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The impact of Coronavirus on the Global Supply Chain

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Abstract

Modern international production is organized in global value chains, where through the use of outsourcing and offshoring methods specific stages for end production are located in foreign countries, according to the comparative advantages of these locations. This status quo has stagnated over the last decade, due to the negative experiences during the COVID-19 pandemic and other exogenous shocks, as well as increasing shift towards global geopolitical rivalry, while simultaneously the competition in digitalization and globalization places industrial and service companies in a state of perpetual challenge. For this purpose and because the number of such external imminent threats are likely to soar in future, there is a need for policies to promote global value chains resilience, which is the ability to withstand and recover from shocks as soon as possible. One of these policies includes reshoring production sites, particularly in crucial sectors of the economy. Reshoring-related policies implemented by governments are on the rise, even though they are still far limited in total scale. This work will examine offshoring and reshoring as key policies and focuses on its microeconomic and macroeconomic motives.

Zusammenfassung

Die moderne internationale Produktion ist in globalen Wertschöpfungsketten organisiert, wobei durch den Einsatz von Outsourcing- und Offshoring-Methoden bestimmte Schritte des Endprodukts entsprechend den komparativen Vorteilen dieser Standorte im Ausland angesiedelt sind. Dieser Status quo stagnierte im letzten Jahrzehnt aufgrund der negativen Konsequenzen der COVID-19-Pandemie und anderen exogenen Schocks, sowie der zunehmenden Verschiebung hin zu globaler geopolitischer Rivalität, während gleichzeitig der Wettbewerb durch Digitalisierung und Globalisierung industrielle- und Dienstleistungsunternehmen in einem Zustand ständiger Herausforderung bringt. Zu diesem Zweck und weil die Zahl solcher drohender externer Bedrohungen in Zukunft wahrscheinlich in die Höhe gehen wird, bedarf es politischer Maßnahmen zur Förderung der Resilienz der globalen Wertschöpfungsketten, d.h. der Fähigkeit, negative exogene Ereignisse weitestgehend abzuschirmen. Eine dieser möglichen Maßnahmen beinhaltet die Rückverlagerung von Produktionsstandorten, insbesondere in wichtigen Wirtschaftssektoren. Die von Regierungen umgesetzten Maßnahmen im Zusammenhang mit Rückverlagerungen sind auf dem Vormarsch, auch wenn ihr Gesamtumfang noch immer sehr begrenzt ist. Diese Arbeit untersucht Offshoring und Reshoring als Schlüsselmaßnahmen, sowie ihre mikroökonomischen und makroökonomischen Motive.

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List of abbreviations

GVC	Global Value Chain
GSC	Global Supply Chain
TFP	Total Factor Productivity
R&D	Research & Development
OECD	Organisation for Economic Co-operation and Development
GDP	Gross Domestic Product
WTO	World Trade Organisation
EMEA	Europe and the Middle East
NRI	Network Readiness Index
INSEAD	Institut Européen d'Administration des Affaires
HCC	High-Cost Country
LCC	Low-Cost Country
G20	Group of 20
ILO	International Labour Organisation
BEM	Big Emerging Markets
UNCTAD	United Nations Conference on Trade and Development
SCM	Supply Chain Management
SARS	Severe Acute Respiratory Syndrome
MNC	Multinational Corporation
NEM	Non-equity modes
EMNC	Emerging Multinational Companies
GCBI	Greenfield Cross-Border Investment
FDI	Foreign Direct Investment
YOY	Year over Year
ERM	European Reshoring Monitor
EEA	European Economic Area
ICT	Information & Communications Technologies
MGI	McKinsey Global Institute
KET	Key Enabling Technology

GPT	General Purpose Technology
EEA	European Medicine Agency
WSTS	World Semiconductors Trade Statistics
WIPO	World Intellectual Property Organisation
BOT	Balance of Trade
ZVEI	Zentralverband Elektrotechnik- und Elektronikindustrie
IOT	Internet of Things
ROW	Rest of the World
ITRS	International Technology Roadmap for Semiconductors
ECSEL	Electronic Components and Systems for European Leadership
TRIPs	Agreement on Trade Related Aspects of Intellectual Property Rights
API	Active Pharmaceutical Ingredient
FDF	Finished Dosage Form

List of symbols

<i>imports of good j</i>	Import amount of a specific good j
<i>input j by industry i</i>	Part of the production, which is created in a foreign country
<i>consumption j in industry i</i>	The costs of transportation + imports - export
<i>Offshoring_{it}</i>	Offshoring is the proportion of input in an industry i at time t
<i>Outsourcing_{it}</i>	Outsourcing is the proportion of input in an industry i at time t
\sum_l (<i>input purchases from industry l in industry i</i>) _{t}	Total input purchases from an industry l into industry i to a specific point of time t
\sum_l (<i>domestic purchases from industry l in industry i</i>) _{t}	Total domestic purchases from an industry l into industry i to a specific point of time t

Introduction

The terms “offshoring” or “backshoring”, or furthermore “outsourcing” and the corresponding opposite “insourcing” are even known to people who hardly ever deal with business or politics. This is because the outsourcing and relocation of corporate activities abroad has been an absolute standard for companies for decades. Nowadays, the economic consequences of these methods are controversially discussed and criticized in politics. Both the positive and the negative sides of offshoring are pointed out again and again, so proponents point out that offshoring leads to positive productivity effects. Not only for the industrialized country, but for all countries involved. But it is not that simple, because offshoring not only affects countries on a macroeconomic basis, but also on a microeconomic sphere and can make a difference in the working life of individual people. People are afraid, that they cannot keep up with the competition from Eastern Europe and Asia and thus will lose their jobs or have to accept losses in income. This has consequences in voting behavior (Populism) during political elections and contributes to the general skepticism about globalization. Economists, on the other hand, emphasize the opportunities of an intensely intertwined foreign trade, which is based on the knowledge of traditional foreign trade theory. New technologies are spread in the world mainly through international trade. For emerging economies, importing new technologies is an essential source for productivity and economic growth. By importing technologies, the efficiency of domestic production can be increased without taking the risks and costs of doing research and development by oneself. (Kasahara, H. and Rodrigue, J. (2008), p. 106).

In the public debate, offshoring, but also outsourcing, is associated with the threat of job satisfaction and falling wages for employees. This contributes to the fact that this topic must endure a lot of polemics from many sides.

The enquiry of the economically most convenient company location holds a tremendous value for the company’s success, especially in a world dominated by globalism. It is a

must for more or less every company with upscaling objectives to find a solution for the best location to place its company production. Site relocations are heavily associated with massive time – and capital costs, that is why the correct decision on company location matters results in being a huge obstacle and challenge on the road of acquiring a successful company strategy. The decision on outsourcing a company is normally not revisable, or at least it is not recommendable to do so. In order to be successful in the market on the long term, the production costs in the global market must stay competitive. To expand the company's global presence and at the same time enjoy cost benefits of other countries, many enterprises of the secondary sector relocated their production abroad. As a production site Germany loses in the production of standardized and labor-intensive products each year. These aspects hold tremendous challenges for companies in the industrial world. The keen competition pushes companies to its limits, especially concerning the fast and rational decision making on strategical matters. Due to the COVID-19 pandemic, the world experienced a critical slump in the global economy. In relation to that, companies need to overthink their strategical alignment in offshoring to save money. I will further discuss this point in my work later.

It is by looking into the history of economics very easy to detect, how outsourcing has become so popular. The decision to change location only became attractive for companies because the revolutionary developments in information and communication technology over the past few decades have broken the production chains. Transport costs decreased, globalization and thus international trade became more important and this made it economically sensible to produce goods away from the end consumer. In the future, even more barriers will slowly but surely be reduced by globalization and improved communication options, such as the outsourcing of office activities. This cooperation with third parties - also known as outsourcing - is becoming increasingly popular, as a result of which office work is outsourced to external service providers. This networking is an important part of the future-oriented Smart Office process. In chapter 2 of this thesis, I will further analyze the basics of the work, reflecting on the importance of offshoring as a whole, but also defining key terms like outsourcing, backshoring, nearshoring, reshoring, onshoring, location factor systems and foreign trade theoretical mechanisms. In chapter 3, I will write about the fragmentation of the production process and production overall, before emphasizing on the effects of corona virus on the global supply chain.

The main object of my thesis is a purely foreign trade theoretical one. It sees itself on the cross border between international trade policy and traditional economic policy. As I am studying International Management, it is also important for me to include and to keep special resonance to international enterprises and companies and in the same time show how relocation of production affects productivity of threshold countries and, upon reversion, companies in threshold countries. Afterwards, I am heading to another important topic of my thesis, which is the effect of the corona virus on the productivity and global supply chain. After that I am going to discuss the notion of reshoring by examining specific industries in the form of case studies. In chapter 1 I have given a brief introduction to the topic of my thesis. In chapter 2 I will discuss – as already mentioned in the introduction – the basics of the work like terminology, definitions, production and relocation factors and a short excursion to the COVid-19 Pandemic. This excursion on the COVid-19 Pandemic will give a short insight on the current situation with the pandemic consequences. In chapter 3 I will write about threshold countries in general, the general macro-economic differences of threshold countries to industrial countries and how productivity and offshoring is measured. Chapter 2 and 3 belong to the basics, which is a prerequisite to fully understand the rest of my work. Chapter 4 will start with the main theory of my work and will discuss the major consequences of the pandemic on the global supply chain, the importance of resilient GVCs¹ and in what degree companies are being forced to reassess their supply chain. In chapter 5 I will start to debate the concept of reshoring. As the main research area, I am going to look at Europe and its manufacturing industry. This chapter will include two primary case studies. In addition to that I will give an insight on how the global supply chains could work in a post-pandemic world and I will give policy recommendations. On one of the case studies, I will conduct an interview with an expert of a specific industry on possible future reshoring activities. Finally, chapter 6 will summarize all gained knowledge and key findings together.

¹ Global Value Chains

Basics

In this chapter of my thesis, I will be discussing all important terms, which are needed to understand my work. Gaining a deeper insight to the relevant terms is the main point of this chapter. Besides the definition making, this chapter will also discuss which factors decide upon the choice of the correct production location, as well as relocation processes, taking on questions like what are motives for relocation processes and what are the risks of it? Another important aspect is to clarify and make a clear distinction between high- and low-cost countries. The last point will build a bridge to chapter 3, which is going to take a more general stance on the macroeconomic issue of the whole topic.

2.1 Offshoring & Outsourcing

2.1.1 Basics and definitions

Offshoring and outsourcing are often used synonymously, but are in no way the same thing. Outsourcing equals to entire business areas, production, organizations or sub-areas being outsourced within the country's border to other companies or to a subsidiary. On the other hand, offshoring describes the very same thing, but this time across national borders. The only major difference between those two terms is the border crossing aspect of offshoring (to off-shore). Many companies are increasingly asking themselves which of their value chain activity is best performed somewhere else, hence the outsourcing aspect. This way of internal value chain strategy, together with the acceleration of the digital age and globalism, has changed entire lives of hundreds of million people across the world, as well as entire industries and possibilities for companies, but also a significant

change in risk calculation. (Contractor, F. et al. (2008), p.1) Of course, offshoring/out-sourcing is not in all industries of similar importance. For instance, the computer industry is an industry that has a high proportion of offshoring measures, while other industries show much lower tendencies to practice offshoring. The growth of offshoring measures continues does not increase monotonously, but takes place in spurts and is often accompanied by set – and drawbacks (Geishecker, I. (2006), p. 566).

The chain of activities of all companies who deal with offshoring their production can be broken and even micro dissected down into their component pieces, all along the value chain. The production process can be defined in several finished stadiums, with the possibility of each being extracted, in their need of different forms of human capital. That is why highly skilled labor is required for the design or development of a product, while for the assembly of a product it is enough to engage mainly low skilled labor force (Feenstra, R. C. und Hanson, G. H. (1996), p. 242). Depending on the industry, the level of skillfulness of the labor force can change. For example, an automobile made by a major producer has more than twelve thousand parts and the firm can decide, if to produce it internally, or outsource (Contractor, F. et al. (2008), p.5). In relation to that, the need of skilled labor force concerning the realization of each part can understandably change. It is in the company's duty and task within its strategic management to calculate the needs to realize and implement its products.

On a multinational level, offshoring is highly influenced by transaction costs and the market conditions of suppliers (Tang, J. & do Livramento, H. (2010), p. 123). In addition to that, the skill level of workers may also be an important factor for offshoring, which is directly linked to the productivity level of a company. The higher the production level of a company, the bigger the chance it is going to outsource. The larger the firm, the higher the chance to engage in offshoring. These factors are all highly correlative, just as the perception that offshoring is endogenous to productivity (Tang, J. & do Livramento, H. (2010), p. 124).

As we can see, the decision to outsource depends of several developments and factors within a company and external of it. There are numerous terms further relevant and familiar to outsourcing and offshoring, like nearshoring, reshoring or farshoring, which I will explain briefly now.

Let us start with the concept of reshoring. Reshoring is the decision to advocate a relocation of manufacturing activities, which have been previously moved abroad back to the original home country of the main company. This is a trend pretty common in the last 10 – 15 years, especially in Germany, where companies like STIHL, Steiff, Electrostar or Adidas relocated back to their native country (Made in Germany 2020). Mainly because of the digitalization of production processes (keyword: “Industrie 4.0”) companies have found their way home from foreign European and Asian soil. However, the abrupt dismissive action of relocation back home has significant consequences for the foreign national economy. Not to mention the individual consequences for the workers employed there and their families. Therefore, social cushioning and the creation of alternative jobs seem to be the order of the day, in order to make the reshoring process sustainable and fair.

Next, nearshoring and the opposite of it, farshoring are on the list. Nearshoring is more or less a sub-category of offshoring. It turned out to be a common practice for many businesses all around the world. It heavily emphasizes on cultural fit, because nearshoring outsources essential business functions to nearby countries, thus similar cultural elements can be identified. Language and cultural barriers can be successfully taken down (Baltic Assist 2020). But how exactly does it save costs and money? Obviously, countries with similar cultural heritage and language will have similar costs of living, because of close trade and cultural ties (e.g., many neighboring countries in Europe). It saves money because of lean management. By hiring workers from a trusted third-party, you only pay for the expertise once you really need it. (ibid.)

Farshoring is the exact opposite to the described concept of nearshoring. It ignores the cultural boundaries and the convenience of outsourcing production to cultural relevant and familiar places for the sake of cost-saving in remote countries. It prioritizes cost savings by saving materials and labor, because they are much cheaper in far-flung locations, leaving the enterprise with more budget free for other projects. Consequently, farshoring has the potential to increase the company’s income. However, this does not come without issues. Some of them are language barriers, time zone issues and structural issues like taxation issues or individual custom problems.

2.2 Location factors

2.2.1 Basics and definitions

Every manufacturing company needs a place where the products offered getting produced. This geographical location is called the production site. By choosing the type of outsourcing/offshoring described above, companies will have to deal with multiple risks and opportunities. It decides about the success or failure of an entrepreneurial activity. No location is identical to another. Each of them has a different set of positives and negatives to offer. The decision for a location point is considered a long-term investment, that is very difficult to reverse, because of its massive cost factor (Kreus, Lindner, & von der Ruhren, 2004).

There are different theories and definitions to structure location factors. The first one to fully give a definition for it was Alfred Weber, the young brother of the famous sociologist Max Weber. He defined location factors as “By its nature a sharply defined advantage, which for an economic activity occurs when it is in a certain place, or Generally takes place in places of a certain type.” (Weber, 1909).

Behrens, who gave a more modern approach to the topic of location factors continues further: “Location factors are characteristics of a geographic location that make it for the the implementation of industrial production attractive. ”(Behrens, 1971)

Both have created models, the so-called location factor systems. These systems try to structure location factors, thus meant to be taken into considerations by enterprises when choosing a location site. Weber’s model emphasizes on criteria, like the cost criteria (e.g., the costs of production). He reduces the location determining costs on material, labor and transportation costs. He interprets the material price differences as transportation cost differences, because it is irrelevant for the company, if it gets the material from a closer source of supply at higher prices, or from a distant source at lower prices (Transport Geography, 2021). Olga Haaker on the other hand structures the location factor in her own model into qualitative, quantitative and subjective types. Furthermore, she classifies

“hard” and “soft” location factors. Hard location factors have a measurable impact on the capital value of a location point, while soft location factors cannot be measured.

All in all, these various models try to structure and explain the very best way to implement a valuable location factor strategy for a company. Location factors are meant to be taken into consideration when choosing a location site. Location factors result from the local conditions and either positively or negatively influence the success of an entrepreneurial activity.

2.2.2 Location factor system

It is not the main interest of this work to analyze the various models of monitoring and implementing location factor systems. Because of that I will only briefly analyze one location factor system and then continue with production and relocation and its pros and cons. To further understand this work it is integral to grasp how recommendations for operational practice could look like. The main objective of this part of chapter 2 is to give a short systematic analysis of all relevant location factors on which business decisions depend.

Rüschepöhler, Meyer and Behrens introduced an empirical-realistic location factor system with the objective to analyze all relevant location factors. Out of these relevant location factors, business decisions can be derived, resulting in a practicable way for enterprises to work with. Rüschepöhler on one hand worked with location requirements and location conditions and compared those two relevant factors with each other. By comparing these two factors, the optimal location site can be found and unnecessary ones are being dismissed. Rüschepöhler uses the criterion of "location-dependent profitability", which is calculated from the ratio of the difference between "location-dependent revenues and costs" to "location-dependent operating capital" (Rüschepöhler, 1958). Meyer on the other hand emphasizes more on the sales region. Before deciding for a site location, several variants of adequate sales region are chosen. Then, the optimal location within the range of possibilities is being determined by using the location factors for the location assessment (Krol B., 2010).

Behrens model is perhaps the best empirical location factor system, used widely by different scholars. His model is characterized by the sales end, which he uses to describe

a location factor system. Based on the economic profitability principle, Behrens takes into account location factors that are relevant to costs and revenues and thus also includes the sales end in the analysis. The focus of his remarks is to develop the system of location factors. He makes a fundamental distinction between the location factors of the use of goods and sales. The use of goods is further subdivided in procurement and transformation, sales in sales contacts and sales potential. In addition to cost factors, Behrens also lists non-quantifiable market and industry factors in the immediate corporate environment. In doing so, he withdraws the location decisions from exact calculations and instead assigns them as the result of a qualitative comparison of the relevant location factors of potential locations (Behrens, 1961, p. 95).

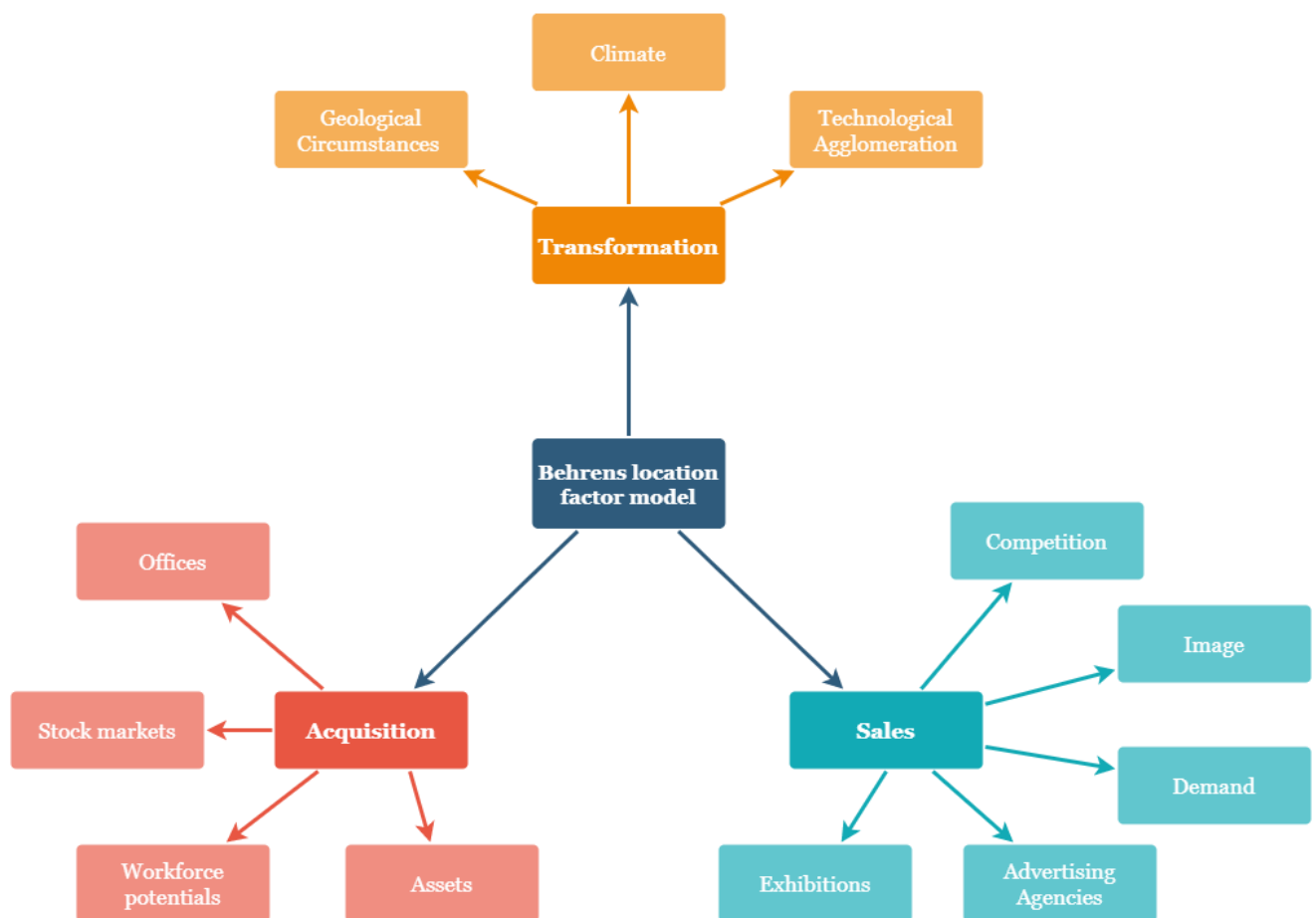


Figure 2.1: Behrens location factor model based on own figure (following: Krol B., 2010).
 Note: Acquisition and sales are divided into two sub-categories: acquisition-contacts and acquisition potentials and sales contacts and sales potentials.

There are multiple ways to calculate the relevant location site by using several location factor systems, but as already stated above, it is not the topic of this thesis to do an in-depth study on that. I have now described some variants on how to assess location factor systems. Besides defining the correct place for the production location site, it is also integral for an enterprise to be aware of potential opportunities and risks of a relocation, as not to be surprised by unexpected events during the time-consuming implementation processes of production relocation. Additionally, the motives and concerns of corporations, ex ante and ex post production relocation will be discussed.

2.2.3 Production and relocation – possible chances and risks

Companies that relocate production abroad see various opportunities in this strategic decision. First, a company needs to carefully evaluate its next steps. When deciding to move, its production activities will be interrupted and the company needs to emphasize its resources on the activity of logistics and organization. This whole process is accompanied by a learning-by-doing process. Overall, the firm contemplates that there is a big chance of an increase of its profits in the new production location. Generally speaking, a firm always cautiously evaluates the opportunity of moving, but all decisions made will still be taken with limited rationality (Simon & Feigenbaum, 1984, p. 26). Any information a firm has before moving is entirely perceptual and not a must. Even if there is a high concentration of resources in a targeted area, there is no certainty that the new location will offer higher chances and therefore higher profit. Indeed, an area with an above average of resources attracts mostly firms with an above average level of global knowledge and capabilities. But this is not always the case, especially in modern times, where all over the world small compact clusters of average firms or the presence of very few knowledgeable firms are being observed, especially in threshold countries (Fratesi & Senn, 2008, p. 23).

But what are the main reasons of outsourcing/offshoring activities?

In this regard, the Economics and Social Science Institute of the Hans Böckler Foundation carried out a works council survey in 2007. In this survey, 2,070 companies were asked

about their motives for relocating production (cf. Hans Böckler Foundation, 2008, p. 9). The results of the survey are listed in percentages and shown in the following graphic.

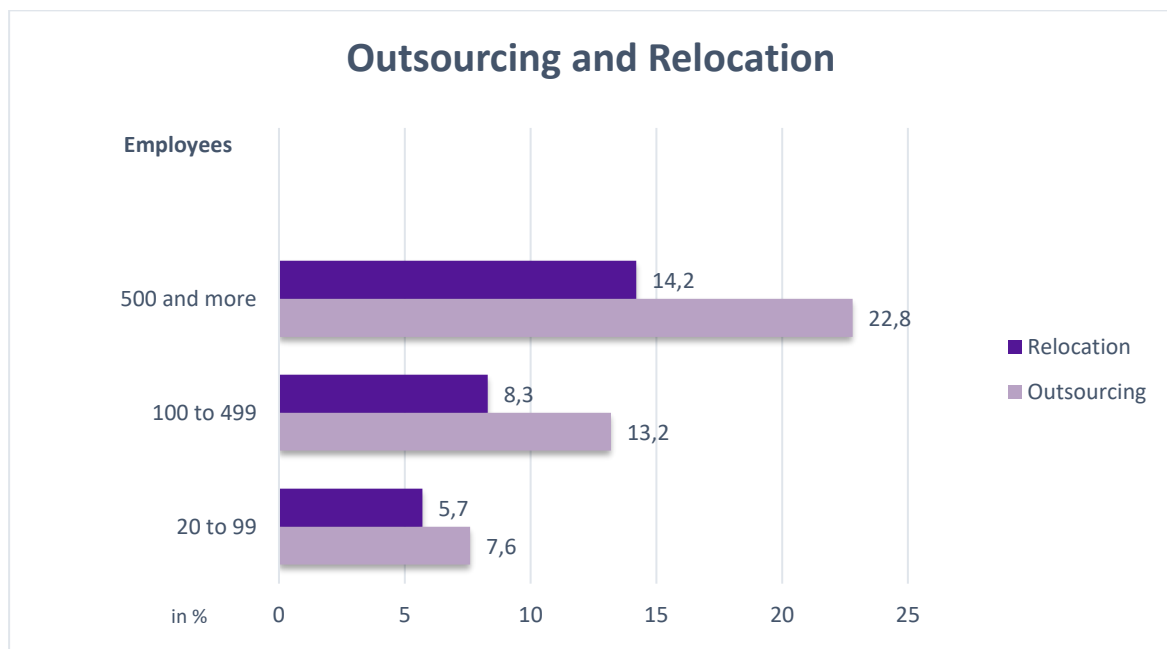


Figure 2.2: Relocation and outsourcing according to company size based on own figure (following: Hans Böckler Foundation, 2008).

The results show, that saving costs and the redistribution of operational competencies were the main reason for offshoring activities. Further, the acquisition of new markets came up third, while following an important customer was the least important reason.

The same study also made a survey about the reasons of internal outsourcing activities since 2005.

