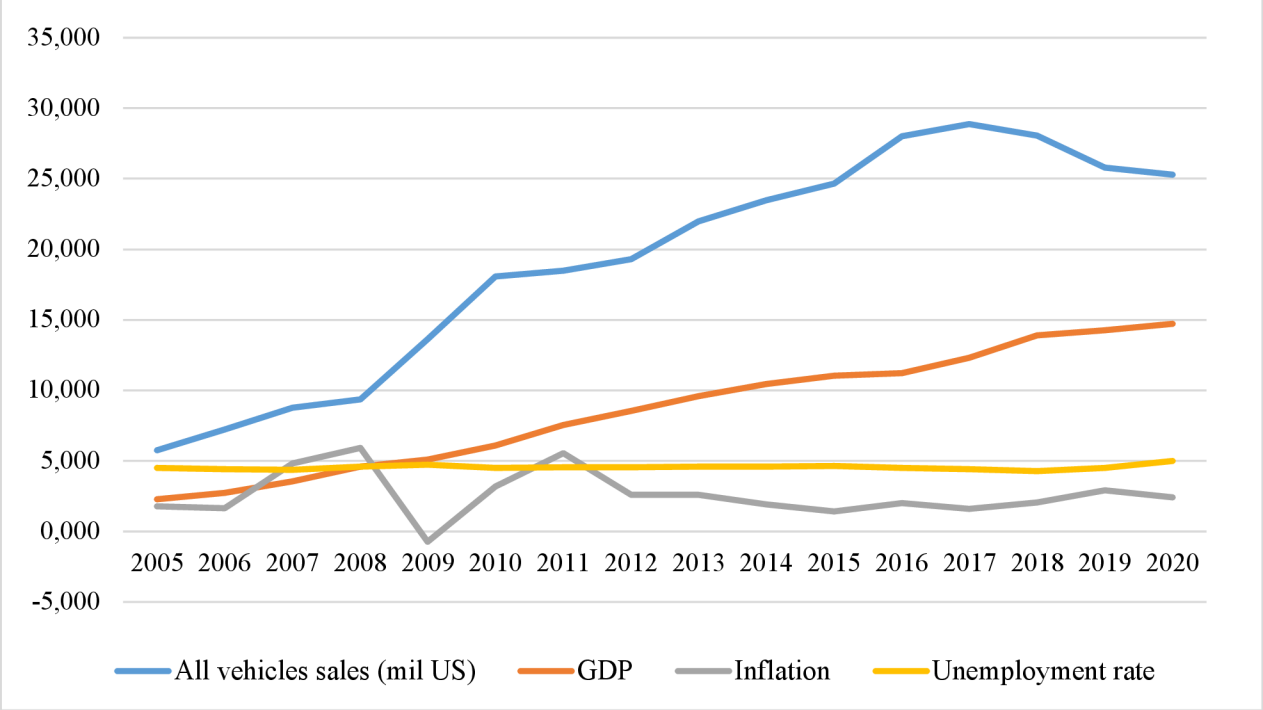

Figure 14 Selected macroeconomic indicators and number of cars sold in China, 2005-2020

Source: own processing based on Knoema data, 2022

However, the Chinese economy operates on a different principle than it is used to. Everything is planned for a certain period in advance. In China, the government regularly issues plans with specific steps and concrete goals that needs to be achieved. According

to some experts, the economy does not always work on a market mechanism, and in some cases, it is described as artificial. This, of course, can affect the final results.

4.3.1 Data analysis

The aim of this chapter is to test the relationship between macroeconomic variables and the number of vehicles sold in China. To test the relationship descriptive statistics and quantitative analysis will be used. Total car sold represent dependent variable and GDP, inflation rate and unemployment rate are the independent variables. As already mentioned, due to the difficult availability of data from China the period between 2005 and 2020 was chosen. All variables are presented in numerical form because the variables are measurable. The analysis and all data manipulation were done in Statgraphics. The research question of this chapter is if there is a strong relationship between number of car sales with GDP and inflation rate in China.

