Automotive industry as a factor of regional competitiveness in the Czech Republic

by

Bc. Martin Rejka

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Declaration of Authorship

I, Martin Rejka, declare that this thesis titled, 'Automotive industry as a factor of regional competitiveness in the Czech Republic' and the work presented in it are my own. I confirm that:

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"I'd rather live in a cave with a view of a palace than live in a palace with a view of a cave."

Karl Pilkington

Abstract

by Bc. Martin Rejka

The automotive industry is one of the most important industries in the Czech Republic. This diploma thesis identifies its main characteristics and assesses its impact on regional competitiveness. The hypothesis tested in the practical section of this thesis is that suppliers producing high value-added products contribute to regional competitiveness more than suppliers of simple products. A review of relevant theories provides a sound reasoning to support this hypothesis. An analysis of available data from the Czech Republic, however, leads to a rejection of this hypothesis as the results from the practical part signalise that in the Czech Republic the impact of suppliers of simple products is higher than the impact of high value-added suppliers.

JEL classification: L62, L14, D24

Key words: automotive industry, regional competitiveness, global production networks, Czech Republic

Abstrakt

by Bc. Martin Rejka

Automobilový průmysl je jedním z nejdůležitějších průmyslových odvětví v České republice. Tato diplomová práce identifikuje jeho hlavní charakteristiky a zhodnocuje jeho dopad na regionální konkurenceschopnost. Hypotéza testovaná v praktické části je že dodavatelé produktů s vysokou přidanou hodnotou přispívají regionální konkurenceschopnosti více, než dodavatelé jednoduchých produktů. Přehled relevantních teorií poskytuje solidní argumentaci podporující tuto hypotézu. Analýza dostupných dat z České republiky však vede k odmítnutí této hypotézy, neboť výsledky praktické části této práce naznačují, že dopad dodavatelů jednoduchých produktů je v České republice vyšší, než dopad dodavatelů produktů s vysokou přidanou hodnotou.

JEL klasifikace: L62, L14, D24

Klíčocá slova: automobilový průmysl, regionální konkurenceschopnost, globální produkční sítě, Česká republika

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Abbreviations

ANT	actor networks (theory)
CC	commodity chain
CE	Central Europe
CEE	Central and Eastern Europe
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement
CKD	complete knock down
CMEA	Council for Mutual Economic Assistance
CPS	cyber-physical system
CZK	Czech crown (currency)
CZ-NACE	Czech-Nomenclature générale des Activités économiques dans les Communautés Européennes
CZSO	Czech Statistical Office
ESPON	European Spatial Planning Observation Network
EU	European Union
FDI	foreign direct investment
GCC	global commodity chain
GDP	gross domestic product
GPN	global production network
GVA	gross value added
GVC	global value chain
HR	human resources
IMF	International Monetary Fund
INRA	Institute National de la RechercheAgronomique

IRI	International R&D Investment Scoreboard
ISPV	Informační systém o průměrném výsledku
IT	information technologies
JV	joint venture
KPMG	Klynveld Peat Marwick Göerdeller
MNC	multi-national corporation
MNE	multi-national enterprise
NACE	Nomenclature générale des Activités économiques dans les Communautés Européennes
NUTS	Nomenclature des Unites Territoriales Statistiques
OEM	original equipment manufacturer
OICA	Organisation Internationale des Constructeurs d'Automobiles
OLS	ordinary least square
PwC	PriceWaterhouse-Coopers
R&D	research and development
SME	small and medium enterprises
STAR	Science and Technology Advanced Region
SUV	sports utility vehicle
ŠÚSR	Štatistický Úrad Slovenskej republiky
TPCA	Toyota Peugeot Citroen Automobile
UN	United Nations
VaVpI	Výzkum a Vývoj pro Inovace
VC	value chain
VW	Volkswagen
WTO	World Trade Organization

Chapter 1

Introduction

The automotive industry is an industry with a strong presence in the Czech Republic. Cars are probably the most complex and the most technologically complicated products ordinary people buy.[1] That, coupled with the fierce competition in the automotive industry, puts enormous stress on car makers and suppliers to continually produce superior and innovative products. The automotive industry in global terms is one of the most R&D-intensive industries and is considered a strategic industry of a global significance.[2] A contemporary trend in the automotive industry is that lean production methods force the car manufacturers to outsource production of parts and complex modules to suppliers, which puts the large car manufacturers in a position of mere assemblers. This reliance on the supply network causes that a larger portion of the value added is shifted towards the automotive suppliers. That means that the value added is nowadays more

[1] There are also other highly complicated products that people buy at lower prices - for example cell phones or computers. But it is the complexity that puts cars on another level. For example a modern cellphone is indeed complicated and its production requires high capital investments, but it is on the level of a car radio in terms of complexity. But car producers have to deal with other spheres of technological complications than just electronics - for example means of propulsion, safety, comfort etc.

[2] Despite the automotive industry in the Czech Republic lacks more high-value added production and R&D activities, it is superior to automotive industries in other CEE countries. Even though Slovakia currently produces more cars per capita than the Czech Republic, the author thinks it is safe to say that Czech automotive R&D activities, that are virtually non-existent in Slovakia, put the Czech automotive industry far ahead.

regionally dispersed than earlier in the history of the car production. Higher demands on suppliers force them to source other things from other suppliers and so on, which creates a multiplier effect. The dynamics and the contemporary ripple effects are especially important for regional development. For those reasons this diploma thesis focuses on the properties and characteristics of the automotive industry and aims to identify factors that affect the regional development with a special emphasis on the automotive supplier sector.

The theoretical part focuses mainly on literature review of the theories around global production networks (GPN). Several predecessors that have been shaping the GPN theory such as value chains, commodity chains or actor networks are examined. Additionally, several phenomena relevant to the automotive industry that branch from the GPN theory are explored to deepen the understanding of the automotive industry. Specifically, those phenomena are foreign direct investments, spillover effects, upgrading and R&D activities.

The diploma thesis is divided into two sections. The first section deals with the theoretical background and its main method is a review of relevant literature summarised into a comprehensive theory of the automotive GPN and its impact on regions. The second section – practical, in the beginning summarises the development of the Czech automotive industry in pre- and post-1989 periods, characterises its features with respect to FDI, R&D, provides an example of an automotive cluster development in one of the regions and describes the current condition of the Czech automotive industry. The crucial part of the practical section is an analysis of the regional competitiveness with respect to the automotive industry, specifically the supplier sector. It draws onto the findings from the theoretical part and uses relevant tools to properly assess regional competitiveness.

The main objective of this diploma thesis is to assess the automotive industry as a factor of regional development and competitiveness in the Czech Republic. Numerous studies reflecting regional competitiveness have been conducted, but none of them considered the automotive industry as its shaping factor. The author's hypothesis is that high value-added production contributes to regional competitiveness more than low value-added production. The goal is to

identify similar characteristics and divide the 14 Czech NUTS III regions into several groups regarding their competitiveness. Additionally, an assessment of each of the groups follows, attempting to recognize the specific factors that affect the regions' competitiveness and the possibilities for future development. It is expected, that despite the fact that the Czech Republic is considered to be an automotive hub on the whole, the spatial distribution of the automotive industry is uneven and that there are superior regions as well as severely under-developed regions. Lastly, the possibilities of policy makers regarding the automotive industry-related competitiveness on the government level and on the level of the regional self-governing units are discussed.

Chapter 2

Theory

2.1 Possible approaches to the study of the industrial impact on regional development

According to Blažek (Blažek 2012) there are two identifiable approaches to the study of the industrial impact on regional development. The first approach is institutional, which identifies the complexity of regionally specific factors as the main source of competitiveness. Examples of this category are clusters, learning regions, triple helix [1] or regional innovation systems. Blažek says that "a common belief of those theories is that the activity of the agent and its characteristics is influenced by the surrounding environment, which is commonly understood as a man-made socio-economic or socio-cultural environment." (Blažek 2012, p. 210) While this approach provides a sound reasoning for the regional development, its scope is only regional and does not account for the global processes that are increasingly more prevalent in the contemporary globalized world.

The second approach is represented by theories that highlight the importance of vertical inter-firm relationships. Examples of the latter category are global commodity chains, global value chains or global production networks. The

[1] A concept of relationships between universities, the government and industries.

basic belief of those theories is the idea that "not only complicated, but even simple products are produced as a result of cooperation of many firms, while using know-how, resources, capital and labour force from all over the world." (Blažek 2012, p. 214) This approach seems more convenient for the study of the effect of the automotive industry on the regional development. The reasons for that are following: 1) the global nature of the automotive industry means that the processes are not country-specific and despite the fact that only one country is examined in this paper, a general outlook on the automotive industry is necessary; 2) despite the basic "global-" theories account for only the internal network actors, specifically the GPN theory accounts even for some external institutions that are usually covered by the institutional theories. This added dimension puts the GPN theory on another level and to a certain degree makes it comparable to the institutional theories on the regional scale; and 3) the rise of multinational enterprises means that many firms have much greater power in deciding what and where is going to be produced than other institutions and the regional characteristics. Naturally the other institutions and the regional characteristics can influence the multinational enterprises, but the final decisions are always in the big players' hands.

For those reasons the theoretical part examines the "global-" theories and especially the theory of global production networks. Despite the institutional approach seems outdated in the light of the "global-" theories, it is not neglected in the practical part of this paper, on the contrary, it is used together with the modern approaches to form a model that describes the Czech regional competitiveness. The reason for that is that on the one hand the automotive industry is truly a global industry and hence must be treated like one, but on the other hand the Czech Republic represents a relatively small region and the knowledge of the more "region-specific" factors is beneficial for its understanding.

2.2 Predecessors of Global Production Networks

International trade plays an important role in the global automotive industry. Historically, actors within the automotive industry have participated in international trade to varying degrees. As I outline later, actors that participated in the global trade network reaped greater rewards than those that did not. The theory of Global Production Networks (GPN) stems from several different theories with varying degree of importance, and can help explain the processes behind the automobile industry today. Understanding those theories is essential for understanding the complex phenomenon of GPN.

2.2.1 Value chains

Value chain theory is relatively the least useful one for this topic, yet it provides us with important insights. The theory suggests that corporations are responsible for identifying and enhancing areas in which value may be added in production, marketing and distribution processes. Michael Porter (Porter 1990) believes firms are the only actors capable of competitive advantage, which means only companies can achieve competitive advantage. According to Porter, this ability comes from a strong leadership and certain company policies, such as those that create pressure for innovation, establish early-warning systems, welcome domestic rivalry, and tap into global networks to make use of the selective advantages of other nations. (Porter 1990) The most limiting aspect of this theory is its pure linearity, because it focuses only on the existing chain of processes and neglects corporate power that affects processes outside of this chain and can benefit from the value chain. (Henderson et al. 2002) There is actually one company policy a firm should pursue according to Porter (Porter 1990) that does not fit this omission. That is the use of alliances, but Porter himself says this should only be used selectively, because it only can achieve selective benefits, but it always presents significant costs. This creates direct discrepancy with the other theories and makes Porter's theory almost impossible to use for the study of GPN.

2.2.2 Commodity Chains

The theories of Commodity Chains (CC) are focused on all levels of trade – international, national, regional and sectoral. Two distinct approaches have been taken in this field. Global Commodity Chains (GCC) is an Anglophone approach developed by Gary Gerefi. Filiéres is a francophone approach developed by researchers from INRA and CIRAD.[2] Even though both approaches generally cover the same subject matter, they differ in theoretical and political grounding. (Raikes et al. 2000)

2.2.2.1 Filiéres

The Filiéres concept is based on technocratic agricultural research and originates in France in 1960s, when it studied agricultural contracting. Until the 1980s, it focused only on local production and the area of international trade was overlooked. (Raikes et al. 2000) Its main objective was to monitor commodity flows in order to identify the agents, activities and the hierarchical relationships between the agents. (Henderson et al. 2002) It also applied the theory of transaction costs to study the restructuring of specific filiéres, which is something the anglophone approach omitted. (Raikes et al. 2000) Another distinction from the GCC approach is its multidisciplinary approach and the use of bewildering number of theoretical concepts, such as empirical research, quantitative methods, or anthropological approach. Theoretical inconsistency is sometimes thought to be the burdening factor of this theory, thus calls for more unified approach have been made. (Raikes et al. 2000) The limiting factors of this theory are that it considers only large firms and state organisations (other agents are neglected) and it does not thoroughly consider the nature and properties of the linkages within and between the agents. (Raikes et al. 2000)

[2]Institute National de la RechercheAgronomique (INRA) and the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)

2.2.2.2 Global Commodity Chains (GCC)

The Global Commodity Chains (GCC) theory was developed within the context of the agricultural and timber industries in the early modern era. Hopkins and Wallerstein described a commodity chain as a network of production and labour processes, whose finished product is a commodity. (Raikes et al. 2000) Gereffi and his collaborators took a more comprehensive approach, by defining GCC as "sets of inter-organizational networks clustered around one commodity or product, linking households, enterprises and states to one-another within the world economy."(Raikes et al. 2000, p. 7) Gereffi's work also highlighted the importance of coordination and new global buyers. (Gereffi et al. 2005)

Gereffi has identified four dimensions of GCC – input-output structure, territoriality, governance structure and institutional framework. (Henderson et al. 2002) The core dimensions are described below.

The input-output structure and territorial coverage define the configuration of firms. The input-output structure consists of the linkages between raw materials, knowledge, production processes and service functions. Territorial coverage is the spatial patterning and the extent of its concentration or dispersion. (Henderson et al. 2002; Raikes et al. 2000) Territorial coverage is particularly important, as Sturgeon and Greffi (Gereffi et al. 2005) note, due to the tight interdependencies between geographically clustered firms and the embeddedness of tacit knowledge.

The governance structure dimension has so far received the most attention by scholars. The governance structure defines two forms of GCC: producer-driven and buyer-driven GCC.

Buyer-driven chains prevail in fields with low barriers to entry in production, such as apparel, footwear or personal computer industry. Producers in those kinds of chains are subordinated to the main players controlling design and marketing and the production is usually outsourced to the most cost-efficient areas, typically in developing countries. Large retailers and brand name merchandisers hold the production rights and are responsible for product design, specification, purchases and marketing. Production is in the hands of relatively independent

dispersed producers, who operate as original equipment manufacturers (OEM). The majority of the value added does not come from the production process, but from the brand name and marketing. The power of the brand name merchandisers and retailers is significant. Research on the horticulture and shoe industries have proven that global actors can and do exert power over the smaller actors, despite the ownership of production, processing or transport facilities is still in the hands of the small firms. (Henderson et al. 2002; Raikes et al. 2000; Gereffi et al. 2005)

On the other hand, the producer-driven chains, such as the automotive or aircraft industries, have large barriers to entry. Institutional power is exercised vertically, from corporate headquarters through to its subsidiaries. As a result of subsidiary ownership, value tends to flow "upwards" – to higher levels of corporate governance. In those chains, it is usually the low value-added activities that are outsourced to developing countries. Yet some industries are hard to fit into one of those categories, for example the computer industry is very capital intensive and carries large barriers to entry. Certain products, such as consumer electronics, could easily be defined as buyer-driven industries as the products are fast moving and the production costs are getting lower. (Henderson et al. 2002; Raikes et al. 2000)

The institutional framework dimension is the latest development within the GCC theory. The institutional framework of a GCC provides the opportunity for a subordinate GCC participant to better access certain markets and face lower costs than would an individual small producer. A subordinate participant also has greater accumulated knowledge and information through the process of learning-by-doing and can achieve faster and smoother upgrading. (Raikes et al. 2000)

2.2.3 Actor Networks (ANT)

The Actor Networks Theory attempted to remedy the drawbacks of the previous theories, however, it also has limitations. The main focus of ANT is on the relationships between actors of a particular network. It argues that a network can

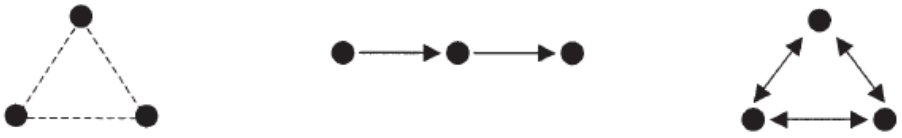
only be understood through the relationality of objects and their role in shaping individual entities in networks. ANT also does not perceive space and distance in absolute terms, but as "spatial fields" and scopes of influence, power and connectivity. The ANT, however, does not consider structural preconditions and power relations, which happen to be an important factor in shaping production networks. (Henderson et al. 2002) The ANT also fails to identify the differences in nature between macro and micro-levels, instead focusing on relative size and scope of these two areas. (Murdoch 1995)

VC/GVC, GCC, ANT or Filiéres have at least one shared shortcoming. Those theories operate mostly with the term "chain". Networks provide an additional tool for analysis and understanding theories of global production network. An attempt to bridge the gap between chains and networks was developed by Lazzarini in his theory of Netchains. (Lazzarini et al. 2001)

2.2.4 Netchain

Lazzarini's theory of Netchains combines the qualities of both networks and chains (hence the name Netchain) and is based on three types of interdependencies – pooled, sequential and reciprocal. (Lazzarini et al. 2001) Graphical representation of the interdependencies is shown in figure 2.1.

FIGURE 2.1: Interdependencies in Lazzarini's netchain concept



(a) *Pooled* (b) *Sequential* (c) *Reciprocal*

Source: Lazzarini et al. 2001, p. 11

Pooled interdependence involves discrete or autonomous agents, whom are more or less anonymous, because the relationships between them are sparse and indirect. Knowledge in this type of interdependency is diverse and is exchanged directly or indirectly via products. The sparsity of the relationships means that

there are externalities in the network – its value will increase with its expected size. Compatibility between firm's products is the key to capture the externalities in the network, and results in pooled interdependence. (Lazzarini et al. 2001)

Sequential interdependence, unlike pooled, involves direct sequential relationships between agents – the output of one firm is another firm's input. This relationship is essentially a supply chain. Transaction costs within the network can be managed by proper inventory management, logistics or attempts to optimise sequential production. Planning is the most efficient way of managing sequential interdependencies, because it provides the agents with a schedule of material and work flows necessary for efficient production process. (Lazzarini et al. 2001)

Reciprocal interdependence is the most complex one among the three forms of interdependence. Within this framework, firms exchange outputs to use as inputs. Commodities therefore flow in all directions and firms are mutually dependent on the choices their business partners make. Strong connections and dense networks are therefore needed. Strong ties are important with respect to knowledge, because this type of interdependency involves a high degree of information specialization. With this in mind, it is clear one firm would not be able to function with other firms who posses the remaining knowledge needed for completion of the production. For optimal production, mutual adjustments must be achieved. These adjustments are made with both partners involved. The main source of mutual agreement is past experience, because it reveals the partner's performance, actions, fosters learning and reinforces social norms. Agents should therefore behave as well as possible, because it directly affects their future businesses with the current partners. (Lazzarini et al. 2001)

The core of the Netchain theory is the combination of all three types of interdependencies mentioned above. Intra-organisational interdependence is then addressed by appropriate policies accordingly to its type. (Lazzarini et al. 2001)

Lazzarini's netchain theory has one significant drawback – it does not attempt to describe how chains and networks (netchains) integrate within the economy. Hofstede (Hofstede 2003) discusses this problem because its understanding can provide us with better knowledge to serve the needs of the economy. The

word that has been associated with the level of netchain integration and its structure is transparency. Hofstede posits that the netchain transparency depicts the whole netchain as the focus of the theory, rather than the individual organizations. Transparency is in Hofstede's view understood as a state of unhindered information flow. That means that the final consumer is able to say where the product comes from, who made it and who benefited from its production, but on the other hand it also means that the producer knows who bought their product or how consumers behave. That is obviously idealistic situation, but knowledge of its degree is beneficial for predictions of market needs and quick responses.