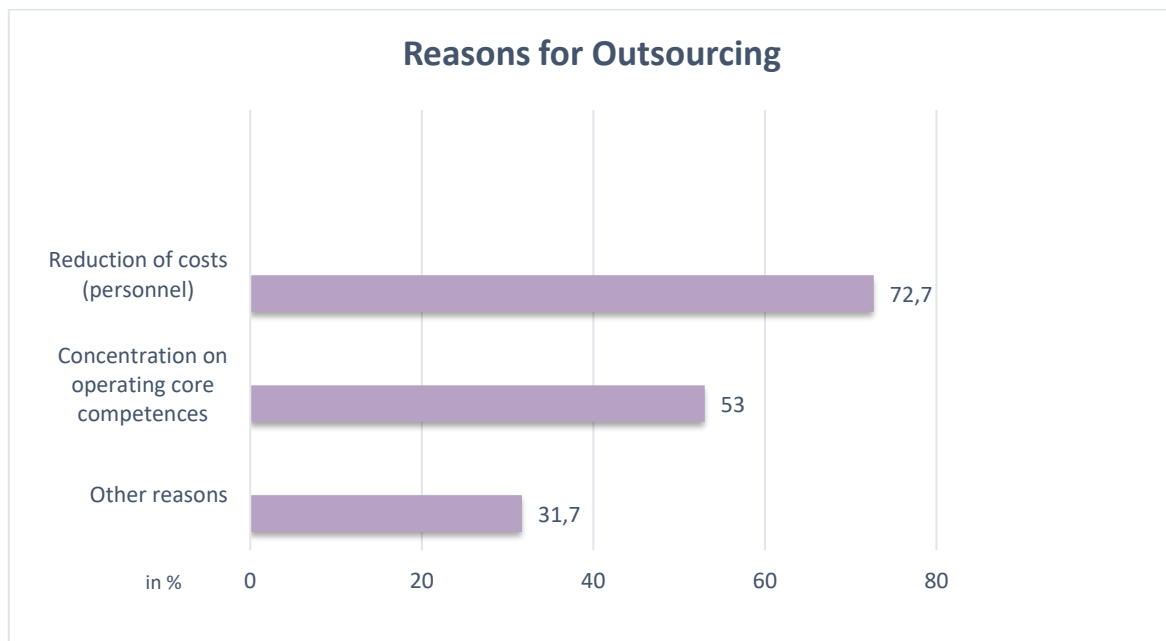


Figure 2.3: Reasons for outsourcing. Information from works councils whose operations have relocated or outsourced since 2005 in % based on own figure (following: Hans Böckler Foundations, 2008).

Here, the savings of personal costs with 72,7 % was the main reason to internally outsource. Followed again by the redistribution of operational competencies (53 %) and last with 31,7 % other reasons (cf. Hans Böckler Foundation, 2008, p. 14). It is very important to remark, that since the time when this survey was made, many things have changed, for instance the main concentration of corporations in their domestic country in comparison to foreign countries => redistribution of operational competencies. Nowadays, companies and corporations are more willing to shift their production to a foreign site, while concentrating on the development of relevant products on the domestic site. Another important aspect is, that firms will only internationalize and follow a customer if it is a key customer. This key customer is usually responsible for a large proportion of the company's turnover and thus, indispensable for the business relationship. Saving costs is the by far most important factor in the decision-process of moving abroad. For more and more companies, increasing cost pressure is a challenge that has to be mastered. Since personnel costs make up a large part of company expenses, companies see this cost factor as having a particularly large potential for savings (Destatis, 2018). In Germany during 2014 and 2016, most firms who relocated their production moved their production site to Central – and eastern Europe (63 %) (see *ibid.* Destatis). Other chances and motivating

factors for product relocation are government incentives (taxes, earnings etc.) or the proximity to distribution channels. The latter one heavily associates with the redistribution of operational competencies.

Furthermore, the Hans Böckler Stiftung created in their 2012 manual for the German works council 4 internalization strategies to describe the motives of decision makers in German corporations concerning outsourcing activities (Klepzig et. al, 2012, p. 27). These strategies are each different to one another. In each strategy, the decision maker lays his emphasis on a specific factor:

- The costs optimizer
- The market developer
- The resource-user
- The exporter

The cost optimizer continues to operate the sales market. He has no other interest than to benefit from the low-cost advantages from a country. Core-competences stay in the domestic country, while cost-intensive processes are being offshored.

The market-developer on the other hand does the exact opposite. He develops an offshoring market in a foreign country with the target to succeed in that market. Example: Motorcycle producer (for instance Ducati) in Brazil.

The resource-user seeks to find innovative cluster to offshore there. For instance, Zelenograd for the electronics and computer industry in Russia, or the usage of e-mobility in mega cities in China or United States. The process of savings of raw material resources (for example agriculture industry in Brazil) can be also included in that scheme.

The exporter, as the name indicates serves the global needs and requests via exports from the company headquarters. He purposely concentrates all value-added steps in the domestic facilities to prevent any know-how outflow. The exporters strategy can be mostly monitored in the high-tech production market.

All in all, the creation of these names for each strategy is to further indicate an understanding for the different motives of each decision maker. Principally every company and

its decision-making unit will be confronted with the topic of relocation and production offshoring/outsourcing. Each of these theorems and strategies is accompanied by a set of critical location factors for the internalization strategy. (cf. Kinkel, 2009)

The positives and chances of offshoring & outsourcing are clear and to a huge part because of financial (cost saving) reasons. But what about the risks and challenges? Relocation of production inherent many issues and challenges that are part of the decision-making process and strategy management, for instance loss of personnel, technology issues or operational consequences and thus, financial problems.

Relocation triggers a huge risk for loss of important personnel. The range covers skilled workforce to mid - & senior management. Important key-customers and stakeholders could be affected by that loss of workforce and personnel (Richter consulting, 2010). Furthermore, relocation can enhance issues with information management and technology. Because of the relocation of systems and tools, significant time and budget is required. This automatically leads to the next major risk factor, which is the adequate moving of equipment in a new surrounding while problems with the infrastructure or improper set-up or damages to the equipment can occur. For logistics and the overall implementation of complex operation between the point of origin and the point of consumption, many issues in the inventory management like relocation and organizing inventory into a new warehouse can occur (Richter consulting, 2010).

If these operational risk factors are not lowered and ultimately solved with an adequate strategy, difficulties in the financial situation will be the consequence. Issues like decline in the productivity and product quality will lead to issues with customer relationships and ultimately to disastrous financial consequences. An ill-planned relocation will considerably weaken the corporate's performance and can only be prevented by strategies to minimize the risk like direct communication, timing and inventory buildup combined with adequate budgeted costs. Moreover, the procurement of regular progress reports during the time of relocation for the managerial staff is a must (CCIM² Institute, 2021). Only via that way of communication, considerable strategies to minimize risks can be implemented.

² Certified Commercial Investment Member

2.3 Measurement analysis

I will now discuss two phrases, which have been and will be often mentioned in this work: The analysis of production and offshoring and how it is being measured. To understand the calculation of these two important factors is crucial for my work. Measurement of both variables is not that easy, particularly the measurement of offshoring raises some difficulties, because it can only be measured by proximity. Measurement of production is easier to do in comparison to offshoring and closely linked to the growth rate of the TFP³. Let me now elaborate on the measurement analysis in more detail.

2.3.1 Measurement of production

The production rate operates with efficiency. Firms convert their productivity through the transformation of inputs to outputs. Production is the efficiency level of that transformation and the measurement of production is the numerical translation of that efficiency level. Every company has a different level of production and thus, efficiency. The more efficient companies will survive in the market, while the less efficient ones will struggle to survive. As already mentioned above, measurement of production is linked to the growth rate of the total factor productivity (TFP). The TFP analysis goes back to the Solow Residual Definition by Nobel-prize winning economist Robert Solow in 1956, but has been used in many theoretical and practical studies by other scholars and there are many variants of it (Nobelprize, 1987). Productivity is generally referred to as the ratio of input to output. TFP does not measure the part of output which is generated through input factors like work and capital. TFP measures the technological progress and if it grows, then because these technological input factors are used more efficiently. Technological change is the major determinant of supreme economic growth. Economic historians can prove that. Technological knowledge is an essential variable in the measurement of production, because it creates economic value and thus, it is indispensable in the TFP calculation (Lipsey, R. G., & Carlaw, K. I., 2004, p. 1119). The measurement of TFP was highly differently interpreted by scholars over time. Some held the rational believe, that TFP measured the rate

³ Total Factor Productivity

of technological change, while the other group thought that TFP only measures the externalities and scale effects of technological changes. Others believed that TFP measures nothing useful (ibid, 2004, 1121). The truth lies probably somewhere in between. Taking into account, that our world is increasingly digitalized and technical, it can be noted that differences in TFP internationally are more than just differences in technology. However, the technological level of knowledge in a country is still a crucial parameter, hence the importance of R&D (Research & Development) in a country.

Where is new technological knowledge generated? This predominantly happens in a few developed countries by a few multinational corporations. This newly generated knowledge is also passed on by companies to production sites abroad. It is found in high-tech goods and is carried out into the world through trade. The transfer of knowledge therefore takes place through company interdependencies and through (foreign) direct investment. High technology goods include computers, electronics, optical instruments, and medical technology. All these goods are expensive and are thus called R&D goods. Many surveys and studies have shown a positive correlation between a high standard of R&D investments and improvements to a nation's standard of living. When markets spend more on R&D, it increases the technological level, which increases real wages and the quality of life of a nation's population (Necati, A. et al., 2018, p. 160). But how is the TFP connected to R&D? Is there a higher correlation between investments and R&D and an increasing rate in the total factor productivity? In the study by Griffith et al. (2004) it is shown that the greater the technological potential resulting through R&D, the higher the productivity rates would be. They argue that technology transfer and innovation provide two essential sources of R&D on TFP growth. The conclusion was that high R&D plays a great role in increasing TFP rates in OECD countries (Griffith et al., 2004). Another major study by Bravo-Ortega and Marin from 2011 shows the impact of a few R&D indicators on the productivity rate using the data from 65 countries from different markets - 32 from developing countries, some threshold countries and a few industrialized countries over the period of several decades (1965-2005). Necati et al. writes in their article from January 2018 "Estimating the Impact of R&D Spending on Total Factor Productivity for OECD Countries: Pooled Mean Group Approach:"

“Their paper concluded that per capita R&D spending is strongly exogenous, which is different from other empirical studies regarding this relationship. In addition to demonstrating the high social returns to R&D expenditure, their research estimated that a 10% increase in R&D per capita generates an average increase of 1.6% in the long-run TFP. The long-run R&D elasticities estimated in the paper are statistically significant and economically meaningful.” (Necati, A. et al., 2018, p. 162).

These are very important numerical results, as it shows a positive correlation between R&D efforts and the creation of positive digits in the TFP rate. This shows for instance, that if an emerging country or even a developing country with a positive R&D effort of 2% of the GDP, which is a very high digit, would achieve a 20% increase in R&D per capita and create a 3.2 % increase in the total factor productivity. If emerging or developing markets manage to import many R&D goods, technology will also spread into the country, thus increasing the TFP rate on the long run. The import of computers is a good example of that productivity can be enhanced by technology. International companies are not only researching in industrialized countries, there are also increasing the amount of R&D centers in emerging countries such as China, India and Russia (Belitz, H., & Mölders, F., 2013, p. 12f). The growth in productivity in the emerging countries is therefore heavily dependent on the import and use of technological goods.

However, efforts are being made in some countries to regain more protectionism. This could have a negative impact on productivity development and is a heavily discussed topic in economic policy. This trend is not recorded since the Trump administration but very well before that already. Due to the COVID-19 pandemic, the protectionist efforts have regained popularity. This makes domestic economies more vulnerable and leads to trade imbalances, since the value chains during COVID-19 are being disrupted (Voxeu, 2021).

2.3.2 Measurement of offshoring

In terms of business activities offshoring means to establish business functions like manufacturing or production in a nation abroad, away from the country where business is normally being done. We have understood by now, that this is often to take advantage of

better conditions in a foreign country, so the business can take advantage of that and make significant savings for the business (Investopedia, 2021). There are different variations of methods to evaluate offshoring. The most used way to measure it is from Feenstra and Henson, who created the standard method for offshoring evaluation in 1999. This standard method of evaluation is split in two:

- Broad measure of foreign outsourcing
- Narrow measure of outsourcing

The distinction between these two ways of measuring offshoring/outsourcing is crucial. The broad measure of foreign outsourcing can be measured as follows:

1)

$$\sum_j [\text{input purchases of good } j \text{ by industry } i] \times \left[\frac{\text{imports of good } j}{\text{consumption of good } j} \right]$$

The input purchase of good is measured by the formula above. This input purchase of good is the part of the production, which is done not domestically, but in a foreign country and then imported in the country of origin, where it is being moved into the output of production. The consumption of good j are the costs of transportation + imports – export. By doing that, we receive the first measure of foreign outsourcing, which is the broad measure of outsourcing described above. This calculation is done for every industry i , while in the narrow measure of outsourcing it is done different (Feenstra, R. C., & Hanson, G.H., 1999, p. 924).

2)

$$\sum_i [\text{input purchases in industry } i] \times \left[\frac{\text{imports in industry } i}{\text{consumption in industry } i} \right]$$

A narrow measure for offshoring is generated in that the focus is directed on those purchases that are from the same industry as the end-product. This means that industries of consumption and end-product are identical which equals to

$i = j$. The consumption in industry i is the same as above: costs of purchases + imports – exports. The narrow measure overall captures the idea of outsourcing in the best way. Depending of the industry the consideration of outsourcing is done differently. In the automobile industry for instance, the purchase of parts in the industry by a US automobile company from another company in the US is considered outsourcing. Basically, the main difference between those two measures is, that the narrow measure works with foreign outsourcing, which are production activities, that could have been done by a company within the domestic country (Feenstra, R. C., & Hanson, G.H., 1999, p. 924-925). The import of not semi-finished parts for the final product is accepted as offshoring, if these stocks of semi-manufactured products could also be produced in the home country or it has been in the past.

These two following formulas (3), (4), show the difference between offshoring and outsourcing in the respective calculation. Both calculations are done with the denominator as output in industry i at time t . Offshoring is the proportion of input in an industry, which is being imported (input purchases from industry l) by another supplier on the output. The imported input is the supplier's share on the overall output. The outsourcing formula works exactly the same, only with the difference, that the input is made by a domestic supplier or by a subsidiary company. The main differentiation between these two formulas is the origin of the respective input.

3)

$$Offshoring_{it} = \frac{\sum_l (\text{input purchases from industry } l \text{ in industry } i)_t}{(\text{output in industry } i)_t}$$

4)

$$Outsourcing_{it} = \frac{\sum_l (\text{domestic purchases from industry } l \text{ in industry } i)_t}{(\text{output in industry } i)_t}$$

The narrow and broad measures are eminent calculations in the challenge of reliably measuring offshoring. These calculations show mathematically the characterization of offshoring and its close cousin outsourcing, which is the substitution of imported intermediate inputs for domestic inputs. However, measuring offshoring is not an easy task and there have been developed several approaches, but most of them face tremendous challenges, like data problems. The measurements are done roughly, i.e., actual offshoring values are probably underestimated, since the prices for imports of the semi-finished products are generally lower than the real sales prices of these goods (Winkler, D., 2009, p. 107). Thus, many researchers operate with “proxy” measures, which means they use available data to calculate offshoring and they do not measure offshoring directly. Overall, it is very hard to show a reliable statistical indicator of the global level of outsourcing and offshoring on a numerical scale (Bottini, N., et al., 2007, p. 10). There are only approaches or “proxy” measures like the measures described above by Feenstra and Hanson (1997), which is also the most widely applied. Offshoring activities are entirely made by management decisions on the micro scale; thus, it cannot be easily linked to statistics, that are collected on a national, international or sectoral level (World Trade Organization, 2005).

There are a few different proxy measures, who have been created by researchers and scholars to measure offshoring. Some of those measures are as follows:

- A measurement based on MNE (Multi-national enterprise) firm level data, where the flow of intra-firm exports from the parent firm to the affiliate et vice versa (Marin, 2004).
- A proxy measurement based on the workforce of a firm or sector, which is located at foreign affiliates (Head and Ries, 2002).
- The import of all goods from low-wage countries and only from these countries. Some companies outsource the entire production of a product, while still selling it under the original brand name in the home market. (Anderton and Brenton, 1999).

Many researchers have also relied on so called input-output tables to measure offshoring. Input-output tables are an economical tool and were developed by Wassily Leontief for the US in 1919 and 1929. The tables link different industries in one economy. Input-output tables allow simultaneous measurement across industries within the realms of imported intermediate products. It describes the interdependence in the production systems as a system of deliveries between various sectors of production. Leontief won the 1973 Nobel Prize for elaborating the input output method and its possible applications (Nobelprize, 1973). I am not going to go into further detail on the input-output table, because it would be beyond my scope here and it would miss the point of my work. Overall, it can be summarized that the literature on offshoring has made a tremendous effort to create a wide range of different data sources to measure the extent of offshoring. It was crucial for the sake of a deeper understanding of my work to generally comprehend the way offshoring/outsourcing is being calculated in the scientific world. To trace the consequences of the Corona pandemic on globalization and every globalization tool connected to it (e.g., offshoring & outsourcing), an overview on the different ways of measuring offshoring is surely convenient.

2.5 Excursus on the corona pandemic

In this chapter and for the sake of relevance to the current situation and my thesis, I want to briefly address the significant changes in the worldwide globalization and the act of offshoring/outsourcing due to the pandemic situation. The SARS-CoV-2 pathogen belongs to the group of coronaviruses and the official name of the disease is called COVID-19. A coronavirus first became apparent in the 1960's discovered years ago. With the newly discovered SARS-CoV-2 there are now seven human pathogens Coronaviruses known. Among other things, the coronaviruses can cause MERS and SARS and thus be deadly for the human species (cf. Robert Koch Institut, 2021). There are multiple virus variants of the main strain, which are more infectious than the basic virus, for instance the SARS-CoV-2 Line B. 1. 1.7., which was first discovered in Great Britain and another Mutation called Sars-Cov-2 Line B. 1. 351. first spotted in South Africa. There is some evidence of reduced vaccine effectiveness against these variants (cf. Robert Koch Institut, 2021).

Especially the economy and the health care system struggle with the consequences of this pandemic situation. On an economical level, the COVID-19 disease imposes limits on the globalization. Never before has there been a similar situation in modern times like now, where the drawbacks of globalization are significantly showcased. Global production is weakened by the actions to contain the disease, because there are worldwide delivery shortages and production is progressing slowly due to a lack of employees and presence. Offshoring & outsourcing has played a cardinal role in the development of our worldwide modern society and its creation of intercultural strong ties between all countries in this world, not only on a business level. Due to the pandemic, these international boundaries have experienced a significant drawback and reduction. Companies need to rethink their strategy and invest in an onshore business if they want to remain competitive (Kajjumba et al., 2020, p. 1). This shift in strategy has high topicality and could immensely change the way how globalism will function in the future.

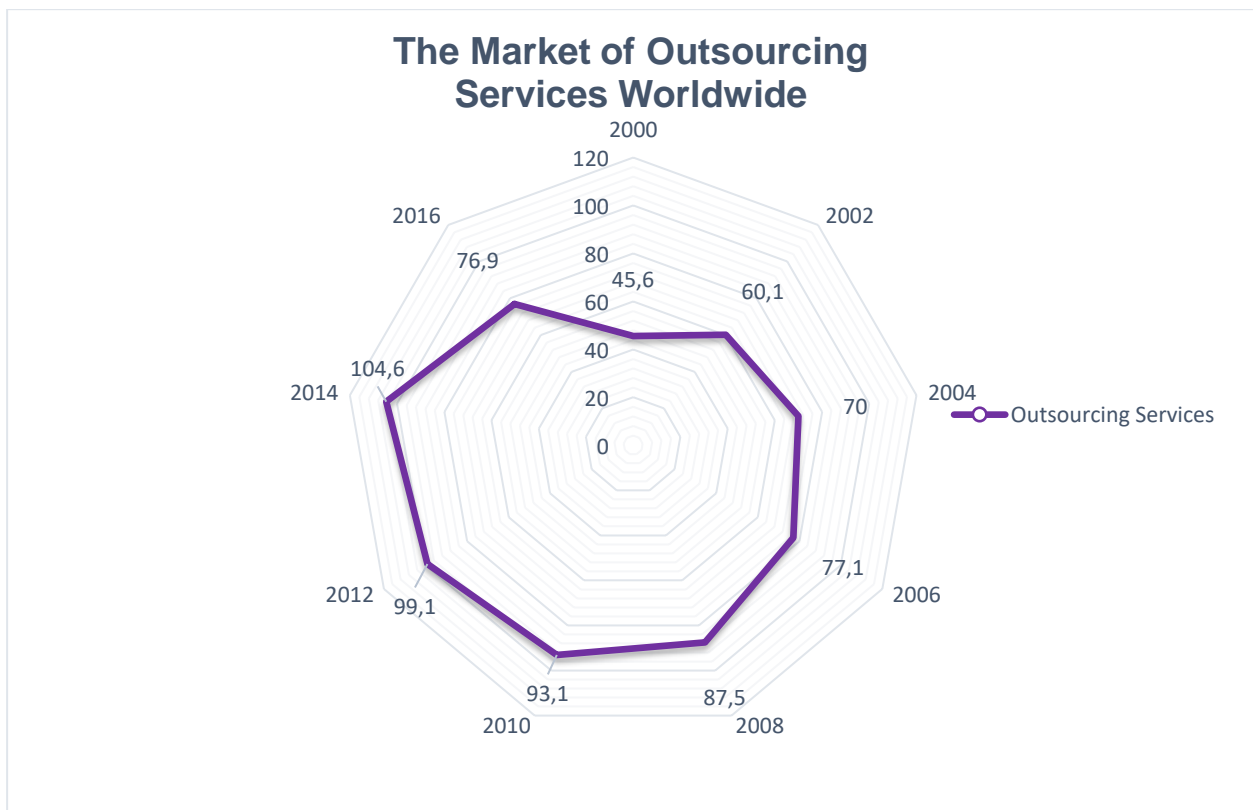


Figure 2.4: The market of outsourcing services in the world in the period 2000 – 2016 in bn. USD (following: *The peculiarities and procedures of the transition to outsourcing by construction companies in Ukraine, 2017.*)

Note: In the years 2017-2019 before the outbreak of the Corona virus strain it increased to 92,5 bn. in 2019 (Kajjumba, G.W. et al., 2020).

The figure shows the market of outsourcing activities worldwide during the period 2000-2016. An increase of outsourcing services can be observed during the 00's when outsourcing became highly popular among industrial countries. 2013 a small breakdown occurred, before accelerating again in 2014. All in all, outsourcing activities have tremendously risen during the new millennium in comparison to the 90's. The largest share of the revenue came from the Americas, followed by Europe and the Middle East. Africa (EMEA) and the Asia Pacific Region covered just a small part of the total revenue (Statista, 2020). Due to the pandemic, nearly every thinkable industry sector has been affected. From the medical sector, through financial services, the cultural sector up to travel & transport.

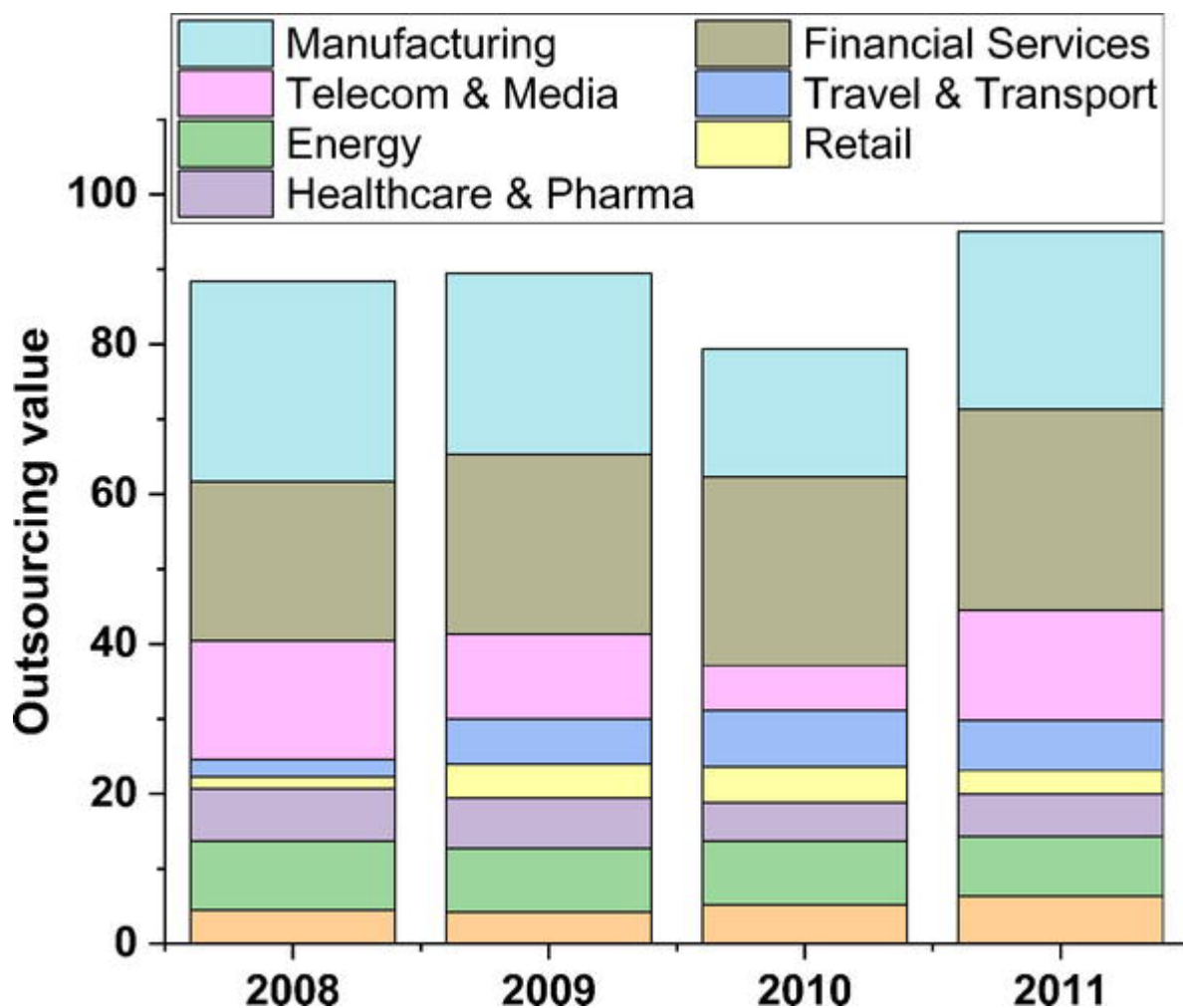


Figure 2.5: The outsourcing value of prominent sectors during 2008 - 2011. (following: Offshoring-Outsourcing and Onshoring Tradeoffs: The Impact of Coronavirus on Global Supply Chain, 2020.)

Reshoring or backshoring has become a major possibility for companies to re-evaluate their strategy on a supply-chain level for time after CoVid-19. Because of the reliance on offshore supplies, many corporations experienced disruptions on the supply chain level. This happens during a time which is already symbolized by major discussion between different economical trade-philosophies between raising protectionist policies and increasing pressures for more sustainable business models (Javorcik, 2020, p. 111-116). The consequence of these complicated times with unpredictable future perceptions is the call for more self-reliance, which has already started in some countries, like for instance in Japan. Backshoring or nearshoring have become major possibilities for firms to evaluate. These topics are being raised in the economic and political debate, urging measures to better protect, reinforce, or even reinstate the macro-regional or national production of these goods (Barbieri, P. et al, 2020). I will further deal with this topic later in my work.

In Germany, a survey done by the German chamber of commerce and industry show the perceived effects and consequences on corporations. These effects are listed below (cf. Deutscher Industrie – und Handelskammertag, 2020):

- less demand
- Cancellation of orders by customers
- lower capital expenditure
- Standstill of business activity
- Logistical shortages in supplier products
- absent employees
- lack of goods and services
- interrupted sales channels
- impending bankruptcy
- Decline in equity
- Liquidity constraints
- Deterioration in industry ratings

- increasing debts
- difficult borrowing / high borrowing

These negative effects can push companies substantially back to reshoring activities.

In this chapter I have briefly showed the negative impulses the pandemic has on globalism. However, this excursus is purely a basic one. The main ingredient of my work here will intensively discuss later the effects of the corona virus on the global chain, on globalism overall and future trends and strategies enterprises could reinforce to possible similar occurrences in the future, in order to cushion the negative consequences of pandemics and similar catastrophes as much as possible.