Correlation analysis

The first step of data analysis was to define the relationship of the selected variables. In other words, to find out to what extent the two variables are related. For this purpose, the correlation was conducted. According to the Pearson's correlation coefficient there are three possible results of correlation: positive correlation, negative correlation and no correlation. A positive correlation means that two variables are moving in the same direction. This means that when one variable is increasing, the other is also increasing. Whereas in a negative correlation, one variable decreases while the other increases. Zero correlation exists when there is no relationship between variables. Correlation coefficient is calculated as a number between -1, which mean the strongest negative correlation, and 1 strongest positive correlation. If there is no correlation the value is 0,00. (McLeod Saul, 2020; The Data School, 2021)

From this perspective, it can be seen in the table 1 that there is a strong positive relationship between GDP and number of sold vehicles. On the other hand, number of cars sold has negative relationship with inflation. Colour coding was also used to show the magnitude of the relationship. The more saturated the colour, the greater the positive (blue colour) or negative (red) relationship. If the P-value of two variables is less than 0.05, it means a statistically significant non-zero correlation at the 95% confidence level. P-value between

GDP and vehicle sold is 0,000 which indicates a linear relationship at the 5% significance level. However, P-value is higher than 0,05 in the remaining cases.

Table 1 Correlation between variables

	Vehicles sold	*GDP*	*Inflation*	*Unemployment rate*
Vehicles sold	1			
GDP	0,948745715	1		
Inflation	-0,229971986	-0,17501	1	
Unemployment rate	0,121670756	0,221218	-0,17715403	1

Sources: own processing

Multicollinearity

Multicollinearity occurs when two or more independent variables in the regression model are highly correlated to each other. In this case it would mean that there is strong correlation between GDP, inflation or unemployment rate. This problem can make interpretation of model more difficult. (Songhao Wu, 2020) According to Dancey & Reidy the Pearson`s coefficient can be interpreted according to following table:

Table 2Pearson's correlation coefficient

Correlation Coefficient	**Interpretation**
1	Perfect
0,7 – 0,9	Strong
0,4 – 0,6	Moderate
0,1 – 0,3	Weak
0	None

Source: own processing based on Dancey & Reidy, 2007

As it can be seen in the table 1, strong correlation is only between GDP and vehicle sold. Between independent variables only weak correlation can be seen. Due to this fact, no multicollinearity occurs between the independent variables.

Autocorrelation

Autocorrelation usually occurs in a set of data in which patterns are repeated. The values of similar variables, such as income or economic data, are often correlated with each other. Autocorrelation can have a positive value, especially if the trend in the pattern is upward. Declining trends often have a negative value. Such patterns are often analysed in economics. An example would be predicting the price movement of a stock based on historical data. If there is a positive autocorrelation, it means that if the share price rose yesterday, it will most likely rise today. And vice versa. (CFI, 2022; Tim Smith & Patrice Williams, 2021)

To test an autocorrelation in the regression model`s output the Durbin Watson test was conducted. The Durbin Watson test provides a test statistic with a value from 0 to 4. If the value is 2, it means that there is no autocorrelation, 0-2 is a positive correlation and 2-4 is a negative correlation. The hypotheses are following. H_0: there is no autocorrelation, H_1: the autocorrelation exists. The analysis showed that the Durbin-Watson statistic was less than 1, which means that there is autocorrelation in the conducted model. (Statgraphics, 2022; Hiroshi Iyetomi et al., 2020)

Multiple regression

Multiple regression, or also called multiple linear regression, will help explain the relationship between multiple independent variables against one dependent variable. So, regression allows to estimate how each (independent and dependent) variables change. It can predict different outcomes under a scenario where the values of the coefficients associated with multiple variables may change. The multiple regression model is based on following assumptions: there is a linear relationship between the dependent and independent variables. This was testified in the correlation analysis. The results from correlation analysis also showed that the independent variables are not highly correlated, which is second assumption of multiple regression. (Hayes Adam, 2022; Rebecca Evans, 2020) The formula for the multiple regression is following:

$$y = \beta_0 + \beta_1 X_1 + ... + \beta_n X_n$$

Figure 15 Multiple regression formula

Source: Scribbr, 2020

"y" in the formula represents the predicted or expected value of the dependent variable. Then X_1, X_n are the independent variables. β_0 represents the values of "y" when all independent variables are equal to zero. β_1, β_n are the estimated regression coefficients and that represent the change in "y" relative to a one unit change in the respective independent variable. (Rebecca Evans, 2020)