It could be inferred that the more transparent the network the better, but that is not the case of every netchain. Some netchains are reliant on the unknowing of information and an effortless availability of some information could be detrimental. The automotive industry is a great example of this. Since cars are extremely complex machines, it is very hard for ordinary people to determine the quality of every single part of the car. That puts car manufacturers in a position where they can fool their customers by using inferior materials or technologies.

Ludwig Theuvsen (Theuvsen 2004) analysed the transparency issue from an organizational point of view using Lazzarini's concept of interdependencies. Theuvsen argued that the more interdependencies in the netchain (caused by a greater division of labour), the lower the transparency and also described three key factors determining the netchain transparency. The first factor is the degree of specialization, which is inversely proportioned to the vertical integration of the netchain. The second determinant is the number of potential partners, which relates to the number of both suppliers and customers. The third factor is the frequency of transactions. The higher the value of the three factors, the less transparent the netchain is. Since the automotive industry is extremely vertically disintegrated, the number of customers and especially suppliers is large (relative to other industries) and since the nature of the automotive industry demands frequent transactions in order to stay competitive, the overall transparency of the industry according to the Theuvsen's analysis is very low.

Despite the paragraph above states that lower transparency is beneficial

to the automotive netchain, it is so only relative to their counterparts – customers. If the producers are isolated from the rest of the economy, lower transparency is also detrimental. The reason for that is that not only the customers benefit from the effortless access to information, but also the managers. When the netchain lacks transparency, it is hard to execute effective decisions and the netchain's effectiveness suffers as a result. To conclude this issue, transparency brings the producers both advantages and disadvantages, hence a proper management that keeps the transparency at the desired level is in place.

2.3 Global Production Networks (GPN)

The concept of production networks is considered to be the most complex tool for understanding the global economy. Production network theory does not attempt to describe the existence of some networks, but rather to describe its structure, properties and relations. (Coe et al. 2008; Blažek 2012) The term "global" overcomes some limitations of previously used terms "international" or transnational". The inclusion of a "national" dimension does not accurately reflect how the non place-specific processes penetrate the place-specific ones and vice-versa. (Henderson et al. 2002)

Richard Lamming (Lamming et al. 2000) attempted to classify production networks based on two factors – the innovativeness and the complexity of the product. The innovativeness dimension recognises two types of production network – innovative and functional. The innovative production network needs to be primarily flexible and agile in order to be competitive, while the functional network needs to be simply cost-effective (in other words lean). The complexity dimension simply differentiates between technologically complex and simple products. According to this classification, the automotive industry is ranked as a production network of functional and highly complex products. Although the study identifies cars as functional products, the modern car production is very innovative and the competition in terms of technological advance is fierce in the automotive industry.

A very important aspect of GPN is that they are inherently dynamic. There is no such thing as static GPN. GPN changes may either affect the functionality of the whole GPN or subunits of the GPN. (Coe et al. 2008) The GPN also recognizes critical factors other than intra-firm organization to the success of the overall GPN. As cost reduction calls for further specialization inter-firm relationships within, and in some cases outside of the GPN, are becoming more important. The key incentives for the firms come from the GPN itself and the firm's position within the GPN to a certain degree determines its success. (Blažek 2012)

There are two crucial differences between the approaches of the Value Chain and Global Commodity Chain theories and the Global Production Network theory. The first one arises from the definition itself. While chains are merely just linear structures, networks incorporate interconnections between different chains and involve many other types of network configuration. The second one is that the chain theories focus primarily on the governance of inter-firm activities, whereas GPN theory attempts to cover all relevant sets of agents and processes that may affect the GPN, such as Research and Development (R&D), the government, or labour unions. The GPN theory can shed light on the multiplicity of actors involved in the decision sphere, or in the case of the Czech Republic, highlight the strengths and weakness of external actors in the production process. (Coe et al. 2008; Blažek 2012)

Similarly to Gereffi's GCC theory, GPN theory acknowledges the same two basic types of GPN – producer-driven and consumer-driven. Producer-driven GPN can be characterised as a production pyramid. The leading firm is at the upper tier and exercises its power to control the lower levels of production. The lower the firm stands, the less power it possesses. A typical example is the automotive industry, where the leading firm is an automaker, which has its extensive supplier base. Buyer-driven GPN is essentially the same as Gereffi's interpretation – the leading firm stands at the very end of the sales chain, directing their suppliers. An example of buyer-driven GPN is large supermarkets, which tell suppliers needs and expected costs for these supplies. (Blažek 2012)

2.3.1 Position within GPN

The position within GPN is one of the key aspects that affects the possible success of a firm. The positions of suppliers within a GPN are outlined below. There are three basic positions of suppliers within GPN – Tier 1, Tier 2 and Tier 3.Some authors mention a Tier 0,5 (Humphrey et al. 2003; Pavlínek 2012)

2.3.1.1 Tier 1

Tier 1 suppliers have the best position in the supplier hierarchy. They supply the most technologically advanced parts, typically whole modules and systems and also conduct their own R&D. This can be represented for example by brake systems, dashboards or interiors. (Blažek 2012; Pavlínek et al. 2013; Pavlínek 2012)

They usually have close working relationships with the leading firms. Their relationships are based on trust and are oriented towards the long-term. This is mostly because they supply the highest value-added goods and services for the manufacturers and securing a Tier 1 supplier is particularly painstaking. (Humphrey et al. 2003)

2.3.1.2 Tier 2

Tier 2 suppliers usually supply simpler products, but sometimes elementary development is necessary at this stage. These firms do not necessarily have to have extensive reach (what do you mean by this?), but they are required to be flexible, meet quality requirements and obtain certifications. (Pavlínek et al. 2013; Humphrey et al. 2003)

2.3.1.3 Tier 3

Tier 3 suppliers are at the bottom of production. They supply only very simple products, such as cables, fasteners or switches. The value added by such products

is low, because they do not require extensive R&D or capital investments. Firms at Tier 3 are the weakest within the GPN and are easily replaceable. Firms at this stage maintain their position through low prices. (Blažek 2012; Pavlínek et al. 2013; Humphrey et al. 2003)

2.3.1.4 Tier 0,5

Tier 0,5, sometimes called the Global Mega-suppliers, is a category that Humphrey (Humphrey et al. 2003) adds to the usual three Tiers. These tiers are the largest players in the supply sector. Global coverage is necessary for those suppliers so that they could fulfil the needs of their customers anywhere in the world. They also have their own extensive R&D operations, because sometimes they supply modules that have to meet certain criteria set by the leading firms. (Pavlínek 2012)

An important result of Pavlínek's study (Pavlínek et al. 2013) related to the supplier sector has shown that the lower the firm is within the GPN (within its Tier structure), the lower the economic contributions to the host region. Not only because the productivity and efficiency are lower, but also because the yield from the corporate and individual's taxes is lower. And as is explained later in this chapter, a prerequisite for a region to grow is that the firms within the region are doing well.

2.3.2 Basic conception

There are three important elements in the GPN framework that govern the production process– value, power and embeddedness. (Henderson et al. 2002)

2.3.2.1 Value

Value creation is the main purpose of any GPN. Simply put, value is the sequential transformation of inputs to outputs. Inputs can be moth material – for example raw materials, or semi-finished products, and non-material, such as knowledge and labour. A similar logic is valid for outputs, as well. An important prerequisite for this process is that the output (typically some product or service) is demanded by others. (Coe et al. 2008)

To further examine the concept of value, the expression "value creation" must be defined. At first, any sort of value must be created - this is called the initial value creation. A significant component of this process is the set of conditions under which labour power is transformed into actual labour (Henderson et al. 2002), or more generally, how inputs are transformed into outputs. (Coe et al. 2008) This includes employee skills, working conditions, or production technologies. After the process of the initial value creation, value enhancement follows. The most important elements in this process are the nature of technology transfers within and between GPNs and the degree of supplier engagement in product sophistication (both quality-wise and technology-wise). As a consequence of the latter, focus is also aimed at the development of the demand for skills over time and whether suppliers are able to begin this process on their own.

Once value is created, it must be captured. Value Capture involves mainly issues of ownership, the nature of corporate governance and matters of government policies. (Henderson et al. 2002) Unlike initial value creation and enhancement, value capture is not institutionally and physically tied to its origin. Externalities are produced. (Coe et al. 2008) This creates quite a big problem for some regions, as an unfavourable setting of above mentioned issues means, that even though a great deal of value is created in some place, it can be drawn from the place somewhere else.

2.3.2.2 Power

The source of power and its distribution within GPN is the deciding factor of value enhancement and capture, which directly affects prosperity. There are three main forms of power mentioned in literature – corporate, institutional and collective. (Henderson et al. 2002)

Corporate power stems from the hierarchical structure of GPN and is the ability of the leading firm to influence decision making and resource allocation of firms occupying lower tiers of the GPN. Power distribution is always asymmetrical in GPN, as is as value added and profit distribution (Henderson et al. 2002; Pavlínek et al. 2013) Despite extreme asymmetry in some cases, absolute dominance of the leading firm, i.e. power monopoly, has been rejected, because even the smallest firms still have the option to form alliances with other small firms. (Henderson et al. 2002) Institutional power refers to the power exercised by national institutions, international inter-state agencies, international credit rating agencies, and other institutions, such as the IMF, WTO, World, Bank, or various UN organizations. The degree of power exercised by those institutions varies. For example, institutions within the EU have much greater influence than elsewhere. Institutions that are not as widely recognized as the above mentioned ones are also important and in some cases even desired by firms, for example institutions that establish international standards. Codified standards can make it more feasible for a firm to open new operations, but on the other hand they can be a burden too, because in some cases established standards may be too constricting and are thus undesired. (Henderson et al. 2002; Coe et al. 2008) Also, credit rating agencies have considerable impact, both directly for many lead firms and indirectly through credit risk assessment. (Henderson et al. 2002) Institutions, much as any other GPN element, are virtually grounded to a specific place, hence the specific nature of GPNs is exceedingly complex.(5)Collective power is power exercised by actions of collective individuals, such as trade unions, employee associations or organizations unifying interests of particular group. These organizations may have local or global impact and exercise their power directly on companies or indirectly through government or international institutions. (Henderson et al. 2002; Coe et al. 2008)

2.3.2.3 Embeddedness

Embeddedness refers to non-economical GPN's connections with its surroundings. That involves especially social and spatial arrangements, in which the GPN is embedded. Those connections then affect GPN's strategies, values, priorities and managers', workers' and owners' expectations. Firms of any size are inherently influenced by socio-cultural atmosphere and institutions of their home country. Each firm emerges from a specific environment, which affects its trajectory. For example in the case of post-Soviet countries of East Europe, those trajectories might be path-dependent. The institutional background needs to be taken into account when firms invest in countries with different institutional background. Embeddedness further spreads into two forms – territorial embeddedness and network embeddedness. (Henderson et al. 2002; Coe et al. 2008)

Territorial embeddedness reflects the process and the degree of firm's "absorption" in a certain place. Firms do not just locate themselves somewhere, but they also interact with other firms in that area and influence each other, whether to the benefit or to the detriment of each other. Territorial embeddedness is one of the key factors of regional development. As lead firms establish new subsidiaries in new regions, they create an environment that fosters the development of local networks and economic prosperity. This might also be a negative feature, because when the lead firm decides to leave the region, many other firms cease to exist and the network may fall apart in the process of disembedding. A lead firm's commitment and engagement to the host region then becomes crucial factor of regional development, because it directly affects value creation, enhancement and capture. (Henderson et al. 2002) Coe (Coe et al. 2008) adds that the nature of embeddedness is becoming more and more complex as geographical extensiveness of GPNs increases and argues that this process is mutual, because it can be described as "placing" firms or "firming" places (i.e. looking for a place for a particular firm or looking for a firm for a particular place).

Network embeddedness refers to connections among firms from one GPN, regardless of their country of origin or placement. The most important features

of those connections are their architecture, durability and stability, which determines individual firm's network embeddedness (i.e. the relations of a firm with other firms within the network) and embeddedness of the network as a whole (this takes into account both business and non-business agents, such as government institutions, schools etc.). As Gilsing et al. (Gilsing et al. 2008) mention, the key in this case is technological proximity. When a firm cooperates with its partners in close technological proximity and when the connections are dense, there is great potential for high exploration performance. In other words, when GPNs are highly central, the chance of being faced with new and important knowledge is high – which must inevitably turn into higher performance. On the other hand, when the technological distance is larger, performance drops.

2.4 Upgrading

Upgrading is a very important process in GPN that ensures development. Upgrading has been gaining importance lately as globalization creates fierce competition. In its essence, "to upgrade" means to make something better, make it more efficiently or move to more skilled activities. The main source of upgrading is knowledge, which needs to be created, transferred and diffused in order to foster innovation. (Humphrey et al. 2002)

An important role in the process of knowledge utilization plays governance, especially local governance. Some authors emphasize regions as the nexus of innovation effects, which means that innovation and development within some network is not solely the outcome of incidental synergies, but is also fostered by governance networks. (Humphrey et al. 2002)

Some authors (Pavlínek et al. 2013) distinguish between three types of inter-firm upgrading – process, product and functional upgrading, but some authors (Tuijl et al. 2012; Humphrey et al. 2002; Pavlínek et al. 2010) add one more category – inter-sectoral or chain upgrading.

Process upgrading refers to more efficient transformation of inputs into

outputs. The key is to recognize the production system and implement better production technology. This can be achieved either by investments into new technologies, logistics or production organization. Product upgrading occurs when more sophisticated products with higher value-added are made. Functional upgrading leads to implementation of new strategic non-production methods (or abandoning existing obsolete methods), that increase value-added. It can be for example marketing, design or R&D. (Pavlínek et al. 2013; Humphrey et al. 2002) The fourth type, chain upgrading means that firms shift to completely new productive activities, presumably with higher value-added. (Tuijl et al. 2012; Humphrey et al. 2002)

The above mentioned types of upgrading are sometimes referred to as economic upgrading and its measure is productivity, value-added or profits. Value or profit created by economical upgrading has to be received by someone. This can be not only the firms, but also its employees, shareholders or host regions. This distribution of the upgrading outcomes depends on organizational structure of the firm and does not guarantee upgrading for everyone. The social impact of economic upgrading, more precisely its outcome distribution is referred to as social upgrading (or downgrading). It is measured by the number and the quality of job positions (i.e. wages, job stability, quality of work environment etc.). (Pavlínek et al. 2013)

In addition to economic and social upgrading, Pavlínek (Pavlínek et al. 2013) establishes regional upgrading. It is somewhat similar to social upgrading, because it accounts for distribution of value-added by the process of economic upgrading and job-level elements, but it also assesses the ability of the region to capture this value (see the importance of value capture in the previous chapter). It is measured by corporate tax contributions, reinvested profits, strengthening of agglomeration effects (technology and knowledge spillovers – this is assessed in detail below) and employment.

From a regional point of view, the key factor is whether, and to what degree, the economic upgrading is followed by social upgrading and regional upgrading. Economic upgrading on itself does not mean anything for the region.

A firm may be profitable, investing into new technologies or moving upwards in the GPN hierarchy, but unless this firm-level improvement is accompanied by social and regional upgrading, the region's does not profit from this. It may even be worse off, for example if the firm replaces workers by machines, it clearly does it so as to improve its productivity. Lower employment, however, presents problems for the region. The relationship between economic and social and regional upgrading is affected by four basic elements: position of the region in GPN, firm's strategies, the type of production and the relative position of employees. (Pavlínek et al. 2013)

Position of the region, respectively position of the firms located in the region, in GPN is associated with power. Tier structure revealed above indicates that firms higher in the hierarchy of the GPN can exercise greater power. Especially the very top levels, represented by multinational corporations and global-scale suppliers (Tiers 0,5 and 1) possess a great deal of power and decisive functions (R&D, marketing etc.). This power increases the value-added and at the same time attracts additional qualified workforce and investment. On the other hand, the bottom level of the GPN has very little power. Firms that usually produce low value-added products do not require highly qualified workforce and they can be easily replaced. (9)The contrast is clear between a highly qualified workforce generating high value, attracting knowledge and further investments and a low-qualified workforce, that generates very little value-added and can be easily replaced by someone who can make it more cheaply.

The strategy of the firms is another important element of social and regional upgrading. Since globalization increases competition, suppliers are continually asked to supply more advanced and cheaper products. (Pavlínek et al. 2013) Two strategies arise – either focus on increasing productivity through technological and organizational innovations, or strategy of cutting costs, represented for instance by laying workers off or reducing their wages. Same as with the previous element, the preferred way in context of regional upgrading is obviously the former one.

The type of production is the most important according to Pavlínek.

(Pavlínek et al. 2013) Gereffi et al. (Gereffi et al. 2011) recognize five different types of production – labour intensive, low-tech manufacture, medium-tech manufacture, technology intensive and knowledge intensive. All five types of production are usually included in all GPN, it is just their ratio that differs. For example apparel GPNs use more labour-intensive and low-tech manufacturing productions, IT and hardware GPNs use more knowledge and technology intensive production. The automotive GPNs are somewhere in between the two previously mentioned – while it needs quite a lot of technology and knowledge intensive production due to the innovation speed of the automotive sector, it also needs a lot of low- and medium-skilled production. Both the upper and the lower part of this spectrum have positive and negative impact on social and regional upgrading. While the upper section creates high-quality jobs for educated people and brings higher value-added, there are not many of those jobs. On the other hand, the lower section of the production spectre offers jobs for many people, more effectively dealing with unemployment, but those jobs usually lack quality.