3

Fragmentation of the production process

3.1. Introduction

The developed countries are steadily refining their division of labor and create a structure of production-related dependencies based on the division of labor. A good example of the fragmentation of production processes is the Boeing 787 Dreamliner. To build this medium-sized aircraft, you need 43 suppliers spread over 135 locations around the world. The Offshoring of the many parts is around 70%. The countries that produce the parts do not share a common pattern of any particular technology advantage. What matters is experience and local knowledge (Global Macro Monitor, 2017).

Next to experience and local knowledge one significant other factor is important: the numerous helpful tools of trading products and the futuristic ambivalent characteristics of these tools. The term “fourth industrial revolution” has become tremendously popular in the last couple of years and describes the increasing automation of traditional and industrial practices using smart technology and digitalization. Internet of Things, Artificial Intelligence (AI), 3-D printers, energy storage and quantum computers are new technologies that have enormous potential to change the world. Only countries that are using these new technologies in a strategic manner will benefit from it. The future for countries, companies and individuals will depend on how far they embrace these new technologies. This task requires high cooperation between technological companies (“big tech”) and governments. A way to measure the readiness and skill level for countries to implement smart technology and digitalization is the Network Readiness Index (NRI). The Global Information Technology Report, published by the World Economic Forum in partnership with INSEAD⁴ and Cornell University, compiles this index. The index includes 134 economies and 60 individual Indicators (Network Readiness Index, 2020).

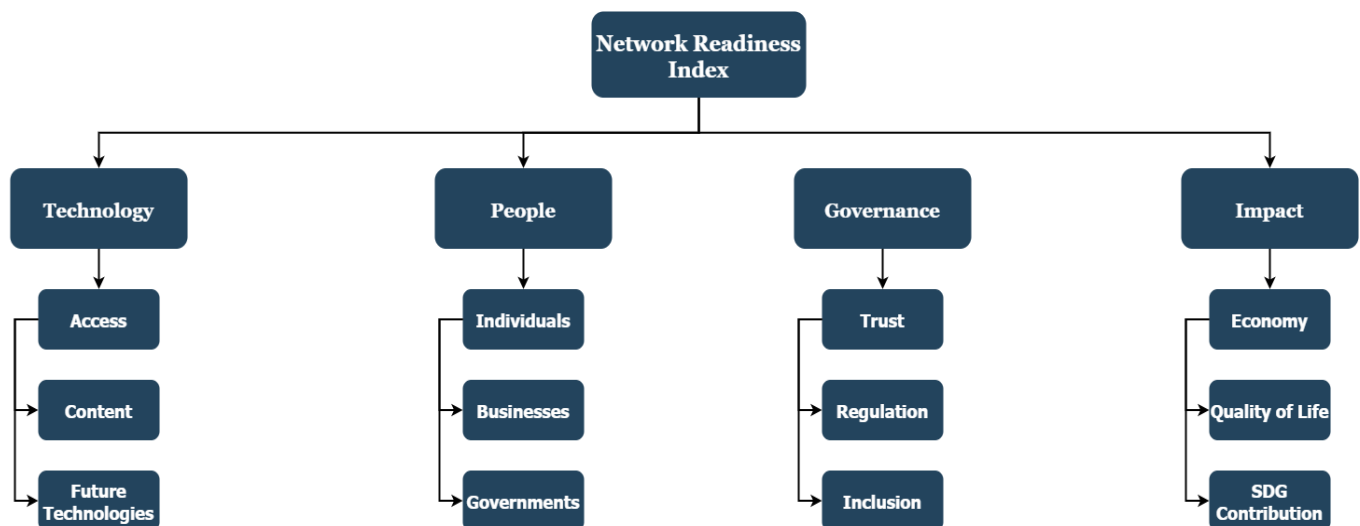


Figure 3.1: The main categories Technology, People, Governance and Impact and its three sub-pillars as the major rating system of the index based on own figure (following: www.networkreadinessindex.org, 2020.)

⁴ Institut Européen d'Administration des Affaires

Innovation is increasingly based on digital technologies and business models, just as terms like technology, people, governance and impact, who are being used as important variables in measuring the performance of each country. In 2016, the top 3 were Singapore, Finland and Sweden. 4 years later in 2020, the Top 5 are Sweden, Denmark, Singapore, Netherlands and Switzerland. High-wage countries or higher on the income scale are in the forefront standing countries. In the middle are emerging countries like China, Russia and India (Network Readiness Index, 2020, p. 032 – 035). The countries in the last third of the list are countries that will probably not be considered as offshoring/out-sourcing targets in the near future. The notion of “digital transformation”, which implies a radical metamorphosis in the nature of how business has been done up till now. This will also change the way how offshoring is done in the future, especially with COVID-19 as an issue, which will accompany us still for a very long time. Digital transformation is clearly happening at an increasingly faster pace and the NR data shows, that digital transformation is happening at all levels: internationally, nationally and locally. This will of course affect the outsourcing/offshoring mechanism of trade and the global supply chain (ibid, 2020, p. 014).

Due to the revolutionary developments in information and communication technology and the rapid transformation of digitalization described above in the offshoring sector, the only relevant question in the future will be whether objects or services can be provided and sent in electronic form. It is no longer just companies and sectors in different countries that compete with one another, but also individual workers or production teams that perform similar tasks in different countries. This way of “new globalization” is far more unpredictable for companies to adjust (Blinder, 2006, p. 115). This leads to the believe, that emerging and non-industrialized countries could catch up on richer countries if they understand how to jump on the unstoppable train of digital transformation. However, the technological divide is a huge challenge for low-cost countries and non-industrialized countries to overcome. This technological divide is not only between high and low-cost countries, but also in high-cost countries between metropolitan areas and rural parts. This brings me to my next point which is of a macro-economic nature. To understand foreign trade theory and thus, outsourcing and offshoring and the global supply chain it is imperative to study global economies and its protagonist like high – and low-cost countries or first world and threshold countries. Of course, the following chapters are crucial for the main ingredient of my work which is going to operate on the global supply chain and a

new possible sustainable trend related with the disruptive effects of COVID-19 on global economic sentiment.

3.2 High and low-cost countries

From a macroeconomic point of view, there are countries with certain characteristics where production turns out to be particularly favorable. Companies are primarily interested in countries that are characterized by low personnel and low labor costs. This is the classic paradigm of doing offshoring business and falls under the category of global efforts called global sourcing. Initially, the process is called low-cost country sourcing. Bhattacharya, Sen and Korschun describe low-cost country sourcing as follows:

“Although the term does not specify which costs are actually lower, one is usually referring to the vast difference in labor costs between the high-cost country (HCC) and the low-cost country (LCC). Typically, the labor cost difference ranges between a factor of two to twenty, meaning that a wage rate including benefits in an HCC of €20 could translate to as little as €1 in an LCC.” (Bhattacharya et al., 2006).

The reduction of costs is not the only reason for firms to be present in LCCs. Low-cost countries are also described as growing fast and increasing customer demands has turned countries who fall into the category of LCC into crucial sales markets. Firms who manage to get a significant market position in LCC can successfully breed cash cows in the future. Taking all these aspects into account it is again very important to remark, that low-cost country sourcing is an opportunity but also a challenge which needs to be planned with great care. As already described above in chapter 2.3, there are numerous risks and challenges to overcome like increased distances for travel or fluctuating currencies. Once this is done, comparative advantage can be achieved. Companies can benefit by that by locating activities of the value chain in a way that reduces cost and thus increases customer surplus (Lockström, 2007, p. 18).

3.2.1 Current global wage differentials

The distinction between high-cost countries and low-cost countries is done because of the categorization on the basis of overall production costs. But this is not the only indicator. The biggest difference between a high-cost and a low-cost country, lies in the cost of labor (see Lockström, 2007, p. 1 f.). Derived from this aspect, a distinction is often made between high-wage countries and low-wage countries. Since the focus of this work is on the relocation of production to low-wage countries and its connection to the supply chain during the pandemic, I am especially interested in international firms activity in LCC. In addition to the subdivision into low-cost and high-cost countries, countries can also be divided into developing, emerging (threshold) and industrialized countries. This distinction takes into account other factors in addition to labor costs such as economic growth per year or unemployment rate.

The following graphic 3.2 shows the real wage index of all G20 countries before the COVID-19 crisis. Real wages are adjusted for inflation and changes in the prices of goods and services, that is why it provides a better representation for countries wage disparities.

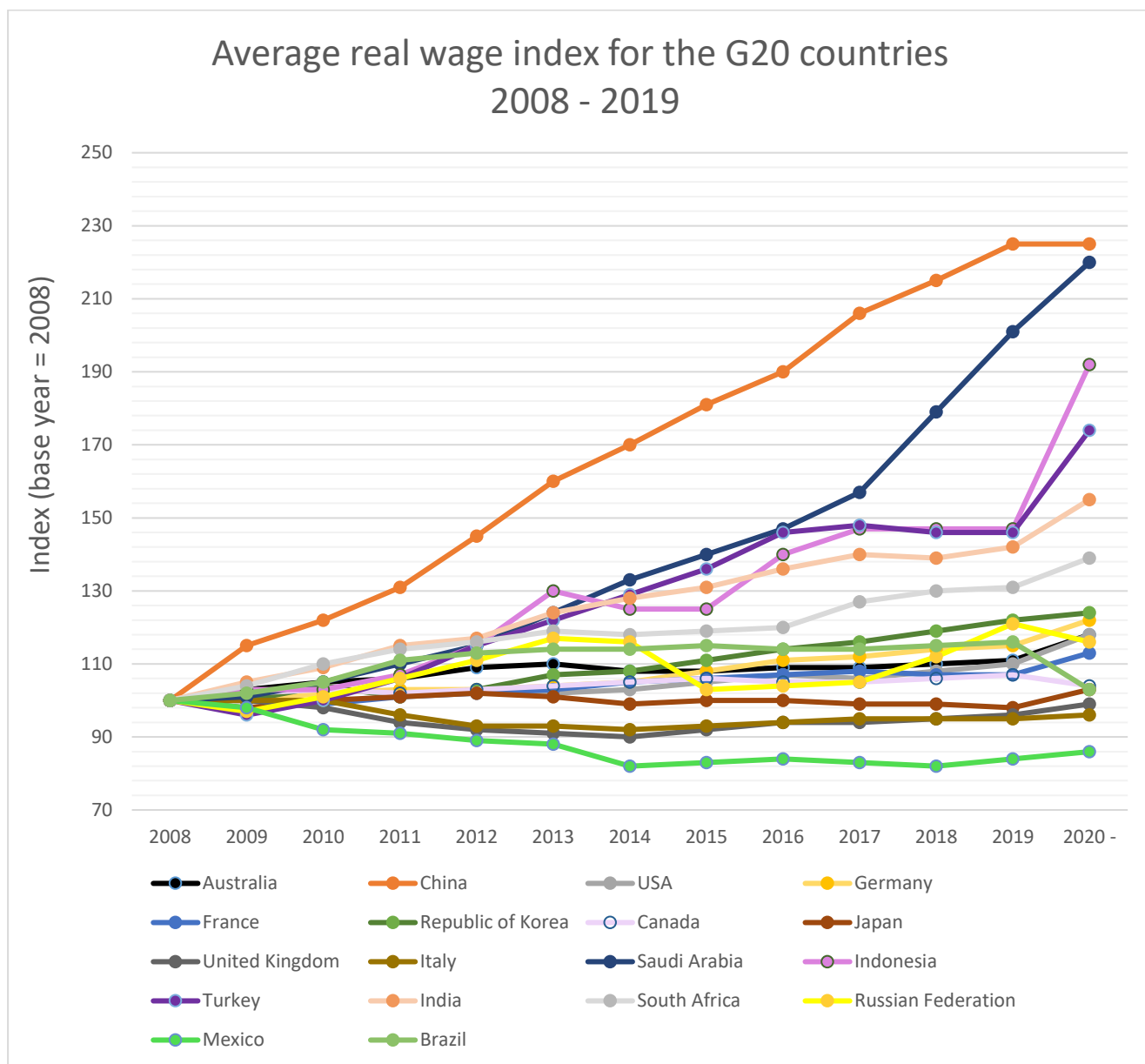


Figure 3.2: Average real wage index for the G20 countries from 2008 - 2019 (following: www.ilo.org, 2020.) Note: From 2019 onwards are the forecasted trends for the following years.

As it can be seen on the graphic, wage growth has excessively increased in countries like China, India and among advanced G20 economies in the Republic of Korea and slightly in Germany. The lines starting from 2019 show the forecasted trends for the upcoming years, where Germany, Australia the UK and especially Indonesia and Saudi Arabia among emerging countries were thought to gain a lot in the upcoming years. Overall, all countries in this group except for Mexico experienced positive growth in real wages over this period of years. There are big disparities already between the G20 countries. On a global perspective, these inequalities in terms of average annual income per capita are

tremendously stronger. Many companies see this as an opportunity to lower personnel costs by lower salaries depending on the country of choice.

The COVID-19 pandemic has obviously changed a lot and it is still not entirely clear how big the impact of the pandemic is on wages in 2020. There is some data from various national statistical offices showing, that around two thirds of countries who officially put these short-term statistics available showed at least slower average wage growth or even a strong jump in the statistics, mostly due to the fact that lower-paying jobs were lost during the crisis. This effect called “composition effect” occurs, when the large scale of people who lose their job are mostly low-paid workers. As a consequence, this will trigger the mean of the remaining employees in a country (ILO Global Wage Report, 2020, p. 36). In theory, events like that have huge influence on offshoring/outsourcing activity and thus, on the global supply chain. If the regular work force cannot work, this will negatively influence the global distribution and the global supply chain market. Nonetheless, in the years before the crisis, real wages increased most rapidly in Asia and the employment rate was high. This is not just only the merit of China, but also due to other countries like India, the Republic of Korea, Vietnam and Thailand, where real wage growth among workers grew the most out of all regions over the period of 2006 – 2019. In comparison to that, real wages increased much more slowly in Northern America and in Northern, Southern & Western Europe (ibid, 2020, p. 33).

This observation is part of the whole notion that threshold countries are getting more and more important by the day. This effect has lasting consequences on how offshoring/outsourcing is done and in combination with economic and political uncertainties in the presence and future like pandemics, industrialized countries are more and more pushed towards reevaluating their actions and needs and contemplate new strategies on how to agitate with the new rules pushing the boundaries on the global supply chain. In the next chapter I am going to deal with the rising importance of threshold countries, since some emerging countries have also begun to outsource their production, in particular well-developed countries like India and China, who both have a high level of technology. The motives are similar to those in the industrialized countries, but the access to foreign technology is particularly noteworthy in threshold countries. Due to that access, the development can be accelerated considerably.

3.2.2 Rising Importance of threshold countries

To make the work easier to understand, it is essential to note that terms like threshold countries, emerging countries, (big) emerging markets (BEM) or newly industrialized country mean the same thing. They all describe a market that has some characteristics of a developed market but does not fully meet its standards.

Since reforming the economic system in the 90's in Asia and eastern Europe, emerging countries rapidly grew as witnessed by the replacement of the G8 group by the G20 as the economically strongest countries worldwide. The economic performance of threshold countries is also reflected in the fact that prosperity in emerging economies has increased. The rise of the emerging economies had an impact on the developed world. Manufactured goods from emerging countries found their way onto the markets of industrialized countries and have triggered strong structural and adaptation effects there. Cheaper products were available for consumers and this led to an increase in purchasing power. In the 00's countries like Brazil, Russia and India also entered a path of growth and formed together with China the BRIC countries. Within industrialized countries, the share of trade flows shrunk in total, because of the growing importance of emerging economies. Chinese exports accounted 2008 for 16.5 % of the US and 13.3 % of the EU imports, while the Japanese cumulative weight of the US and EU in its total export dropped dramatically in the 00's, from 31% in 2000 to about 19 % in 2008, while trade within East Asia gained a boost over the years between 2000 – 2010 (Borin A. et al, 2012, p. 8). Still, the introduction into the economic world market of emerging countries had a positive turnout for many industrialized countries. The great demand for goods in these countries, for instance from Germany, have increased the exports to industrialized countries. In addition, many companies have started to promote local production in the emerging countries and thus bring specific knowledge, in particular to emerging countries, which are continuing to grow as a result (Deutsche Bundesbank (2015)).

Principally speaking, the emerging countries still have considerable growth potential. The productivity gap and the income gap are still very large. The main requirement for

the emerging economies to catch up are, that the expansion of reforms is being carried out, especially in China and the Eastern European countries. For the latter, considerable European integration is of high relevance. For threshold countries who heavily rely on raw material extraction differentiation is noteworthy, so they can achieve a status with less dependency on raw material production. The emerging markets of emerging economies have a lot more to offer than just low labor costs. On a firm's scale, emerging multinational companies (EMNC) have closer ties with their governments than their OECD peers. That is why these EMNCs often remain state-owned or at least state-controlled, especially in the oil and telecommunication/IT sector (Goldstein, 2009, p. 144). The cost saving agenda of the late 1980s and 1990s therefore turned to an anachronistic side note, as many things have changed significantly. Threshold countries can compete with industrialized countries in a number of sectors, like mathematics, telecommunications or science. India's telecommunication and information technology plays a major role on a global level in providing high class technological solutions (IBEF, 2021). In Russia, a high technology business area named "Skolkovo" was constructed in the last decade to directly compete against the infamous American innovation center Silicon Valley in California. Over 250 firms belong to the business area not far away from Moscow (SK, 2021). Skolkovo includes different clusters, each belong in the area of information technologies, telecommunications, space technologies and nuclear technologies. Facilities like that have drastically changed the way how threshold countries are perceived by the industrialized world.

All in all, the emerging markets have caught up and developed significantly over the past 20 years. The share in global economic output has risen sharply. However, this trend seems to be weakening recently. The foreign direct investments at the global level are in 2017 fell tremendously (- 23%). With growth rates around 0% in the industrialized countries, the cross-border investments to threshold and developing countries have declined. This development worries politicians and economists around the world, particularly in emerging markets. For these countries international investments is vital to keep industrial development going (UNCTAD 2018).

The reason for this is presumably to be found in the industrialized countries, where there has been a decline in demand. The COVID-19 pandemic is yet to be included in this assessment. These factors trigger the competition between first world countries and emerging countries. To further understand the differences between Emerging Markets and industrialized markets I will now compare the two directly with each other.

3.3 Comparison between developed market and emerging market

To compare both markets accordingly in the beginning, I will pick the two most prominent members from their respective markets: The United States and China.

The labour productivity of a country is a significant indicator for the wealth, growth and overall capacity to compete worldwide. The indicator provides information about the efficiency and quality of the work factor in the production process. In the years between 2014 and 2019, China's labour productivity stuck between 6.926 % YOY⁵ in 2014 and 6.166 % in 2019. China's population reached 1,400.05 million people in Dec 2019, while its unemployment rate increased to 4.24 % in Dec 2020. Monthly earnings of China stood at 1,070.78 USD in Dec 2019. In the United States, the labour productivity rate is significantly lower, ranging between 1.5 % in the beginning of 2015 and 1.4 % in mid. 2019. In 2016, the labour productivity rate was even negative (Ceicdata, 2020). Economists anticipate, that in the next few years, wages in these two countries will continue to converge, but China is still very far away from the American standard.

The gross domestic spending on research and development (R&D) is another important aspect, which reflects the competitiveness of a country. If a country does not invest in R&D, it cannot stay competitive in comparison to a country which invests. A well invested stock of human knowledge is a major catalysator for globalization. In figure x, we can observe that China continuously approached the American level of R&D spending. It started well below 100 billion in 2000 and raised to over 400 billion in 2018, while the US spends just over 500 billion in 2018. China heavily emphasizes on R&D and in its 13th five-year plan (2015 – 2020) targeted 2.5 % of GDP on R&D by 2020. In 2019, China spent 2.23 % of GDP on R&D. These expenditures can compete with the level of spending of the United States (Chinapower.csis, 2019).

⁵ Year over year

The import content of export, as % of the total exports is an essential figure to judge the intensity of offshoring a country undergoes. As can be seen in figure X, the share of imported inputs in exports in all economies increased during 2005 – 2015, except in China. In Hong Kong it increased by 6.4 % to 26.7 % in 2015, while in the USA it cautiously increased from 9.3 % in 2005 to 12.6 % in 2015. In Japan, the import content of export increased by only 3 % to 13.4 %, while Germany stuck between 19.3 % in 2005 and 21.8 % in 2015. India in comparison grew by only 0.4 % in 10 years to 19.2 %. China had a high import content of export share in 2005 with 25.7, but it diminished down to 17.4 % in 2015.

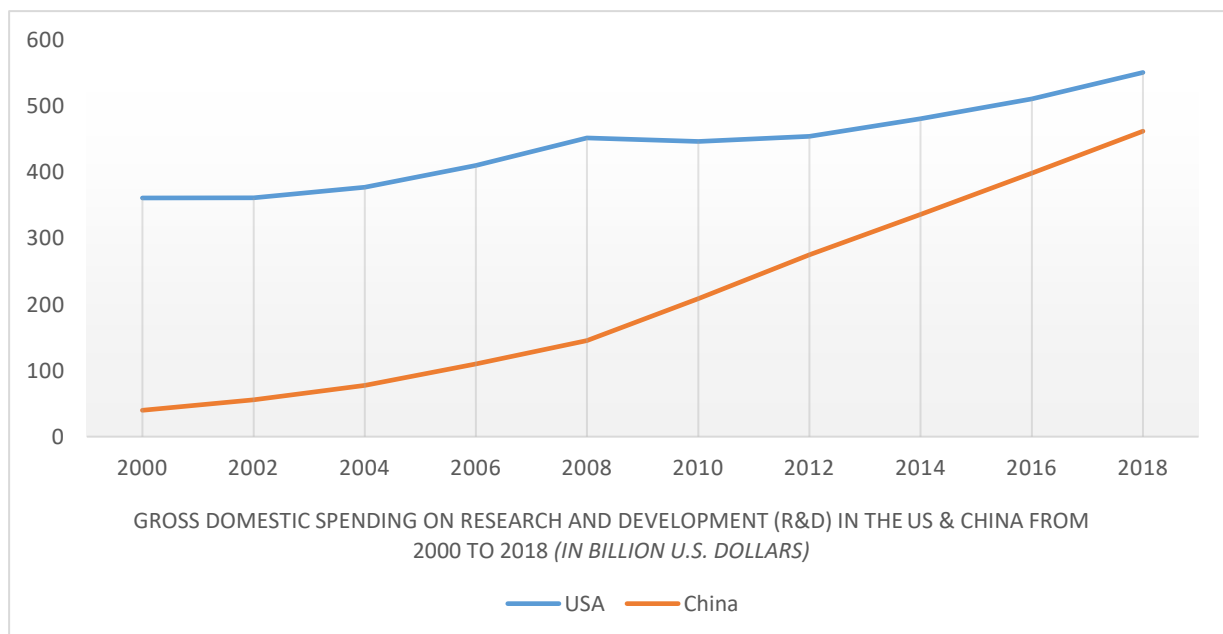


Figure 3.3: R&D spending table based on own figure (following <https://www.statista.com/statistics/1102478/research-and-development-gross-domestic-spending-g7-countries-china/>, 2018.)

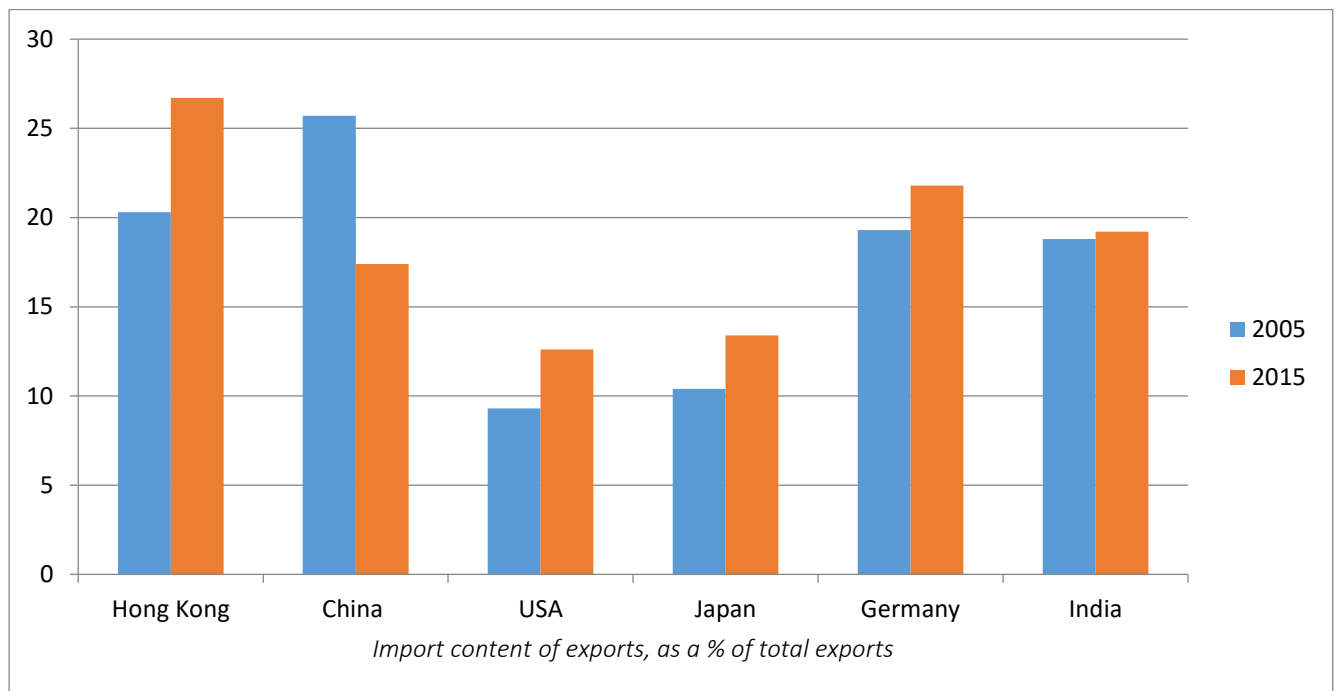


Figure 3.4: OECD Input-output tables based on own figure (following <https://www.oecd.org/sti/ind/input-outputtables.htm>, 2015.)

In Figure x and x the total factor productivity from 2010 – 2019 at constant national prices for China and the United States are shown. The TFP of China stays between 0.94 and 1.0 during that time period, while in the US its between 0.974 and 1.016. As already described in chapter 2.4.1 of my work, the TFP is a crucial economical key figure, because it shows observers and scholars how efficient countries perform without attributing the accumulation of capital and labor, which normally are parameters that are always associated with growth. The TFP describes inputs that are being used more efficiently, such as productivity or technical know-how or human creativity connected with innovation (Investopedia, 2021). The TFP was often used as an explanation for the growth of the Asian states during Japan's economic boom in the 80's (which already started in the 50's) or the economic growth of the tiger states from the 1960s to the 1990s (World Bank, 1993).