To test stated hypothesis in this thesis, the dependent variable is represented by number of vehicles sold in China. GDP, inflation and unemployment rate represents independent variables. To run the multiple regression the Backward stepwise selection was used. The principle of this method is that system will start by fitting all the independent variables in the model. Then it will check P-value of each variable. If the P-value is bellow 0,05 (thus the variable is not statistically significant at the 95% confidence level), the system will remove the variable. After this step inflation and unemployment rate were removed from the regression model. The only variable that remained in the model is GDP with P-value under 0,05. R-squared indicates that the model as fitted explains 90% of the variability in vehicles sold. In other words, the R-squared represents the proportion of variability explained by the model which high in this case. (Statgraphics, 2022)

To test a significance of entire regression is it important to do **F-test**. It compares a model with no independent variables to the specified model. The hypothesis for F-test captures figure 17. P-value is less than 0,05 so in this case the H0 is rejected and H1 is accepted. This means that chosen model provides a good fit. (Statgraphics, 2022)

$$H_0: \beta_{l+1} = \beta_{l+2} = \cdots = \beta_{l+k} = 0,$$
$$H_a: \text{at least one among } \beta_{l+1}, \ldots, \beta_{l+k} \text{ is not 0.}$$

Figure 16 Hypotheses
Source: Minitab, 2015

Whenever performing a linear regression, it is important to determine if there is a statistically significant relationship between the independent variable and the dependent variable. For this purpose, **t-test** was conducted. Hypothesis are following: H0: $\beta 1 = 0$; HA: $\beta 1 \neq 0$. As the p-value that corresponds to t was less than 0,05, null hypothesis was

rejected because there is a statistically significant relationship between GDP and vehicle sold. (Statgraphics, 2022)

4.3.2 Results of data analysis

Regression analysis confirmed a positive relationship between GDP and car sales only. This means that if GDP grows in China, the number of cars sold in the country will rise with it and vice versa. The correlation between car sales and unemployment or inflation has not been proven. Neither has the relationship between GDP, inflation and unemployment rates been demonstrated, which may be surprising from an economic point of view.

The observed statistical results may contradict the principle of the market mechanism. However, this shows that the economy in China is very specific. It is common for unemployment to fall with GDP growth. In the case of China, Figure 15 shows that unemployment has remained at a very similar level over the years. However, this is due to the strong influence of the Chinese government. It is very usual for state-owned enterprises to increase the number of jobs when unemployment is high. For example, there has been a problem with high absolvent unemployment in recent years. Thus, the state-owned oil company Sinopec, at the instigation of the government, has increased the number of new jobs twice, by 3 500 graduate jobs. (Argument, 2020)

The inflation rate may also have been affected significantly by the economic stimulus packages issued by the government. This shows that, despite official claims, state-owned enterprises do not only operate on market principles. Of course, time lags could also have played a role, causing the effect of one variable to become evident only with a longer time delay.

5 Risks from the microeconomic environment

The PESTE analysis conducted helped to highlight some of the risks that could potentially threaten companies in the automotive industry. However, the main focus was on political, economic, social, technological and environmental factors which affects chosen sector. That said, the analysis conducted provided insights only from a macroeconomic perspective and mainly for car manufacturers. Unfortunately, it is not possible to see from this analysis what risks the microeconomic environment poses to car and auto parts manufacturers.