The element of workers position (or status) focuses mainly on the lower section of the production spectre mentioned in the previous paragraph. Workers in the lower positions may be further divided into two categories. The first one are the senior workers with experience and therefore certain level of performance can be expected. Those workers usually work regularly and have permanent contracts and benefits such as increased wage for working overtime. The other category are irregular low-experience workers working in the most time-sensitive positions (such as packing or loading trucks). Both of those categories of workers face different possibilities of social upgrading. The former group can experience stable positions, benefits of unions, whereas the latter group usually gets worse (time specific) job contracts, they are easily replaceable and since they are predominantly represented by women, immigrants and low-skilled people, they can face double discrimination on account of their employment and social status. (Gereffi et al. 2011)

2.5 Spillover effects

The ownership structure also plays a quite important role in GPN productivity, especially in the case of small countries, such as the Czech Republic. There is a clear distinction between foreign-owned and domestically owned firms. Foreign owned firms are usually larger in scale, have access to more capital and better connections with multinational corporations. Those factors must inherently reflect in prosperity.

Spillover effects can be characterized as a product of impossible full internalization of foreign firm's advantages. Simply put, foreign firms are not able to fully utilize the advantage of their superior products/technologies and as a result it may spill over to the local suppliers. The automotive industry is a great example to study linkages and spillovers because it is characterized by large number of suppliers for a relatively few lead firms and a high degree of vertical disintegration. (Pavlínek et al. 2014) Additionally, Balachander's study (Balachander et al. 2003) showed evidence that there is also a reciprocal spillover effect from acquiring a line or brand extension as a result of the favourable impact that the acquisition of a new partner makes on the parent company. Simply put, the parent company that is investing from abroad does not only benefit from the lower costs and the relative ease of production, but it is also beneficial from the strategic point of view.

Spillovers can be divided into two types – productivity and technology spillovers, which can be further divided into two forms – horizontal and vertical spillovers. (Pavlínek et al. 2014)

Productivity spillovers are the results of simple presence of a foreign firm in domestic economy, which takes the form of for example greater availability of information regarding new technologies, or competitive pressure on domestic firms to produce better products. Foreign firms usually have higher standards and requirements, so when domestic suppliers want to supply them, they have to improve and meet those standards. This process of imitating foreign firms' standards and technologies makes them more productive and competitive. (Pavlínek et al. 2014; Javorcik 2004) To connect this with the previous chapter, this kind of spillovers

relates to process upgrading. Technology spillovers occur when a foreign firm diffuses its know-how and technology among domestic firms in order to increase not only the domestic firms' productivity, but also their innovation capabilities. This kind of spillover combines process and functional upgrading and is therefore more beneficial to the host economy than mere process upgrading. (Pavlínek et al. 2014)

Horizontal technology spillovers are mostly unintentional and affect broad spectre of firms in the host economy (productivity wave caused by some large investment spreads naturally across the whole sector, including direct competitors).Vertical technology spillovers are both intentional and unintentional and spread within the production network. Intentional (or direct) spillovers refer to direct 'training' and instructing of domestic firms by foreign firms and unintentional (demonstrational) spillovers mean that firms try to imitate technologies of foreign firms to which they are linked. (Pavlínek et al. 2014) Javorcik's study (Javorcik et al. 2005) revealed that there are three major scenarios that occur when Czech suppliers interact with MNEs. The first one is that suppliers whose performance is superior tend to be chosen to cooperate with MNEs more often, the second one, related to the first one, is that domestic suppliers make purposeful improvements because they assume that improvements will make for a higher chance to source to MNEs and the last one is that while MNEs offer some sort of support to their suppliers, this support is limited. Javorcik also discussed the degree of foreign ownership. Presence of domestic capital means that superior foreign technologies and knowledge are better absorbed into the domestic economy and thus the spillover effects are higher. Ownership restrictions on the one hand promote spillover effects, but on the other hand discourage firms with the most sophisticated technologies from investing. Meyer's study (Meyer et al. 2009) also identified, that the composition of vertical spillovers is related to the level of development of the host economy. Unintentional spillovers are likely to occur in poor countries with very little effort, while in developed countries, it is more about complex competitive relationships and intentional spillovers.

The final effect (positive or negative) of vertical spillovers is to a large degree dependent on the quality and intensity of forward and backward linkages.

Inter-firm linkages foster intended and unintended spillovers and are dependent on the absorptive capacity of the firms. Absorptive capacity is an important element in firm's learning process, because it helps the firms to identify, adopt and take advantage of knowledge from the environment. It depends particularly on the firm's R&D capabilities. Firms that conduct their own R&D are more likely to understand and use external knowledge and technologies and thus benefit from R&D. This is important not only for the firms, but also for the host economy, because, when the conditions are not favourable, spillover effects may be even negative for the host economy. For example, technological advance caused by foregin direct investment (FDI) that is not absorbed by domestic firms may lead to crowding-out effects, loss of competitiveness, downgrading, closure of domestic firms and higher unemployment. (Pavlínek et al. 2014; Meyer et al. 2009)

The final effect, however, also depends on the degree of foreign presence. Buckley and Wang (Buckley et al. 2010) studied the relationship between the degree of inward FDI and spillover effects in China and came to a conclusion that the relationship is curvilinear. That means that past some point the overall effect starts diminishing, because the negative spillover effects outweigh the positive ones. The problem of this study is that it is based on a rather narrow data. Since the relative presence of Western companies in China is still low, the curvilinear effect has been observed only on the inward FDIs from Hong Kong, Macau and Taiwan and no significant relationship has been found for other western investors. This might come from the close cultural proximity of China and the three mentioned Asian countries, because Asian companies usually maintain strong culture. In the beginning the inward FDI from other Asian countries quickly settles and generates positive spillover effects, but as the economy gets more and more saturated, its effects diminish as it lacks diversity.

2.6 Foreign direct investments

Foreign direct investment has always played an important role in developed and developing countries across the world. Perception of the place, image and brand

awareness are some of the most important factors in firm's FDI decision making. Even though firms try to evaluate potential investment places as well as possible, their information is still limited. The whole process involves a lot of bureaucracy, imperfect competition and distorted perceptions of risk. Some firms do not even consider broad range of investment options, but they are rather swayed to invest in places where the big firms invest, because big investments give them a certain level of belief that the risk is low. (Loewendahl 2001) Then there are also investment incentives provided by governments to attract investors. But investors base their decisions on multiple factors and investment incentives may only have a small impact compared to other factors.

From the government's point of view, FDIs have been perceived as purely positive, especially in Central Europe (CE). FDIs were supposed to bring prosperity and both physical and human capital inflows, but some authors failed to recognize that prosperity precedes FDI, not the other way around (Pavlínek 1998) and despite the vast theoretical background supporting positive effects of inward FDI, the evidence is still too limited to draw general conclusions. (Javorcik et al. 2005)

FDIs have several direct and indirect effects. Direct effects include changes in employment, trade, capital formation and tax revenues. Indirect effects include influenced industrial behaviour and performance of host countries through acquisition of skills, technologies and other beneficial elements (described in the previous chapter devoted to spillover effects.)Even though much time has been spent studying FDI, there is still no clear consensus whether FDIs are beneficial for the host economy or not. Results of cross-sectional studies tend to favour positive effects of FDI, econometric studies based on panel data favour negative effects. (Pavlínek et al. 2014) Meyers's study found out that FDI effects have a curvilinear relation to the level of economic development – as long as the host economy is very poor or very rich, it benefits from the inward FDI (middle-income economies do not). (Meyer et al. 2009)

There are two basic types of FDI – cross border export-oriented and market capture FDI. Cross border export-oriented is the form of FDI that has

only limited positive effects for the host economy. Its purpose is to take advantage of low production costs (they focus on labour-intensive productions) in developing economies and to improve competitiveness in markets outside of the host economy. Those FDIs tend to concentrate in peripheral regions and its production is re-exported. Export-oriented investments tend to lack territorial embeddedness and it is also anticipated, that those firms will be the first ones to leave the host economy in search of even cheaper labour. (Pavlínek 1998) A predecessor of cross border export-oriented FDIs was outward processing. It was based on a few simple relationships. Foreign firms would supply materials, components or tools to domestic firms in lower-wage countries and the domestic firms would re-export the finished product back to the foreign market. This was the purest form of cost cutting and exploitation of developing countries and at the same time the most unstable form of cooperation. (Lemoine 1998)

Market capture FDIs are much more beneficial, because they also aim to service the host economy (as opposed to only export its production) and their operations are usually more durable. This type of investment is usually associated with direct investment in already existing domestic firms, bringing additional capital, know-how and organizational skills. Market capture FDIs not only desire to lower the costs, but they also want to integrate their operations in new markets and take advantage of using production methods, skills and knowledge from developed countries in developing countries creating competitive advantages. (Pavlínek 1998) Such firms become territorially embedded and foster positive regional development.

An alternative way to differentiate FDIs is to distinguish whether it is a greenfield or a brownfield investment. A clear picture of the regional impact of greenfield and brownfield investments shows Pavlínek's study. (Pavlínek et al. 2013) Pavlínek compared the regional impact of Škoda Auto, which is a highly embedded brownfield FDI and TPCA, which is export-oriented greenfield FDI, and concluded that the direct short-term and measurable economic contribution of Škoda Auto to the host region is about three times higher than in the case of TPCA.

Fritsch and Mueller (Fritsch et al. 2004) studied how new firm establishment affects regional development, which is important for the purpose of this diploma thesis. They concluded that the indirect effects of a new firm establishment (improved competitiveness) outweigh the direct effects (new jobs) and surprisingly, this is valid also in the case when the firm is not doing well and even when the firm does not survive. This is exactly because of the fact that the indirect effects outweigh the indirect ones. A loss of a few jobs is relatively unimportant to the economy, but the contestability of the market, that has been improved permanently, counts. According to Fritsch and Mueller the peak of the positive effects occurs about 8 years after the firm's establishment, and thus there is a significant lag between the initial investment and the highest effect. The authors argue that this is due to crowding-out effect that is prevalent in the first years after the establishment. Further research (Mueller et al. 2008) has proved this theory on the case of Great Britain and developed it by extension that in order to benefit from the new firm, the region must have a "proper" entrepreneurial culture, otherwise the effect is negative even in the long run.

2.7 R&D

R&D has been mentioned a few times in the previous chapters in connection to other phenomena, however, it needs to be assessed more in detail. From the previous notions, it is quite clear that the more R&D is conducted, the better for both the firms and the regional economy. R&D is considered to be a crucial factor of functional upgrading, which is through other mechanisms transferred into social and regional upgrading. (Pavlínek 2012)

Fast pace of the global economy, especially the automotive industry, is putting pressure on multinational corporations (MNC) to continuously improve and come up with new products and features. Since R&D brings in probably the highest portion of value-added (McGill University and the Conference Board of Canada 2012), MNCs are careful when it comes to its localization. Research in

general can be divided into several sub-categories – basic research/development, applied research and developmental work.

Basic research and development are the most strategic functions. It takes a lot of time, money and qualified workers to conduct basic research, hence it tends to be centralized the most. Strategic functions are usually held close to MNCs headquarters in the core regions. Developmental work tends to be decentralized the most. Development of simple components does not require strategic decisions and can be conducted on plant-level. Applied research stands somewhere in between the two extremes, being decentralized to division- or module-level. (Pavlínek 2012)

Despite the immense degree of industrial globalization in general, R&D remains to be one of the least globalized activities, but much like any other branch of industry, R&D is influenced by globalization processes. There are two basic types of R&D activities – demand- and supply-driven . In the case of the automotive industry, R&D activities are mostly demand-driven. Demand-driven R&D is associated with large markets and the availability of generic price-sensitive inputs. (Narula et al. 2010) That means that there is not one universal set of features that is demanded everywhere by everyone, but rather differentiated preferences. Demand-driven R&D seeks to identify and utilize the knowledge of different market's preferences. To specify this in the automotive industry, some markets demand small cars with low fuel consumption, some markets demand heavy-duty and durable cars and some markets demand more luxurious cars. That is why MNCs may establish specific regional R&D centres in their important markets. (Pavlínek 2012) Supply-driven R&D is associated with the exploitation of location-bound assets. Those assets may take the form of universities or research institutions, and the human capital and knowledge they produce. Supply-driven R&D seeks to tap into knowledge provided by foreign regions or specialized clusters and take advantage of that knowledge. The impact of both of the types of R&D on the host economy is different. Demand-driven R&D is tied to the continuation of production activities and therefore it is relatively unstable. On the other hand, supply-driven R&D is much more territorially embedded, autonomous and knowledge-intensive,

which makes the R&D activities dependent on the local knowledge and therefore more likely to remain in the region. (Narula et al. 2010) Even though the latter type has not been used much historically, its importance is growing, as says Carlsson (Carlsson 2006), who also adds that supply-driven R&D activities make the whole R&D genuinely more globalized.

As a main strategic function, R&D has to cope with two major challenges that globalization brings. The first one is the necessity to continually come up with new products and the second one is to cut the costs. The automotive industry has been dealing with those opposing challenges by common platform strategies since the 1990s. This strategy is based on using one car platform for different models, which saves tremendous amount of money in R&D. About 80% of the car parts are invisible to the eye and therefore they can be shared among different models without disrupting consumer's opinion. After the initial development of a platform, R&D can then focus on the 'visible' parts of the car, such as design or equipment. (Pavlínek 2012) Common platforms are not only used by one car manufacturer, but it has become quite common that the same platform is used by multiple car manufacturers, which cuts the costs even more.

The role of suppliers in R&D has been growing rapidly in the past decades. Car manufacturers are giving up more and more R&D activities and require their suppliers to conduct the R&D. As it was outlined above, especially Tier 0,5 and Tier 1 suppliers have to engage in R&D. It is estimated that the suppliers' share of automotive R&D grew from 40% in 2000 to 60% in 2010. Tier 0,5 and Tier 1 suppliers are responsible for the whole modules and must cooperate with each other to achieve compatibility. The best way to cooperate is to be concentrated together, because tacit knowledge is transferred the best by demonstration and practice. This has lead to even greater concentration of strategic R&D close to the cores of the automotive industry. This proximity importance makes it very hard for economies outside of the core region to attract strategic R&D functions. (Pavlínek 2012)

2.8 Contemporary automotive industry GPN trends

Contemporary trends show that the automotive industry is getting more specialized and cars are getting customized for regional markets. Some of the important trends are mentioned below.

A study by van Tuijl mentions the phenomenon of CKD. CKD stands for complete knock down and it means that "complete modules and systems are transhipped from overseas suppliers and assembled in the CKD plant". (Tuijl et al. 2012, p. 4) The CKD strategy is connected to another phenomenon regarding the modular nature of modern car production. Since leading (especially Tier 1) suppliers supply whole modules and manufacturers merely just assemble them, more value added and strategic decisions is shifting towards the suppliers.

Follow sourcing is another strategy practiced by large manufacturers. It relates specifically to suppliers, because large manufacturers expect their leading suppliers to follow them to new and prospective markets. Follow sourcing ensures quality and high standards across different markets. Sometimes slight changes need to be made for specific markets, but those changes are usually small scale so that it is still efficient to use the same supplier for multiple markets.

Last, but not least important distinction of the contemporary car production from the traditional is the use of platforms. Nowadays, despite some car manufacturers offer wide range of models, different models often share the same technology. Multiple models can be based on the same chassis and undercarriage and the only difference between the models is its appearance. This is true even for models of different car manufacturers, because some manufacturers are part of the same group or have made agreements to cooperate and share their technologies. The reason for that is simple – cost cutting. This strategy was first used in the early 1990s, when Volkswagen faced a crisis and reduced its number of platforms from 16 to 4. (51)

With respect to modern car production methods, it is necessary to mention Industry 4.0. Industry 4.0, also known as the fourth industrial revolution, is a global trend that encompasses the shift to automation, extensive use of data

and communication technologies in industrial production. Simply put, it means smarter production that takes advantage of modern technologies. A term often conjoined to Industry 4.0 is Cyber-physical systems (CPS). CPS are solutions that enable an automatic communication between two or more independent production facilities or equipments that have two major consequences. The first one is that goods can be produced more efficiently, machines can replace workers where human factor was irreplaceable in the past (this also means that the risk of human error is minimized) or that production is highly customizable and agile while being lean. This consequence is economically desirable and is the main driving force of Industry 4.0. The second consequence, inherently connected to the first one is the human side of the "rise of technology". The use and the development of the automation technology requires an extensive education in completely new fields and also requires the workers to shift to completely new positions. This presents a problem for both the current workers, who are used to operate the machinery by themselves, and for the education system itself, because it needs to prepare workers for the future conditions. Despite the fact that this consequence is costly and some people see it as a negative factor, it would be wrong to say that this consequence is unwanted, because it is simply the price for the economic efficiency.

2.9 Summary of theoretical findings

In this section the author presented a summary of reviewed theories that are relevant to the practical part of this diploma thesis. The majority of this section was devoted to the description of the GPN theory and related phenomena. Since the automotive industry is probably the best industry to which this theory can be applied.

It can be concluded, that the supplier sector of the automotive industry is vastly heterogeneous and thus different players have different impacts on regional development. According to the theory, Tier 1 and 0,5 suppliers are the most influential players in the market. They produce the highest value-added, they are more likely to develop ties with superior western MNEs, they conduct the

most R&D and other strategic functions, they are more embedded, they attract and employ people with higher education and qualification, and they are generally more likely to be beneficial to the region in terms of social and regional upgrading. All of those factors are beneficial to the host region. On the other hand Tier 3 suppliers are according to the theory the least influential. Tier 3 suppliers only produce simple products, employ people with low qualification, R&D is pretty much non-existent and their institutional power in the GPN is the lowest. Tier 3 suppliers should thus be the least preferred investors in the region[3]. Those theoretical conclusions support the hypothesis that higher value-added producers contribute to regional competitiveness more than the low value-added suppliers.

[3]Although there might be some cases where Tier 3 suppliers are the best choice, for example for regions with high unemployment rate and low qualification of workforce. That is because the unemployment may be the most acute problem of the region and also the education and qualification requirements of Tier 1 suppliers would probably draw a lot of people from more advanced regions

Chapter 3

The Automotive industry in the Czech Republic

The European Union (EU) is, after China, the second most important region for car production with almost 17 million cars produced in 2014, which accounts for roughly 19% of the global production. (OICA 2015) Car production grew massively over the past years especially in many Central and East European (CEE) countries. For example between 2008 and 2014, car production in Hungary grew by 26,4%, in Slovakia by 68,7%, in the Czech Republic by 32,2% and in Romania by 59,6%. (OICA 2015) Increased car production in the CEE countries stems mainly from the favourable geographical location close to the European automotive industry core and a cheap labour force.

The automotive industry has always been considered to be an industry with a significant impact on the whole economy. What makes the automotive industry unique is the complexity of the final product. A car is made of thousands of parts and requires many operations to assemble it, which makes the production network wide and dense.[1] It is not only the size of the automotive industry that

[1]The aviation industry is similar and maybe goes even beyond automotive industry in this matter, but it lags behind with other important qualities, such as fierce competition or innovativeness. For example the average age of passenger cars in European countries is 8 years (European Environment Agency 2015), whereas the average age of aircraft fleet is 13,2 years (Business Airport International 2015) or the large passenger aircraft market is pretty much divided only between Boeing and Airbus.

makes it important, but also its linkages with other industries, fierce competition and the focus on innovativeness.