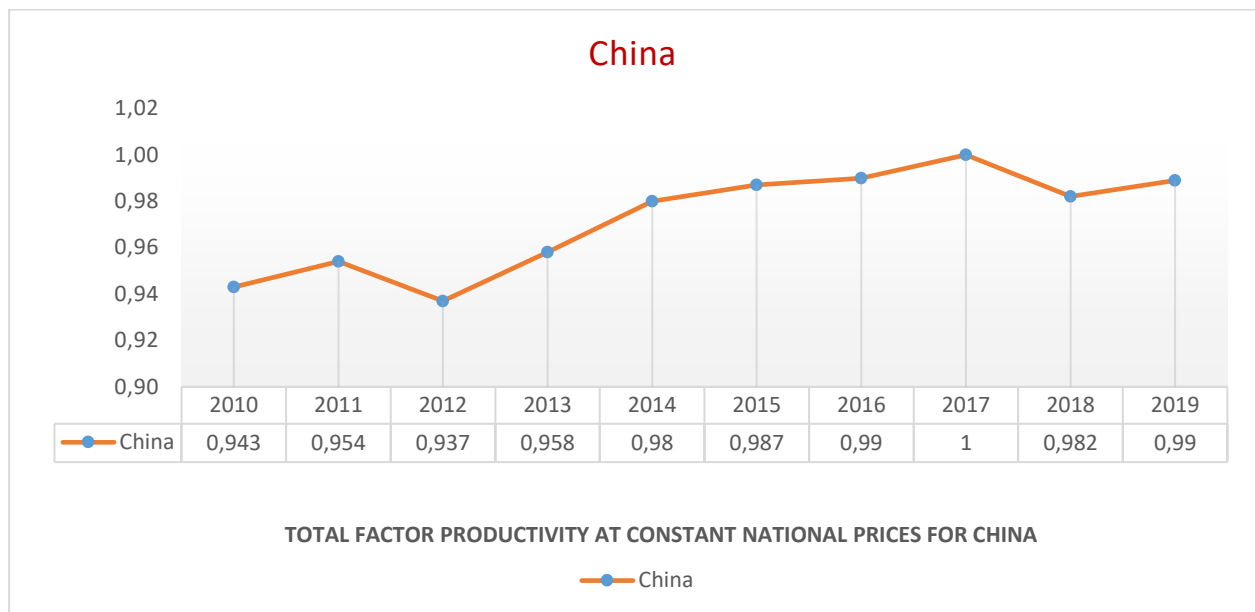


Figure 3.5: Total Factor Productivity at Constant National Prices for China based on own figure. (following <https://fred.stlouisfed.org/series/RTFPNACNA632NRUG>, 2019.)

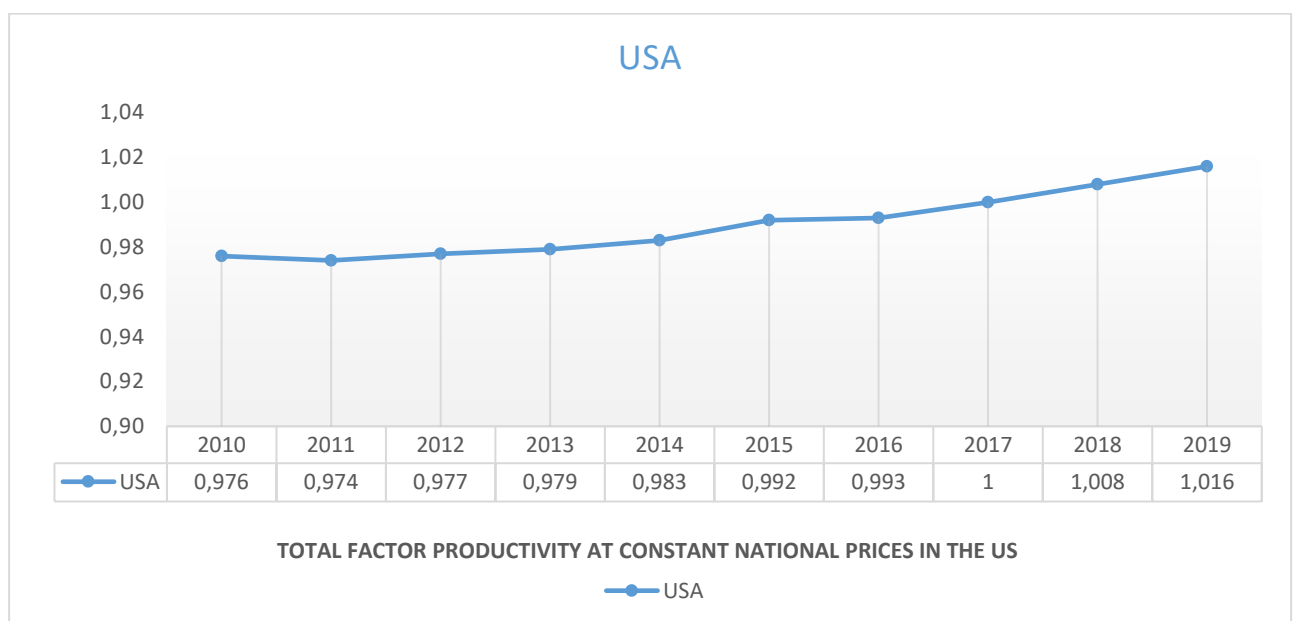


Figure 3.6: Total Factor Productivity at Constant National Prices for United States based on own figure. (following <https://fred.stlouisfed.org/series/RTFPNAUSA632NRUG>, 2019.)

Concerning the TFP of China, there has been massive critique on its economic development by western scholars. Especially Krugman in his paper “The myth of Asia’s miracle” from 1994 hideously criticized the Chinese economic boom as a mere accumulation of inputs based on less efficiency. The extent on how unique China’s growth in comparison

to other Asian countries is, is still not very clear even to this day (Sun & Troilo, 2011, p. 657).

However, what is considered true is, that emerging markets like China, India and Russia rely heavily on the industrialized countries increasing their own exports. These emerging countries are developing from the labor-intensive shoe and clothing industry to more capital-intensive goods. Developing countries like Bangladesh and Vietnam took over these industries to fill the void left by the emerging countries. Now these emerging markets and their corporations are also heavily engaged in offshoring activities (Hanson, G. H, 2012, p. 52). There is a differentiation between countries “stuck” in the assembly stage” and emerging markets slowly proceeding to improve to the manufacturing stage. The latter is the stage some Asian emerging markets like Hong Kong, Korea, Singapore, Taiwan and to an extent China is, while many countries in Latin America, for instance Mexico and Brazil remain in the assembly stage (ibid, 2012, p. 47). While in the late 90s and early 2000s China was in the process of processing plants that assemble imported parts (assembly stage), it has now differentiated and evolved its approach to globalization (Feenstra & Hanson, 2005). As in industrialized countries, companies in emerging countries will operate in offshoring activities to save factor costs and to restructure their production process. The difference is that gaining access to better inputs for production plays a much more essential role in emerging countries than in industrialized countries.

There are two major challenges for the Asian countries mentioned above. First to integrate themselves closer to the main market of technology, which is still heavily dominated by some western countries, initially by the United States and secondly to invest into education. In China’s example this means to broaden the level of education also to other regions in the country, which are not directly or not too far away located from the yellow and East China sea. The reinforced opportunities to outsource services also require a higher level of education and will disadvantage groups with lower skill levels, if education is not redistributed accordingly. China’s main problem is the education level schism across its regions. The number of undergraduates per 10.000 population is a significant indicator to show the education development in a region or a nation. In China, the three provinces with the greatest number of undergraduates per one hundred thousand population are solely in the east. Contrary to the east, Yunnan, Guizhou and Tibet are the provinces with the least number of undergraduates and all of them are located in the west. The rate of higher education to GDP growth follows a similar pattern (Wang, L. & Xiao,

W., 2017, p. 6796). China's main task is to formulate a long-term plan to support the development of education in the poorer western region and to increase the performance level of businesses located in the west to further prepare for outsourcing opportunities. The integration of the non-eastern regions in China will also increase political stability in the country, which is only convenient for its offshoring activities and its strategic innovation objectives. In economic policy and political science, one of the main fundamentals to ensure economic prosperity and innovation is political stability (Posner, A, 1997). Income inequality and a huge percentage of poverty will lead to political instability. Social neglect will lead to riots and violence. The history of threshold countries is filled with political instability and thus negative consequences on economic prowess. Some emerging markets have tremendous authoritarian traits, for instance China. The upcoming decades will show how emerging markets will deal with increasing demand of civilians on democratic participation. This will obviously influence the economic stability and economic performance of their respective country.

To summarize, although many emerging countries are benefiting from the offshoring phenomenon and are experiencing an enormous economic growth, there are still many problems and uncertainties regarding the future. Emerging economies are also driven by their own social problems and are caught up with economic problems. These include growing inequality as well as educational, infrastructural and institutional constraints that are being dismantled. It has not yet been decided who will be the winners of the benefits of globalization and whether social goals can also be achieved through globalization. Technological change is also inextricably linked with the consequences of globalization. The economic growth is in large part due to technological developments. At the same time, the technological innovations have a destabilizing effect, especially in regard to the impending loss of jobs. Due to the COVID-19 pandemic the globalization agenda may undergo significant changes of either revolutionary or sustainable nature. This will be now discussed in the second half of my thesis.

The pandemic and the global supply chain

4.1. Introduction

The pandemic has moved the boundaries in nearly every possible direction and set off alarms in every industry or segment which exists. For the so-called western world, this was a shock, as the world we knew it was put on hold and we had to limit our freedom. Something, which sounds blasphemous in our liberal and individual driven society. Economically speaking, the supply chain disruption left its scars. One of the most popular articles by Tonby and Woetzel (2020) stressed the fact that we will have to move from globalization to regionalization and that the Asia world could prove its ability and emerge as winners after the pandemic. In the wake of this crisis, we could observe a massive restructuring of supply chains, by production and sourcing may move closer to the end consumers and companies may be driven to regionalize their production chains and near or backshore (Tonby & Woetzel, 2020, p. 5). In other words, the current model of global supply chains shows to be an anomaly, especially for commodities with a concentration around vulnerable nodes. The magnitude of this pandemic is yet to be seen. How are we going to look at it come 10, 20 or 50 years? It is very well possible, that we will look at this event like historians, economists or intellectuals look at the fall of the Berlin wall, or the collapse of Lehman brothers in 2008 and the economic crisis back then with the subsequent rescue of the financial sector by governments. We live in a time of tensions and adversity. Protectionism versus Globalization, political left versus right, the shifted role of discourse (over truth) in a post-modernist world are examples for these tensions. Narratives become more important than data and the sensation of the backstory of “tensions” are massively pushed by the media, since we live in a world which needs an adversary.

The COVID-19 pandemic makes those other tensions visible, but also replaces them strongly. At the same time, it introduces new discussions on how politics and economy (international business) can be done. Some of these discussions resolve around the digital world, other operate on tourism and how experience could go virtual, if tourism is not possible? Other discussions question the main notion of the 20th century, which is competitiveness. Can it be replaced by cooperation, collaborative intelligence, digitalism and co-creation? What about supply chain management? Can it be replaced by virtual supply networks, while still achieving the same level of minimizing costs and optimization like traditional supply chains do? Obviously, it is not the topic of this work to discuss or even to answer these questions, as they are too far-fetched. But when discussing the COVID-19 pandemic, the most important aspect is to draw rational conclusions and not to stick too much in the past in between older tensions. Then we can be innovative and try patterns that have not been tried before. The COVID-19 pandemic may be a chance for that.

4.2 The disruption of globalization and offshoring

Globalization is everywhere. It has many dimensions and wherever we lay our eyes on, we will not see many things in our life, which is not affected by Globalization. Dr. Nayef Al-Rodhan and Gérard Stoudmann defined Globalization in their article from 2006 “Definitions of Globalization” as a process of economic integration, e.g., the transfer of policies across borders, the transmission of knowledge, as well as cultural stability and most importantly the reproduction, relations and discourses of power (Al-Rodhan & Stoudmann, 2006, p.3). It is an abstract dimension, connotated by some as evolutionary progress and by others criticized as a destabilizing enforcement on poor countries by rich countries. Due to the pandemic now, many of these dimensions and characteristics have been questioned. How severe has or will the pandemic disrupt globalization and thus, offshoring and outsourcing? This chapter will provide a diagnosis on that matter.

4.2.1 Globalization and Global Supply and Value Chains

The main engine behind production across national borders are the global value chains (GVCs), efficiency driven with the objective to relocate production to low-cost countries to save labor and production costs. The expansion of GVCs have exceptionally risen

since the early 1990s, when the world entered the era of hyper-globalization. This hyper globalization is characterized by world trade overtaking world GDP significantly due to low cost of information and communications. This has resulted in the most dramatic turnaround in the economic fortunes of developing countries, because broadly open systems are good for the world and for average citizens in all countries (Subramanian & Kessler, 2013, p. 4, 18). In the global economic crisis 2008-2009, this process of hyper-globalization stagnated, but resurfaced in the next decade, albeit in the wake of protectionism talks by several countries. Internationalized firms found out they were exposed to more risk during and after the crisis when comparing the cost savings from global supply chains (GSC) with risk exposure from their implementation. Similar to the global economic crisis in the late 00's is the current situation with COVID-19. The risks of failure and the costs of GSC are higher now, than back in 08-09. This is additionally explained because of higher tariffs due to trade disputes, for instance the US-China trade war. This trade war under the Biden administration has not made any changes to tariff structures (The Diplomat, 2021). What happens at the very peak of world economy and politics affects us all, especially the supply chain strategy of the top economic countries in the world. Furthermore, the COVID-19 situation has triggered a reassessment of how not to waste any resources and further enhance production even with significantly less workforce. Robots are implemented and more used now in the production area of industries, making it less expensive in developed countries. Many international companies originating from developed economies have been re, or nearshoring production back to their home country or in less risk affected destinations, while further enhancing robots in mass-production and logistics (Kilic & Marin, 2020).

In supply-chain management (SCM), experts distinguish between operational and disruption risks. While operational risks are less damaging, as they describe lead-time and demand errors, disruption risks are tremendously worse in damage. Examples of disruption risks are natural disasters, wars or pandemics (Ivanov, 2020). Because of the globalized structure of GSCs, many companies and thus, countries became very prone to epidemic outbreaks. The COVID-19 outbreak from the Wuhan area in China is no exception. The disruption risk type: Pandemics is different in its characteristics. It starts small, but increases in size and infests many geographic regions. Ivanov describes three individual components typical for SC risks:

- Long term disruption existence and is unpredictable scaling
- Ripple effect and epidemic outbreak propagation in the population
- Simultaneous disruptions in supply, demand and logistics infrastructure

Recent examples include SARS, Ebola, swine flu and COVID-19 (ibid, 2020). Due to this multifaceted effects and risks, it is not to wonder that COVID-19 might cause long-term economic disasters in numerous countries across the world. These effects have very much questioned globalization as the global main model overall (The Economist, 2020). Not only in the mind of normal citizens, but also at the HQs of multi-national enterprises. The pandemic is toxic to international business and combined with protectionist intentions by governments, we could very well see a rethinking on many aspects concerning globalization. This cannot be scientifically proven now as it stands, because we are still in the midst of a pandemic, but we can still draw our conclusions.

4.2.2 Implications on Multinationals and International Business

One aspect is quite clear: the overall impact of COVID-19 on international business is still to unfold. We have seen many occurrences in the last couple of years that had a lasting effect on international business. The departure of the United Kingdom, as well as the economic policy of the Trump administration combined with volatile energy prices in various segments had a (negative) lasting effect on international business and management. Some economic sectors are highly suffering due to the effects of the pandemic, while others not so much. But it is not only behaviour economic sector, which decides the fate of companies during times of global disruptions, but also the size of companies. MNC's are more and more fragmenting their value chain by outsourcing value chain activities where it is most efficient. This has changed over the past 30 years due to major changes in behavior of global economic activity. Buckley and Strange call these changes and implications in their 2015 article on "The governance of the global factory" global factory (Buckley & Strange, 2015, p. 2) However, this phrase has been used well before 2015. Gereffi (1989) used the term "global factory" to represent a global manufacturing system, where production capability is distinguished to a various amount of developing as well as industrialized countries. Since the modern era, the costs of internalization exceed the

benefits, changing the structure of MNEs significantly away from highly internalized institutions. The market imperfections have reduced because of deregulation and liberalization of trade and investment and the rapid development of tele communication, technology and digitalization (Buckley & Strange, 2015, p. 4-7). Multinationals and therefore international business have more and more become like networks, similar like a neuron, with branches connecting various branches of the global value chain. The networks with the highest coordination and management control with their value chain partner has the biggest advantages (Christopher & Towill, 2000, p. 206-208). This network system of MNCs (Multi-national corporation) promises cost advantages and diversification benefits, but also comes at a cost, because it increases abruptly the complexity of such a system. Like everywhere else, reliance on highly complex structures makes it vulnerable to unpredictable disruptions like pandemics or natural disasters.

COVID-19 and other, similar disruptions in world history are so called supply shocks. Supply shocks are unexpected, surprising events that change the supply of a product or trade task. It can be positive or negative and it requires an unforeseen change in price to qualify as a supply shock. The COVID-19 pandemic was a negative supply shock, because it resulted in decreased supply and demand (Investopedia, 2020). Many of the most gifted and economically strongest countries experienced heavy supply shocks, for instance China, Korea, Italy, Japan, the United States and Germany. These countries are protagonists in the global value chain, with each of them being an important supplier to each other in various economic sectors, from manufacturing exports to the automotive sector. These nations account for about 55 % of the world GDP, about 60 % of manufacturing worldwide and 50 % of overall manufacturing exports.

Large economies & COVID-19	GDP	Manufacturing	Exports	Manufactured Exports	COVID-19 cases
US	24%	16%	8%	8%	0.1%
China	16%	29%	13%	18%	8.52%
Japan	6%	8%	4%	5%	0.3%

Germany	5%	6%	8%	10%	0.2%
Italy	2%	2%	3%	3%	2.7%
UK	3%	2%	2%	3%	0.1%
India	3%	3%	2%	2%	0.0%

Figure 4.1: Large economies and COVID-19, based on own figure, 29. February 2020. Sources: World Bank's World Databank, WHO)

Any supply disruption and negative (or positive) demand shocks in one of these listed nations will have global consequences. These global repercussions will slow down trade substantially not only in the economically speaking most powerful nations, but in the entire world, resulting in a “supply chain contagion”, which is another word for a global recession. In this case, the supply shocks in these markets who do the most trade will have negative consequences on countries, that are much less addressed by the pandemic (Baldwin & Tomiura, 2020, p. 60-61).

This shows the inevitable consequences the complex interconnective attribute the global trade market has with its GVC system and it highlights the vulnerabilities of the modern MNCs. Today's GVCs are built solely on efficiency and cannot cope with consequences with high impact disruptions like a global pandemic. This calls for procurement and balancing efficiency activities, but as well for competitive risk management in global management. The code word for a better future is resilience management. Lean and effective value chains will stay prone to unforeseeable disruptions if they cannot build a better resilience management. It is not only with pandemics, but also small, localized events like fire, earthquakes, volcano disruptions or floods can have major GVC disruptions. We have seen examples like this in the last decade, highlighted by the Fukushima incident, the 2004 tsunami in South-east Asia and on a lesser scale, the 2010 eruptions of Eyjafjallajökull in Iceland.

4.3 Improving Resilience of the Global Value Chain

The one-sided focus of the last decades on lean structures, efficiency and cost reduction had major consequences for the global economy and thus, for the existence of many humans all over the world. Due to our ignorance, many people predominantly from poorer countries and from socially weaker strata all over the world are suffering from the economic consequences of the pandemic. We must clearly recognize that traditional risk assessment management cannot deal with future unforeseeable and unpredictable events like the one we are experiencing right now. That is why MNCs need to adopt new management models that take the increasing diversity and complexity of risk into account (Gunasekaran et al., 2015, p. 6810-6811).

These new management models built on the idea of balancing efficiency considerations with the management of all type of risks could very well be the new agenda set by MNCs. I have many times already mentioned in my work, that some scholars do predict, that the pandemic will move MNCs to re-shore some of their value chain activities. But instead of highly internalizing the organization, it could be much more realistic that MNC will set the target straight by improving the resilience of the GVC and move away from the one-sided concentration of profit-maximation and efficiency. The term “resilience” experiences increasing acceptance in the world of (international) management to describe organizations, economies or societies and their capability to maintain functionality and to learn from disruptions or other negative events. The term “resilience” originates from Latin and means to “bounce back, to leap” (Macmillan dictionary, 2021) and describes the current incomprehensible situation we are finding ourselves since the outbreak of the virus. From an economic point of view, building higher resilience could be one of the few ways to adapt to a post-pandemic world. It becomes an important organizational capability to avoid or successfully deal with similar future catastrophes (Sharma et al., 2020). Common traditional probabilistic risk assessment and professional resilience assessment are quite different in their approach. While probabilistic risk assessment tries to forecast disruptive events and hazards, the latter emphasizes on maintaining functionality and reorganize more rapidly during disruptions. To foresee hazards and disruptions is a very hard and unsecure procedure, which is limited in analyzing complex systems, that are characterized by masses of uncertainties. The number of large uncertainties is very hard to analyze

in the probabilistic risk assessment, so increasing the resilience of the system from inside out to make it more stable against disruptions is the far better way to deal with hazards, then to try to avoid unpredictable events, which are simply not avoidable (Van der Vegt et al., 2015). This strategy however goes at the expense of efficiency and productivity gains that globalization has brought. Moving away from the efficiency driven mindset and replace its portfolio with different values like economic self-sufficiency could prove convenient for MNCs.

4.3.1 Balancing risks and opportunities

There are different consequences embossed on both sides of the coin. As described above, global value chains which become increasingly regionalized will turn out to be significantly less affected by global risks and any other supply chain disruptions. But going that way will also result in a loss of efficiency, due to not allocating resources accordingly or missing out on realizing higher potentials from specialization. Nearshoring to a more limited geographical area could also reduce a manufacturing firm's ability to be flexible. This could turn out to be a bad consequence when hit by region-specific shocks (Arriola, 2020). The configuration and implementation of a combination of both ways could balance the risks and opportunities in a respectable manner. Investing in the creation of resilient value chains could enhance the balance of risks and opportunities. This notion was discussed way before COVID-19 and similar disruptions. Helena Carvalho et al. described in their article "Supply chain redesign for resilience using simulation" from 2012 two fundamental characteristics, where resilience could be designed-in by implementing the following responsiveness capabilities: Redundancy and flexibility. These two capabilities are resilience amplifiers and can be used by MNCs as a strategy to deal with disruptions by increasing responsiveness capabilities through the usage of redundancy and flexibility (Carvalho et al., 2012, p. 331-332). Flexibility goes hand in hand with redundancy and is defined as the skill set to restructure previously existing capacity, while redundancy is described as a share of additional capacity as a replacement for the loss of capacity resulting due to disruptions and disturbances. There are many ways on how redundancy can be done, the most common form however is the easiest one: Make sure

to keep some resources in reserve so they can be used in times of disruption and uncertainty. This can be done through multiple ways, for instance by having different and various suppliers, extracting safety stock from these suppliers and thus, having an amount of overcapacity. These are one of many safety measures MNCs can take to lower the likelihood of negative GVC disruptions. Either way this comes at a cost for MNCs, as transportation costs increase, while efficiency decreases, because the safety stock is being piled up in times where no disruptions are experienced. This causes an underutilization of already existing resources.

Carvalho et. al argue that the measures against disruptions (additional suppliers, safety stock, back-up stock) can be seen as an insurance against uncertainties. Due to that “insurance premium” MNCs can adapt faster to significant changes. Psychologically speaking a company’s consciousness may be more resilient to uncertainties and more innovative and consequent in its decision making due to the safety measures it took by creating safety stock and capacities. This flexibility may allow companies to adapt faster to significant changes in the global value chain.

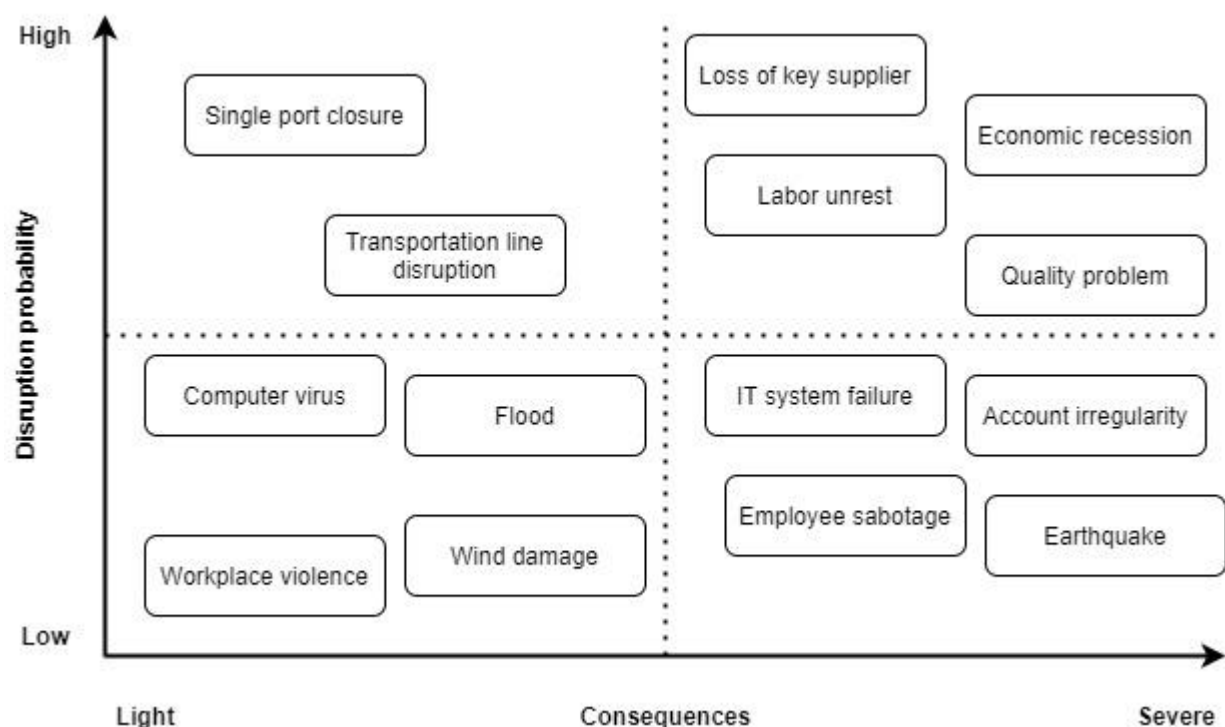


Figure 4.2: Enterprise vulnerability map based on own figure (following: Sheffi, Yossi & Rice, Jr, James. (2005). *A Supply Chain View of the Resilient Enterprise*. MIT Sloan Management Review.).

The figure x shows various “vulnerabilities” a company can suffer from and the severity of the consequences of each disruption. Maps like these can help companies to prioritize their actions against disruptions. Depending on the company’s position in the competitive market and its responsiveness in the supply chain it will either lose market share after experiencing various disruptions listed above in figure x or solidify their position or even successfully upscale (Sheffi & Rice, 2005, p. 44-45).

Everything written above is summarized in Figure x below. Investing in redundancy increases costs, but also the firm’s flexibility, while the efficiency decreases. This will lead to an equilibrium between efficiency, redundancy and flexibility with the main objective to create more resilience and thus minimize a MNC’s vulnerability and global value chain risk.