Internal data from XY, a company that manufactures truck braking systems, was used to obtain this information. This company has relationships with both European and Chinese suppliers who supply it with automotive parts and components. Each component is put out to tender, taking into account various aspects that influence the choice of supplier. This chapter attempts to answer the question of what risks European suppliers bring to Chinese suppliers when selecting a suitable supplier in XY. As XY does not wish to be named, the tender will be described only briefly and then will address factors that may play against Chinese suppliers when selecting a supplier for certain parts or components.

5.1 Introduction of a company XY

XY has been in the automotive industry for more than 100 years. It is headquartered in Munich but can be found all over the world, with more than 100 locations in over 30 countries. It specializes in braking systems, steering systems and driver assistance solutions for rail and commercial vehicles. Its main focus is innovation and, as a result, it is constantly creating new opportunities for the company. Their products contribute to increased safety and energy efficiency. XY`s core values are opportunities arising from megatrends and success through global expertise. (Internal information)

As already indicated, the company is divided into two main divisions: rail and commercial vehicles. The rail division equips transit vehicles such as metro cars and light rail vehicles, freight trains, locomotives, mainline passenger trains and high-speed trains. Beside braking systems, XY is a major supplier of intelligent entrance systems, auxiliary power supply systems, control components, control technology and much more. The Commercial Vehicle Division offers braking systems for trucks, buses, trailers and even agricultural machinery.

In addition, they excel in powertrain-related systems and torsional vibration dampers for diesel engines. (Internal information)

5.2 Selection procedure in company XY

The first step in the tender process at XY is to create an inquiry for the required component. An internal system is used for this purpose. An authorised employee has to enter all relevant information into this system. This should include details of the item requested such as part number, part description, quantity required, incoterms, project name, delivery location, the date by which samples are required and when production will start. The drawing is an important part of the inquiry as it carries very important information for the supplier. On this document, the supplier can see the required material, surface treatment, name of standard with technical parameters, dimensions, special characteristic or other technical notes from the engineer. Once all the information is collected, it is sent to the selected suppliers via this internal system. This will start the next phase, which is the collection of offers from suppliers.

The collection of offers usually takes several weeks. Of course, it depends on the priority and timing of the project. To compare bids objectively, at least 3 bids must be collected. This is an internal rule that must be followed, otherwise the process cannot move forward. Internal employee has to evaluate which suppliers are most competitive based on the piece price. However, the selection of a potential supplier cannot be made solely on the basis of its competitiveness.

The responsible person must also keep track of the cost of goods unloaded for each supplier. The landed cost is the sum of the costs associated with the creation of the product, transportation and receipt of the product by the customer. It includes, for example, the price of raw materials, the production process costs, profit, logistics costs, other charges such as import duties, transport insurance, etc. In XY, suppliers most often price according to the terms of the incoterms EXW, which do not include any transport costs. Therefore, in order to get a full overview of the landed costs, the internal employee has to request a logistics calculation from the logistics department at XY. The main reason for this is better price comparability between suppliers. (Lipienski Kristina, 2020)

To determine if all technical expectations are met, a feasibility agreement must be requested from the suppliers. A Feasibility Agreement (FeA) is an internal legally binding contract. In this document, the supplier shall provide all technical information concerning the part required to determine if all specifications on the drawing have been met. This document makes it clear whether the supplier has taken into account all dimensions, whether he has priced the correct material, whether he has specified the correct surface treatment, etc. This must be assessed by the responsible engineer, the quality department and purchasing department at XY.

If all of these conditions are met, the purchasing department must ultimately select the supplier to whom a particular contract will be awarded. However, this is not the end of the process. The selection of the supplier must be approved by senior management (from the logistics, quality, purchasing, supplier development and cost analysis teams). The responsible purchasing officer must therefore organise a presentation in which the selected supplier is compared with other suppliers who have also priced the part in order to demonstrate the competitiveness of the selected supplier. In addition, it is important to summarise the reliability of the selected supplier, the technical proficiency, all the costs associated with the part (landed costs), present the project for which the parts are required, etc.