The Czech automotive industry has been affected by two major changes – globalization and institutional changes represented by economic transformation after the fall of the communist regime in 1989.

3.1 Restructuring of the Czech automotive industry

Despite a considerable development of the automotive industry in the socialist countries in the late 1980s, it never became globally important. It accounted only for about 6% of the worldwide car production and most of the cars were dedicated for the domestic socialist market. (Pavlínek 2002)

The Automotive industry before 1989 was characterized by vast limitations. Czechoslovakia, the former Soviet Union and East Germany were the only CEE regions with their own car development before World War II, however, due to its isolation, it could not match the superior car production of the Western countries. The period after World War II was affected by the socialist development model. One of its parts was the Council for Mutual Economic Assistance (CMEA), which ensured a "proper" division of labour. One of the CMEA's most significant impacts on the Czech Republic was that it had to supply trucks for the entire CMEA, which meant that the development of passenger cars in Tatra Kopřivnice was halted and the development of passenger cars was left only to Škoda. Škoda's operations, together with East-German Trabant and Wartburg, represented production type based on an indigenous development, the other types were licensing based on western technologies (practiced for example in Poland or former Yugoslavia) and the lack of a complex passenger car industry development (that appeared for example in Hungary, Bulgaria or Albania). Indigenous development was, due to its tradition, up to certain time (1980s) relatively independent

from Western technologies. Its limitations stemmed mostly from the central planning nature of the economy and the lack of investment capital. In the face of such limitations, the production model was sustainable due to the lack of competition in the socialist market, which lead to a virtual monopoly. Productivity gap between Eastern and Western countries, caused by the obsolete methods and production capital and the slow adaptation of changes, was attempted to be narrowed by licensing of the Western technologies. Such licences ensured that Eastern cars met at least some quality requirements of the West and that it gained competitiveness in the Western markets. (Pavlínek 2002; Pavlínek et al. 2010; Pavlínek 2000)

As stated above, the condition of the socialist automotive industry worsened in the 1980s. Socialist car producers could not only keep up with their Western counterparts, but they also could not keep up with the demand. As a result, shortages existed in all CEE countries, because imports from other CEE countries were limited. (Pavlínek 2002) The collapse of the socialist regime in 1989 was the most significant event for the automotive industry in the socialist countries since World War II. The transformation of the automotive industry in 1990s constituted of three major changes – disintegration of CMEA, market liberalization and an influx of foreign direct investment. (Pavlínek 2002; Bornstein 2001) The disintegration of CMEA meant that the domestic CEE producers lost their Eastern customers and therefore had to reorient towards production that would satisfy Western customers. However, not all producers accomplished to compensate for the loss of the Eastern market, especially those in the small countries. (Pavlínek 2002; Bornstein 2001) Liberalized market brought a convertible currency, the elimination of quantitative restrictions or reduction of barriers to entry. All of this meant increased competition on the Czech market, which was especially difficult for the domestic producers used to supply products inferior to those of the Western countries. The domestic consumers were also severely affected by this change. The economic crisis and shock therapy policies weakened purchasing power of domestic households, which was further weakened by the rising prices of the domestic products. On the other hand, the market liberalization made it possible to shift from obsolete to modern products, leading consumers to expect

previously inexperienced high-performance utilisation qualities. (Pavlínek 2002; Bornstein 2001; Lung 2004)

3.1.1 The importance of FDI in the post-1989 period

The influx of foreign direct investment (FDI) is associated with market liberalization, which provided Western producers with the opportunity to tap into underdeveloped Czech market and take advantage of relatively cheap production costs and skilled labour force. But foreign investors were not attracted solely by the possibility to capture the new market, but also by investment incentives, relatively low level of technological complexity and the absence of trade barriers, which meant foreign investors did not only improve their competitiveness on their home market, but also on the host economy's market. (Pavlínek 2002; Lung 2004) The CEE domestic producers lacked the capital needed to keep up with the West even prior to the collapse of the socialist regime, but the situation even worsened after that. To survive the increased competition, domestic producers had to invest into new technologies and modernization of production. As a result, two survival strategies emerged – 1) a defensive strategy based on a simple continuation of the present processes and a focus on supplying to the domestic market based on low-cost production and 2) strategic transformation based on an acquisition of a foreign partner that would invest into production modernization, direct restructuring and a general integration of the firm into the European market. Naturally, the strategic transformation was the better way sustainable in the long term. (Pavlínek 2002; Meyer 2000) Prior to the FDI stage, there was an outward processing stage, which comprised of several common features as the FDI stage (such as transfer of knowledge and technology), but the foreign firms did not acquire partial ownership of the firm and such linkages usually did not last long, because they represented by far the easiest model for relocation to regions with cheaper labour. (Lemoine 1998)

In the early stages of the FDI influx, the majority of FDIs flew into already established businesses and into modernization and extension. Then, in

the latter stages, the FDIs' target locations structurally changed to investments in higher value-added production that could employ highly qualified workers. Additionally, the structure of the capital origin changed - while in the beginning the majority of capital came directly from abroad, reinvested capital had been increasing its role and in 2001 reinvested capital from foreign investments exceeded direct capital inflows. (Wokoun et al. 2010) This signalises that foreign investments in the Czech republic are not solely for the purpose of capital extraction, but that foreign investors value Czech environment and continually want to develop and deepen their ties.

The importance of the FDI in the Czech Republic is significant, especially in the automotive industry. In 1996, FDI accounted for 66,9% of the automotive industry (motor vehicles and trailers NACE sector) output, 39,9% of the labour force, 80,2% of the investment outlays, 55,8% of the value added and 64,3% of the own capital. (Zemplinerova 1998) Offensive restructuring led to a complete domination of Western investors, which on the one hand meant the loss of the domestic ownership structure, but on the other hand created conditions for a successful integration into the European market, which can be illustrated for example by the employment level - between 1998 and 2008, the amount of people employed in the automotive industry doubled and wages grew by 60%. (Pavlínek et al. 2013; Pavlínek et al. 2010; Pavlínek 2002)

Foreign-owned firms are also not the most stable structures, as Pavlínek (Pavlínek et al. 2007) points out. Since foreign investors are driven by their own economic interests and not by the interests of the host region, the long-term effect of FDI is uncertain. Although as Wokoun (Wokoun et al. 2010) shows, reinvested capital exceeds direxts inflows, which supports the argument that foreign investors do not intend to leave the Czech Republic when the investment's profitability drops.

FDIs also present a challenge from political point of view. Srholec (Srholec et al. 2004) describes two governmental approaches to FDIs. The first one emphasises economic development based on domestic investors. This approach

regulates the inflow of FDI for example by setting a minimal share of domestic capital or by concentrating of the FDIs within designated areas. The second approach, much more liberal, sees FDIs as a welcome source of economic development and the investment conditions (and incentives) are equal for domestic and foreign investors. The Czech Republic has adopted the liberal approach from the beginning, but its implementation was rather slow in comparison to the other CEE countries.

3.2 R&D

The overall persistence of the low value added activities is further deepened by the lack of high value added R&D activities. A sparse network of R&D facilities, mostly co-located with manufacturing plants, was developed predominantly by German and American investors, who sought to take advantage of the cheap and skilled researchers for routine non-strategic R&D. (Pavlínek et al. 2009; Pavlínek 2004; Pavlínek et al. 2010)

Broadly defined automotive industry accounts for roughly 15% of the total labour force and 41% of the total R&D expenditure and despite sparse R&D activities in Western-European terms, the Czech Republic is conducting more automotive R&D than any other CEE country, which means it is improving its relative position faster than other CEE countries. Due to the increasing number of firms conducting R&D, the number of R&D workers as well as the R&D expenditure has been growing over the past decades. Also the importance of standalone R&D centres, usually located in metropolitan areas to take advantage of the skilled labour, is gaining importance. The Czech automotive industry R&D is currently thought to be moving from peripheral to semi-peripheral position and can be compared to countries such as Austria or Spain and its most limiting factor is that it focuses on the lowest development activities with the lowest value added. The total R&D expenditure of the narrowly defined automotive industry (NACE 34: Manufacture of motor vehicles, trailers and semi-trailers) in the Czech Republic quadrupled between 1997 and 2008. (Pavlínek et al. 2010) According to Ženka

and Čadil (Ženka et al. 2009) FDIs have helped to develop medium- and high-tech manufacturing firms (that are more likely to engage in R&D activities). The share on production of medium-tech and high-tech firms reached 35%, respectively 10% in 2005.

Narula and Guimon (Narula et al. 2010) argue that CEE countries have aggravated position in attracting high value added supply-driven R&D activities because of fewer location advantages and a lower absorptive capacity relative to the core regions. But according to the authors opinion, the Czech Republic has by far the best position among CEE countries due to its proximity to Germany and partly even Austria. Also, according to a study by KPMG (KPMG 2016), the Czech Republic, compared to the other new EU members, is number one in company spending on R&D and the capacity for innovation, which surely makes a valid point when a firm is to invest in a new country.

3.2.1 Example of R&D development in Ostrava region

An interesting example of the development of R&D activities presents Ostrava region in the East of the Czech Republic. Ostrava region has always historically been an industrial region, focused predominantly on heavy industry – metallurgy and mining. After the fall of the socialist regime in the early 1990s, the fall of industrial production created structural problems such as high unemployment or social exclusion.

The influx of FDI in the late 1990s, especially into the automotive industry revitalised Ostrava's industry. The most recent flagship investment has had a huge impact on the whole region. In 2006, a Korean car manufacturer Hyundai decided to invest €1,2b into a new production plant in Nošovice near Ostrava to produce small and medium sized cars specifically designed for the European market. (Hyundai 2016) As an investment incentive the manufacturer received 15% of the total investment in tax reliefs and necessary infrastructure from the government. On top of that Hyundai has also been granted subsidies on in-house

R&D expenditures as well as the possibility to deduct R&D expenditures from its tax base. Additional knowledge generation and transfers were facilitated by the support of the regional cluster program, which promoted cooperation between policy makers, companies and the Technical University in Ostrava. (Tuijl et al. 2012)

Despite all of the government's will to support the local R&D to facilitate regional upgrading, the final decision whether to conduct R&D in Ostrava region or not was in the hands of Hyundai. As the cluster manager noted, the aim of Hyundai in Ostrava region is to produce cars, not to conduct R&D. Ostrava has been selected for its favourable geographical location, industrial tradition, skilled labour force and an easy access to CE supplier base (the last reason is mildly contradictory to the fact that Hyundai still prefers to use Korean suppliers to the domestic ones). (Tuijl et al. 2012) Hyundai's corporate policy is a separation of production and R&D – while 95% of R&D of Hyundai cars sold in Europe is conducted in the automotive core in Germany, all Hyundai cars designated for the European market are produced in the Czech Republic, Russia and Turkey. (Hyundai 2014) This further proves the recent decision of Hyundai to extend its R&D centre in Frankfurt. (Auto.cz 2013)

While Hyundai decided not to engage in any complex R&D activities in the Ostrava region, there are other firms who did – for example suppliers that followed Hyundai to Ostrava. Sungwoo Hitech had to open a new European R&D centre in order to satisfy the special needs of the European customers. This centre in Ostrava uses domestic engineers, mainly for cost reasons, and plans an expansion according to market needs. (Tuijl et al. 2012) An another example is a German Tier 1 supplier Siemens VDO, which has originally started in Ostrava as a producer with no R&D functions. But over the time it acquired some R&D functions as well as other strategic functions and transformed from a pure production plant into a leading hi-tech R&D centre. The last example is when an American supplier Visteon took over Czech producer Autopal, forming Visteon-Autopal. Visteon initially searched for a CEE partner not only to exploit its low

production costs, but also to upgrade its R&D activities. Nowadays, Varroc Lighting Systems (former Visteon-Autopal, recently bought by the Varroc Group) is a leading Tier 1 and 2 supplier and represents the Varroc Group as the global centre of excellence. (Varroc 2015) Varroc recently opened a new R&D centre in Ostrava and closely cooperates with the Technical University in Ostrava – they have for example donated a device to the university to conduct crash tests on order to facilitate knowledge generation. (Tuijl et al. 2012; Autofox.cz 2012)

The example of the Ostrava region shows that the role of the state in upgrading is limited and indirect, but not negligible. Even though Hyundai has received many incentives to establish R&D activities in Ostrava, it simply did not choose to take advantage of them, because it was not aligned with their corporate strategy. On the other hand, the state's indirect support and orientation on supply-driven R&D in this region is paying off in the long run, as suppliers are taking advantage of the favourable R&D incentives and infrastructure.

3.3 The current condition of the automotive industry in the Czech Republic

The position of the Czech Republic in the automotive industry is, as is outlined above, exceptional. In terms of absolute car production, the Czech Republic currently ranks 5th in the EU and 15th globally, having produced 673 241 cars in the first half of 2015. (OICA 2015) Relatively, the Czech position is even better, ranking 2nd in the world with 118,7 cars produced per 1000 citizens in 2014, right after its Slovakian neighbour. (OICA 2015; CZSO 2015d; ŠÚSR 2015) The position is significant not only on the field of the final car assembly but also in the supplier sector. Out of the top 100 global automotive suppliers, 40 are present in the Czech Republic. (PwC 2015; Czechinvest 2015b) Narrowly defined (CZ-NACE 29) automotive industry currently employs 105,3 thousand people (CZSO 2015b) and broadly defined[2] automotive industry employs roughly 290 thousand people.

[2] Škoda, TPCA, Hyundai and Tier 1, 2, 3 suppliers

(Czechinvest 2015b)

To introduce the current Czech automotive industry a brief overview of the three passenger car manufacturers present in the Czech Republic is given below.

3.3.1 Škoda Auto

Škoda Auto is currently the most important player on the Czech automotive market, with over 120 years of history. As a part of VW concern (Bloomberg 2010), Škoda's cars are positioned as small and cheap cars targeting the middle class population, with pricing and features set in order not to cannibalise the other models of the VW concern. In its 3 Czech production plants in Mladá Boleslac, Kvasiny and Vrchlabí, it produces 5 out of its 6 currently offered models in various configurations. Models range from small and city cars CityGo (the only model that is not produced in the Czech Republic, but in a new plant in Slovakia) and Fabia, through a middle class Octavia, Rapid and Yeti up to an upper middle class Superb. In addition to the Czech and Slovak production plants, Škoda recently opened production plants in Russia, China and India in order to supply the developing markets. (Škoda Auto 2015a)

In 2014, Škoda reached its new sales record, selling over 1 million cars worldwide. The most successful model is Octavia covering almost 38% of Škoda's sales, but the sales of the new Rapid and Yeti models are increasing rapidly – in 2014 by 84,6% and 26% respectively. Škoda recently invested €45m into a new engine centre in Mladá Boleslav where further investments are planned as well as in the Kvasiny facility. (Škoda Auto 2015b) In 2014 alone, Škoda spent over 10,2 billion CZK on R&D and 7,6 billion CZK the year before that, which makes Škoda the most significant Czech R&D conductor (Škoda Auto 2015b) (Škoda's parent company – Volkswagen – is in this measure also exceptional, because it has the largest European R&D expenditures of all firms, higher than the combined expenditures of the 2nd and the 3rd firm on the list. (IRI 2015)) Modernization

and production expansion investments in the Czech facilities underline their importance and signalize high territorial embeddedness and bright future prospects.

Škoda Auto is also one of the leading producers in terms of HR, R&D and social activities. Škoda aims to reduce bureaucracy, promote simple communication between employees as well as to implement smart IT technologies to simplify ordinary processes. Škoda also runs its own high school and a university oriented on educating future technical and managerial employees. Škoda further established "Škoda Academy" to continually improve employees' qualification throughout series of courses and eLearning activities.

From the regional point of view, Škoda aims to be a "good neighbour" and to care about its employees. The tools chosen to achieve such goals are, for example, promotion of education, safety, child care, environmental sustainability or support of culture and sports. (Škoda Auto 2015b)

3.3.2 TPCA

Toyota Peugeot Citroen Automobile (TPCA) is the second youngest passenger car manufacturer in the Czech Republic, located in Kolín in the Středočeský region. It is a joint venture between a Japanese car manufacturer Toyota and a French group PSA Peugeot Citroen, where Toyota took most of the manufacturing responsibility, while PSA took care of the supplier network. (Czechinvest 2015a; TPCA 2015) TPCA produces small city cars of the three mentioned car brands – Toyota Aygo, Citroen C1 and Peugeot 108 (Peugeot 107 before its modernization in 2014). All of those three models are virtually (technically) the same, sharing the vast majority of components and only differing visually.

From the beginning, the production was designed to be as green as possible, also with emphasis on cost efficiency. Unlike the production of Škoda, a significant share of the TPCA's production is not intended for the Czech market – only 1% of the cars produced in Kolín are sold in the Czech Republic. (Czechinvest 2015a) Unlike Škoda, TPCA does not conduct extensive R&D, because most of the production knowledge is transferred from other factories of the group. (Pavlínek

et al. 2013) The lack of high value added functions as well as export orientation make TPCA far less beneficial for the host region than in the case of Škoda, as is mentioned earlier in the thesis.

3.3.3 Hyundai Motor Czech

Hyundai is the youngest car manufacturer in the Czech Republic, located in Nošovice in Ostrava region. Similarly to Škoda and TPCA, it produces small and medium sized cars (ix20 and i30), but recently has extended its production with a higher class SUV model Tuscon. (Hyundai 2015) The Hyundai Nošovice factory, one of the most modern in Europe, closely cooperates with its Korean sister company Kia located in Žilina, just 50 km across the Slovakian border. The Hyundai factory in Nošovice supplies Kia with transmissions and in return is supplied with engines, which saves the costs of both factories.

As it is outlined in the section devoted to R&D in Ostrava region above, Hyundai does not conduct much R&D and thus contributes to regional upgrading merely just by mitigation of unemployment. It may sound negative that it is "just" the employment factor, but since Ostrava faced high unemployment rate at that time, this investment was highly appreciated – the investment of Hyundai created 3300 jobs directly and another 7000 through its suppliers. (Czechinvest 2015a) Additionally, its growing supplier network in Ostrava, supported by schools, other institutions and the close proximity of Slovakian and Polish automotive industries just across the border, conducts more and more R&D and thus contributes by functional upgrading.