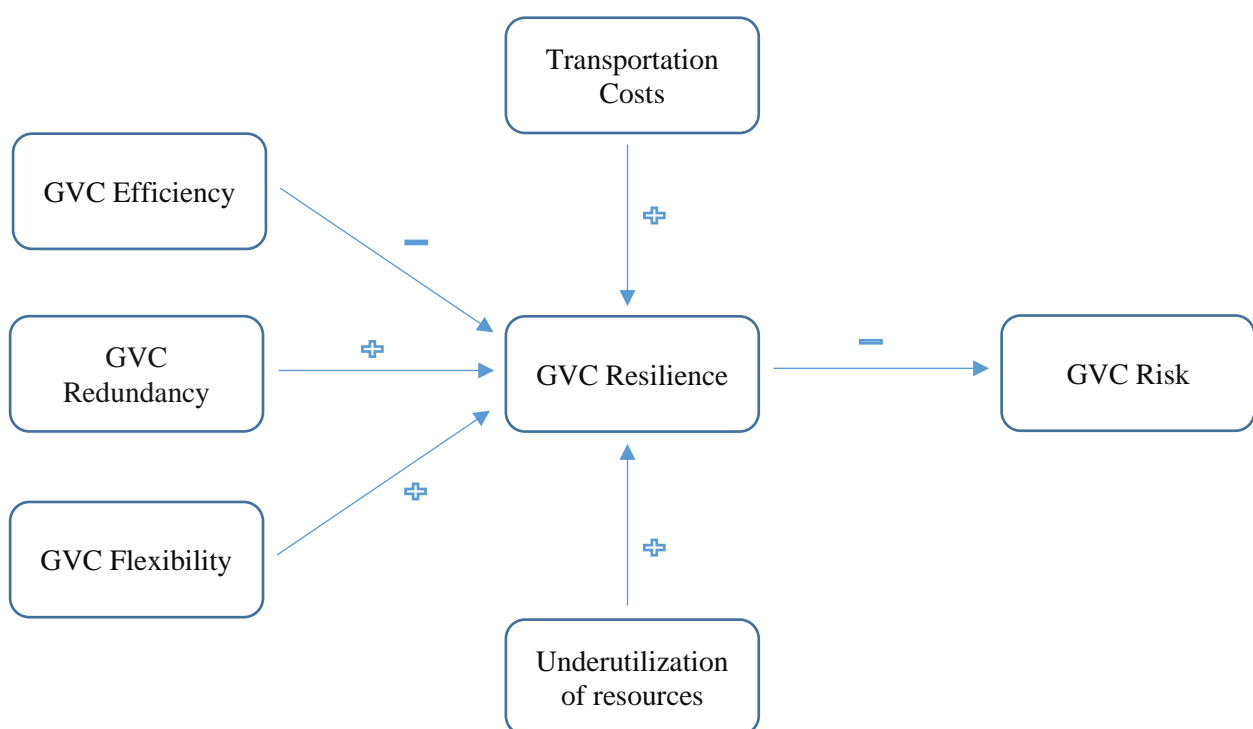


Figure 4.3: Effects of Global Value Chain Resilience based on own elaboration and figure.

It is to be acknowledged that these risk-mitigation models surrounding the creation of resilience are still in their infancy. It will take some time and definitively some cross-examination by scholars of international business between various companies and multinational corporations around the globe. COVID-19 can be used as a collective mass experiment to find further results on that subject. This can be done classically empirical by subjecting hypotheses to this topic on different levels of aggregation (individual, organizational, national) or by working with individually selected case studies.

These past decades MNCs have been the ones to orchestrate the global value chain solely based on maximizing efficiency. By doing that MNCs have got increasingly vulnerable by risks and disruptions. The main point of this chapter was to show how important higher resilience is to withstand disruptions in the global value chain. This chapter or even this work's proposition is not to bring arguments against offshoring or globalism, but to point to the possible vulnerabilities of modern MNE as an organizational form. The act of separation of basic functions and activities within a corporation's boundaries is highly risky. The effects of COVID-19 in 2020 reflect that. But not only pandemics, also trade wars and other unexpected critical events have shown that phenomenon. MNCs need to find the correct balance between focusing on efficiency without falling vulnerable to risks and emphasize on building resilience, without becoming excessively uncompetitive and disadvantage supply chains. However, this dilemma is not new to decision makers, considering how many decades it has already been an issue before.

The process of reshoring to Europe: Concepts, case study and frameworks

5.1. Introduction

The topic of internalization covers a large proportion of my work. One important part of the internalization framework is the phenomenon of reshoring. In my last chapters I have written a lot about offshoring, outsourcing and its relation to the global value & supply chain, as well as increasing the security of supply-related policies through establishing GVC-resilience. Out of political reasons, the notion of offshoring has become increasingly important in the world, particularly in the European Union and in the US. The international order in the wake of supply shortages due to the pandemic has ultimately changed to the geopolitical rivalry between the United States and China, while the European Union takes somewhat a secondary role in this fierce competition. The evidence on reshoring highlights, that in the last decade reshoring activities are on the rise, especially in certain industries (more on that later). In the United States during the final months of the Trump administration in 2020, reshoring created more jobs than FDI, primarily in the transportation equipment and electronics sector (FDI intelligence, 2020). On a political policy level, Japan's reshoring strategy is to directly pay companies to shift production back home, especially from China (Japan Times, 2020). This could very well work as an impetus for other countries to do the same, especially with insecure supply chains all over the world due to the further unpredictability of the COVID-19 pandemic and its various mutant strains.

In this following section, which will be the most relevant section of my thesis, I want to emphasize on the European Union, the industries and companies in relation to reshoring. It will discuss the following key points:

- Certain European industries
- Its likeliness of reshoring activities
- Possible places of nearshoring/backshoring
- Reshoring before COVID-19 pandemic
- Strategic autonomy (the competitiveness of the EU economy)
- Empirical evidence on reshoring based on case studies operating on specific products

There are many sectoral potentials for the European Union for reshoring out of different reasons, which are either political or economic. Due to the COVID-19 pandemic, sectors which out of political reasons undergo reshoring processes tend to increase, because of regional competitiveness and possible product shortages and supply security.

Furthermore, the following chapter will present reshoring-related policies after COVID-19 enabled by two key trading partners of the European Union: The United States and the Russian Federation. This will showcase that there are examples of successful reshoring activities in other countries, but it can only be taken as an exception to the general rule, which is that overall reshoring policies implemented are still very limited.

To the end of this main chapter, I will present two case studies out of two different industries with two different factors: One case study out of the electronics industry, driven by economic factors and one case study out of the pharmaceutical industry, but this time driven by political reasons. The result of this case study will showcase the line of approach of future reshoring dynamics in the European Union. This marching course will be heavily dependent on political change and the intention and willingness of policy makers for overall policy change.

5.2. Reshoring of production activities in European manufacturing

The onset of reshoring production activities in Europe is heavily connected to the renaissance of geopolitics and the change of the international trade order, especially now during this Coronavirus catastrophe. The discourse about the division of labour and production is very old. Adam Smith and Émile Durkheim discussed consistently multiple possibilities of how to divide labour and production in their books, the latter especially from a sociological point of view. Adam Smith accentuated that the division of tasks would lead to economic progress and prowess by providing a more efficient means of producing goods (Vincent-Lancrin, S, 2003). Over the following decades well into the 20th century, the (neo)liberal economic school of thought argued consistently, that decision on the location of production should solely be decided by market actors and protagonists and not by the government. Governments should primarily reduce and at best, demolish barriers and reduce any tariffs to trade. Any action should be based on considerations of efficiency (Slobodian, 2018).

What followed was the golden age of globalization from the 1970s until 2007/2008 financial crisis, when global trade and FDI plummet. Since then and particularly during the 2010s, international operations did not rely too much on investments in physical assets. Non-equity modes (NEMs), besides greenfield cross-border investment projects and FDI one of a few entry strategies into foreign markets became more prominent. Exporting and contractual agreements were routes to choose from (Entry strategies Weebly, 2019). Of course, the progress of technology assisted MNCs who heavily internationalized through NEMs in reaching markets worldwide through digital channels and without any significant physical presence. Adding the growing vulnerability of global value chains (see chapter 4) and geopolitical and worldwide instability due to trade wars and pandemics, it is no wonder that there is a slight trend towards near – and backshoring activities. This trend aligns with the worldwide slow growth in world trade and cross-border investments since several years. This relatively new phenomenon, coined “slowbalisation” by the Dutch trendwatcher, author and economist Adjiedj Bakas describe the increasing regionalization of economies (Financial Times, 2020).

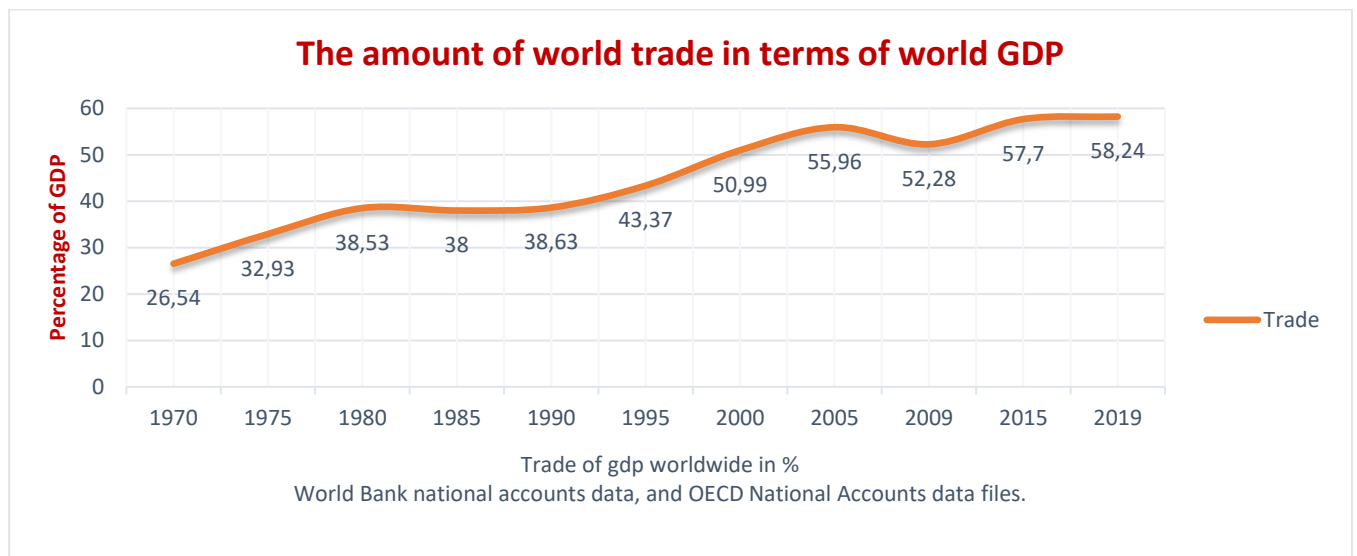


Figure 5.1: The amount of world trade in terms of world GDP in percentage based on own figure. (following: data.worldbank.org, 2020.)

The percentage of trade in terms of world GDP has not increased drastically in the last 10-12 year, after experiencing a very healthy period between 1986 and 2008, where the contribution trade made to global FDP was fairly remarkable (see Figure x).

Looking at all these figures and data's I have collected so far in my thesis, it is surely not wrong to allege that COVID-19 is not alone responsible for increasing reshoring activities from companies all over the place. There is a pre-existing trend towards more regionalized economies and thus, reshoring actions. The observation that COVID-19 could accelerate companies' motivation to reshore and nearshore in the near future and further incentivize a supply chain rethink has its eligibility.

In the following chapters I will further discuss nearshoring in the context of the European Union, starting with the factual record on reshoring pre-COVID-19.

5.2.1 Reshoring before COVID-19

The empirical record on reshoring pre COVID-19 does not go much in depth and most studies concentrate on specific industries or regions. The Austrian scholar Bernhard Dachs from the Austrian Institute of Technology has contributed a lot to the research on backshoring before 2020, together with S. Kinkel (2013) and C. Zanker (2015). In these studies, the years between 2007, when Romania and Bulgaria joined the European Union and 2015 are being examined. These studies heavily rely on intra-European Union

reshoring and reflect the first “serious” impulses of backshoring activities after the financial crisis of 2007-2008.

In all these surveys and studies data from the European Manufacturing Survey (EMS) is being used, covering a significant number of companies in the European Union. Between 2007 to mid – 2009 3 to 7 % of all firms, where data was recorded on, backshoring has been performed (Dachs & Kinkel, 2013, p.1). In all studies backshoring/nearshoring is a rare phenomenon. This is not surprising taking into account how much China has risen during these years and how much the overall internalization environment has changed. The possibility of backshoring rises with firm size, thus making large firms more adequate and competent to perform backshoring activities (Dachs & Kinkel, 2013, p.4). In this context, firms who mass produce with more human resources and innovation are more likely to backshore than firms who produce single units. Backshoring was done by 4.3 % of 2450 examined firms, which is a total of 105 companies. The probability of them coming from the high and medium - technology sectors was higher than medium to low technology sectors (Dachs et al, 2019). The reasons for that will be explained later on in chapter 5.2.3. Out of all countries, Germany has continuously showed the lowest backshoring level beginning in 2007 up until 2019 with 3.2 % (Dachs & Kinkel, 2013) (Dachs et al, 2019). The dataset which observed several countries showed that Spain, Austria and the Netherlands engaged with the highest amounts in reshoring activities (ibid). Overall, it shows that there have been constant slight impulses of companies nearshoring from China and other Asian countries back to Europe over the last couple of years. However, the number of companies reshoring back to Europe is still relatively small and thus, this trend should by no means be overrated.

Another valuable cross-country analysis on reshoring and backshoring was the European Reshoring Monitor (ERM) which was a project done between January 2015 and December 2018. The project is still existing and to this day considers and observes reshoring cases in the European Union. It is a monitoring platform which collects information and data on reshoring cases via different sources, like media, press, literature and TV news. In addition to that, the monitor creates and updates an online database of materials on reshoring as references (Reshoring Eurofound Europa, 2021). The methodology of finding evidence of reshoring decisions can be split between three elements: Media monitor-

ing, monitoring of relevant articles/reports and monitoring of policy initiatives and legislation implementation, either at EU or national level. The definition of back – and nearshoring used by ERM is mutually aligned: Backshoring is defined as an activity that was previously offshored and relocated to the home country in the EU, while nearshoring is the relocation of offshored activities to another country in the European Union, next to the home country (ibid).

The analysis shows, that there has been an increase in near – and backshoring cases every year during the period 2014-2018. In 2018, the two countries with the highest share of cases were Denmark and Sweden. The findings of Dachs et al. (2019) concerning the size of the companies were overall confirmed, because most of the cases in the Eurofound (2019) study were implemented by larger companies with more than 250 employees in total (60 %) (ibid). The countries from which production came home from or was reshored were mostly members of the EEA (European Economic Area), including Switzerland and the EFTA countries (Iceland, Liechtenstein and Norway) and then from Countries in Asia. China accounted for 30 % reshoring cases, while the before mentioned EEA area for a total of 47 % (Reshoring Eurofound Europa, 2021, p. 18-19,).

The greatest number of cases were inhabited by the manufacturing sector (86 %), while the information and communication sector came second (only 5 %). The manufacturing sector can be split in five sub-categories, which are defined as the most relevant to reshoring:

- Wearing apparel
- Food products
- Machinery and equipment
- Computer electronics and electric equipment
- Transport equipment

These five sub-sectors represent 47 % of all manufacturing cases and 43 % of total manufacturing jobs gained (ibid, p. 20).

In summary the collected data highlights that the motivation for reshoring appears to be continuously stable over the years before the outbreak of the Covid-19 pandemic in late 2019. These reshoring processes are increasing steadily, but are nowhere near at the

level to say that they are having a perceptible influence on the economy of the European Union as a whole. The motives for reshoring have been already discussed in my work so far. For the motives to be implemented, the level of awareness on problem solving must increase. The Reshoring Eurofound monitoring platform describes a phase several months before the COVID-19 incident in Wuhan, where the risks of outsourcing and offshoring are increasingly discussed within firms:

“As of February 2019, we are witnessing a phase characterized by a greater awareness of the risks and the hidden costs of outsourcing and offshoring. The geographical dispersion of operations may disappoint cost-cutting expectations and compromise product quality and premium quality positioning.” (Reshoring Eurofound Europa, 2021, p. 35).

This does not come with a surprise, since I have already mentioned in my work, that the trend towards more reshoring has been observed by scholars well before COVID-19. The move towards international reconfiguration is being discussed in (large-scale) companies since several years. The option of “rebooting” its internalization activities can be diverse. It is not only possible by doing back- or nearshoring but for the sake of understanding I will stick to those two internalization strategies.

Reshoring in the European Union has been so far an intra-European phenomenon, while simultaneously the percentage of reshoring from Asia, in toto from China, has risen. While technology rises, it can be expected that reshoring activities will increase further in the upcoming years, due to technologies ability to increase productivity and production quality. This does not mean however, that companies do not continue to follow offshoring/outsourcing strategies. The advantages of offshoring/outsourcing its production for certain companies in specific industries will further exist, albeit in a slightly different way due to macroeconomic uncertainties.

In conclusion it should be said that these studies mostly operated on a microeconomic level. The amount of literature on macroeconomic reasons for reshoring is still very scarce, especially for the current COVID-19 situation. There will be sufficient results on that in several years and since reshoring is an ongoing process, monitoring this economic phenomenon in Europe will be crucial.

5.2.2 Reshoring policies by other countries

This chapter examines the reshoring policies inducted by chosen major European Union trade partners like the United States of America, where reshoring and the overall matter of globalization played a huge role in the 2020 elections in November and the Russian Federation. The purpose of this chapter is to show that reshoring policies and differentiated GVC tactics were long in use well before the outbreak of the COVID-19 pandemic. In which way the pandemic functions as a catalyst for future trend-setting innovations in the sphere of globalization is yet to be fully examined.

The public debate regarding China, offshoring and reshoring in the United States has been very intense in the last couple of years. Already during the Obama administration there have been fierce discussion about the weakening manufacturing in the US. During the Obama administration, the then president Obama highlighted the creation of the private “Reshoring Initiative”, a platform which spreads the message of reshoring production back to the United States. It helps manufacturers and suppliers on how to effectively meet the needs of their local customer to battle against the lower priced offshore competitors. On the platform, successful reshoring activities from American firms have been made public for interested companies to take note (Reshorennow, 2021).

The willingness to “buy American” by American citizen is high. Eight out of ten consumers would prefer to buy an American product to a foreign one. Additionally, 60 % of Walmart shoppers are willing to pay 10-15 % more for items made in the United States (Kinkel, Pegoraro and Coates, p. 189, 2020). With the help of government support and the knowledge of consumer buying preferences for products made and labelled “made in the USA”, American manufacturers can enjoy major benefits in direct competition to foreign manufacturers. The policies for supporting reshoring activities by manufacturers in the EU and the US is very different. Both in the Obama and Trump administration, policies were inducted to supplement US companies to produce and buy in their home country. These policies could be lower corporate tax rates, or local incentives for companies to produce at home or even direct pressure on American companies. The American way of supporting reshoring activities relies heavier on the practice of subsidizing (Kinkel, Pegoraro and Coates, p. 191, 2020). However, in reality many American companies still engage in offshoring activities, simultaneously to deploying reshoring strategies. Accord-

ing to Oldenski reasons for that are because offshoring could make sense for one production line, but for another reshoring could be the better internalization strategy (Oldenski, 2015).

In comparison to the European Union reshoring is a dominant topic for policy makers in the United States with the main point of discussion circulating around the notion of bringing back jobs to the US. In 2017 about 190 000 jobs were announced due to reshoring (and FDI), which was the highest since records began. In comparison to the amount of manufacturing jobs lost in over 20 years (5 million), this is perhaps slightly gratifying for the people who had to endure this life changing situations (Kinkel, Pegoraro and Coates, p. 186, 2020). Kinkel et al. further describe the surge of manufacturing jobs in their article "Industry 4.0 and Regional Transformations":

"For the first time in decades, more manufacturing jobs are returning to the US than are going offshore. Reshoring, plus foreign direct investment (FDI) surged in 2017. Manufacturing job announcements reached 171,000, up 50% from 2016 and a remarkable 2,800% from 2010. This brings the total number of manufacturing jobs brought to the US from offshore to over 576,000 since the manufacturing employment low of 2010. The 171,000 reshoring and FDI job announcements equal 90% of the 189,000 total manufacturing jobs added in 2017."⁶ (Kinkel, Pegoraro and Coates, p. 187, 2020).

These numbers clearly show that reshoring activities were already in use well before the COVID-19 incident years later and further proves my hypothesis, that the COVID-19 pandemic could work as a catalysator for future trend settings concerning reshoring activities by companies, which mostly pursue an individual customer-oriented strategy in the domestic market, the important value of Industry 4.0 and its effect on globalization and a reconsideration of the functions of the global value chain. During the pandemic and the alleged mishandling of the COVID-19 situation by the Trump administration, the global crisis has diminished many manufacturing jobs since early 2020 by about 700 000 in less than half a year from March to August 2020 (US Bureau of Labor Statistics, 2021). Even facing this internal labor catastrophes, the possibility of the pandemic to start a trend

⁶ Taken from: www.reshorennow.org

towards more back – and reshoring activities by companies could very well happen. Over 160 000 reshoring and FDI jobs were announced in 2020 alone in the midst of the COVID-19 crisis (Reshorennow Data Report, 2020). This is a surprising uptick in reshoring job announcements if one considers how dazzled and volatile the year 2020 has been for American domestic politics. It can be assumed that the newly elected Biden administration will further show effort to strengthen the domestic manufacturing sector by providing help to companies who seek to reshore back to the US. However, Biden's team will center their activity more towards climate change in comparison to his predecessor and even the Obama administration several years ago (Joe Biden, 2019). How he plans to combine it with bringing production back to the USA remains to be seen.

While the US is more directly targeted by domestic reshoring policy makers than the European Union (see above), there are multiple ways to accelerate reshoring in a country. Depending on the emphasize every market and region has on for instance cost factors, “Made in” reputation effect or delivery time and quality issues, options to encourage nearshoring or reshoring may vary. Nearshoring or reshoring can be accelerated by increasing production costs in countries that heavily attract offshoring firms, by environmental, financial or monetary policies or by moving production closer to their respective markets to encourage flexibility (Platanesi, B & Arauzo-Carod, J-M, 2019). In the United States, it can be speculated that environmental or innovation policies combined with R&D spending can encourage further reshoring activities, while reducing harsh tariffs and other trade policies conducted by the previous administration. In difference to the European Union the US has different reasons for reshoring. Those so called “push” factors⁷ are mostly cost related like transportation costs, costs of sourcing or rising labor costs at the offshore destination and violation of intellectual property rights and thus the loss of competitive knowledge. Quality issues seem to be more essential for European companies, while American companies see the narrowing cost levels between emerging and developed countries as a crucial point (Kinkel, Pegoraro and Coates, p. 190-191, 2020). Even though the policies and emphasizes of both the EU and the US tend to differ massively from one another, reshoring is considered as an important future tool to further validate and enrich the economic territory of their respective markets.

⁷ Push factors are reasons why people or companies want to leave from a particular place or situation

Any gains due to reshoring can be offset due to further offshoring activity because of a strong currency leverage. A weaker currency can demand opposite actions. This leads me to the next country Russia, another formidable trading partner of the European Union with an entirely different strategy and reasoning concerning reshoring activities. Over the last years Russian companies have commenced building their own production facilities back in Russia. Reshoring has turned to an urgent solution due to the devaluation of the Russian ruble. Labor and overhead costs have become much cheaper in Russia than in neighboring countries. Another factor is that southeast Asian countries are moving away from cheap technologies, the labor force is becoming more expensive, and the prices for their products are growing. In addition to that an argument pro reshoring is the logistics advantage Russia has because of its proximity to both European and Asian sales markets (Izvestia, 2016). This makes the country specifically attractive for foreign direct investment projects. In 2020, despite the COVID-19 pandemic, Russia still accounted a sufficient number of FDI projects which were implemented, even though the oil price fell during that period (Ey, 2020). This data shows, that Russia is a favorable target for foreign investors with long-term plans. The reconfiguration of supply chains will have a lasting effect on how business is going to be done in Russia in the post-COVID world.

The Russian case shows how reasons of reshoring can either be forced upon and not entirely voluntarily or motivated out of concerns of the competitive level of the home market like in European countries. Both cases are similar because they tend to be dependent on China. The rise in production costs in China, where average wages tripled over the last decade is the main economic driver of why the reshoring motive is growing stronger in the Russian federation (Шабашкин (Shabashkin), 2017 p. 29). Combined with a deteriorating currency, this calls for rapid actions to solidify the Russian market. Thus, under the current conditions, the use of reshoring in Russia is justified not only from the economic point of view, but also from the political one. With the help of reshoring in Russia, the degree of localization of strategically important industries, especially in the high-tech industry increases.

The COVID-19 pandemic did not disrupt major international flows in Russia and in the United States by the end of 2020, there was a rapid recovery in trade in both goods and services (Mamedyarov, 2021). International Internet traffic and telephony have skyrocket-

eted, and ICT (information and communications technologies) has intensified. The objective to further develop the reshoring agenda in the US and Russia has not weakened during the pandemic. In Russia, mainly political reasons like sanctions imposed by the west were responsible for the increase of reshoring activity, while the American case is very much dominated by economic reasons like trade wars against China. In both countries, as well as for the European Union (see next chapter), support for reshoring has been mostly via indirect routes to encourage FDI inflows, reshoring and innovation creation. As of today, it is impossible for both countries to say if these reshoring activities may remain isolated occurrences or are part of a bigger revolutionary change, accelerated by the COVID-19 crisis. At least in some economic branches, new approaches and global trend settings could be very realistic. I will elaborate on that in the following chapter, focusing on the European Union and sector-specific potentials for reshoring during the uncertainty with the ongoing COVID-19 pandemic.

5.2.3 Selected economic sectors and reshoring to the European union

Depending on the industry and sector, there can be various factors (e.g., political or economic) that drive geographic shifts and thus the possibility of reshoring and moving production back to the home country. Last year's McKinsey Global Institute report (MGI, 2020) analyzed the possibility of value chains to change their geographic location in chosen economic sectors. In the following vertical figure, all economic factors are listed. The second horizontal figure represents all political factors. These are the political and economic reasons for value chains to potentially shift borders in the future. The economic factors include the geographic shifts that are unfolding, high capital intensity and economies of scale, that make geographic shifts more expensive and thus unlikely, high knowledge intensity, that impede geographic shifts, the access to resources, that make it difficult to shift location, then the demand growth and strategies to locate near consumer markets, that drive geographic shifts, high product complexity, which reduces the likelihood of geographic shifts, regionalization of value chains due to reducing lead times and increasing flexibility and lower trade intensity due to product characteristics, for instance perishable or heavy products that limit the possibility of changing the production location.

The political factors in the report include security concerns, competitiveness concerns, sufficiency concerns and future concerns. National security concerns equal to governments that could intervene in value chains, so they can safeguard technologies with dual-use, meaning for civilian and military use such as semiconductors and communication equipment. National competitiveness concerns could push governments to induct industrial policies aiming to capture leading shares in emerging technologies like AI or electric vehicles. Sufficiency concerns was traditionally always linked to energy-concerns, because governments drive to be energy dependent and self-sufficient. Due to the COVID-19 risk self-sufficiency concerns increased the essential factors to food, medical equipment and pharmaceuticals as well. These three factors are highlighted and discussed in the McKinsey Global Institute Report, while the last political factor is added by me. The future concerns are yet to be seen as a result of possible GVC agenda changes by the global economy, because the COVID-19 crisis has amplified profound fault lines in the functioning of GVCs and exposed the fragility of a model characterized by high interdependencies between various companies across several countries.



Figure 5.2: Economic factors that drive geographic shifts based on own figure (following: McKinsey Global Institute Report, 2020).