After a successful presentation it is possible to order Production Part Approval Process (PPAP) and first samples of the part. The purpose of PPAP is to demonstrate that the supplier correctly understands all the requirements of the customer design documentation and customer specifications and that the manufacturing process is capable of producing a product that consistently meets these requirements. (Nguyen Jimmy, 2021)

5.3 Comparison of European supplier and Chinese supplier during decision process

After describing the process and aspects that influence the supplier selection decision, this chapter will focus on the comparison of the competitiveness of the Chinese supplier with the European supplier. It will also look at what factors put the supplier from each of the selected locations at a disadvantage, what the advantages of the location are and why, if any, the European supplier was preferred to the Chinese one. For this purpose, 3 specific parts were selected that were inquired by company XY. First chosen example is standard (or catalogue) part, plastic cover unit is second and last described part will be spring.

In most cases, Chinese suppliers have lower prices per part than most European suppliers. At first glance, therefore, suppliers from this location appear to be highly competitive. However, other factors also play a role in the supplier selection process, which will be described in the following subsections.

5.3.1 Standard part

This part is not technically demanding. For example, it can be a bolt, nut, fitting, screw, circlip, etc. Such a part usually has a drawing without very detailed specifications or even no drawing at all. These standard parts (or also catalogue parts) has to be produced according to specific norms such as DIN standard, ISO standard. DIN, which stands for Deutsches Institut für Normung (German Institute of Standardization), is a standard that sets unified standards for products and processes such as quality, minimum performance, dimensions, etc. The ISO standard is issued by the International Organization for Standardization, which is a non-governmental organization. These standards develop standards to ensure the quality, safety and efficiency of products, services and systems (DIN, 2022; ISO, 2022).

These standards include any technical specifications such as dimensions, required material, material declaration of substances, requested surface treatment, required material resistance, dimensions. These norms often refer in the text to other standards for more detailed information on the selected topic. XY cannot provide DIN, ISO or VDA standards to the supplier for legal reasons as this would infringe the copyright in these standards.

For European suppliers such a part is in most cases no problem. They are familiar with the standards and have them at their disposal. If the drawing refers to the standards, they have always been followed so far and R&D approved from a technical point of view. However, this is unfortunately a problem with Chinese suppliers. Many suppliers from this location are not familiar with these norms so the given specifications are not followed.

In this particular case, this standard part was requested from European and Chinese suppliers. After receiving the offers, the comparison showed that the Chinese supplier offered a rapidly lower price in comparison with European suppliers. However, on closer examination it was found that no standard was met. Unfortunately, the Chinese supplier was not familiar with these standards and therefore did not bring this to the attention of the purchasing department. Upon review by the engineer, it was found that the part offered was not technically acceptable as no specification from the standard was met. For this reason, a supplier from Europe was selected for this business.

5.3.2 Plastic Cover Unit

Another example is the plastic cover unit, which is more difficult and technically demanding than the previous part. Part of this components are also pins made of made of pewter bronze (CuSNn6) so it is not purely plastic. Unlike the catalogue part, this plastic part has a very detailed and specific drawing. This allows the supplier to find out all the dimensions, surface treatment specification, etc. In addition, all suppliers also received a 3D model of the required part, which allows them to price it as accurately as possible. The technical specifications of the required material, such as temperature resistance, properties, etc., are specified in XY's internal standard. This kind of XY norm is allowed to be shared with suppliers. On the drawing there is also stated that the exact material must be followed, so no alternatives are allowed. This is because any change in material would mean a fatal technical failure.

In this case inquiry for this part was sent to two suppliers in China, remaining six suppliers are from Europe (mostly from Germany). Chinese suppliers have the most attractive price. European suppliers have expensive prices per part by 30%. However, the price difference is much higher for the tools and moulds in which the parts will be produced. With a Chinese supplier, XY would pay 80% less, a huge difference and a big saving over European

suppliers. For these reasons, Chinese offers have attracted the most attention. However, before any decision could be made, a feasibility agreement was requested from the contractor, which upon receipt was forwarded to the engineer for the evaluation.