3.4 Education and R&D

As is mentioned in the previous sections, the Czech Republic has a rich industrial tradition, which means there are a lot of qualified workers and the education system is aligned with it. According to 2011 census (CZSO 2015a), over 1,1 million people were employed in the manufacturing industry, which was 22% of all

economically active people. Such huge labour force base, combined with the low labour costs (the average labour cost savings in the Czech Republic compared to the Western countries are 40%-60%), make a great cost-quality ratio of the skilled and educated workforce, which is especially relevant in comparison to the other CEE countries. (Czechinvest 2015a)

Any sort of R&D activity starts with proper education. Currently, there are 11 universities in the Czech Republic that have technically oriented faculties and study programmes (Jobs.cz 2015) and other specialized four-year secondary education schools whose education level almost reaches the level of universities. (Czechinvest 2015a) According to 2011 census (CZSO 2015a), there were over 176 thousand people holding a degree from a technical university (out of which 140 thousand were still economically active), which makes roughly 16% of all graduates.

In 2013, there were 1 709 technically oriented R&D departments in the Czech Republic, employing over 15 thousand R&D workers and spending 39 billion CZK annually. However, the geographical distribution is far from equal, leaving most of the R&D activities in a few regions. (CZSO 2015c) R&D activities are closely tied to metropolitan areas, where the supply of qualified R&D workers is greater than in the peripheral areas. Just eight out of the 14 regions - Praha, Plzeňský, Liberecký, Pardubiský, Moravskoslezsky, Zlínský, Jihomoravský (who all have technical universities in its capital) and Středočeský region (benefiting from the close proximity of Prague, Plzeň and Liberec) stand behind 87% of the R&D expenditure. (CZSO 2015c)

Also, 23 out of 25 technically oriented centres of excellence and regional R&D centres are located in the capital cities of the regions mentioned in the previous paragraph or in their immediate proximity and many of them were founded by the technical universities. (VaVpI 2012) Centres of excellence are important R&D institutions (3 out of 4 technical centres of excellence are rated as “high impact”) supported with money from public funds that promote R&D and its commercial use, while regional R&D centres are usually smaller projects with regional impact (none of the regional R&D centres is rated as ”high impact”).

3.5 Supplier network

Due to the contemporary trend of horizontal production decentralization, the role of automotive suppliers is growing, especially in such industrialized countries as is the Czech Republic. The Tier structure of the Czech automotive suppliers is described below, revealing disparities in their size and localization.

The Tier supplier structure is based on CzechInvest database, assuming the wide definition of the automotive industry, is displayed in table 3.1. (Czechinvest 2015b) For clarity purpose, since some suppliers are members of more than just one Tier, it separates suppliers that are exclusive members of just one Tier from those that produce in more Tiers.

The most obvious fact is that the higher the Tier, the fewer suppliers there is. This stems from the quasi-hierarchical structure of the automotive GPN. A small number of car manufacturers is supplied by a limited number of Tier 1 suppliers, more Tier 2 suppliers and many Tier 3 suppliers. Another important fact is that the higher Tier suppliers tend to have more employees, which is in harmony with the numbers of suppliers in each Tier because fewer higher Tier suppliers have to process semi-finished products supplied lower Tier suppliers.

TABLE 3.1: Tier structure of the Czech automotive supplier sector

Tier	Tier-exclusive members	Total number of employees	Average number of employees	Multiple-Tier members	Total number of employees	Average number of employees
Tier 1	140	50 912	363,7	262	99 937	381,4
west	97	41 361	426,4	183	76 034	415,5
east	43	9 551	222,1	79	23 903	302,6
Tier 2	188	69 276	368,5	370	131 443	355,3
west	137	52 565	383,7	256	95 850	374,4
east	51	16 711	327,7	114	35 593	312,2
Tier 3	318	67 216	211,4	457	102 245	223,7
west	212	33 754	159,2	279	73 350	262,9
east	106	34 462	325,1	160	47 026	293,9

Author's own computation, data source: Czechinvest 2015b

Further calculation revealed that there is a significant supplier size difference between western[3] and eastern[4] part of the Czech Republic. An average (exclusive) Tier 1 supplier in the western regions has 426,4 employees while in the east it is 222,1. The same is valid even for Tier 2 suppliers with an average of 383,7 for the west and 327,7 for the east. The last examined Tier 3 shows opposite results, with an average of 159,2 for the western suppliers and 325,1 for the eastern suppliers. Since the position of a supplier within the GPN is an important precondition for regional upgrading, this result suggests that regions in the west should experience upgrading more than in the east.

3.6 Investment incentives

As is mentioned above, the Czech Republic has adopted a liberal way of awarding investment incentives. Srholec (Srholec et al. 2004) points out that despite the fact that investment incentives have to be equal for all investors according to EU laws, the Czech investment incentives are actually set in favour of foreign investors. The reason for that is that the incentives are aimed at large investment projects that usually only large multinational companies can afford. FDIs are generally thought of as investments that bring positive externalities (spillover effects) to the host economies and providing those externalities are larger than the social costs tied to the investment, governments tend to support it in form of investment incentives. From the investor's point of view, investment incentives are essentially an internalization of positive externalities that the investment brings to the host economy. (Srholec et al. 2004) However, it is extremely difficult to predict the extent of the positive externality that the investment brings. That is why firms may be settling with an incentive that is lower than the expected positive externality.

Srholec (Srholec et al. 2004) argues that investment incentives may lack its primary effect in globalized world. The reason for that is a competition among

[3]Regions: Praha, Středočeský, Jihočeský, Plzeňský, Karlovarský, Ústecký, Liberecký, Pardubický, Královéhradecký and Vysočina

[4]Regions: Jihomoravský, Olomoucký, Zlínský and Moravskoslezský

countries and regions. To remain competitive regions must offer incentives that are at least as good as incentives of the other regions. This logic gradually increases incentives up to the point where the incentive equals the social value of the investment, which makes the investment incentive pointless and the incentive becomes a net rent of the investor. But again, in the authors opinion this logic is limited by the need to predict the size of the externality, which is unique for each investment and therefore problematic to predict.

A study conducted by Schwarz (Schwarz et al. 2007) also revealed that investment incentives are rather costly. According to the study the expenses necessary to establish one job place averaged around 1,6m CZK and in some regions reached almost 15m CZK. The major problem that this study revealed is that investors usually utilize investment incentives in regions that are not problematic, which causes inefficiency in the whole system. Another problem was that some large investments attracted many foreigners and hence crowded-out the local people for whom the incentive was intended to. A similar problem was also that the "supported" sectors attracted employees from other sectors, which meant that the incentive supported merely the sector rather than the whole region.

In the Czech Republic, the majority of the investments incentives are provided on the government level and only a small portion is administrated by regional self-governing units. The Czech Republic has an Investment Incentives Act (no. 72/2000 Sb.) that is valid from year 2000 and controls the investment incentives process. According to the Act (Zakonyprolidi.cz 2016), investment incentives can have a form of tax reliefs, transfers of estates including its technical infrastructure for concessionary price, financial support for re-qualification and employee tutoring, financial support for creation of new jobs, financial support to acquire equipment necessary for strategic investments and property tax breaks. An investment incentive is provided based on an official intention presented by applicant residing either in the Czech Republic or abroad. The institution that governs investment incentives is the Ministry of Industry and Trade and other Ministries participate by issuing statements and recommendations. Also, the Ministry of Labour and Social Affairs administrates investment incentives for job creation

and worker re-qualifications. An important role in the process also plays a state agency CzechInvest that provides predominantly advisory services. (Wokoun et al. 2010)

The whole investment process starts with an assistance with finding of a proper location, an establishment of supplier relationships, continues with a direct and indirect support of the investment itself and ends with an aftercare program that helps with further development of the business. (Czechinvest 2015d)

The current legislature provides investment incentives for three types of investment – manufacturing industry, R&D/technology centres and centres for strategic services. The automotive industry covers the first two mentioned and in the past years happened to represent the vast majority of the awarded investment incentives. Standard incentives for both types of investment include a 10 year corporate tax relief, financial support of up to 300k CZK per one created job, up to 50% of the total costs of employee requalification courses and 5 year property tax liberation[5] in prioritised industrial zones, providing the municipality approves.[6,7]Further strategic incentives of up to 10%[8] of the eligible (capped by 1,5 billion CZK) can be provided for large investments (total investment of 500+ million CZK creating over 500 jobs in the case of manufacturing industry and 200+ million CZK and 100 jobs in the case of R&D centres). To qualify for the standard manufacturing incentives, the investment must exceed certain investment threshold – 50 or 100 million CZK, according to the target region – a relatively small number of the regions with the lower threshold are for obvious reasons the peripheral regions. Additionally, the job creation and requalification incentives are also intended only for investments in an even smaller group of the most disadvantaged regions. In the case of R&D centre investments the thresholds are lower – a 10 million CZK investment and a creation of 20 jobs. (Czechinvest 2015c)

[5]This incentive is new since the Investment Incentives Act was novelised in May 2015 (Zuska et al. 2015)

[6]Currently there are three prioritised industrial zones – Ostrava-Mošnov, Most-Joseph and Holešov

[7]The exclusive recipients of property taxes in the Czech republic are minucipalities, hence they have to approve the extent of the tax liberation.

[8]12,5% in the case of simultaneous R&D centre establishment (Czechinvest 2015a)

Since 1998, 278 automotive related investments were supported, creating almost 69 thousand new jobs. Out of those 278 projects, 109 had Czech investors, followed by 56 from Germany and 28 from Japan. (Czechinvest 2015c) However, not all investment incentives met with predicted success. As Wokoun (Wokoun et al. 2010) mentions, the final effect of investment incentives in some regions was different than what was expected because new investments attracted people from other regions, which is the same conclusion that Schwarz reached in his study. (Schwarz et al. 2007) This presents a problem because it is almost impossible to "tailor" an investment specifically to the needs of some region. Some of the significant investments that received investment incentives in the past years are Simoldes Plasticos or SSI Technologies, whose stories are described in the next paragraph.

Simoldes Plasticos is investing 800 million CZK in Rychnov nad Kněžnou (Královéhradecký region) to build a factory that will employ 300 people. (iDnes.cz 2015) Simoldes Plasticos is already a VW's supplier and is planning to supply plastic components to Škoda Auto facility in Kvasiny, just 5km from Rychnov nad Kněžnou. The close proximity of the Škoda facility and the investment incentives were the main reasons why Simoldes Plasticos chose to establish the factory in Rychnov nad Kněžnou. The other example - SSI Technologies, is building a factory that will create 250 jobs in Přestanov in Ústecký region. SSI Technologies is an American producer of magnetic sensors and the Přestanov investment is its first project outside of the USA. Some of the reasons for investing in Přestanov were the availability of skilled labour force, investment incentives and a recent connection to the highway. But to the detriment of the Czech development, this highway connects Přestanov only to Germany, the part that would connect it to Prague is missing and thus many of its managers chose to live in Germany rather than in Prague. (E15.cz 2015)

To further develop the industry, CzechInvest runs a program to support existing suppliers. One of the pillars of this program is the support of joint venture (JV) creation. Czech suppliers in the supplier database maintained by CzechInvest are automatically considered to be interested in JV formation. According to

the needs of both the suppliers and the large foreign investors, CzechInvest tries to match those that could form a JV. Creation of JV comes along with several benefits such as better access to new markets, production and non-production synergies or the possibility to create just a short-term flexible project. Small and medium Czech suppliers value most the possibility to access the superior foreign distribution network, knowledge and finance. On the other hand, investors expect flexibility, innovativeness and knowledge from the domestic environment. Another tool to help the domestic suppliers are meetings with foreign investors when several domestic suppliers are invited based on the needs of the investor. During such meetings, the investors typically explain their expectations and the suppliers present their products or solutions. (Czechinvest 2015e)

3.7 The role of regional self-governing units

The role of the regional self-governing units in the investment process and the overall localization of the industry is limited. As mentioned in the example above, municipal self-governing bodies play a small role with respect to the possibility and the extent of potential property tax liberations for new investments. The role of the regional self-governing bodies is apparent in the sphere of regional planning documentation. The Principles of Regional Development is the main document of regional development that states basic needs for an efficient arrangement of the region and sets rules for the decision making process in case the regional arrangement is to be changed. The Principles of Regional Development are superior to the Regional Planning documents, which are municipal planning documents aiming to find prerequisites for sustainable development and balance between natural, social and economic needs. The last regional development document is the Regulation Plan, which specifies the utilization of certain parts of the municipality.

Despite the regional planning documentation gives the regional self-governing units limited agency to influence potential investors, its power can be significant when governed properly. An example of such great governance is the town of Dolní Břežany, located just a few kilometres south from Prague. Dolní

Březany managed to attract several important R&D investors and turn inauspicious brownfields into modern facilities and together with neighbouring towns have become an R&D hub with transnational importance called STAR (Science and Technology Advanced Region). The town focuses solely on R&D activities, ruling out heavy machinery and manufacturing by prohibiting freight from the town and further improving conditions for the R&D activities. (HiLASE 2015) Surely, the Dolní Březany micro-region benefited from its close proximity to Prague and its pool of R&D workers end education capacity, but dozens of other towns around Prague had the same opportunity and did not use it the way Dolní Březany did. What attracted investors to Dolní Březany were the clear and elaborated Regional planning documents that are the result of good governance.

Relatively new institutions engaging in regional development are Regional innovation centres (that are however not present in all regions[9]). The Regional innovation centres work as associations of corporate bodies supported with public money that aim to promote linkages and cooperation among businesses, universities, research centres and other institutions in the field of innovation and R&D. According to the regional innovation centre of the Jihomoravský region, the creation of new hi-tech jobs pursues further creation of jobs in the service sector and therefore helps the regional development more than it would be apparent at the first sight. (Jihomoravské inovační centrum 2015)

3.8 Model

To evaluate the competitiveness of the Czech regions, a new model is established in this section. This model draws onto the previous research of regional competitiveness and several key features of the GPN theory discussed earlier in this diploma thesis. The core of the model consists of three categories of indicators that have previously been used to assess regional competitiveness. This core is expanded by two major elements that stem from the theoretical approach and relate

[9]Currently, regional innovation centres are present in Středočeský and Jihomoravský regions, Ústecký, Olomoucký and Pardubický regions are in the late stages of establishing one and Liberecký region is planning to imitate regional innovation centre of the Jihomoravský region.

to the automotive industry and the GPN theory in general. Those two elements are the regional R&D activities and the regional concentration of the automotive industry supply sector and its position within the GPN. This extension reflects the importance of the automotive industry for the economy in general and for the regions in particular.

3.8.1 Method

The model consists of a quantitative analysis of relevant regional data and a consequent categorization of the 14 Czech NUTS 2 regions. The model stands on 5 pillars that reflect various aspects of regional competitiveness – economic inputs and outputs, population and its qualification and education, socio-environmental and technical infrastructure, R&D activities and regional concentration of the automotive industry supply sector. A detailed description of the selected pillars and reasoning behind its selection is given below.

The main outcome of the quantitative part of the analysis is a numerical representation of the regional competitiveness, which is put in a graph for clarity and an easy comparison. Each of the 14 Czech regions has its own graph representing its relative competitiveness in various aspects.

The relative representation is chosen to mitigate unit discrepancies among the indicators. The indicators are divided into groups according to the pillar structure of the model. To aggregate the individual indicators within one pillar, absolute values of each indicator are converted into relative values, with the base value being the theoretical top value among the regions. The relative data representation further helps with the graphical representation, because the final value of each pillar is also relative and therefore the pillars are comparable with each other.

3.8.2 Structure

3.8.2.1 Economy

Economic prosperity is one of the key aspects of regional development and thus is used even in this model assessing regional competitiveness. The economic pillar is divided into two groups – inputs and outputs. This categorization follows previous studies of competitiveness. Huggins (Huggins 2003) based his competitiveness index (also further examined by Pělucha 2009) on three factors – inputs, outputs and results. In this pillar, only inputs and outputs are used, while the third factor is partially used in a separate pillar, enriched by other related factors and partially in the inputs group of this pillar.

The inputs in this pillar are – the number of small and medium businesses (less than 250 employees), the degree of economic activity and labour costs. Labour costs were originally in Huggins's (Huggins 2003) model in the results section, but in this model are considered as inputs, because the model aims to reflect the needs of businesses for which the labour costs are an important aspect. Similarly, the degree of economic activity suggests the overall condition of the region. Higher number of small and medium enterprises is thought to contribute to innovation capacity and economic prosperity.

The labour costs indicator is further divided into several groups to reflect the specifics of the businesses in different Tiers. Labour costs in the model are observed for two groups of employees – machine service workers and assemblers and specialists in the field of mechanics and science. For each Tier a different ratio of those two groups is determined and the data is weighted accordingly. This Tier distinction is used also for several other pillars and aims to provide more accurate results for the different Tier suppliers. Weights for the individual tiers are discussed in the data section below.

The outputs in this pillar are represented by GDP per capita, GVA per capita and per worker and unemployment rate. GDP per capita is one of the most widely used indicators for economic prosperity and GVA to a certain degree improves the GDP indicator, because it also accounts for own capital costs. The

unemployment rate indicator can be ambiguous, because higher unemployment rate signalizes structural problems and worsened economic prosperity. On the other hand higher unemployment rate means higher supply of labour and thus lower costs of labour. But since labour costs are accounted for in the inputs section, lower unemployment rate is in this case beneficial.

The economy pillar uses data from CZSO and ISPV from the year 2014, except for the GDP data that are from the year 2013. The formula of this pillar is following:

$$I^r_{Econ} = 0,15\frac{G_i}{G_{max}} + 0,05\frac{V^1_i}{V^1_{max}} + 0,05\frac{V^2_i}{V^2_{max}} + 0,05\frac{U_i}{U_{max}}$$
$$+0,1\frac{N_i}{N_{max}} + 0,1\frac{A_i}{A_{max}} + 0,5C_i$$
$$where$$
$$C_i = a\frac{1}{\frac{C^1_i}{C^1_{min}}} + b\frac{1}{\frac{C^2_i}{C^2_{min}}}$$

Where: G = GDP/capita, V^1 = GVA/capita, V^2 = GVA/employee, U = unemployment rate, N = number of SME, A=rate of economic activity, C = wage costs, C^1 = wage of machine service workers and assemblers, C^2= wage of specialists in the field of mechanics and science, a and b=parameters reflecting the ratio of those workers in various tiers. The base values for all tiers are a = 0,864 and b = 0,136, which reflects the ratio of those employees across the whole manufacturing industry according to ISPV. (ISPV 2015) The values for Tier 1 are set to give more weight to specialists and for the lower Tiers to machine service workers and assemblers.

3.8.2.2 People

The people pillar is also divided into two sections. The first one reflects education, the second one reflects qualification.

Education and qualification are important prerequisites for industrial

localization, especially for the complex and fast-paced automotive industry. The education part of this indicator follows education structure of the regions, specifically the number of people with secondary education, tertiary education and technically oriented tertiary education. Similarly to the labour costs section in the economy pillar, even education is weighted according to the individual Tier's needs. The qualification part of this indicator follows the share of people already employed in the manufacturing industry and reflects the degree of the industrial tradition in the region.