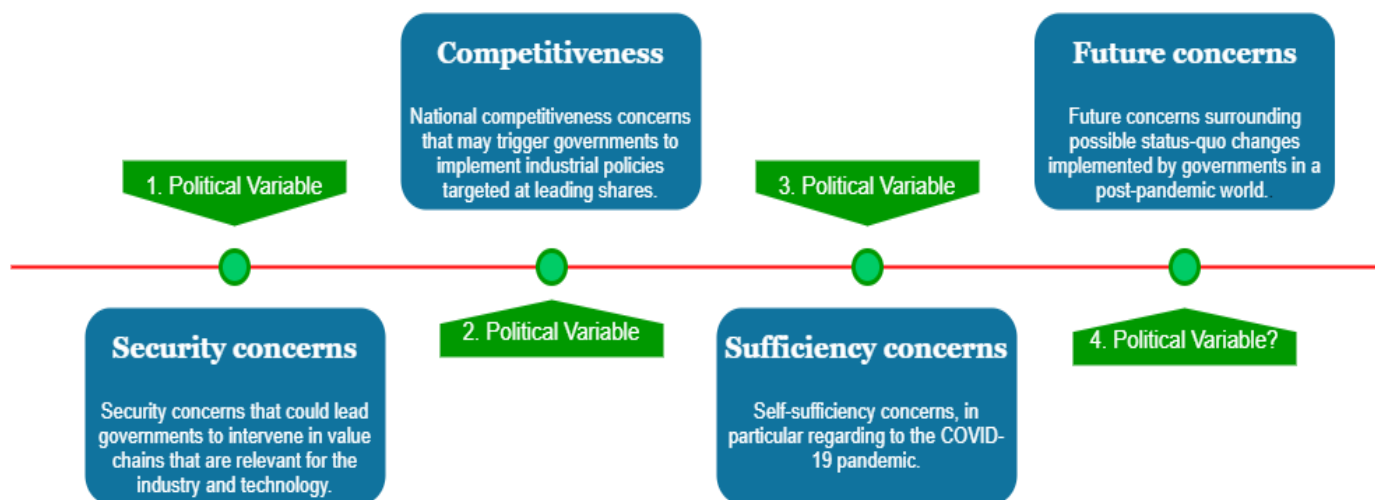


Figure 5.3: Political factors that drive geographic shifts based on own figure (following: McKinsey Global Institute Report, 2020).

The MGIR⁸ characterizes four main categories of sectors in the value chain, each of them with different features and facets. These include: resource-intensive products, regional processing, labor-intensive products and global innovations (MGI, 2020, p. 36.). The analysis highlights that trade is becoming more regional, especially in the automotive, semiconductors, chemicals & food and beverage industry. In general sectors in the global innovations category are most likely to reshore to the European Union, but some out of different reasons. Semiconductors, pharmaceuticals, automotive and medical devices are shifting location out of political reasons, while the electronic sector like electrical equipment and computers shift due to economic reasons. Goods in aerospace, automotive, chemicals, medical devices and electrical and machinery equipment are increasingly traded within the European Union (MGI, 2020, p. 45.). Labor-intensive products and regional processing GVCs will geographically shift more in future, but they will not affect the

⁸ McKinsey Global Institute Report

European Union much. Labor-intensive products like textiles and apparels are shifted more and more to South-east Asia due to the rising wages in China (see chapter. 3.2.2. & 5.2.2). Resource intensive products like agriculture and wooden products are traditionally traded within the European Union, even though since the economic recovery of global players, the global demand for wood has risen and led to shortages of wood and steel in Germany, thus boosting trade outside the EU (Newsline, 2021).

The aspect of future is profoundly important in the topic of possible new types of global supply chains. Industries can be classified in different trajectories for GVCs, which in turn can be differentiated into GVC-intensive industries, geographically distributed industries, which both belong to the primary manufacturing sector and service industries with the archetypes distributed, lower value and concentrated, higher value. These industries can be systematically measured by the different trajectories. One such a model encompassing the relevance of different trajectories by industry was made by the 2020 World Investment Report by the United Nations conference on trade and development (UNCTAD). The classified various trajectories develop each GVC segment and frames it into them, resulting in four different trajectory archetypes: Reshoring, Diversification, Regionalization and Replication. The elements of the four trajectories are as follows:

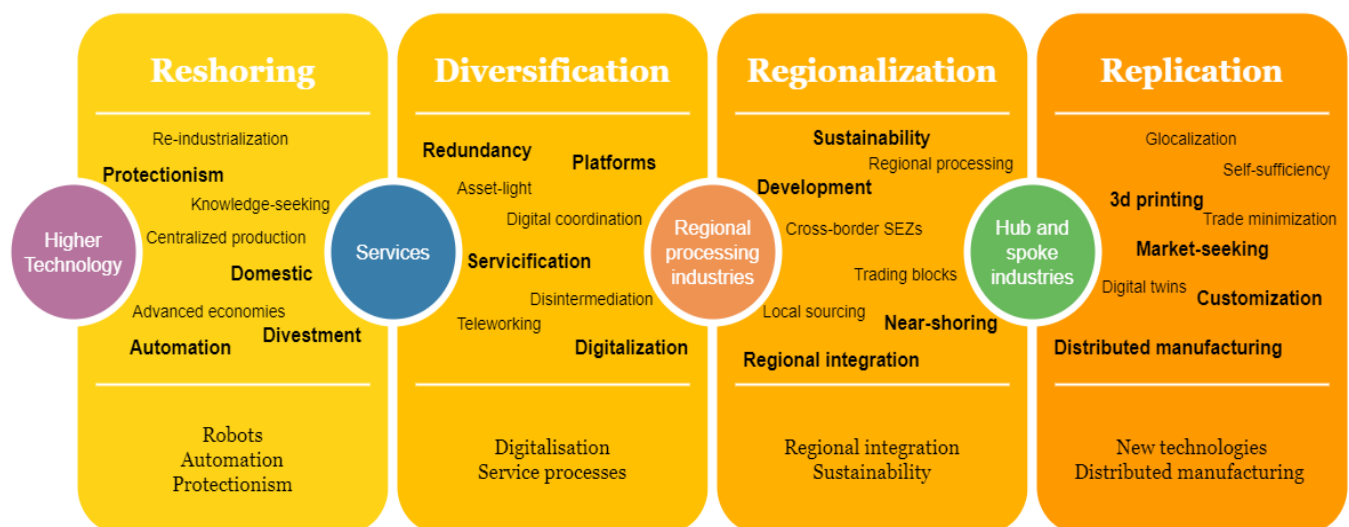


Figure 5.4: Elements of trajectories based on own elaboration (following: UNCTAD, World Investment Report, 2020).

In the center part of the figure the main elements of each trajectory are enlisted. Beneath of each trajectory the key drivers are listed, while in the circular figure of each trajectory the prevalent industries are stated. In the case of reshoring the key drivers are higher-technology and GVC-intensive industries. Each trajectory has a different impact on international production:

Reshoring:

- Shorter and less fragmented value chains
- More concentrated value
- Less offshoring, as well as less outsourcing.

Diversification:

- Higher fragmentation of supply chains
- More concentrated value added
- Increased offshoring and outsourcing of services

Regionalization

- Shorter physical supply chains
- While steady level of fragmentation
- Geographically distributed value added
- Increasing level of outsourcing.

Replication:

- Shorter, less fragmented value chains
- High geographical distribution of activities
- More concentrated value added
- Higher outsourcing activities

In the reshoring trajectory the most crucial elements of modern GVCs are being challenged, namely offshoring and the fragmentation of tasks (World Investment Report, 2020, p. 156.). Advanced technology like automation and robots play a key role. In the sector of manufacturing, the reshoring trajectory is essentially relevant for the higher-

technology industry (e.g., automotive and machinery and equipment electronics). Protectionisms is also a key driver in this trajectory, because some high-tech industries either provide important goods, for instance medical equipment or because they are considered as crucial industries by the government, such as the automotive sector or the electronics industry (ibid, 2020, p. 157). To sum up it can be said that the trajectories provided in the World Investment Report reflect on possible directions international production could take during this decade. Robotics, A.I., automation processes and imposed protectionism by governments who push for self-reliance are the main drivers for reshoring in the European Union. Figure 5.5 shows how GVC-intensive/higher-technology sectors like automotive or the electronics and machinery industry are those industries most likely to reshore next to distributed services like retail trade and transportation and logistics.

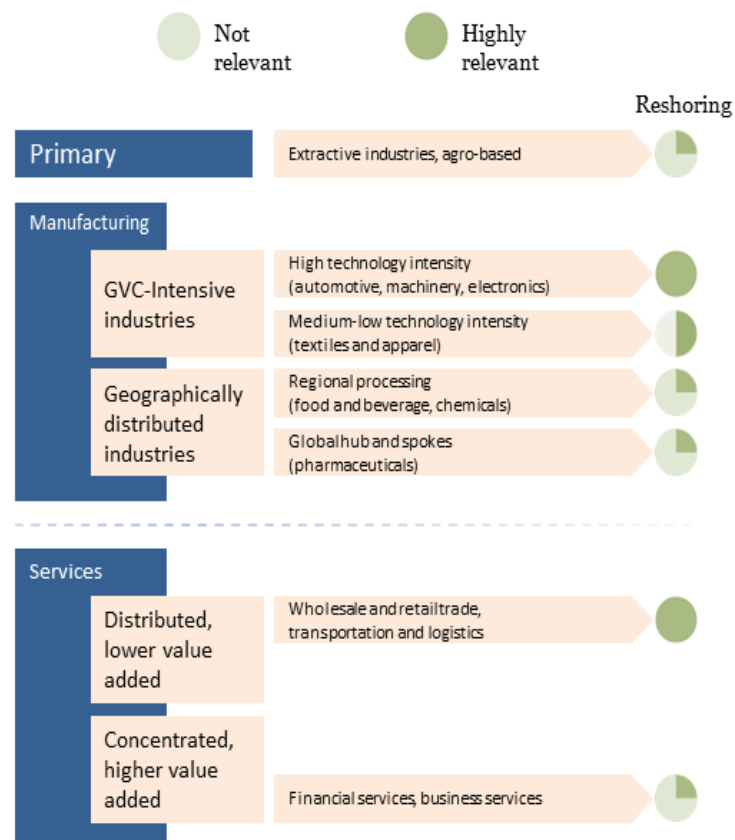


Figure 5.5: Relevance of reshoring in the European Union by industry based on own figure (following: UNCTAD, World Investment Report, 2020).

In summary, this chapter applied to reshoring processes in the European Union by sectors in which there is a certain degree of agreement that high-value industries are the ones most likely to reshore/nearshore back to the European Union. The observation made in this chapter that some sectors are more likely to experience reshoring are to be analyzed with care and caution. This subject is very complex and it is very hard to determine exact numbers, hence the scarce sources on reshoring, especially after the economic shutdown due to the pandemic in the first quarter of 2020. The fact is that a trend can be observed, but tendencies and movements, in particular of economic nature can shift very fast. Many of these sectors discussed in this chapter are highly heterogeneous. The electronics industry for instance has many specific niches where reshoring is more likely to happen.

In my next chapter I will write a case study analysis on one such product of the electronics industry: the semiconductor. It is a global key technology and therefore highly essential for the economic prowess of the European Union. Afterwards I will discuss the second case study: Pharmaceuticals. The pharmaceutical industry is primarily interesting in the context of the COVID-19 crisis and it has potential for future reshoring schemes to further improve the European pharmaceutical industry and to increase access to medicines for patients, in particular in period of crisis.

5.3 The diversification of the manufacturing footprint in the microelectronics and pharmaceutical industry

5.3.1 Introduction

Both pharmaceuticals and semiconductors are labeled as KET (Key Enabling Technology) products. Both belong to a branch within the KET family⁹ under the header of micro tech-

⁹ Others are: advanced manufacturing, advanced materials, photonics, artificial intelligence and security and connectivity

nology in the case of semiconductors and life science technologies in the case of pharmaceuticals. These products characteristics are mostly related to high capital expenditure, rapid innovation cycles and associated with highly skilled employment (Interregeurope, 2021). These technologies are highly essential for Europe's economic competitiveness and for its citizens, because they operate and find solutions in societal challenging areas like global warming, the health industry and reducing dependence on fossil fuels.

Microelectronics such as semiconductors have become indispensable in today's high technological society. It is a GPT¹⁰ device and thus a technology that can affect an entire economy on a global level (Igi-global, 2021). The global microelectronics industry is highly fragmented and internationalized. The fragmentation is characterized by a task-fragmentation due to the product's complex nature, which has a strong effect on the whole microelectronics industry. Their immense influence on different industries is shown by the fact that semiconductors as part of the microelectronics family is found in different downstream industries and end-products, for instance computers, cars and smartphones (Dornbusch, p.13, 2018).

The vulnerabilities of supply chains in times of crisis due to shortages and export bans, while simultaneously demand surges was visible in the context of the global COVID-19 outbreak in 2020. The health system was partially overwhelmed in late March 2020 in the European Union, which afterwards the European Commission tried to tackle any problems concerning shortages and national stockpiling. This phenomenon is not entirely new and COVID-19 just highlighted an issue, which haunts the European Union since 20 years: there is a problem with drug shortages in the European Union and the problem could very well be associated with a range of outsourcing activities over the last decades. Shortage notifications in 14 OECD countries between 2017 and 2019 soared by more than 60 % and the number of shortages increased 12-fold since 2008. (Grumiller et al., 2021, p. 25-26). The European Union shows effort to continuously monitor the impact of the pandemic and possible future calamities on pharmaceuticals supply chains to prevent possible shortages. The EMA¹¹ is acting as the central protagonist in coordination with all European Member States to hinder any possible supply disruptions.

In the following section both case studies will showcase the structure and dynamics of

¹⁰ General Purpose Technology

¹¹ European Medicine Agency

each GVC, its vulnerabilities and its capability for reshoring. I will specifically emphasize on each segment's potential for reshoring. The primary technique I am going to use is the pattern matching technique to get the best results. By doing that I am bound to find the internal validity of the case study by comparing the empirical and predicted patterns (Yin, 2003, p. 143). If they are similar, the case study can be validated. Each case study section concludes by giving policy recommendations and an outlook on the future, with a new possible variant of GSC.

5.4 Case study: Pharmaceuticals

The pharmaceutical industry, often cited as a priority for reshoring, has been declared by many officials as the primary target for reshoring concepts, due to its vulnerability of shortages, non-transparency, and supply chain disruptions (Centrum für Europäische Politik, 2021). For a better in-depth examination and overall understanding I will start with the industries global value chain.

5.4.1 The pharmaceutical global value chain

The pharmaceutical industry is relatively young on a historical level. It only started to develop rapidly after the events of the second world war. From 1850 to 1945 most pharmaceutical products were produced by simple methods (Haakonsson, p. 78, 2009). The industry experienced a huge breakthrough after major discoveries like penicillin were made during and after the second world war. During the last decades the industry enjoyed a complete transformation into one of the world's most rewarded industries, due to the rules of the free market, competition, lower wages by new competitors like China and India, scale effects, buyer orientation towards price and quality and the establishment of organizations like the WTO. Western pharmaceutical industries also induced pressure on their respective governments to create international standards for the protection of patent rights, which resulted in the creation of the TRIPS¹² agreement (ibid, 2009, p. 79-80). Due to this the pharmaceutical GVC dynamics are characterized by different aspects:

¹² Agreement on Trade Related Aspects of Intellectual Property Rights

- 3 paths of drug development
- 4 stages of drug creation
- 3 differentiated GVC approaches

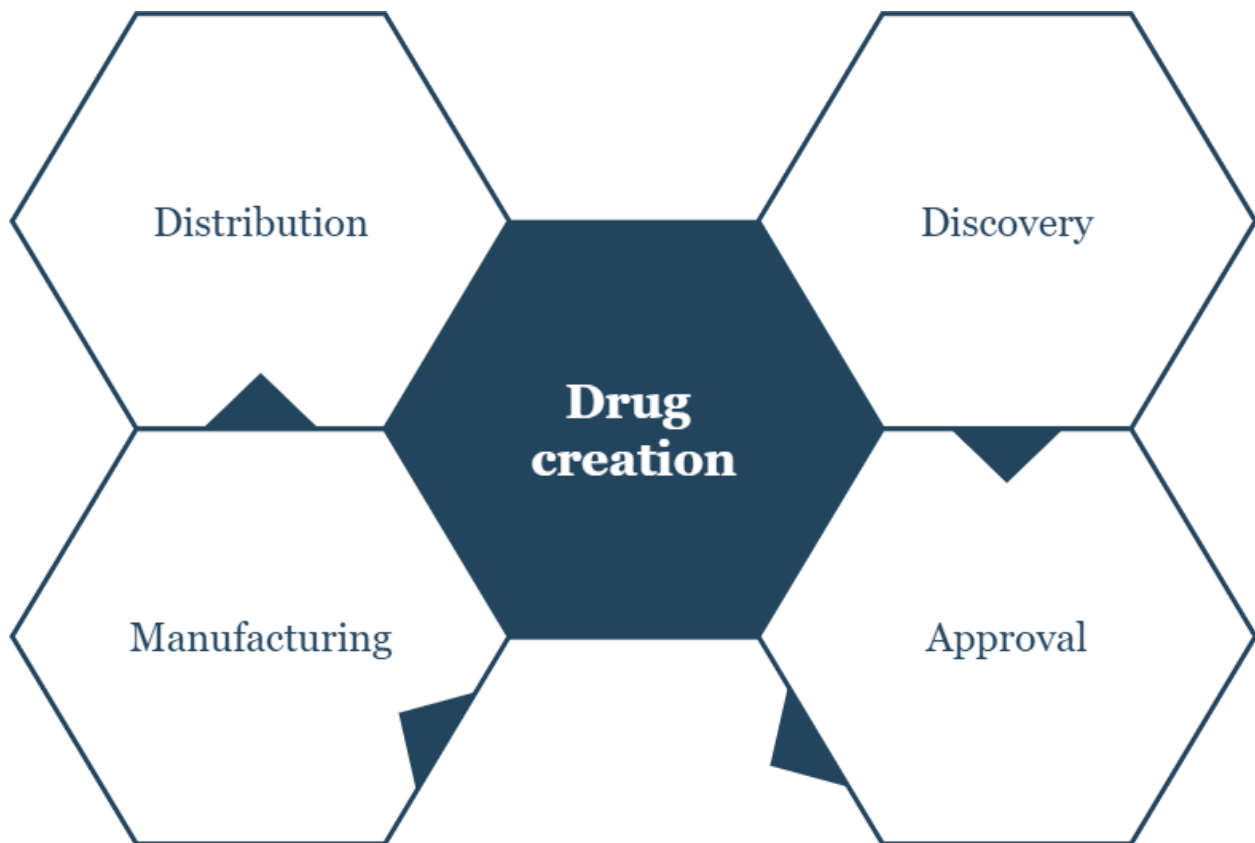


Figure 5.6: The four key stages of drug creation based on own elaboration.

There are 3 types of drugs with different development stages and cost values: new concept drugs, preceded drugs and generic drugs. New concept drugs are the most innovative creation, targeted to cure diseases and thus the drug development type with the highest cost. Preceded drugs are less expensive and its concept builds on existing developments. The latter, generic drugs, are the least complex innovation and are associated with the lowest cost value. It skips the first two stages of the product development (see figure 5.7) (Kedron, P., Bagchi-Sen, S., 2012, p. 817). The 4 stages of drug creation are pretty common in any global value chain, associated with discovery of new drug concepts through massive R&D, the approval of a creation, then the manufacturing and supply of approved drugs and lastly the global distribution and successful marketing of the new product. After completing stage 3 and 4 the product enters the industrial scale (see figure 5.6) (ibid, 2012).

Global pharmaceutical value chain

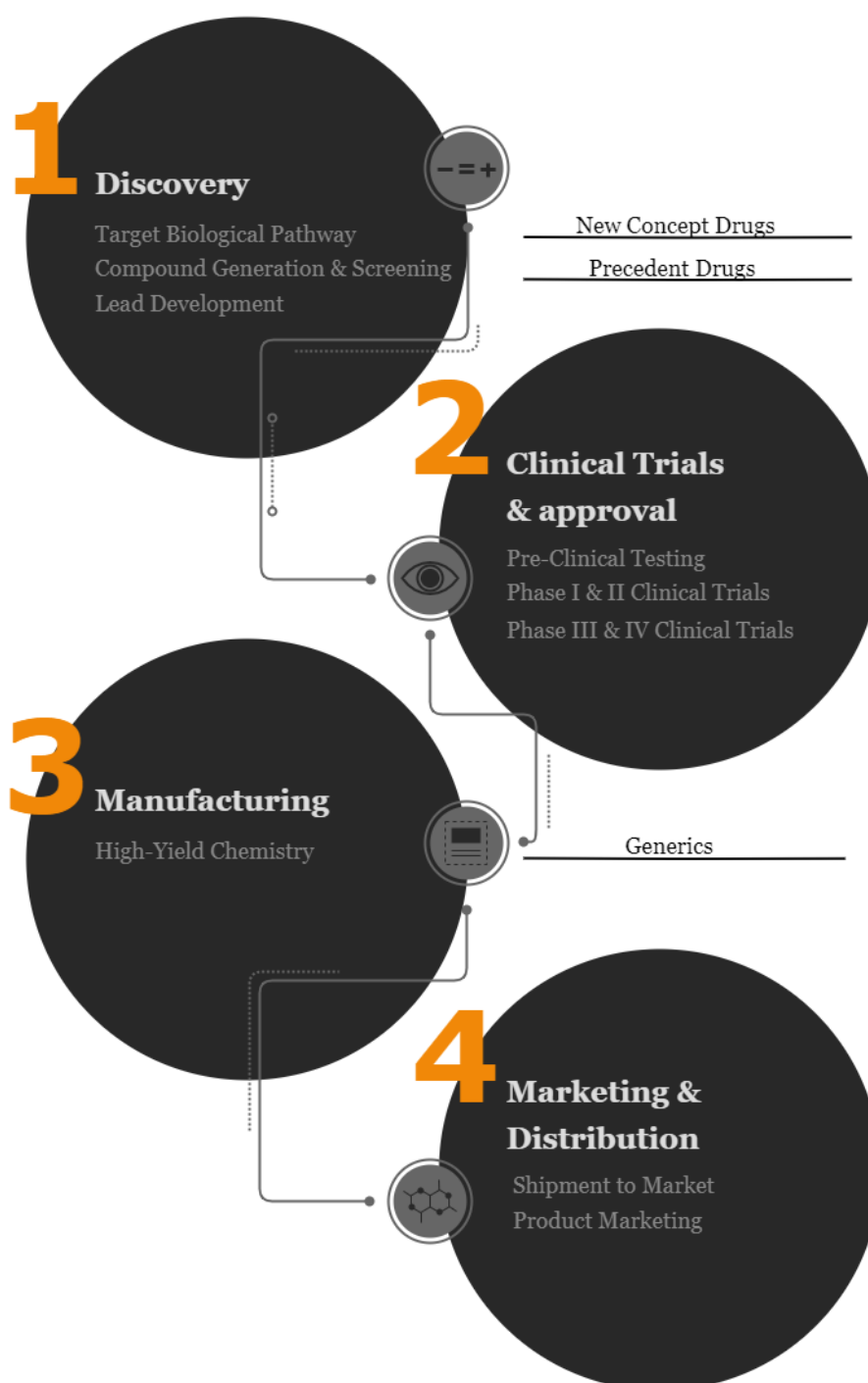


Figure 5.7: The global pharmaceutical value chain and the three types of different drug development paths based on own figure (following: Kedron, P., Bagchi-Sen, S., p. 818, 2012).

This GVC is again differentiated into 3 approaches once it enters the global industrial scale, depending on the region, patent or non-patent and production networks. They are distinguished between branded products, quality generics and low-value generics

<i>Variants of GVC</i>	<i>Branded products</i>	<i>Quality generics</i>	<i>Low-value generics</i>
<i>Products</i>	Patented	Life-style diseases, branded generics	Anti-infective, off patent
<i>Producers</i>	Vertically integrated, research marketing companies in Europe and the US	Outsourcing by R&D and marketing companies to low-cost production sites	In developing country based companies
<i>End Markets</i>	Industrial countries and high income groups in China, India	Industrial countries, Middle class groups in developing countries	Developing countries, Government tenders, Sub-Saharan Africa

Source: Kedron, Bagchi-Sen, 2020. Haakonsson, 2009.

Branded pharmaceutical products are mostly patented, vertically integrated and producer driven. They are found in developed countries and among high income groups. Quality generics are buyer driven governed, found in industrial countries and middle-class groups in developing countries, while low-value generics are not driven, off patent, must have WHO-quality and are found in developing countries. The latter off patent type is mostly imported from India and China to the European Union for consumption or export, while high quality pharmaceuticals are produced and processed in the European Union. Generic products are distinguished between APIs¹³ and FDFs.¹⁴ APIs is the ingredient of the drug, which enables a certain effect in the consumer's body, while FDF is the finished and finalized drug product, which is created for the final consumption by the body. By this

¹³ Active Pharmaceutical Ingredient

¹⁴ Finished dosage form

definition, all drugs are a mixture of APIs and other substances to create an DF in the shape of solid capsules or injectable dosage form (Max Nova Healthcare, 2021).

Like in many other branches and industries in world economy China and India convince the pharmaceutical industry with low prices, while simultaneously production costs are 10 times higher in Europe than the world market price. There are still some customers who pay attention to factors like environment, which is why they decide to buy more expensive products from Europe. More complex products are still being produced in Europe, partly also because of historical reasons (Progenerika, 2020, p. 53). In FDFs the EU enjoys a massive trade surplus, while in APIs it has a significant trade deficit, because the European Union imports high volume APIs from East Asia. Since 2000 the Asian market took over the market with high production volumes, while European manufacturers have larger production portfolios and smaller production volumes. Since the 2000 Europe is mostly a producer of complex, smaller-volume APIs in an increasing production portfolio environment (Progenerika, 2020, p. 18) (Haakonsson, 2009).

When looking at trade, India and China's dominant position results by specific regions and industrial parks in their respective countries. Excluding intra-EU trade which is still very high, these two countries inhabit both the most dominant position the global generics pharmaceutical market. Like in other sectors and industries there is an increasing chance of further outsourcing production to other Asian by China and India, mostly to the South-East region of Asia, particularly Malaysia and Vietnam due to increasing wages and environmental regulations, especially in China (see chapter 5, section 5.2.2).

To showcase the changing dynamics of the pharmaceutical GVC, where in the beginning Europe started from a strong position, but was pushed more and more into focusing on nice products due to the Asian competition is the fact that Europe was clearly outperformed by Asia in the production of APIs measured by CEP approvals. CEP (Certificate of Suitability of Monographs of the European Pharmacopoeia) monitors the drug approvals by complying new products with European regulatory requirements. Manufacturers from Asia increased their number from 183 to 2,369 between 200 and 2020 while manufacturers from Europe only grew from 348 to 1,260 CEPs for the same period (Progenerika, 2020, p. 3-5). This frequently proves the changing developments in the pharmaceutical GVC and why some policy makers in the European Union declare themselves in favour of more regionalized value chains.

5.4.2 Potential for reshoring

West to east, and back again could be the slogan for the European pharmaceuticals industry. Provided that it is ready to pay for it. The strategic autonomy behind the proposition of reshoring is a challenge for the members of the European Union. The intention of bringing production back to Europe or to neighboring states of the European Union (e.g., Turkey, Ukraine) started already several years ago and Europe is not the only region where these intentions found breeding-ground. The United States also openly discusses such intentions in politics (Pharmtech, 2021). The main problem is, to put it briefly, the cost factor with tax payers as possible source of money and/or subsidies by pharma producers and the government from an economic policy perspective.

The most important objective for the European Union is to prevent any risks of medicine shortages. For that the European commission declared a pharmaceutical, patient-oriented strategy for Europe to impede shortages, increase stockpiling¹⁵ and the security of supply and production in Europe. This has happened directly as a response to the serious impact the COVID-19 outbreak had on the European pharmaceutical industry. The key points of the strategy are to fulfill unmet medical needs and accessibility and affordability of medicines for customers, providing a competitive industry, strengthened through innovations and digital transformation and reinforce the security of the supply chains to avoid shortages and be prepared for crises (European Commission, 2020). The last key point is where reshoring maneuvers could be attributed to. However, in the official strategy paper of the European commission the word “reshoring” is not to be found once. The explicit strategy of the promotion of reshoring in the European Union’s pharmaceutical sector remains vague. Certain politician like German health minister Jens Spahn or Véronique Trillet-Lenoir have managed to speak positively in public about the matter of reshoring (Politico, 2020). For the decision-makers of the big pharma companies however the term “reshoring” could symbolize a direct threat to free trade, which is a threat to their bottom line.