Unfortunately, the Chinese suppliers used a different material (QSn6.5-01) for the pins, which has different technical specifications. The required material is not so widespread and popular on the Chinese market, on the contrary, the local material is much more available in China. The alternative material was not acceptable in this case, so a European supplier was nominated for this business, despite the higher price.

5.3.3 Spring

The spring is the last example that was selected as the last part requested by XY. Compared to the previous case, this is not a very technically demanding component. The drawing shows the material that should be used for the production, however an alternative is possible. But only if the new material meets all the technical requirements. This inquiry has been sent to both Chinese and European suppliers. After offers were collected, it was clear that the price from the Chinese supplier was the most competitive. So, to move forward, an FeA has been requested and sent for evaluation.

Chinese suppliers offered an alternative material from the Chinese market. According to the feedback from the engineer in charge, this alternative material can be approved as it has very similar properties to the original material in the drawing. However, before making a final decision, it is necessary to request a logistics calculation from the internal logistics team to see the additional costs, as the price quoted is purely a price per manufactured piece without transport (incoterms EXW).

These costs must be calculated for all suppliers who have offered the required item. Unfortunately, this calculation has shown that the logistics costs of Chinese suppliers are very expensive. This has reduced China's competitiveness as the sum of the costs (landed costs) is now higher than that of a European supplier. For this reason, the European supplier was preferred.

5.4 SWOT analysis of Chinese suppliers

Based on the described comparison of Chinese and European suppliers in specific cases and also based on personal experience at XY, a SWOT analysis was created. It focuses on the strengths and weaknesses of the Chinese supplier compared to XY's European suppliers and on potential opportunities and threats.

Table 3 SWOT analysis of Chinese suppliers

Strengths	Weaknesses
- use of local materials - cheaper labour - competitive price	- large geographical distance - high logistics costs and fees - unavailable standards required to obtain technical parameters - use of local materials
Opportunities	**Threats**
- new technologies - electric batteries - electrification of the automotive industry - better accessibility of raw materials in China - pressure from high management to nominate a Chinese supplier	- European suppliers - unfavourable exchange rates - removal of foreign ownership restrictions - rising minimal wage

Source: Own processing

5.4.1 Strengths of Chinese suppliers

The use of local materials is both a strength and a weakness. This is because local materials are more readily available and cheaper in China, so suppliers from that country can have more competitive prices. But on the other hand, in the case of more difficult parts where no alternative material is acceptable, this can be big disadvantage for Chinese suppliers because as already mentioned the requested material (typical for European market) would not be very accessible or popular in this country. China is considered to be a low-cost country, so labour costs are rapidly lower than in Europe, and this also allows the Chinese supplier to offer a more competitive price.

5.4.2 Weaknesses of Chinese suppliers

As it was shown on the standard part example, china is not very familiar with ISO, DIN or VDA norm and due to that is not possible to consider all technical parameters. Unfortunately, in many cases this reduces the chances of Chinese suppliers being nominated for the business. For these reasons, the author classified it as a weakness. Important factors in the decision include geographical distance and the associated high logistics costs and fees. After calculating these costs, Chinese suppliers may no longer be competitive with European suppliers. In case of an urgent need for a part, the Chinese supplier is not able to deliver the goods as quickly as European suppliers, precisely because of the aforementioned distance from company XY. This, of course, plays to China's disadvantage.

5.4.3 Opportunities for Chinese suppliers

Potential opportunity for Chinese supplier is new technology. It was previously mentioned, that automotive industry is highly innovative sector. Use of new technologies such as automation of the production process, machine learning, new features for the driver`s safety or comfort, etc. could gain competitive advantage, differentiate itself from competitors, save costs, attract new partners and much more. Removal of foreign restriction in China (as mentioned in PESTE analysis) could boost local companies to keep up with competitors from abroad.