The data for this pillar are from the last census in 2011 and the structure of the formula is following:

$$I^r_{ppl} = 0,6E_i + 0,4\frac{Q_i}{Q_{max}}$$

$$where$$

$$E_i = a\frac{U_i}{U_{max}} + b\frac{H_i}{H_{max}}$$

Where: Q = the share of people employed in the manufacturing industry, U = the share of people with a degree from a technical university, H = the share of people with secondary education with diploma, a and b are coefficients set to reflect different structure of employees across the Tiers. The base values for all Tiers are set to a = 0,136 and b = 0,864 with the same logic as in the previous pillar.

3.8.2.3 Socio-environmental and technical infrastructure (place)

This pillar reflects living and working conditions in the region as well as technical infrastructure. It is therefore divided into three subcategories – environmental, cultural and technical infrastructure.

The basic units of every business are people and in order to stay and work in the area, the social and environmental conditions must be plausible. Hence regions with better environment and social infrastructure attract more people. (Woltjer et al. 2007, p. 219)(48, p. 219) mention that "region's abilities to compete

depend not only on cost advantages or transport, for example, but increasingly on environmental quality." This factor does not transfer directly to the businesses located (or willing to locate) in the region, because businesses (especially in the manufacturing industry) are not likely to consider environmental quality of the region directly. But it is important from the supply side, because businesses need to attract employees and for individual people environmental quality is important. The environmental sphere of this indicator accounts for forest coverage, the number of specially protected areas and standardised mortality, which reflect environmental condition of the region.

Additionally, the article also states that shared social patterns foster homogeneity and collaboration and result in strengthened collective action, similarly to social and economic connections. This means that good social and cultural conditions result in better overall appeal of the region. The logic of the socio-cultural sphere is essentially the same as the environmental sphere, because it affects businesses indirectly through its employees. For the purpose of the socio-cultural sphere of the model cultural events, exhibitions and community centres are considered.

The part that that accounts for technical infrastructure is probably the most direct in relation to the businesses in the region. On the one hand better infrastructure may be preferred by some people and thus affects businesses indirectly through employee supply (still, some people will prefer living in remote areas with poor infrastructure), but on the other hand it also directly affects the business itself, because unlike the environment and culture, technological infrastructure, such as the road network, is vital to the business functionality. Indicators used for the infrastructure part of this pillar are road network density and the degree of urbanization.

The formula for this pillar is following:

$$I^r_{infra} = 0,1\frac{F_i}{F_{max}} + 0,1\frac{P_i}{P_{max}} + 0,05\frac{M_i}{M_{max}} + 0,1\frac{C_i}{C_{max}} + 0,1\frac{E_i}{E_{max}} + 0,05\frac{CC_i}{CC_{max}} + 0,25\frac{RD_i}{RD_{max}} + 0,25\frac{U_i}{U_{max}}$$

$$M = \frac{\frac{1}{\frac{M_i^M}{M_{max}^M}}}{2} + \frac{\frac{1}{\frac{M_i^F}{M_{max}^F}}}{2}$$

$$RD = 0,5\frac{L_i^h}{\sqrt{S_i * \frac{N_i}{100000}}} + 0,25\frac{L_i^s}{\sqrt{S_i * \frac{N_i}{100000}}} + 0,25\frac{L_i^f}{\sqrt{S_i * \frac{N_i}{100000}}}$$

Where: F = forestation, P = protected areas/100k inhabitants, M = mortality, C = cultural events/100k inhabitants, E = exhibitions/100k inhabitants, CC = community centres/100k inhabitants, RD = road density, U=urbanization, M^M = mortality (males), M^F = mortality (females), L^h = length of highways, L^s = length of speedways, L^f = length of first class roads, S = area (km^2), N = population

3.8.2.4 R&D activities

The R&D pillar assesses innovation capabilities of firms, schools and other institutions located in the regions. It draws onto the theoretical basis of R&D, upgrading and spillover effects from the first section of this diploma thesis. R&D activities are sometimes used as indicators in economic sections when assessing competitiveness (ESPON 2013), but due to its importance for the automotive industry, this category has its own pillar in this model. It is not only necessary precondition for economic prosperity, but also a key factor for future development.

The subsection devoted to upgrading mentions that R&D and other strategic activities represent the most desired type of economic upgrading – functional upgrading. Additionally, the extent of (regionally desired) spillover effects depends on the R&D capabilities of the businesses that are the target of a major FDI influx, which is the case of the Czech Republic. So from this point of view, it is not only important to have R&D to move to production with higher value added, but also to have enough absorption capacity to absorb potential technology and productivity spillovers.

Despite the fact that economic upgrading does not necessarily and directly contribute to regional development, it is an important source of value that is further redistributed by social and regional upgrading – which in turn does have a direct effect on the region's development. R&D activities in this pillar are represented by indicators following the number of R&D employees and R&D centres, R&D expenditure and the share of innovating businesses.

The R&D pillar uses data from CZSO for year 2013 (because of the lack of GDP data for 2014) and its formula is following:

$$I^r_{R\&D} = 0,1\frac{N_i}{N_{max}} + 0,075\frac{Pt_i}{Pt_{max}} + 0,025\frac{Pp_i}{Pp_{max}} + 0,075\frac{Et_i}{Et_{max}} + 0,025\frac{Ep_i}{Ep_{max}}$$
$$+0,25\frac{Gt_i}{Gt_{max}} + 0,1\frac{Gp_i}{Gp_{max}} + 0,15\frac{Ptx_i}{Ptx_{max}} + 0,05\frac{Ppx_i}{Ppx_{max}} + 0,15\frac{I_i}{I_{max}}$$

Where: N = number of R&D centres per 100k inhabitants, P_t = number of R&D workers in technical sciences per 100k inhabitants, P_p = number of R&D workers in manufacturing and construction per 100k inhabitants, E_t = expenditure on technical R&D per 100k inhabitants, E_p = expenditure on manufacturing and construction R&D per 100k inhabitants, G_t = share of technical R&D expenditure on regional GDP, G_p = share of manufacturing and construction R&D on regional GDP, P_{tx} = number of technical R&D workers per 1000 employed, P_{px} = number of manufacturing and construction R&D workers per 1000 employed, I = share of innovating businesses

Weights for individual indicators are set to reflect the relative importance of each indicator. For example indicators reflecting manufacturing and construction R&D have lower impact than indicators reflecting technical sciences because of the presence of the construction industry, which does not affect the automotive industry. The largest weight in this indicator has the share of R&D expenditure on the region's GDP, because it most accurately reflects how much of its resources each particular region is using for R&D.

3.8.2.5 Regional concentration of the automotive industry supply sector

The last pillar accounts for spatial distribution of automotive suppliers. This is important especially for suppliers that are deciding where to localize themselves. First of all, regions with higher concentration of automotive industry can offer more educated and skilled people, mainly because of its tradition in that region. Secondly, the automotive industry is due to its nature very logistic-intensive (zdroj??) and thus shorter transportation distances and clustering in certain regions are preferred.

From the GPN perspective, a higher tier firm exercises more power that comes from its position within the network (therefore does not have to compete by setting low prices) and creates more value added. As the analysis of the automotive supplier data shows, the turnover per employee is about two times higher for Tier 1 firms relative to Tier 3 firms. Additionally to higher value creation, higher tier suppliers conduct and attract more R&D than suppliers in the lower tiers, which, as established in the description of the R&D pillar, facilitates regional development.

Since the spatial concentration of automotive suppliers varies in different Tiers, to further expand relevance of this pillar all Tiers are considered together as well as separately. The reason for that is the following – aggregated data of all three Tiers might, for example, show that a certain region is doing well in the automotive industry. But if this indicator is driven up by a strong presence of just one of the Tiers, its results might be misleading for the firms from the other Tiers. Conversely, the strong presence of one Tier would be interpreted as relatively small and thus discouraging the firms form that Tier from investments. This example is of course valid for this particular example where the Tier suppliers are supposed to prefer to locate themselves close to the suppliers from the same Tier, but it can be valid for any other desired combination if adjusted accordingly.

The data for the last pillar come from CZSO and CzechInvest and its processing was the most complicated. At first, a database of 859 automotive suppliers was divided into groups according to location of each individual supplier.

Then, based on the number of employees of each supplier, the number of inhabitants in each region, employment rate and the total number of employees in the automotive industry supplier sector, the localization index of the automotive industry supplier base in each region was computed. The results for each Tier and each region are then compared with the results of the other regions to get relative data suitable for the model. The index has a following formula:

$$I^r_{L_i} = \frac{I^a_{L_i}}{I^a_{L_{max}}}$$

$$where$$

$$I^a_{L_i} = \frac{\frac{N_{ai}}{N_a}}{\frac{P_i}{P}}$$

Where: I_L = automotive industry localization index, N = total number of people employed in the region, P = number of people employed in the automotive industry supplier sector in the region

The data from CzechInvest, however, have a few drawbacks. Since the CzechInvest database follows administrative headquarters of each supplier, it does not accurately capture the real division of where the value is actually created. This distorts the data especially for Prague, because many firms take advantage of Prague being the administrative centre of the Czech Republic[10] and thus inflate its results with no real basis. But it is not only this case because some suppliers have more branches in different regions, which affects the regional result the same way. The second problem of the data is that since it follows widely defined automotive industry, its results might be affected by other industries. This is valid especially for the Tier 3 suppliers and to a certain degree for the Tier 2 suppliers. The Tier 1 suppliers supply complex parts for the automotive industry and therefore it is unlikely other industries would source from them. But since the lower tier suppliers supply simple products, they can supply more industries than just

[10]Prague is perceived to be an attractive place of business for two main reasons: 1) since there are already many firms located in Prague, it is less likely that a firm will be inspected by government institutions and 2) Prague provides better image, which may be beneficial when dealing with other businesses.

the automotive one.

3.9 Results

The region of Prague is a 100% urban region with superior economic conditions that focuses on the service sector, therefore there is no real need to consider its conditions for the manufacturing industry and therefore is omitted from the following categorization. According to the results, the remaining 13 regions can be divided into five groups according to their level of competitiveness.

3.9.1 Weak regions with limited development possibilities

The first group represents regions with a very low competiveness and three regions fell into this category – Karlovarský, Ústecký and Olomoucký. Those regions on the one hand suffer from the lack of manufacturing tradition and on the other hand this situation does not seem to be counterbalanced by focus on education and R&D.

First of all, the automotive industry in those regions is very sparse, especially the high value added Tier 1 category. For example the Karlovarský region reaches only 3,69% of the level of Tier 1 localization of the most advanced region in this measure. But it is not only the virtually absent Tier 1 that is problematic. All three tiers in all three regions are significantly underdeveloped. With the exception of Tier 2 in the Karlovarský region with 35%, none of the localization levels exceeds 30% of the top value among region.

Secondly, regions in this category reach very low scores in the R&D indicators. The Karlovarský region with only 8,3% of the theoretical top score is the very worst, followed by the Ústecký region with 12,5% and Olomoucký with 27,9% are the three lowest scoring regions among the 13 considered. This might

be the result of the lack of tertiary education, because none of the regions in this category has any sort of technically oriented tertiary education institution. For the Karlovarský and Ústecký region, the education condition is bad even for secondary education, which also ranked at the very bottom, although not as extremely as in the case of tertiary education.

Despite the clear gap in the R&D sphere, all of the three regions are trying to improve their situations by promoting innovation. Regional innovation centre is already established in the Ústecký region and the Olomoucký region is in the process of establishing one. While there are no definite plans in the Karlovarský region, it is also considered for the future.

3.9.2 Regions with the potential to develop low value-added production

The second group of regions are regions with relatively average or below-average condition of the automotive industry, but with the potential to develop lower value-added tiers. Same as with the first group, three regions belong into this category – Královéhradecký, Jihočeský and Vysočina.

Those regions have fairly good scores in the economy pillar as well as in the population aspects. What makes those three regions fall into this category are its low scores in the R&D pillar. All three regions scored around 30% of the theoretical top, which is far below the Czech average. Unlike the three most underdeveloped regions, none of the regions in this category are trying to establish any sort of regional innovation centre or similar institution.

But despite the lack of R&D operations in those regions, each of the regions has a distinct competitive advantage that could enable it to expand its Tier 2 and 3 productions. The Královéhradecký region can benefit from the presence of the two Škoda facilities in its region and the close proximity of the third Škoda facility in Mladá Boleslav. The Vysočina region has its potential in the relatively good location between Prague and Brno with the most important highway leading

through the region. Additionally, one of the best rated technical centres of excellence is located in Telč in the Vysočina region. And the Jihočeský region is the only one of the three that offers tertiary technical education.

3.9.3 Average regions with developed Tier 3 production

This group of regions is somewhat similar to the previous group with the difference that those regions already developed their lower tier productions to an above average level. Representatives of this group are the Zlínský, Pardubický and Moravskoslezský regions.

Both the Zlínský and Moravskoslezský regions have a above-average developed Tier 3 production, while the Pardubický region has a well developed Tier 2 production. The moravskoslezský region reaches the theoretical top in Tier 3 localization score and the Zlínský region ranks on the 2nd place with 94% and also on the 3rd in Tier 2 production with the score of 64%. The Pardubický region is with 67,8% on the 5th place in Tier 3 ranking.

Another distinction from the previous group is that the regions in this group reach higher scores in the R&D sections, scoring on average 15 percentage points more. Zhe Zlínský and Moravskoslezský regions are home to technical universities and several technically oriented centres of excellence and regional R&D centres. While the Pardubický region does not have any important R&D centre or technical university, it has its own regional innovation centre and the best R&D scores among the three.

3.9.4 Competitive regions with developed automotive sector

This category is represented by regions Liberecký and Plzeňský, which have the most developed automotive industries among Czech regions. The scores of those

two regions are the most stable and do not seem to be lagging in any of the considered pillars.

Both of the regions have high shares of supplier localization. Specifically, Tier 1 and 2 is vyzkumthe most in the Liberecký region, while the Plzeňský region excels in Tier 2 and partially even in Tier 3 localization. The Liberecký region is the most exceptional region in context of automotive supplier localization. It is the only region that reached highly above-average scores across all three tiers. The overall localization pillar score of the Liberecký region is 52 percentage points higher than the average, Tier 1 score by 69,6 percentage points, Tier 2 score by 57,5 percentage points and Tier 3 score by 33 percentage points. This makes the Liberecký region the region with by far the highest localization of the automotive industry supplier sector. The Plzeňský region scored slightly below-average only in the Tier 1 indicator (by 9,4 percentage points), otherwise the results were above-average (by 40,5 percentage points in Tier 2 and by 28,4 percentage points in Tier 3).

In addition to the exceptional supplier localization, both regions reach high scores in the R&D pillar. This is due to the presence of high value-added productions (especially in the Liberecký region), technical universities as well as regional innovation centres. Both regions have a rich industrial and manufacturing tradition, which made them prone to develop a competitive automotive supplier network.

Also, both of the regions benefit from their good location. The Liberecký region benefits from the close proximity of the automotive cluster in Mladá Boleslav and the good connection to Germany. The plus of the Plzeňský region is that the highway that connects Prague with Germany leads through the region, which makes for an easy access to both of those potentially beneficial hubs.

3.9.5 Regions suitable for high value-added production and strategic functions

A specific category of regions are regions with somewhat average or below-average development of the automotive industry, but with high potential for developing high value-added functions. This category is represented by the Středočeský and the Jihomoravský region.

The relative share of the automotive supplier sector is the lowest in the Jihomoravský region and the 5th lowest in the Středočeský region. While the absence of a well-developed automotive industry is apparent in the case of the Jihomoravský region, the results of the Středočeský region might be confusing. The Středočeský region on the one hand hosts two major car producers (Škoda and TPCA) and accounts for a large share of the automotive production, but on the other hand is also the biggest and the most populated region, which significantly lowers the relative results. Moreover, the production of the car assemblers is not taken into account, as this pillar only accounts for the supplier sector. But despite the omission of the two car manufacturers, the relative results of the Středočeský region are still below average. It could be inferred that the two car manufacturers would attract many suppliers, but the results are not in favour of this assumption. One possible explanation could be the very presence of the two car manufacturers. Both Škoda and TPCA offer above-average wages, which draws up the labour costs even for other employers and thus makes the region less attractive. (iDnes.cz 2013; finance.cz 2014) The wage indicator used in the economy pillar showed that wages in the Středočeský region are the highest among the 14 regions – both for machine service workers and assemblers and specialists in the field of mechanics and science.

Those two regions also reached by far the highest scores in the R&D pillar, scoring over 30 percentage points over the average result of 42% in this pillar. Both regions benefit from the presence of the two largest Czech cities in their centre. Prague and Brno are a very important business and education centres,

including several technically oriented universities, which make it attractive to establish R&D centres in their proximity and take advantage of the R&D workforce pool - Prague and Brno are hosting regions for some of the most important technically oriented R&D centres of excellence and other regional innovation centres.

3.10 Other results

An important finding of the model is the uneven nature of the automotive supplier localization. From the previous section it is obvious that the automotive industry is localised in some regions more than in others. But for a more precise understanding of the spatial distribution of the automotive industry supplier sector other approach is needed. Since the aforementioned localization pillar of the model accounts for the distribution of suppliers among the regions, it does not account for the distribution within the regions. Any other quantitative analysis would yield similar results since it would require further partitioning of the regions. For this reason a qualitative graphical approach is chosen.

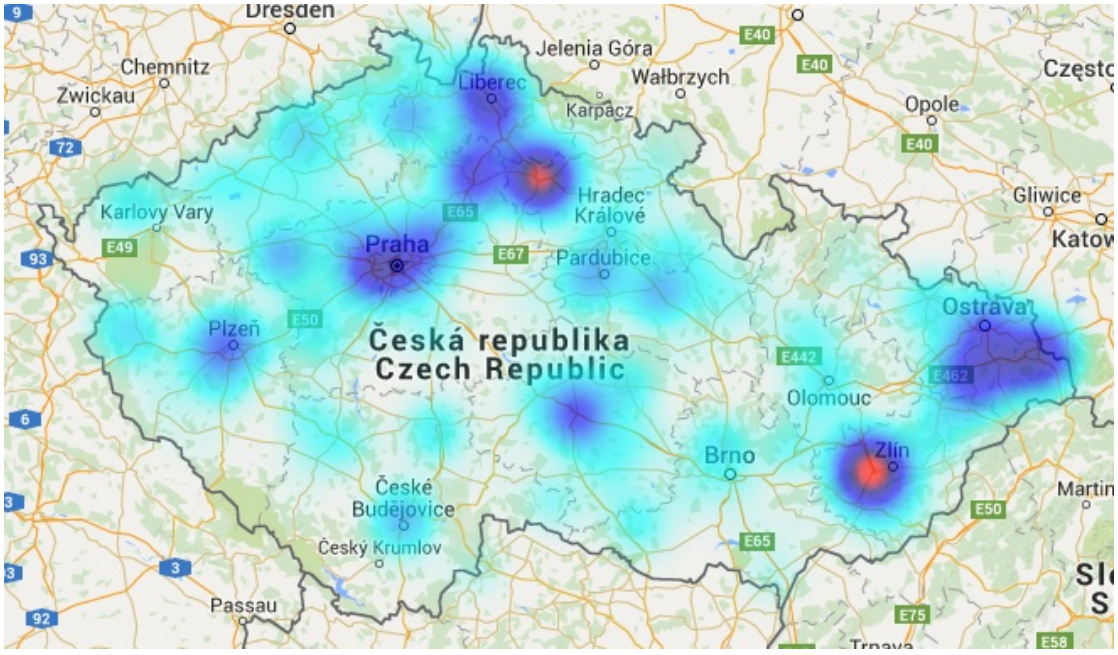
The tool for this analysis is a Google Maps API that enables creation of a heatmap layer over the base map layer. With the help of this tool it is easy to visualise where the automotive industry supplier sector is localised and concentrated. Each of the following maps uses a part of the supplier database (according to the examined Tier) where each supplier is weighted by its turnover.