When it comes to FDF, Europe has done its homework, as it is the biggest exporter of finished pharmaceutical products, meaning the discussion (especially about the resilience of the supply chain) mostly resolves around low-value generic products which are heavily

¹⁵ Required stockpiling of strategic important good by law

under the control of China, India and overall is a highly decentralized GVC. Global decentralization always means a higher level of risk¹⁶ (Unleashed Software, 2020).

The issue with APIs from the perspective of the European Union is, that APIs (which include antibiotics for instance) are highly essential in times of crisis due to its high priority in times of disaster, like for example in pandemics (Haakonsson, 2009). The most effective way to mitigate the risk of such shortages would be to reshore a share of such critical generics. There is a big question mark behind the fact that stockpiling alone could get the deal done. There are different ways of stockpiling methods - they can be done on a national level by a smaller scale or on a bigger scale via monitoring done by the European Union, each with its own advantages and disadvantages. Policy makers should keep that in mind during the process of evaluating a decision.

According to the European Parliament the issue is the dependance on third countries and cost-pressures:

“While these shortages may be attributed to numerous factors (...), there is no disputing the fact that the relocation of plants producing active ingredients and end products has considerably weakened the sovereignty of the Member States. According to the EMA, 40% of medicinal end products marketed in the EU originate in third countries, while 80% of active pharmaceutical ingredients are produced in China and India. Indeed, the only way to save money is to rely heavily on subcontractors in Asia, where labour costs and environmental standards are significantly lower.” (European Parliament, 2020).

But all things considered, one main root of the issue is missing. It is connected with the limited profitability for reshoring due to not only international competition and cost-pressure, but also the buyers and their decision making. Buyers in the EU (e.g., institutions, hospitals etc., not the end buyers) emphasize on a low price, but with the highest degree of quality as possible. Environmental and labour quality of the countries they buy the products off are just important only to a limited extent (Raza, W., Grumiller, J., et al., 2020). This is a major obstacle which speaks against any reshoring intentions. This can only change by a sudden alteration in buyer behavior, or by a significant intervention by

¹⁶ This of course is open to dispute. Decentralized supply chains have a massive risk because there is a possibility of losing control over operations and a huge disadvantage is the increased operational costs in comparison to centralized supply chains.

politics into the free market by including sustainability standards, which in turn would reduce major corporations plans to outsource to new low labor countries like Vietnam or Thailand. The alteration of buyer preference towards more quality, thus more price and more resilient supply chains and progressive sustainability standards could open the door for reshoring or nearshoring/onshoring activities (ibid, 2020). Of course, this is associated with higher costs for buyers and an increase in health insurance costs and a requirement for all of that to happen is that these types of “revolutionary buyers” need to engross a large market share for corporations to change their strategic agenda.

For that everything to happen is highly unlikely and in addition costly. One solution could be a policy mix of the discussed methods with reshoring, stockpiling and market regulation. In figure 5.8 I have incorporated a possible way for reshoring activities in the pharmaceutical industry.

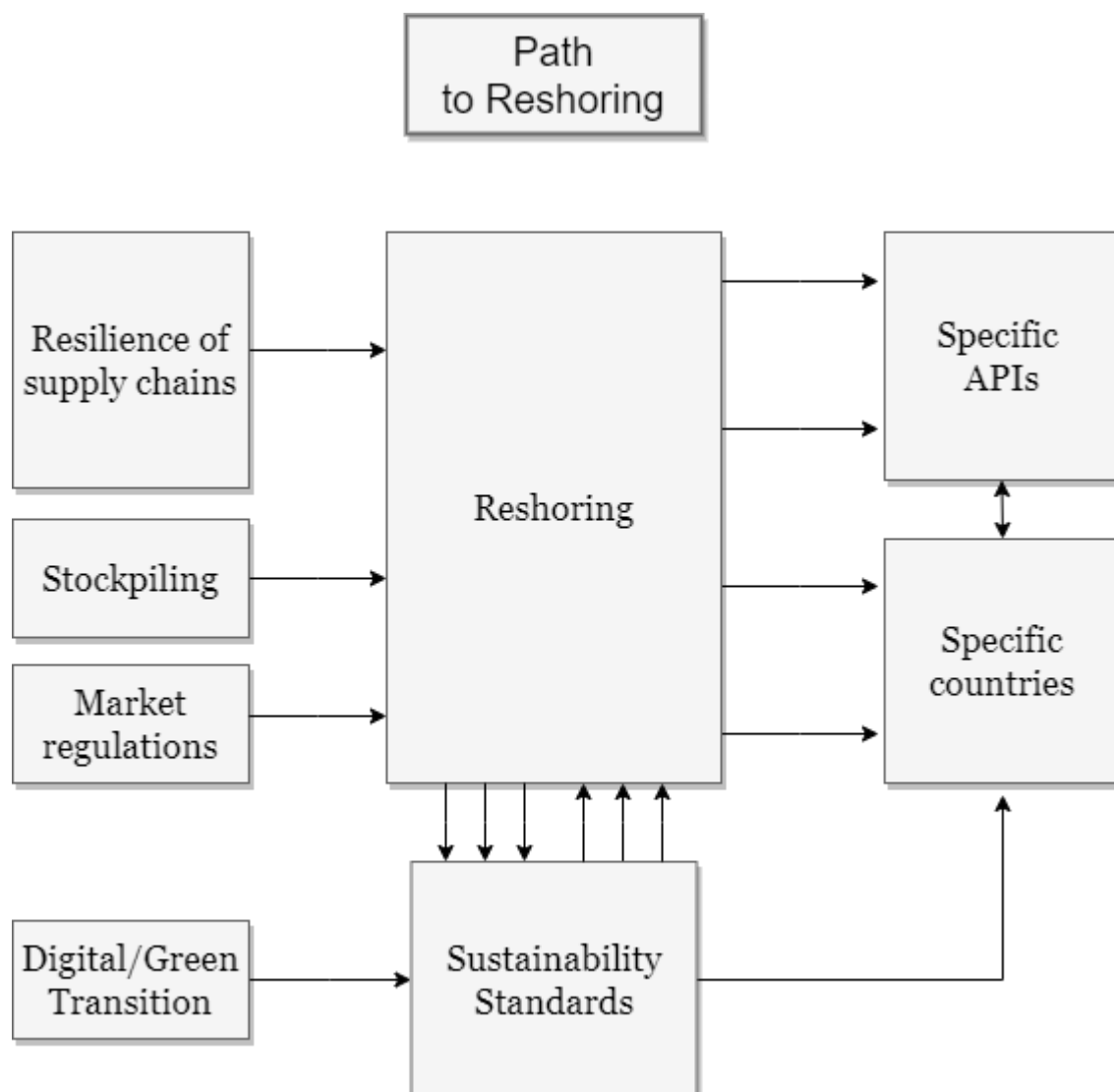


Figure 5.8: A possible way of enabling reshoring in the pharmaceutical industry based on own figure and elaboration.

Note: Changes in buyer requirements and subsidies/tax incentives are not listed in the figure, as these are ex ante policies, which work as a prerequisite for the rest to materialize.

Through the alteration of buyer-behaviour the resilience of supply chains can be increased. For stockpiling, various models depending on scale size can be conducted, with the trade-off resulting between security of supply and cost-effectiveness. Market regulations are a must for any reshoring opportunities to materialize. These 3 key points lead to reshoring, while the market regulations work as an impetus for reshoring. This happens in the framework of digital and green transitions, which lead to sustainability standards. This sustainability standards would increase the strength of the EU industry for low-value generics at the cost of China and India, once the conditions of payment through subsidies and tax incentives for the production of off-patent generic pharmaceuticals are fulfilled. Once reshoring starts, the sampling of specific countries comes into discussions, where both reshoring and nearshoring activities (e.g., to countries located at the EU's external borders) are highly recommendable to keep the portfolio of actions diversified. Out of cost-reasons, only critical key pharmaceuticals should be re – or nearshored to keep the pressure on expenditures for buyers low.

In this context all the steps discussed and made evident in the figure require large scale EU-wide coordination (Kedron, P., Bagchi-Sen, 2012) (Raza, W., Grumiller, J., et al. 2020). This could take time as many inputs in the European Union are not produced on a significant scale anymore.

To sum up, there are many ways to deal with the vulnerabilities exposed by the COVID-19 pandemic on the European pharmaceutical GSC. These vulnerabilities, from availability of products and manufacturing capacities, to high costs and the supply of medicines which lead to small scale shortages during the outbreak can be consequently dealt with by either prioritizing the production of low-value generics and APIs in Europe, ensuring affordability of medicines, the sovereignty of fiscal sustainability and independence and strengthening Europe's path towards digital and green innovations. This case study has examined the possibility of reshoring to be one of these solutions. There is no doubt, that

it is a radical way to strengthen Europe's global market position. The question is if reshoring manufacturing can manage its policy momentum well into the future. If in sometime in future reshoring is employed as a key policy it should be one amongst several economic tools available to promote specific policy objectives.

5.5 Case study: Semiconductors

The main objective of this case study is to predict future trends and its potential for reshoring activity in the European market. Therefore, it is impossible to give unequivocal results, as the outcome lies somewhere in the future. My hypothesis would be that the microchip/semiconductors industry has a great potential for reshoring, but the chance of that to happen is highly dependent on the development of Asian countries, as well as the progression of Industry 4.0 (e.g., digitalization).

First it is imperative to collect data on the overall semiconductor GVC and the competitive position of the European Union, as well as its fiercest competitors before heading to the interview. The industries main distinctive feature is the high R&D intensity and the huge global approach of semiconductors. There is a huge flow of money towards innovation, which is why there are many companies in different parts of the world who concentrate on certain steps in the production of semiconductors, meaning that the level of outsourcing is high. These skills are increasingly fragmented and spread across the world, which is why a semiconductor device could very well cross over 50 countries before reaching the final step of its production circle. Another noteworthy particularity is the high capital expenditure of the industry.

Even amidst the pandemic the worldwide semiconductor market is expected to grow up by 25 % to a total of 551 billion US \$ in 2021. Last year it grew by 6.8 % (WSTS, 2021). As a high-tech device the microchip industry has grown at an incredible pace in the last decades. There are not many products in any industry that can showcase an exponential growth. This only demonstrates the incredible potential the semiconductor industry has.

One of the reasons for that success is a special innovation strategy called “More than Moore”. The More than Moore approach leads to the virtuous circle of the semiconductor industry, which explains the spectacular rise since its inception. Due to transistor scaling a better performance to cost ratio can be achieved, which in turn leads to market growth and growing investments in new technologies. The circle closes by these massive investments which drives further scaling (ITRS2¹⁷ Arden, W. et al. 2021).

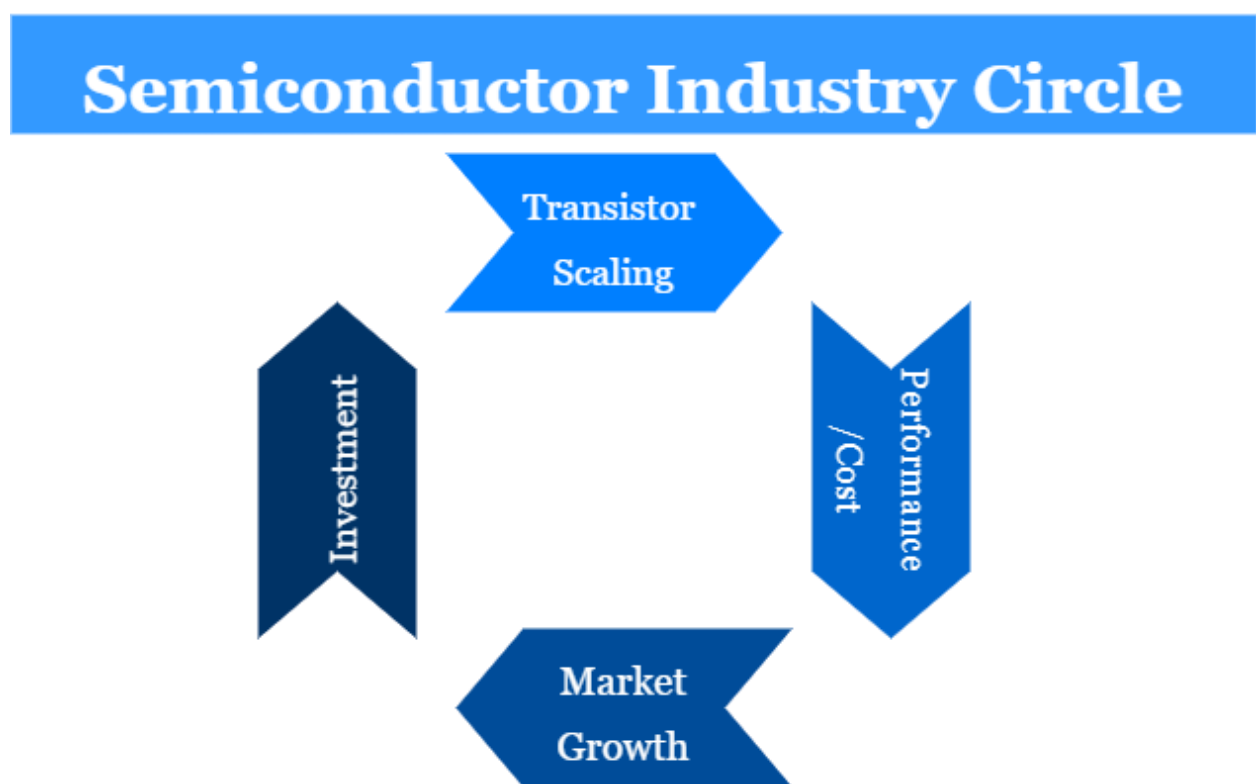


Figure 5.9: The semiconductor industry circle based on own figure (following: International Technology Roadmap for Semiconductors White Paper, 2021).

The More Moore scaling follows the rule of Moore’s law, a historical market demand observation made by Gordon Moore. The appendix definition of the International Technology Roadmap for Semiconductors article written by Wolfgang Arden et al. comes up with the following definition for Moore’s law:

¹⁷ International Technology Roadmap for Semiconductors

“An historical observation by Gordon Moore, that the market demand and semiconductor industry response for functionality per chip (bits, transistors) doubles every 1.5 to 2 years. (...) Although viewed by some as a “self-fulfilling” prophecy, “Moore’s Law” has been a consistent macro trend and key indicator of successful leading-edge semiconductor products and companies for the past 30 years.” (Arden, W. et al. p. 27, 2021).

This law paved the way for the tremendous success of the semiconductor industry by “Moore scaling”, which is the process of continued shrinking of the physical size of micro-chip functionalities (e.g., memory storage) with the objective to improve performance and to reduce cost per function (Dornbusch, 2018; Arden, W. et al., 2021).

However, this special way of scaling requires huge offshoring activities to be processed, predominantly to the east Asian region. When the production costs of a specific region are low and the demand increases, then the revenue of semiconductor sales in general will expand as well. This is why overall global sales shift more and more to the Asia-Pacific region. The US semiconductor industry is still the global market share leader with overall 47 %, while Europe trails with 10 % and the Asia-Pacific region with a total of 40 % (China with 5 %, see figure 5.7). (SIA Report, 2020, p. 7). Depending on the subproduct of the semiconductor the market share change. Europe has the highest stake at the discrete subproduct with 42 %, while for analog semiconductors it trails on second place by 22 % (the US being first). The Asia-Pacific market leads the market share leadership in sales of memory semiconductors and that by a substantial margin (South Korea with 65 %). Moreover, the Asian market dominates the semiconductor related patent industry with Japan being clearly on the top with 37 % and Europe with 15 % (WIPO, 2015; ATI European Commission, 2017).

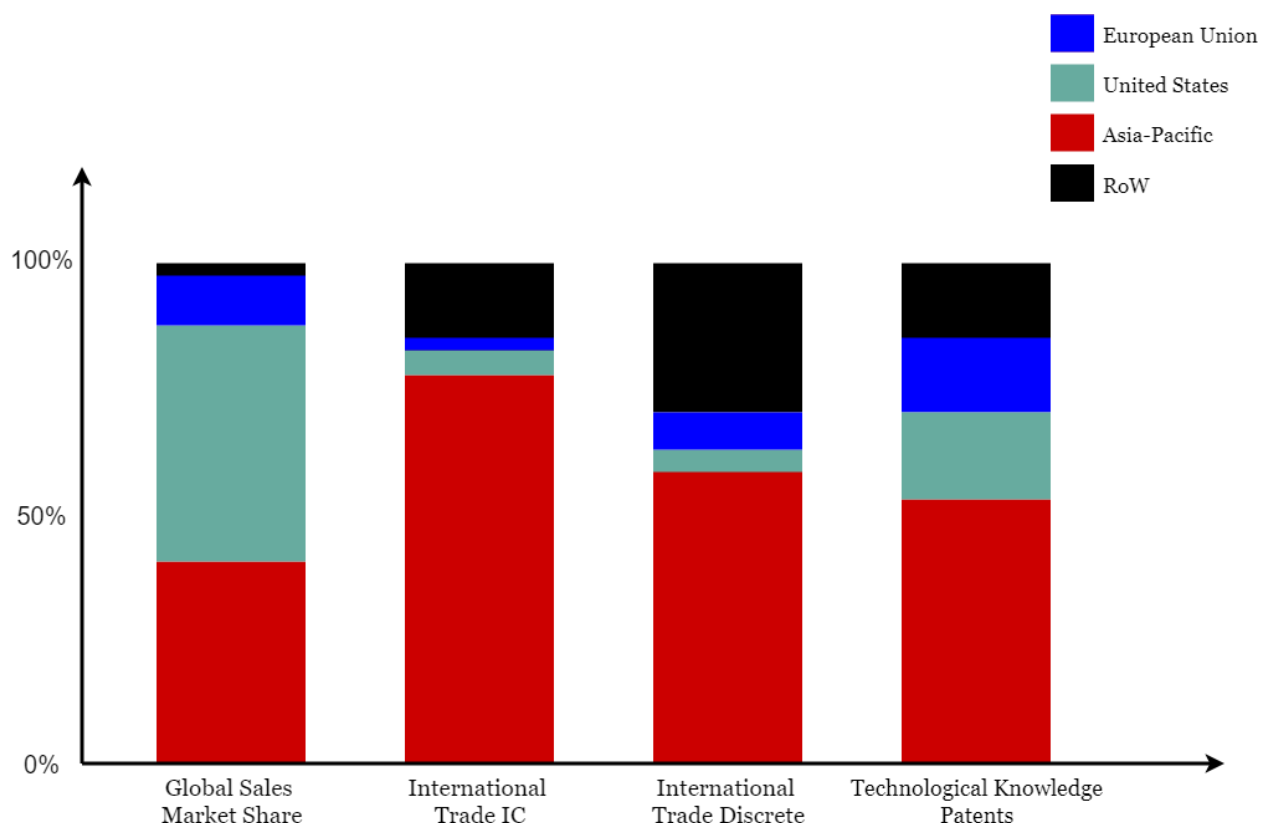


Figure 5.10: Various diagrams illustrating different data described below, based on own figure. Note: RoW means Rest of the World. Asia-Pacific incorporates every country from East – and Southeast Asia, excluding Oceania (following: UN Comtrade, 2020 (WITS); SIA Report, 2020; WIPO, 2015).

Additionally in total trade percentage Asian countries dominate the market (see figure). The only noticeable countries outside of Asia with a somewhat relevant trade share are Germany, Netherlands (within the European Union) and the United States. Germany is the European powerhouse in the global trade percentage of discrete with a share of 7 %. Following Decision's study on the electronic ecosystem, a study specifically prepared for the European Commission, the EU is strong in "More than Moore" technologies. These technologies are primarily used in embedded/professional electronics, such as nanoelectronics and semiconductor (Decision, 2020, p. 113). Most of this nanoelectronics produced from the semiconductor category are used for the automotive industry, an industry the European Union has traditionally been very competitive in. Other important industries include Health & care and Industrial & robotics (ibid).

To sum up, the most important economic area in the semiconductor industry for the EU is in the discrete semiconductor industry. Even though the overall international trade

share in discrete semiconductors is smaller than in the integrated circuits or memory sub-product the EU shows an even trade balance in this product type (discrete). The BOT¹⁸ is the comparison of exports and imports in a specific product line or industry which can reflect the overall competitiveness due to a stable net balance.

Taking all these criteria into account the scope with the most potential for reshoring in the European Union's semiconductor industry is in the field of discrete semiconductors and More than Moore technology. This trend is hastened by technological progression, such as new development in digital manufacturing technologies like Industry 4.0 and the IoT¹⁹. Again, China can work as a role model in that matter, as the government seeks to achieve greater self-reliance in advanced technologies. The People's Republic of China works towards regionalizing its GVCs, particularly its domestic chip industry (Asia Society, 2021).

It is known that Industry 4.0 could play a key role in future reshoring processes. This applies much more to advanced technological industries. However, it could also go the opposite direction and trigger location decisions more towards foreign destinations. One possibility on how Industry 4.0 or IoT could influence location decisions in favor of reshoring are the nullification of factor cost advantages of offshoring locations. Another more flexible manufacturing process, which could move production closer to important buyers. The changes induced by Industry 4.0 for semiconductor producers cover new technology, new business models and new product offers. According to numerous market research companies these new factors will empower small and medium sized enterprises and could enhance the flexibility of manufacturing processes (Brand, 2017; Dachs et al., 2019).

Another important aspect which indicates the future importance of establishing new production sites in Europe is the industry's dependence on consistent R&D and innovation efforts. Historically R&D centers were built not far away from production sites to access the specific knowledge established in relevant markets. The rule was to keep proximity as close as possible (Harvard Business Review, 1997). There is a risk of that to accelerate again, that is why further production capacity needs to stay within the European Union to strengthen the domestic market. The urgency to keep proximity between production sites and R&D centers is one of the biggest barriers to reshoring intentions.

¹⁸ Balance of Trade

¹⁹ Internet of Things

Another major obstacle is the high capital intensity of advanced technologies such as semiconductors. With high capital intensity comes the need for highly capable and skilled workforce and employees. If companies decide to move their semiconductor capacities, they need to be aware of the vast costs associated with reshoring efforts. This too is a question of human resource management as the workforce will need to be relocated, or domestically educated in their respective area. The already highly globalized organization of the semiconductor industry could discourage companies to plan any reshoring efforts. The chance of COVID-19 induced changes in reshoring intentions of companies working in the semiconductor industry is very low, as the semiconductor industry proved to be relatively robust during the high time of the pandemic (Dornbusch, 2018; Beattie, 2020).

However, even though there is a high stream of money through the industry with an impeccable high capital intensity (a semiconductor fabrication plant could cost up to \$4 billion in 2011) (McKinsey, 2011), which pose as a significant obstacle against any reshoring intentions by companies, future changes in business strategies, organization, production processes as well as changes in global supply chains triggered by increasing digitalization, streamlining communications, improved resilience of the GVC and innovations induced by Industry 4.0 could lead to reshoring purposes by companies and governments, not only in the semiconductor branch, but in the advanced technology industry overall. Major policy interventions will be required for that to happen from the political side. Constant overdependence on overseas production is no way healthy for the domestic economic ambitions. Asia and the US have experienced strong support by politics through policy interventions and various projects which aim to boost the competitiveness of their respective electronics industry. This needs to happen also for the EU-27 to not lose any time on the way to support the digital transformation, especially in the electronics sector. The worst thing that could happen now is for the European Union to miss the boat in the future by not implementing the framework to create the appropriate environment for the initiation of Industry 4.0 and the growing digitization. Brussels is eager to extend the ECSEL²⁰ Joint Undertaking program with the help of the 30 ECSEL participating states. A total of €10 billion was budgeted to help the European ECS²¹ market, including semiconductors (ECSEL, 2021; Handelsblatt, 2018).

²⁰ Electronic Components and Systems for European Leadership

²¹ Electric Components and Systems

All in all, a key recommendation would be not to put too high expectations for future reshoring actions, even in an industry which has growing potential for forthcoming reshoring activity. In the background of other decisive factors like exogenous shocks and geopolitics (which have been discussed in this work numerous times) the most important argument for reshoring in the semiconductor industry would be the evolution of digital technologies like Industry 4.0 and the improvement of automation, which in turn will extend a company's ability to hold additional reshoring production networks.

However, the growing importance of emerging economies and the high capital intensity of the industry could restrict the effects of the digital revolution significantly. It can be expected that the so far marginal evidence for reshoring in the semiconductor industry will stay limited, even after the events of COVID-19. The chances of large-scale reshoring in Europe are, as things stand today, unlikely.

In the next section I will commence with the expert interview in order to get a more complete picture of the semiconductor case study and to round out my work's portfolio.

5.5.1 Research design and research method

The aim of this interview is to find out whether the European (in this case predominantly German) semiconductor industry has a serious interest in increasing the return of its production sites to Europe. The expert works at the ZVEI²², the leading sector of digitalization and pacemaker of technical progress in Germany. In the case study so far, I have discussed about the reshoring potential of the semiconductor product chain, but not if the industry itself intends to do that. For that to find out I had to consult an expert directly from the industry, because this was the only way for me to have a different valuable insight on the issue.

There was no necessity to interview multiple experts, because the industry is much less heterogenous in the approach of doing reshoring, than for instance companies from other industries and their individual ideas and motivations, which differ from each other.

²² Zentralverband Elektrotechnik – und Elektronikindustrie

The expert interview was conducted as a semi-structured interview (guided interview), taking into account the following aspects:

- The guideline interview is a partially standardized interview in which the subjective viewpoint is in the foreground.
- The interview is conducted with the help of a guide.
- The guide provides a framework for data collection, with the help of which the results of different interviews can be compared.
- There are no answer specifications for the interviewee, and the interviewees can freely report, or comment and explain.
- The interviewer asks for permission to take notes or record the interview and he is obliged to ask the interviewee if they have any questions
- The guided interview includes open-ended questions and only one question at a time is asked
- The interviewer can determine the order of the questions himself and decides whether he wants to inquire deeper or not

A semi-structured interview should consist of an introductory text, metadata, main and sub-questions, sociodemographic data, and consent to be interviewed.

The introductory text includes the interviewer's introduction, information about the topic, assurance of anonymity if necessary, and a consent form for recording. Main questions and sub-questions are arranged as in a natural conversation. The readiness for a further interview should also be clarified beforehand (Bacher, J., Horwath, I., 2011, p. 43) Jhpiego, 2020).

On this basis, I have developed the interview guideline in the appendix in the course of a research project. After the interview guidelines were ready, the expert interview was conducted. The interview was transcribed immediately after the interview and analyzed as a part of this master thesis.

5.5.2 The interview partner

The search for an interview partner was difficult and it narrowed down to the very last weeks of my work where I found the right person. Ultimately, I got the contact from the homepage administrator from the WSTS²³ who recommended me the ZVEI, but always under the one prerequisite for this data to be treated confidentially. It was not necessary to find multiple interview partners, because the interview partner stated the status quo of the company and industry he worked in.

5.5.3 The interview procedure and evaluation

Prior to the interview, the interviewee was sent the questionnaires by e-mail, so that he could prepare himself in advance. This ensured that interviewer and partner went into the interview with similar prerequisites. The interview took place via online call, in accordance with the current COVID-19 safety measures and was conducted in German language. To ensure a pleasant flow of the interview, the interview was recorded in the evening and the interview lasted about one hour.

The method chosen for the interview evaluation is the qualitative content analysis according to Meuser and Nagel. The aim of the method is to work out the common and typical aspects of the interviews through a thematic comparison. In a thematic comparison, statements that belong together in terms of content are summarized in units, independent of the text passage in which they occur (Meuser, M., Nagel, U., 2005).