In addition, with the Chinese government's support for electric vehicles, the electrification of the automotive industry in China could accelerate, outpacing European competition. The size of the market and the interest of customers is high, as is the readiness of the infrastructure (charging stations for electric cars) compared to Europe. The electrification of this sector is also linked to the battery, which is essential for powering this type of car. This is where China's huge advantage lies. As the figure below shows, Europe is dependent on imports of batteries (Li-ion) from other countries. China has the largest share of the battery market with 55%, while Europe has only 3%. European carmakers are leaders in the development of internal combustion engines, but conventional fossil fuel cars should be on the decline in the coming years. So as the industry becomes more electrified, China's importance could grow. (ING, 2017)

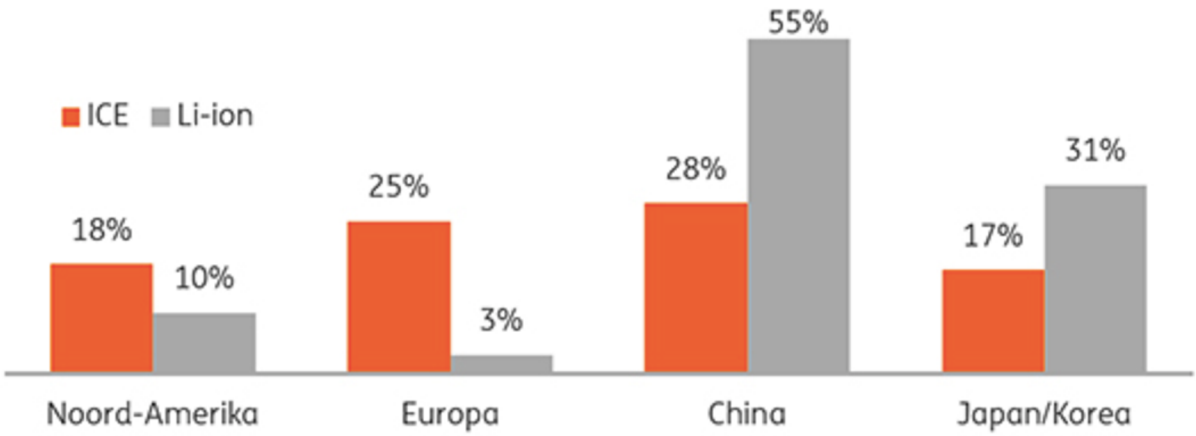

Figure 17 Market share in internal combustion engine (ICE) production and Li-ion ev battery production capacity

Source: ING, 2017

As the chapter "The automotive industry through the ages" has shown, batteries are not the only thing imported into Europe from China. It is also magnets, chips, magnesium and other raw materials that are hard to find in Europe and from European suppliers. For example, XY also needs parts containing magnets and other components for which there is a lack of partners in Europe and therefore has to work with Chinese suppliers.

Moreover, Covid-19 revealed the fragility and dependence of the European automotive industry on China. Sudden shortages of chips and magnesium have disrupted the production of many companies in the automotive sector. The availability of magnets, chips, magnesium and other raw materials in China is therefore another opportunity. Lastly, in the specific example of XY, pressure from high management to nominate suppliers from low cost country, including China, can be also an opportunity for Chinese suppliers.

5.4.4 Threats for Chinese suppliers

As mentioned several times, the removal of foreign ownership restrictions could lead to more competitors entering the Chinese market. China has also different currency so the unfavourable exchange rates could me another threat. However, as it was already shown in PESTE analysis exchange rates in China work differently than in other countries.

However, the biggest threat comes from European suppliers. These suppliers can provide faster and cheaper transport. They are also familiar with European materials, norms and standards, and thanks to the European Union there are customs fees. Also, there may still be a stigma that European suppliers are more reliable and better quality than Chinese ones.

Conclusion

The aim of this master thesis was to identify the risks facing the automotive industry in China. However, to understand the sector as a whole, it was necessary to look at it from several perspectives. To this purpose, sub-objectives were also set. One of the partial goals was to analyze the macroeconomic environment and the risks arising from it. Furthermore, to determine the impact of selected macroeconomic indicators on the number of cars sold. Finally, in order to get an overall picture of the industry, internal data from company XY was used to examine the microeconomic environment. This also allowed the author to identify the strengths and weaknesses of Chinese companies compared to European ones and to identify other related risks.