3.10.1 The general automotive supplier industry

The general data of all suppliers illustrated in figure 3.1 show that there are several core areas of the automotive industry in the Czech Republic. First, the core region of Prague stands out mainly due to the aforementioned administrative "advantage" of Prague as the host region for the firm's headquarters. Probably the most important core of the automotive industry is the triangle between Mladá Boleslav, Liberec and Jičín. As mentioned above, the previous analysis in the

competitiveness model only assessed regions as a whole, but did not account for the localization of the automotive supplier sector within the regions. Figure 2 shows, that this "automotive triangle" is formed by automotive cores of three regions. And since those three cores happen to be close together, they form trans-regional automotive core of much greater importance than on the regional level. Other automotive cores are formed in the Moravskoslezský region, the Zlínský region and smaller cores are in the Plzeňský region and in the Vysočina region.

FIGURE 3.1: Concentration of suppliers from all Tiers weighted by turnover

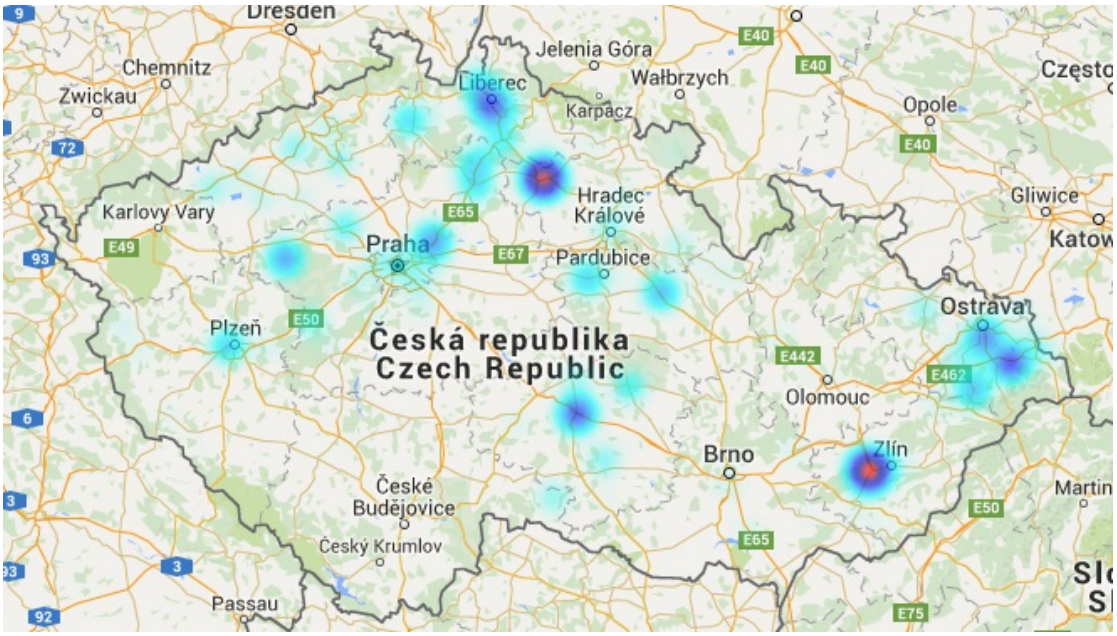


Data source: Czechinvest 2015b, author's own computation

3.10.2 Tier 1

The Tier 1 (represented by figure 3.2) is characterized by the highest degree of heterogeneity. It is mostly localised around large cities and the core regions and in the northern part of the country. While the Tier 1 localization index in some regions is as low as 15-20%, the score of the strongest region (Liberecký) is 380% and the standard deviation of the results is 107%.

FIGURE 3.2: Concentration of Tier 1 suppliers weighted by turnover



Data source: Czechinvest 2015b, author's own computation

3.10.3 Tier 2

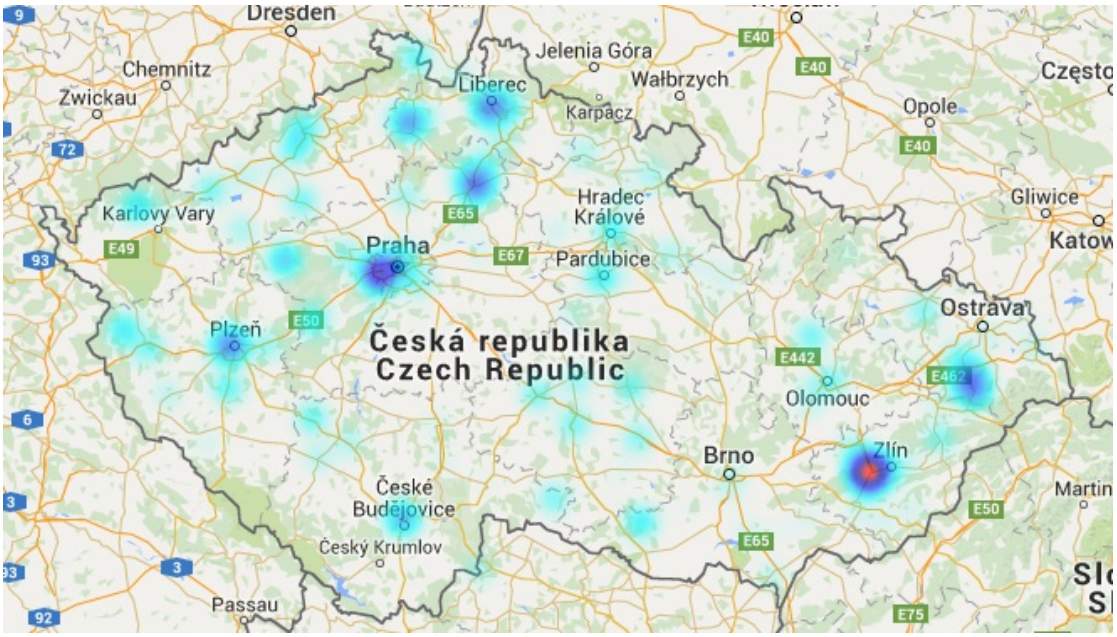
Tier 2 suppliers are also relatively selectively localised (figure 3.3), although it is not as extreme as in the case of the Tier 1. The lowest localization index value is 28%, the highest 274% and the standard deviation is 65%. Most of the Tier 2 suppliers are located towards the west of the country, but also a few Tier 2 cores are in the eastern part as well.

3.10.4 Tier 3

The Tier 3 results (figure 3.4) similar to the Tier 2 results in terms of heterogeneity, although less volatile. The lowest value is 34%, the highest 171% and the standard deviation is 59%. While The Tier 2 suppliers tend to be localised more towards the west, the Tier 3 suppliers are localised more towards the east, especially in the Moravskoslezský and the Zlínský region.

For additional representation Figure 3.5 depicts Lorenz curves of all three Tiers. The Tier 1 Lorenz curve is the most distant from the equality line, which signalises

FIGURE 3.3: Concentration of Tier 2 suppliers weighted by turnover



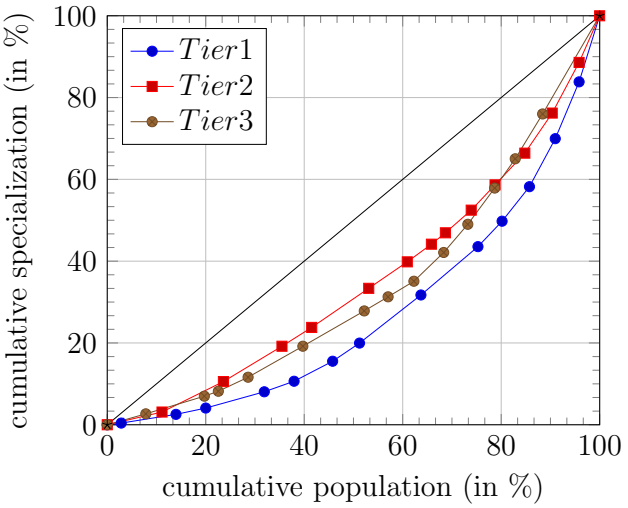
Data source: Czechinvest 2015b, author's own computation

FIGURE 3.4: Concentration of Tier 3 suppliers weighted by turnover

Data source: Czechinvest 2015b, author's own computation

that the Tier 1 suppliers are the most unevenly distributed across Czech regions. On the other hand, Tier 3 and especially Tier 2 Lorenz curves are closer to the equality line, representing more equal distribution of the suppliers among the regions.

FIGURE 3.5: Lorenz curve



Data source: Czechinvest 2015b

3.10.5 OLS model

To assess the impact of the automotive industry on regional competitiveness, the author uses an OLS model to test the impact of Tier 1, 2 and 3 concentration in a region on its overall competitiveness. In this case, the overall competitiveness is represented by an aritmethic average of all pillars of the competitiveness model except for the pillar that measured the automotive concentration. The results from OLS model are in tables 3.2, 3.3 and 3.4 and show that Tier 1 and 2 suppliers do not significantly contribute to the regional competitiveness of Czech regions and thus the hypothesis that higher value-added productions contribute to regional development is not confirmed. On the other hand, the results for Tier 3 suppliers in table 3.4 with a p-value of 0,028 show that Tier 3 suppliers have statistical significance in contributing to overall competitiveness of the host region measured by the model.

Table 3.2: OLS model, Tier 1

Model: OLS, using observations 1–14
Dependent variable: Tier_1

	Coefficient	Std. Error	t-ratio	p-value
const	−0,793675	0,753022	−1,0540	0,3126
model average	1,71884	1,17331	1,4650	0,1686

Mean dependent var	0.304204	S.D. dependent var	0.286784
Sum squared resid	0.906983	S.E. of regression	0.274922
R^2	0.151709	Adjusted R^2	0.081018
$F(1, 12)$	2.146089	P-value(F)	0.168637
Log-likelihood	−0.708320	Akaike criterion	5.416640
Schwarz criterion	6.694755	Hannan–Quinn	5.298327

Source: author's own computation

Table 3.3: OLS model, Tier 2

Model: OLS, using observations 1–14
Dependent variable: Tier_2

	Coefficient	Std. Error	t-ratio	p-value
const	−0,473512	0,650973	−0,7274	0,4809
model average	1,40619	1,01430	1,3864	0,1909

Mean dependent var	0.424665	S.D. dependent var	0.245948
Sum squared resid	0.677813	S.E. of regression	0.237664
R^2	0.138054	Adjusted R^2	0.066226
$F(1, 12)$	1.921992	P-value(F)	0.190856
Log-likelihood	1.330450	Akaike criterion	1.339100
Schwarz criterion	2.617215	Hannan–Quinn	1.220787

Source: author's own computation

TABLE 3.4: OLS model, Tier 3

Model: OLS, using observations 1–14
Dependent variable: Tier_3

	Coefficient	Std. Error	t-ratio	p-value
const	−1,20119	0,683260	−1,7580	0,1042
model average	2,65964	1,06461	2,4982	0,0280 **

Mean dependent var	0.497604	S.D. dependent var	0.295489
Sum squared resid	0.746717	S.E. of regression	0.249452
R^2	0.342147	Adjusted R^2	0.287326
$F(1, 12)$	6.241153	P-value(F)	0.028006
Log-likelihood	0.652745	Akaike criterion	2.694510
Schwarz criterion	3.972624	Hannan–Quinn	2.576197

Source: author's own computation

Chapter 4

Conclusion

4.1 The importance of the topic

From the historic perspective and from the outlook of the data regarding the current condition of the Czech automotive industry it is evident that the automotive industry is an important element of the Czech economy. Due to the industrial tradition and the favourable location the Czech Republic has been the target location for FDI since the fall of the socialist regime in 1989. Currently the Czech Republic produces the second largest number of cars per capita in the world and the automotive industry is one of the most dynamic industries in terms of R&D and innovation. Besides the final car production, the Czech Republic is also the host to many automotive suppliers - 40 out of the TOP 100 global automotive suppliers are present in the Czech Republic. All automotive suppliers together employ roughly 290 thousand people (almost 6% of the working population) and create a turnover of nearly €40b. For those reasons it is safe to say that the automotive industry plays a crucial role in the Czech Republic.

4.2 Theoretical findings

The theory examined in the first section suggests that the automotive industry is one of the most complex phenomena to study, but contemporary theories shed more light on it. The major examined theory was the theory of GPN, which describes the automotive industry, much as any other complex industry, as a dynamic network of consumer-supplier relationships and many elements play an important role in the process of its shaping. The GPN theory concludes that increasingly larger share of production and value added is shifted towards the automotive suppliers and thus a special attention has been paid to the suppliers in the second part. This paper examined especially the elements of upgrading, spillover effects, the suppliers' position within the GPN and R&D activities.

The reasoning of the authors of the examined studies seems to be logical and there are no significant discrepancies. However, there is still not much consensus on the overall effect of FDI on the host economy. While there are obvious benefits from the presence of technologically more advanced investors from foreign countries, some authors provide sound reasons why such presence might have detrimental effect to the host economy. While the arguments for the detrimental effects are logical, it still seems more likely that the long term effects are positive. The reason for this conclusion is that the negative effects are imposed on the domestic suppliers, but not the host economy in general. And while the presence of the technologically more advanced competitor is naturally negative to the domestic competitors, it is just a quality of the free market. In the free market economy the improved efficiency for the price of one's loss is justifiable. Additionally, if the foreign investors choose different location, the domestic production would be crowded out anyway. So from this point of view FDI seems not just as an option, but necessity.

Even though the institutional approaches are not discussed in this paper, it would be useful to come up with a theory that would bridge the gap between the institutional approach and the approach of GPN. Both approaches have their pros and cons and if the pros were combined into a comprehensive theory, some

processes could be explained better, which would make for easier predictions and policy designing.

4.3 The competitiveness model

The second part of this paper drew onto the results of the theoretical findings and built a model based on five pillars that reflect the condition and the competitiveness of the regions in terms of the automotive industry. Three out of the five pillars were based on the traditional approaches of regional competitiveness and two pillars were based on the theoretical results concerning specifically the automotive industry and its effects on regional competitiveness.

The results of the model have shown that, as expected, there are significant disparities among the Czech regions. The most important finding is that the higher the position within the automotive GPN (and therefore with the highest impact on regional development) the more uneven the situation is. The automotive suppliers of Tier 1 seem to be very selective when it comes to choosing a location for an investment. The highest concentration of the Tier 1 suppliers was observed in proximity of technical universities and areas generally well penetrated by the automotive industry. Additionally, the lower Tier production seems to be localised more towards the west, while the Higher Tier suppliers tend to be localised more in towards the east of the country. This might be an important pattern that signalises that the lower Tier suppliers are shifting their production to eastern countries, such as Slovakia, Romania or Hungary. On the other hand, the increased presence of the higher Tier suppliers close to German borders could mean that some suppliers from the German automotive core are choosing the Czech Republic as the country to shift their production to.

The theoretical section has established a sound reasoning to support the hypothesis, however the data have shown opposite results. An assessment of the model using OLS method has led the author to reject the hypothesis that high value-added production contributes to regional development more than simple production. At this point it is important to mention that those results are

valid only for the Czech Republic, which is a highly specific country with unique history and position within Europe. The reason for rejecting the hypothesis might be the overall small number of Tier 1 suppliers, who have high impact only relative to Tier 3 suppliers, but the absolute impact is still low. The author suggests that this could be topic for further studies.

4.4 Recommendations for economic policies

The government level subsidies are already set to promote investment in underdeveloped regions. However, as the theoretical part established, investment incentives do not seem to be persuasive enough for the investors to choose the problematic regions over the attractive ones. Since investment incentives are of a pecuniary nature, they have various distorting effects. One such effect is that when an investment incentive is awarded to a new investor in the region, this investor can afford to offer higher wages to its prospective employees and thus poach employees from the other firms in the region, logically to the detriment of other firms. Additionally, the incentives focus on creation of new job places but there are virtually no policies that would focus on maintaining of already existing jobs. There is also the human element – if there is not enough qualified people that could work for the firm, the firm will most likely choose a place that supplies more qualified workers, because in this case the money offered by the government is too low to take the risk of hiring and re-qualifying under-skilled workforce.

The author suggests focusing on the supply side of the chain by promoting technical education and R&D activities. Some of the promotional policies could for example be creation of new university programs that would motivate (also financially in form of special stipends) prospective students to consider RD career or a systematic raising of public awareness regarding the availability of R&D subsidies. As the case of Ostrava mentioned above has revealed, the promotion of R&D activities and cooperation among various institutions can help the overall development of the industry (not just in the case of the automotive industry). The author sees an enormous potential in creating an automotive cluster in the

Liberec-Mladá Boleslav-Jičín triangle, because this region turned out to be the most advanced in the model and could benefit from the very close proximity of Germany. This would probably deepen the uneven nature of the Czech automotive industry even more, but it appears to be the most effective use of money. It seems ineffective to promote the automotive industry in regions where it is barely present (such as the Karlovarský region), because such support requires enormous amounts of money with uncertain results.

Since some studies have shown that FDI may have a detrimental effect to the host economy's R&D capabilities caused by relocation of R&D abroad, the author suggests to design market protective policies on R&D activities that would prohibit the relocation of the firm's R&D activities abroad for at least several years after a takeover. That would force the firms to continue and develop local R&D and the firms would, hopefully, find benefits in conducting R&D locally.