There are four steps of the analysis to be taken into account when deciding to do a semi-structured interview following Meuser and Nagel (Meuser, M., Nagel, U., 1991):

- Transcription
- Paraphrasing
- Headings
- Comparison of topics²⁴

²³ World Semiconductor Trade Statistics

²⁴ This phrase is not the official translation. The German word used by Meuser and Nagel to describe the fourth step is “Thematischer Vergleich”.

1. Transcription

The recorded interview is first transmitted into text form. Afterwards it must be transcribed, so the data can be collected from the interview and analyzed. The available material must be transferred and replicated in a readable form and the conversation be put on paper true to the situation and content (Meuser, M., Nagel, U., 1991, p. 455). Every information which is not transcribed for the evaluation is lost. The next step is to check the transcription. The transcripts are compared with the recordings and corrected with regard to hearing errors. In this step, it is also possible to anonymize the names of certain persons for instance. Finally, the transcription documents are checked in order to discover ambiguities or inconsistencies (ibid, 1991).

This step lays the foundation for everything what happens next. The length and selectivity of the transcription depends strongly on the competence of the interviewee.

2. Paraphrasing

Paraphrasing is used to reduce the complexity and ambiguity of the content. The texts are arranged according to the thematic units. The content is reproduced in one's own words, true to the text. It is to be noted that with this procedure nothing is misappropriately omitted, nothing added or anything distorted from the original. Long passages can be simplified to the core statement, even if the expert gives the topic a lot of space (Meuser, M., Nagel, U., 1991, p. 456-457). This step is meant to be protocolled and with that, only the most important content of the interview.

3. Headings

The individual passages resulting from the paraphrasing are assigned headings, whereby several headings can also be assigned depending on how many topics were

addressed in the respective passage (ibid, 1991, p. 458) Thus, the material is condensed by thematic assignment and structured. Similar content can be subsumed beneath one specific heading.

4. Comparison of topics

The comparison of topics involves comparing the text passages between the different interviews. By doing that, the data is condensed. It looks for thematically comparable text passages from different interviews, as well as differences, which are noted in detail (Meuser, M., Nagel, U., 2005). Due to the fact that I only have one person to interview, this step is negligible for my work. The objective of the interview is to summarize and to grasp the deep expertise of one person who speaks for his industry. Comparing the opinion on the issue of reshoring of various experts in the industry would be ineffective for my thesis, as I am asking for the overall reshoring potential of the semiconductor industry in the future.

5.5.4 Optimization of results

This chapter presents the results of the expert interviews with necessary comments added. The structure of the results follows the structure of the guideline and the display of the paraphrasing sector (appendix, section 7.3). The questions are split in two parts. This is followed by an interpretation of the results found by the expert interview.

5.5.4.1. The European semiconductor industry in the global supply chain

General Question:

What can you tell me about the nanotechnology industry or more precisely about the semiconductor industry in Europe or Germany? Is Europe attractive as a business location in this field?

“It is one of the most important and innovative economic sectors”

“The automotive industry is a European flagship”

“I also need power electronics there. In this section Europe is very interesting for the world”

General Question:

How massive is the industry in Europe in terms of economic indicators - what are its strengths?

“Automation is important for the European industry, and this is the sector where Europe is relatively strong”

“Another big area besides power electronics is sensor technology”

“The sensors are the sensory organs of electronics, and we Germans are very strong in this area”

“There are only 7 countries in the world that can do microelectronics, and Germany is one of them”

Lead question:

How big is the offshoring level of the semiconductor industry? How fragmented is the value chain?

“Extremely fragmented”

“A chip needs approximately 2 to 2.5 world reversals”

General Question:

Could you give me an example of how many countries a semiconductor device passes through before it reaches the final stage of its production development?

“Silicon wafer travels back and forth around the world for up to six weeks”

“The Americans do the most important part of the production”

“Each continent plays its own important part in the production chain”

General Question:

You often hear about the term resilience. How is resilience important for the stability of the supply chain?

“Very important”

“Resilience means perseverance and is extremely important for the global production chain”

Here the answers were comparably shorter than in other questions. It seems like the interviewee was not very sure what to say regarding the resiliency of the semiconductor supply chain.

Lead Question:

How much did the industry suffer due to COVID-19?

“COVID-19 ensured that the impetus for digitization was strengthened”

“People were forced to stay at home, so companies that are dedicated to digitalization have made a profit”

“It was a problem for the automotive industry”

“In absolute numbers, our industry did not suffer as much from COVID-19 as perhaps other industries”

General Question:

What impact did the trade wars between the USA and China have on the industry?

“The biggest intention of the Chinese is to become self-sufficient in technology”

“The trade wars have had an impact and they will continue to have an impact”

“The nanotechnology industry is far too important for there to be any restrictions”

Again, in this question it did not seem like the interviewee had a lot of knowledge, thus he responded hesitantly.

5.5.4.2 Reshoring in the semiconductor industry

Lead question:

How big is the reshoring potential of the semiconductor industry? How realistic is it that a paradigm shift could occur here?

“The chance is very small”

“Microelectronics is important because politicians have become aware of how important this industry is for our prosperity”

“Complete reshoring cannot be the goal”

Lead question:

What would the industry think of possible reshoring plans of the European Union - would they be for or against?

“The industry would like the politicians to support us in rebuilding more production in Europe”

“Microelectronics want to ensure that they remain a player in global microelectronics”

“The state must invest and provide support, because we need subsidies to remain active in the market”

“If we lose our position as one of the microelectronics-producing countries, we will have a major prosperity problem”

Lead Question:

What is the role of IoT and Industry 4.0 with possible future reshoring activities?

“An increase of new microelectronics factories is demanded”

“These 2 modernization movements will help to push a different kind of reshoring”

“The plant in China continues to operate and we have to build up new manufacturing capacity”

“There will be only one thing, and that is to build up additional capacity”

“We do not want autonomization or self-sufficiency”

“We will have to build up and expand production capacity”

“We as an industry are not interested in autarky”

General Question:

In which direction do you think the Global Production Chain will evolve - regardless of its industry? Will globalization be able to continue to work as it has in the past, or will there be mandatory changes in the global value chain at some point?

“We must continue to do everything possible which keeps our green planet a green planet”

“The future innovations will be through electronics and electronics need energy”

“It is with the help of digitalization and innovation that the global production chain will manage to reinvent itself”

5.5.5 Interpretation

The interview confirmed a few aspects which I already examined in this work and added other interesting factors (chapter 4 and section 5.2 and 5.5).

The semiconductor industry is massively fragmented as showcased by the examples given by the interviewee, and the industry did not largely suffer under the consequences of the pandemic, especially in comparison to other industries. It is not in the interest of the industry to fully reshore, but there is a need of additional production in the domestic region for Europe to stay a global player in the industry. One of the reasons why it is simply not in the interest of the European Union according to the interviewee is that the microelectronics industry overall is a volume industry, and it needs the global market to make any investments into the industry worth. There is a necessity of bringing back a part

of the entire production to Europe to keep the industry in competition. The interviewee openly calls for political support and speaks about investing taxpayer's money into the industry to ensure support and economic prosperity. The importance of proximity to the end users of the products in the case of semiconductors is far too important for the industry to even think about fully reshoring activities. There is also a growing importance of emerging economies for European companies who participate in the microelectronics industry and the high capital intensity (fabrication costs, costs of moving) deem any intentions of fully moving production back to Europe impossible.

The interviewee highlights the importance of the tools coming from the digital revolution. He repeatedly says that for instance the IoT and Industry 4.0 could trigger a different kind of reshoring, in which the plant abroad continues to operate, while we European have to build up new manufacturing capacity domestically. He observes the digital transformation to be accelerators of that. This means the digital revolution, but also the negative experience with COVID-19 and future possible exogenous shocks could lead to a shift in the setting of priorities soon, not only in the semiconductor industry.

It is to be expected that semiconductor companies producing technologies will increase firm's capacities to manage offshored and outsourced production networks abroad in future. In the beginning of the interview, the interviewee stresses the fact that the semiconductor industry is essential for the green transition. This green transition resulting due to the risks of a dangerous climate crisis could lead to more regionalized value chains and thus near/reshoring activities. The semiconductor industry drives innovation in the green transition area which could simultaneously increase reshoring activities and provide an incentive for decreasing offshoring/outsourcing and let companies emphasize on maintaining already existing production sites abroad.

In short, the interview validated many points I have raised so far. Any expectations for large scale reshoring are unrealistic due to reasons discussed. It is not unlikely however, that future trends could lead to shorter and more regionalized value chains in the semiconductor industry and in global economy overall resulting due to:

- The green transition in response to the climate crisis (sustainability)
- The improvement of business processes through digital transformation (industry 4.0, IoT, artificial intelligence)

- Exogenous shocks (pandemics, natural disasters)
- Geopolitical developments (strategic autonomy)
- The promotion of resilience in GVCs

How massive that transition will turn out to be is yet to be seen. In the case of the semiconductor industry, it is more realistic, that these trends leading to shorter value chains are going to undergo parallelly to the further expansion of offshoring activities and world-wide capacities, as forecasted by my interview partner.

Conclusions and key findings

After studying this subject for months, it can be said that three megatrends are to drive global major players investment plans in the post-COVID world:

- the acceleration of cost reduction and customer access to technology – keyword Industry 4.0 and IoT
- a stronger focus on climate change and sustainability induced by the green transition in investment decisions
- A new variant of GSC, with a mix of reshoring, nearshoring, onshoring and offshoring and the promotion and implementation of resilience in GVC to prevent the effects of negative impacts by exogenous shocks

Rather than reducing or closing production elsewhere, there will be a global expansion of capacity. Reshoring and related policies will be one among several policy instruments under the administration of the aforementioned megatrends. Any prevailing expectations of large-scale reshoring in any region of the world is highly unrealistic, but that is not a must in any case. Reshoring can find its justification under the curtain of modernity and trends, which will address us sooner or later. The green transition can change the international order and make technological sovereignty and strategic autonomy for each region crucial. In this environment, reshoring among other policies like nearshoring or onshoring can find its eligibility. Each industry has its own GVC characteristics, for which reshoring and familiar policies need to be tailored. The implementation and promotion of reshoring policies will not work without subsidies and tax money.

However, these cost factors can be kept low if reshoring is complemented with other policies like sector-specific policies (i.e., obligations for companies to source domestically

or use financial incentives to reshore), horizontal policies or stockpiling policies (see chapter 5.4) (Baldwin & Evenett, 2020) (Raza, W., Grumiller, J., et al., 2020).

This work has examined the possibility of reshoring policies embracing the global market and how both the GSC and GVC could be patterned with reshoring as one of its main agenda.

In conclusion it should be stressed that the future development of global economy and the financial markets still contain a number of uncertainties. There is a possibility for reshoring policies to not be initiated whatsoever, or on the contrary to be fully implemented on a large-scale level, albeit the chance for one of these procedures to happen is small.

It only remains to state that we are on the threshold of an exciting time in the next decades in the presence of a changing international order aided by technological progress, the idea of sustainability and the richness of human imagination.

Appendix

7.1 Interview guide

a) Industry and corporation

Company:	
Address:	
Sector:	
Products:	
Number of Employees:	
Sales Market:	

b) Interviewee

Name & Title:	
Length of service:	
Position:	
Business unit:	
Main activity:	

<p>I agree with the Interview:</p> <p>YES <input type="checkbox"/></p> <p>NO <input type="checkbox"/></p>
--

<p>I consent to the publication of the interview:</p> <p>YES <input type="checkbox"/></p> <p>NO <input type="checkbox"/></p>

<p>I want my interview to be published anonymously:</p> <p>YES <input type="checkbox"/></p> <p>NO <input type="checkbox"/></p>

Thank you very much for taking the time for this interview.

You are helping me to write my master thesis in International Management. The main goal of my research is to show the potential for reshoring in the semiconductor industry and for this I need your expertise.

First of all, I would like to ask your permission for tape recording. This will help me in the evaluation of the interview and gives me the opportunity not to have to take notes during the interview, which could possibly distract me.

In the following interview, I will ask you the questions listed below. The questions are distinguished between lead questions and general questions.

Lead questions

How big is the offshoring level of the semiconductor industry? How fragmented is the value chain?
How much did the industry suffer due to COVID-19?
How big is the reshoring potential of the semiconductor industry? How realistic is it that a paradigm shift could occur here?
What would the industry think of possible reshoring plans of the European Union - would they be for or against?
What is the role of IoT and Industry 4.0 with possible future reshoring activities?

General Questions

What can you tell me about the nanotechnology industry or more precisely about the semiconductor industry in Europe or Germany? Is Europe attractive as a business location in this field?

How massive is the industry in Europe in terms of economic indicators - what are its strengths?

Could you give me an example of how many countries a semiconductor device passes through before it reaches the final stage of its production development?

You often hear about the term resilience. How is resilience important for the stability of the supply chain?

What impact did the trade wars between the USA and China have on the industry?

In which direction do you think the Global Production Chain will evolve - regardless of its industry? Will globalization be able to continue to work as it has in the past, or will there be mandatory changes in the global value chain at some point?

Thank you for this informative and entertaining interview.

I would be happy to send you the results of my work. If you have any further questions, please do not hesitate to contact me.

7.2 Transcription

Expert interview - 17.09.2021

Company: Industry Association

Address: Lyoner Straße 9, 60528, Frankfurt am Main, Germany

Sector: German Electronics Industry

Products: Semiconductor and Microelectronics

Number of employees: -

Sales market: Europe

Name & Title: -

Interview partner's position: Referent for Microelectronics and Sensor Technology

Length of service: 15 years

Business Unit: -

Main activity: Support for member companies

The interview partner insisted the interview to be published anonymously.

What can you tell me about the nanotechnology industry or more precisely about the semiconductor industry in Europe or Germany? Is Europe attractive as a business location in this field?

The nanotechnology industry, which includes the semi-conductor industry, is one of the most important and innovative economic sectors in the history of mankind. The world needs innovative components for converters, i.e., AC, DC, etc. The bottom line is that we are talking about DC voltage, AC voltage etc. This is very much needed, for example, in every electric car, that is, the more electric mobility comes on the road, the more power microelectronics is needed, at the same time, the automotive industry is a European flagship, with burners in the first place, of course. The semiconductor industry is of course also needed for the green transition, so that we stay in English, as you said earlier, there is the digital transition and the green transition. The digital transition has the semiconductor industry as an absolute enabler, e.g., processors, lap-tops, computer centers, etc. At

the same time, for the green transition I need power electronics very strongly, for solar modules, wind energy, electromobility and also a very small market for the micro industry are drives. I also need power electronics there. In this section Europe is very interesting for the world.

How massive is the industry in Europe in terms of economic indicators - what are its strengths?

Automation is important for the European industry, and this is the sector where Europe is relatively strong. Automation means everything that helps companies to automate, and only microelectronics is able to make drives more energy-efficient through its enablers. These are the big areas, and another big area besides power electronics is sensor technology. Sensors, explained very simply, if you imagine a human being as electronics, then the processor and the memory are the brain, the sensors are the sensory organs, nose, ears, etc. these are the sensory organs of microelectronics, these are the sensors. That means you can transform a human being into the digital world. The sensors are the sensory organs of electronics, and we Germans are very strong in this area, with Germany always creating about half of the added value in Europe. That means that if Europe has x percent share, then it is usually the case that Germany has half of the total share of x. All in all, there are only 7 countries of the around 190 countries in the world that can do microelectronics, and Germany is one of them. The other 190 cannot. That is an elitist club.

How big is the offshoring level of the semiconductor industry? How fragmented is the value chain?

Well, extremely, that's what I said. A chip needs approx. 2 to 2.5 x world reversals, so that it reaches the last stadium of its production. This happens on average about 2 to 2.5 times, where it travels around the earth. I think that says a lot.

Could you give me an example of how many countries a semiconductor device passes through before it reaches the final stage of its production development?

I can give you an example. If you want to make a chip, you need a silicon wafer. This is a very small part. It first has to be manufactured, that's the so-called supplier industry, but when it gets into a factory, it first has to be processed. To do this, however, someone has to come up with the idea of devaluing such a chip, which is done on the computer. Chip designs are designed on this computer and created on this silicon. They are etched into it using physical methods. And if you now consider that a silicon wafer like this travels back and forth around the world through companies for up to six weeks, you can see how highly complex this manufacturing process is. Imagine intel, which produces its own processors, sitting in Silicon Valley and developing a chip, the architects of a chip, so to speak. In other words, the chips are invented in an American laboratory, they produce masks, and send them to a semiconductor factory in Taiwan. The latter now takes these masks, which were invented in America, and shoots them through his factory with so-called silicon wavers. Then they are flown to South Korea and the chip is scaled down. Now they are separated there, then they are flown to Vietnam. In Vietnam, they are then made with small carriers so that they can be placed on the so called black beetles. Then they fly to America and are tested. After testing, they fly to India where they are further tested and then they fly to their service providers in Europe. There they are tested again, then they are put back on the plane and then they come to China and are put into the car there, for example.

This is how a chip is created. The Americans do the most important part of the production here, i.e., the Americans de facto own every second chip that is in circulation. The Chinese are strong in assembly and testing, while the Europeans are top in power electronics and sensor technology. Each continent plays its own important part in the production chain.

You often hear about the term resilience. How is resilience important for the stability of the supply chain?

Very important, of course. Resilience means nothing other than perseverance and, as in every other industry, resilience is extremely important for the global production chain. I can't say or predict to what extent various resilience strategies might be implemented. I think time will tell.

How much did the industry suffer due to COVID-19?

COVID19 ensured that the impetus for digitization was strengthened. As people were forced to stay at home, they increasingly spent their money on home entertainment, so companies that are exclusively dedicated to digitalization have made a profit. A large part of the semiconductor industry is naturally involved in all these things. This means that the outbreak of the pandemic was not a big deal for parts of the industry, but it was a problem for the automotive industry, for instance. I'm sure you've done some research on the industry and found out that in absolute terms, our industry didn't suffer as much from COVID-19 as perhaps other industries, some of which had nothing to do with us. They definitely had more to complain about, so I don't think we should complain about anything.

What impact did the trade wars between the USA and China have on the industry?

The biggest intention of the Chinese is to become self-sufficient in technology. Their goal is to produce everything themselves. The trade wars have had an impact, of course, and they will continue to have an impact, as I think they will more or less continue under the new Biden administration. In my opinion, however, the nanotechnology industry is far too important for there to be any restrictions.

How big is the reshoring potential of the semiconductor industry? How realistic is it that a paradigm shift could occur here?

The chance of a paradigm shift in this respect is small. I have to elaborate a bit: There is a so-called chip alliance. There is the European pact of skills, which is all about young talent. In all the programs that are running at the moment, microelectronics is important because politicians have become aware of how important this industry is for our prosperity. If we get left behind in microelectronics, we get left behind everywhere so to speak. We are a manufacturing Nation. We have innovative minds. In electronics, every innovation is linked to microelectronics. We have to keep up here with the global players, everyone has recognized that. To what extent we can achieve this is another question. Large companies are talking to politicians, for example to the European commission. Because they are all trying to figure out how much we have to bring back in order to get the technological sovereignty. One hundred percent reshoring, I told you, there will be no region in the next 10 to 20 years that can do that. There will be no region that will be able to

produce all available steps of the supply chain itself. Let's start with why Europe can't do it. For example, where do we get rare earths? Can we produce rare earths here so that we have enough to make microchips? No, we will always have to rely on imports. If I am dependent on imports, purely because I am in Germany and not in Africa or somewhere else where that is simply available. Then I have to have a basis for negotiation, a bargaining chip to continue to get that. And if China has this advantage, because they have bought up all the mines, then I need a negotiating skill with China, then I have to offer them something in return.

So, in our opinion, there will not be a complete reshoring. That can't be the goal either, because if all countries were to become self-sufficient in their regions, then the taxpayers - and there are also figures for this - would have to make a considerable contribution. We Europeans would have to invest several hundred billion euro, up to a trillion euro, we are talking about a thousand billion euro in order to first install everything we need. Since the microelectronics industry is a volume industry, i.e., every company has to produce a large number of units to make the investment worthwhile, we do not have enough customers, but need the 10 billion people as customers. These global customers, called the volume market, are necessary for this to work. And if everyone wants to do it for themselves, no region will have enough customers. That would be far too big of a subsidy business.

What would the industry think of possible reshoring plans of the European Union - would they be for or against?

The industry would like the politicians to support us in rebuilding more production in Europe. This does not mean that we want to produce 100% of all microchip types in Europe, but we have recognized that in order to be technologically more advanced, we need more production in Europe. This is the so-called 20 % that the European Commission has declared. We are currently at 10 %. That is a doubling, but the microelectronics market will also double in the next 10 years. In other words, we would have to quadruple our production in the next 10 years. We are talking about gigantic sums here, two to three billion sums that would have to be invested. The companies can't invest that. If politicians want to do that, they have to invest taxpayers' money. Microelectronics does not want subsidies to fill its bank account, but to ensure that we remain a player in global microelectron-

ics, which we currently are. And for this, tax money will have to flow sooner or later. Because the companies, as you know, are stock corporations, which means they want to earn money with it. They are stock-operated companies, and if the shareholders are not satisfied with the quarterly figures, there will be problems. Unfortunately, that's how the economy works.

In other words, the state must invest and provide support, because we need subsidies to remain active in the market. Companies will not be able to invest on their own due to economic conditions, which is why politics must create these conditions. If we lose our position as one of the seven microelectronics-producing countries, we will have a major prosperity problem. Compared to China, for example, we are slower, but they have a completely different political and economic environment, so any comparison is not very fair.

What is the role of IoT and Industry 4.0 with possible future reshoring activities?

The industrial companies are asking politicians to do something for the components in Europe, so that they are also manufactured locally. The customers of the micro industry are currently asking politicians to do something, this means to produce more microelectronics that are needed here. That is a clear statement, not necessarily reshoring, but an increase and an expansion of new microelectronics factories is demanded. The same applies to the internet of things. The internet of things is nothing other than every octopus arm getting its own brain, where the first preliminary calculations are made before it is typed into the cloud. The cloud represents the large central brain. Metaphorically speaking now. Some arms can act autonomously from the brain without the main brain in the head being addressed. IoT is nothing else in this sense, I hope you understand me. That is the great advantage of the internet of things.

Reshoring actually brings production back. I think that these 2 modernization movements will help to push a different kind of reshoring, namely that it will be additionally built up. No semiconductor company will come up with the idea of dismantling the plant in China and bringing back the activities. It's more the case that the plant in China continues to operate and we have to build up new manufacturing capacity in Germany and Europe. In other words, there will not be a physical return of the factory in this sense, but there will only be one thing, and that is to build up additional capacity. And everyone is striving for this at the moment. And the IoT and Industry 4.0 are accelerators for this, also because

the demand for microelectronics is extremely increased. So, I also have to produce some of it at home in order to be technologically sovereign. Reshoring can take a number of forms, for example, bringing the entire production capacity home or splitting it up. We will have to build up and expand production capacity, also at home. This will be a form of reshoring, but at the same time we will maintain our foreign locations, because the microelectronics industry depends on being close to the end users, and many of them are in East Asia and South-East Asia.

We do not want “autonomization” or self-sufficiency or whatever they call it. Infineon for example wants to continue to produce abroad in a value-adding way, but we do not have anything against intensions producing more in our domestic industry for the purpose of making it more competitive. However, all in all, we as an industry are not interested in autarky.

In which direction do you think the Global Production Chain will evolve - regardless of its industry? After all, it can be assumed that a great deal will change in the coming decades, be it for climate reasons, pandemics, overpopulation, but also technical progress and innovations.

Will globalization be able to continue to work as it has in the past, or will there be mandatory changes in the global value chain at some point?

I think mankind must continue to do everything possible which keeps our green planet a green planet. And we will have to do everything and there are no limits, that the temperature increase of this world does not go to extremes in any form. We see that man tends to innovate, to create, the innovations will be through electronics in the next decades, guaranteed and electronics needs energy. We have to see that we become more energy efficient, meaning that we produce in a CO₂ neutral way and so on. We will have to continue to think as humans, as a whole humanity, about the whole system. There are no limits to CO₂, it flies wherever it wants, there are no limits to extreme weather conditions. We have to see that we still leave a beautiful planet to our grandchildren in a hundred years. However, innovations will continue, technological progress will continue at full speed, innovations will continue to increase energy costs, and we must ensure that everyone has access to CO₂-neutral energy.

With all these aspects in mind, I think that despite various barriers such as climate change, future pandemics, etc., it is precisely with the help of digitalization and innovation

that the global production chain will manage to reinvent itself to some extent, but clearly with the goal of continuing to innovate and doing so with maximum freedom for science and technology as possible. Because only in this way can we find solutions to all the challenges that still lie ahead of us.

7.3 Paraphrasing

What can you tell me about the nanotechnology industry or more precisely about the semiconductor industry in Europe or Germany? Is Europe attractive as a business location in this field?

It is one of the most important and innovative economic sectors

The automotive industry is a European flagship
--

I also need power electronics there. In this section Europe is very interesting for the world

How massive is the industry in Europe in terms of economic indicators - what are its strengths?

Automation is important for the European industry, and this is the sector where Europe is relatively strong.
--

Another big area besides power electronics is sensor technology. The sensors are the sensory organs of electronics, and we Germans are very strong in this area

There are only 7 countries in the world that can do microelectronics, and Germany is one of them

How big is the offshoring level of the semiconductor industry? How fragmented is the value chain?

Extremely fragmented

A chip needs approximately 2 to 2.5 world reversals

Could you give me an example of how many countries a semiconductor device passes through before it reaches the final stage of its production development?

Silicon wafer travels back and forth around the world for up to six weeks

The Americans do the most important part of the production

Each continent plays its own important part in the production chain.

You often hear about the term resilience. How is resilience important for the stability of the supply chain?

Very important

Resilience means perseverance and is extremely important for the global production chain.

How much did the industry suffer due to COVID-19?

COVID-19 ensured that the impetus for digitization was strengthened.

People were forced to stay at home, so companies that are dedicated to digitalization have made a profit.

It was a problem for the automotive industry

In absolute numbers, our industry did not suffer as much from

COVID-19 as perhaps other industries

What impact did the trade wars between the USA and China have on the industry?

The biggest intention of the Chinese is to become self-sufficient in technology

The trade wars have had an impact and they will continue to have an impact.

The nanotechnology industry is far too important for there to be any restrictions

How big is the reshoring potential of the semiconductor industry? How realistic is it that a paradigm shift could occur here?

The chance is very small

Microelectronics is important because politicians have become aware of how important this industry is for our prosperity
--

Complete reshoring cannot be the goal

**What would the industry think of possible reshoring plans of the European Union
- would they be for or against?**

The industry would like the politicians to support us in rebuilding more production in Europe

Microelectronics want to ensure that they remain a player in global microelectronics

The state must invest and provide support, because we need subsidies to remain active in the market

If we lose our position as one of the microelectronics-producing countries, we will have a major prosperity problem

What is the role of IoT and Industry 4.0 with possible future reshoring activities?

An increase of new microelectronics factories is demanded

These 2 modernization movements will help to push a different kind of reshoring
The plant in China continues to operate and we have to build up new manufacturing capacity
There will be only one thing, and that is to build up additional capacity
We do not want autonomization or self-sufficiency
We will have to build up and expand production capacity
We as an industry are not interested in autarky

In which direction do you think the Global Production Chain will evolve - regardless of its industry? After all, it can be assumed that a great deal will change in the coming decades, be it for climate reasons, pandemics, overpopulation, but also technical progress and innovations.

Will globalization be able to continue to work as it has in the past, or will there be mandatory changes in the global value chain at some point?

We must continue to do everything possible which keeps our green planet a green planet
The future innovations will be through electronics and electronics need energy

It is with the help of digitalization and innovation that the global production chain will manage to reinvent itself

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