The automotive industry is an important sector not only for China but also globally. It is an essential pillar of the economy, bringing many technological advances and much more. In addition, many industries are strongly linked to this sector. It is no wonder that it plays an irreplaceable role in the Chinese economy. However, as trends in this sector change, more and more risks are emerging. And these risks can have negative consequences for any company. Preventing negative events or mitigation their consequences can be helped by proper risk management. The most important but also the most challenging part of this process is the identification of potential risk. Therefore, the author has chosen to focus on this phase.

To identify risks arising from the macroeconomic environment in China, PESTLE analysis was conducted. The following findings emerged. China's economy has always been strong and stable. However, despite a powerful recovery after the pandemic, the economy is expected to slow down in the coming period. Another problem is rising inflation. This could also be exacerbated by the war between Russia and Ukraine and tensions with the US. All these factors, along with the rising cost of housing, food and education, may cause demand for cars to fall as Chinese households will not have the budget to buy new cars.

Another important factor is the enormous influence of the government, which plans the economy ahead and is not afraid of significant restrictions. An example is the so-called 0 Covid strategy. Despite the improvement in the pandemic situation and the low number of infected people, China is still introducing harsh measures in the form of lockdown

of certain areas. This, of course, disrupts the supply chain and production disruptions bring losses. In addition, the government is not as transparent and corruption in the country is still quite high. The political regime has so much power that it can influence the market mechanism. For example, China artificially increases the number of jobs when unemployment is higher, adjusts exchange rates, etc. Even during the economic crisis, when most countries saw a decline in the number of cars produced or sold, China continued to grow.

Another important aspect is the high promotion and support for the electrification of the automotive industry in China. While this is a great advantage for electric car companies in the form of subsidies and other benefits provided by the government, it is a threat for firms producing standard-powered cars. In fact, the government is severely restricting such companies. For example, they cannot relocate within China, budgets are very tightly controlled and new fossil fuel vehicle projects are not allowed as much. This threatens not only the car manufacturers themselves, but also the suppliers who produce parts of the standard powertrain.

Since the historical analysis raises the question of whether there is any relationship between macroeconomic indicators and the number of vehicles sold, a regression model was run to answer this question in the case of China. However, this model only confirmed a strong relationship between GDP and cars sold. This means that if GDP increases, the number of cars sold also increases. And vice versa. Conversely, there was no strong relationship between car sales and inflation or the unemployment rate. Surprisingly, there was also no strong correlation between the selected independent variables. This may be influenced by the fact that China does not operate purely on the basis of a market mechanism as already mentioned. The results may also have been influenced by the time delay, where a change in one indicator only becomes apparent after a certain period of time.

Next, the master thesis focused on the microenvironment because according to the author, another major risk for Chinese firms is European competitors. This was confirmed by XY's internal information. Although the Chinese companies had very competitive and attractive prices, a more thorough evaluation showed some weaknesses. As shown in the SWOT analysis conducted, it was found that China is not as familiar with European standards

and materials. The long distance and high logistics costs are also very important. Because it quickly increases Chinese prices and so they are not so competitive anymore.

Moreover, there is even still a stigma in some cases that Chinese products are not of such high quality. Chinese companies are attractive to XY management as they are a low-cost country. However, due to an aging population, it is possible that labor will become more expensive. This could deprive China of a major advantage in terms of cheap labour. In addition, reducing restrictions may attract more competition. As a result, competition would come not only from European suppliers supplying parts to European companies, but also directly on the domestic market.

China can offer huge potential. Not only does it have the largest automotive market, but it is also an important source of minerals, alternative and cheaper materials, and increasingly important batteries for electric vehicles. The government is also rapidly promoting the electrification of the sector, for which it is also better prepared compared to Europe. However, the Chinese automotive environment is currently facing new trends, technological changes, fierce European competition, etc. Therefore, it is very important to constantly map its environment and anticipate possible risks early on.

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