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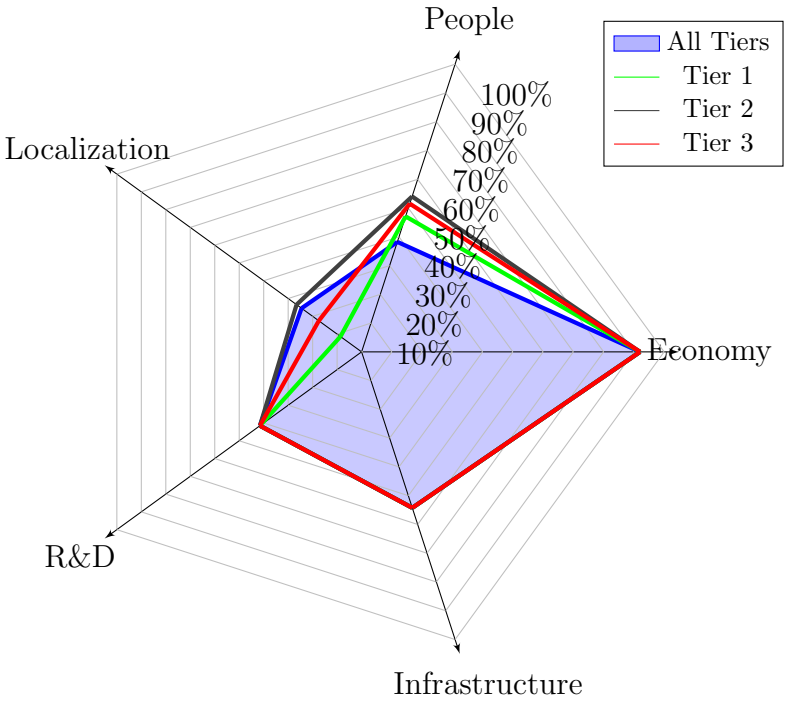
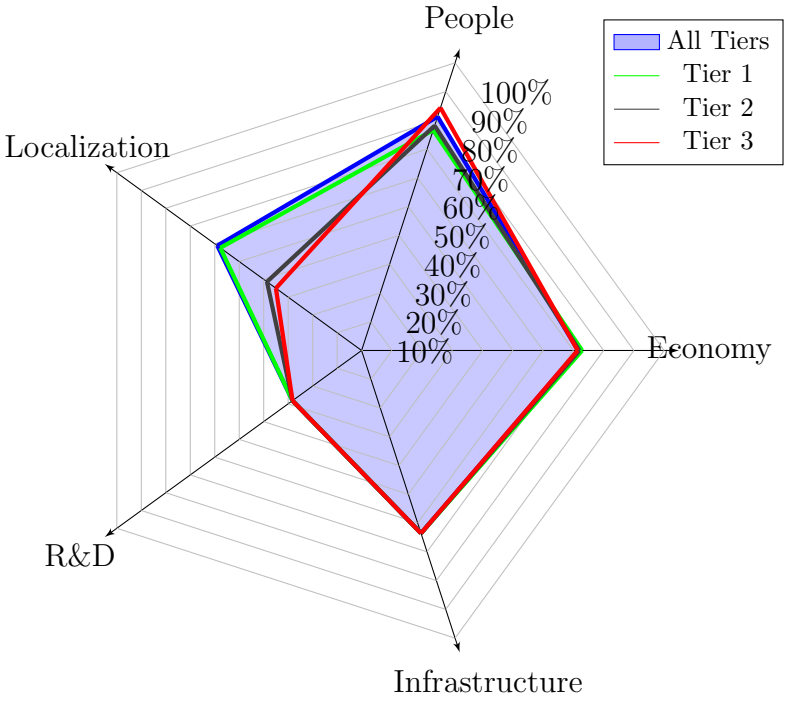
Appendix A: Competitiveness model results

FIGURE 1: Competitiveness model; region Prague



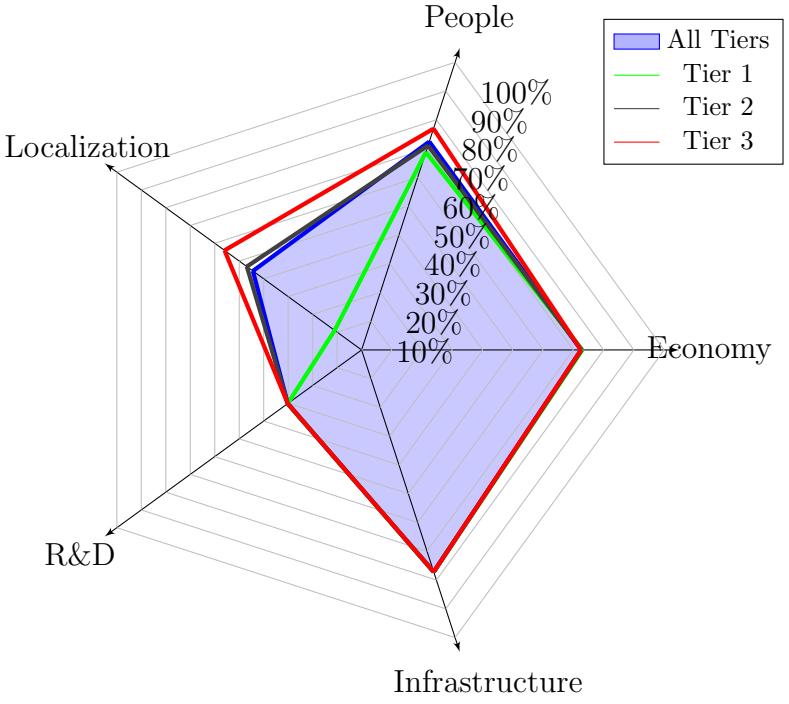
Data source: Czechinvest 2015b

FIGURE 2: Competitiveness model; region Královéhradecký



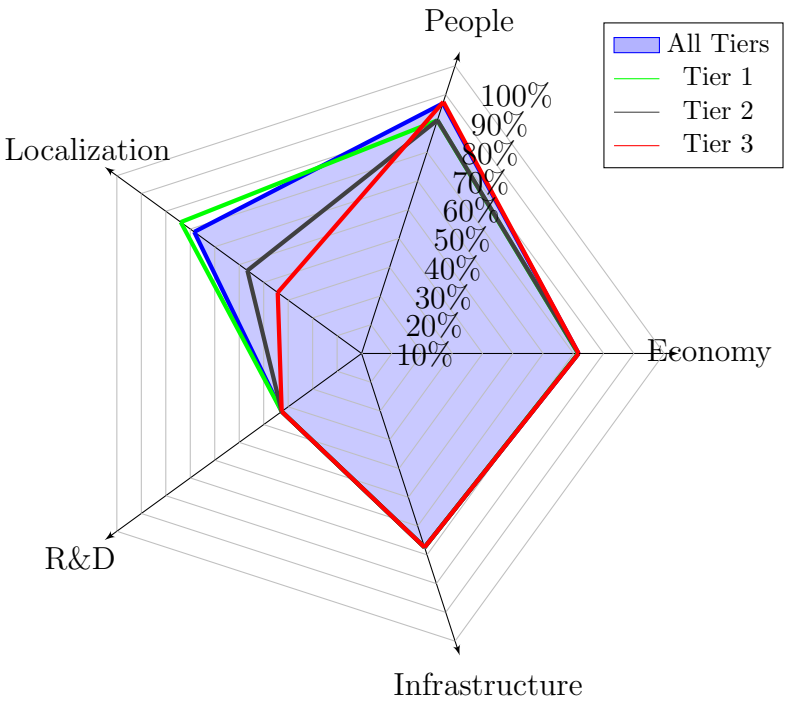
Data source: Czechinvest 2015b

FIGURE 3: Competitiveness model; region Jihočeský



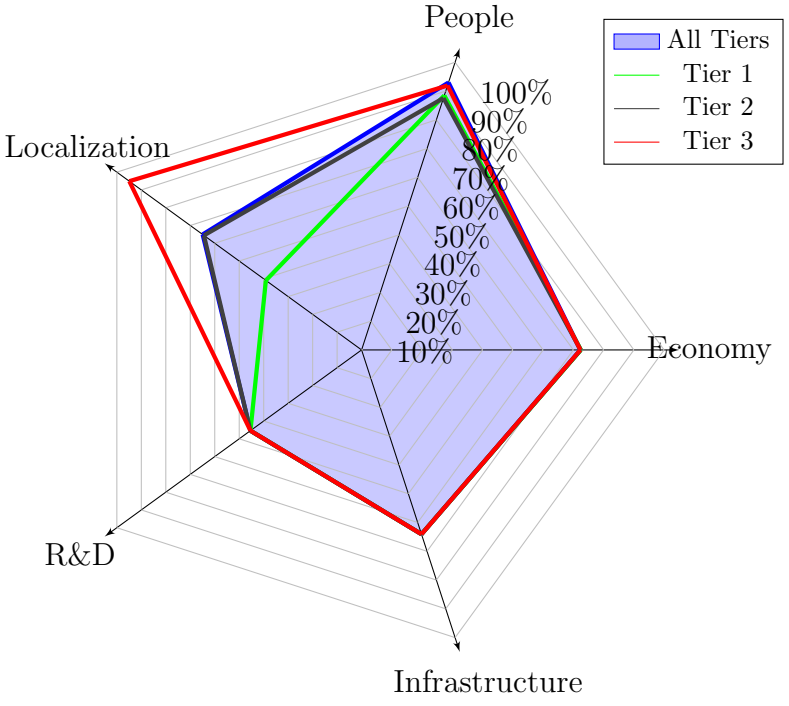
Data source: Czechinvest 2015b

FIGURE 4: Competitiveness model; region Vysočina



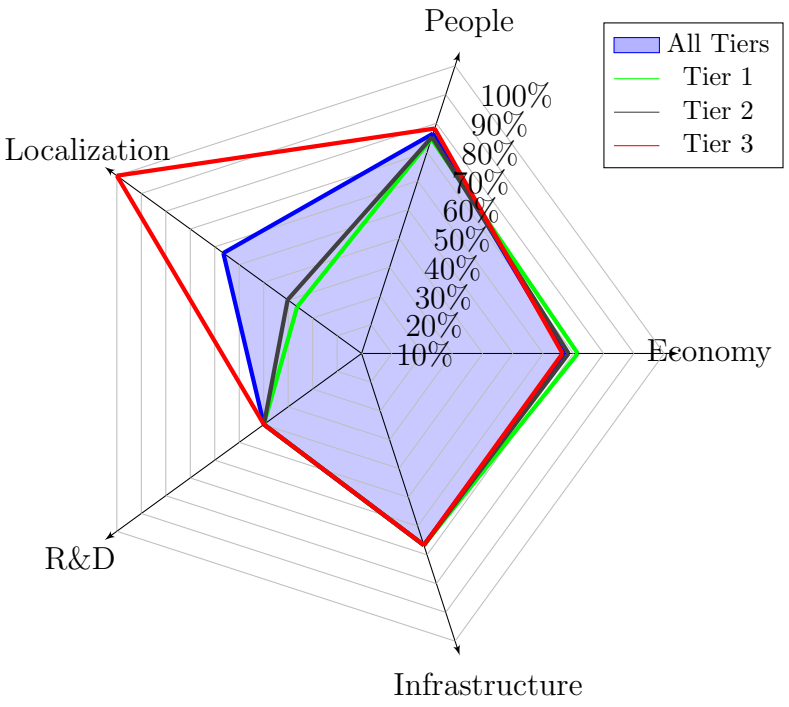
Data source: Czechinvest 2015b

FIGURE 5: Competitiveness model; region Zlínský



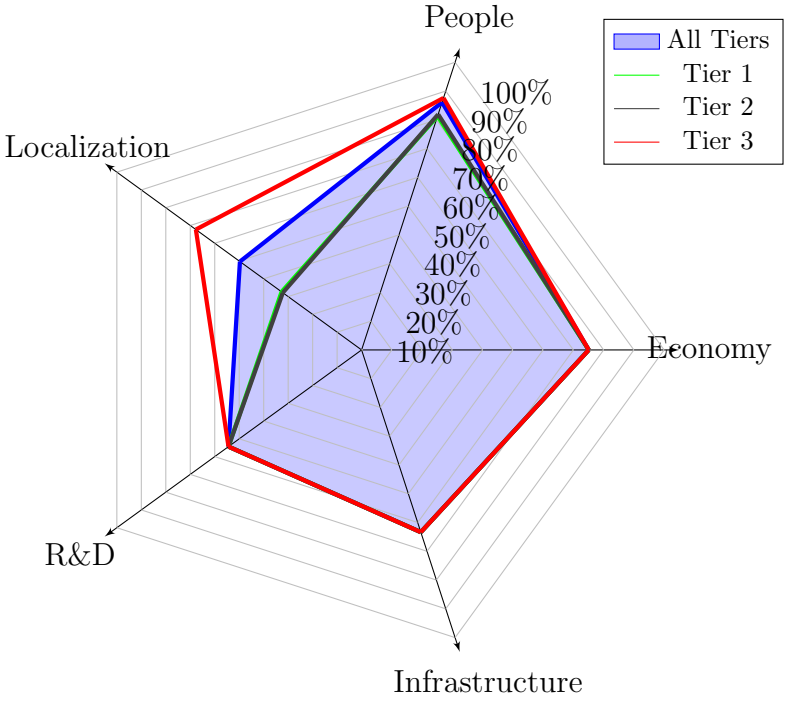
Data source: Czechinvest 2015b

FIGURE 6: Competitiveness model; region Moravskoslezský



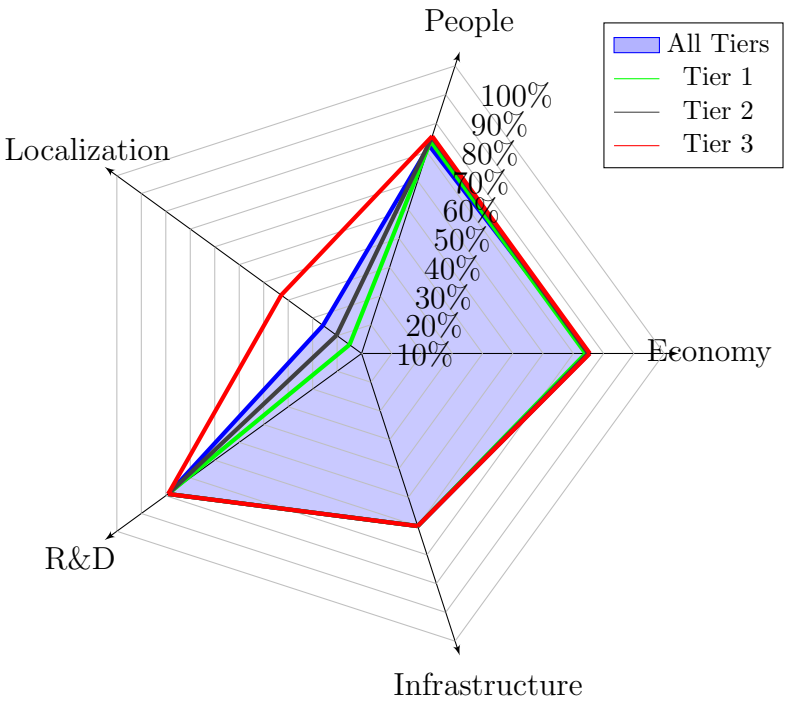
Data source: Czechinvest 2015b

FIGURE 7: Competitiveness model; region Pardubický



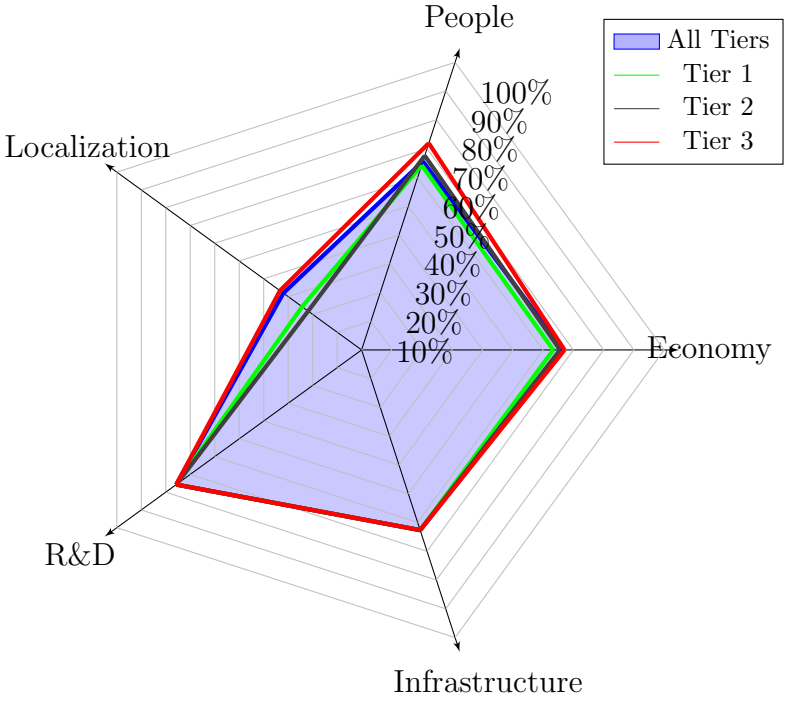
Data source: Czechinvest 2015b

FIGURE 8: Competitiveness model; region Jihomoravský



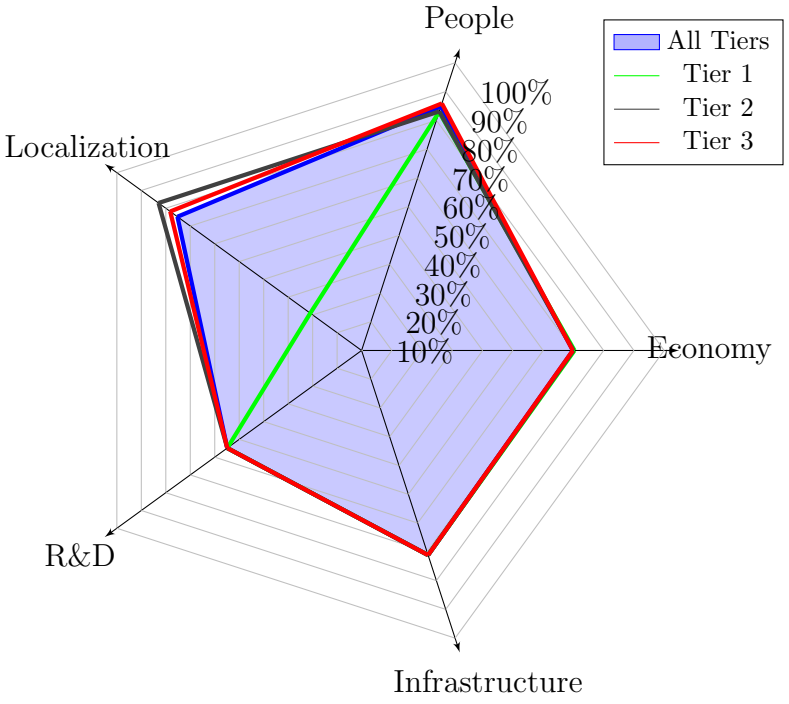
Data source: Czechinvest 2015b

FIGURE 9: Competitiveness model; region Středočeský



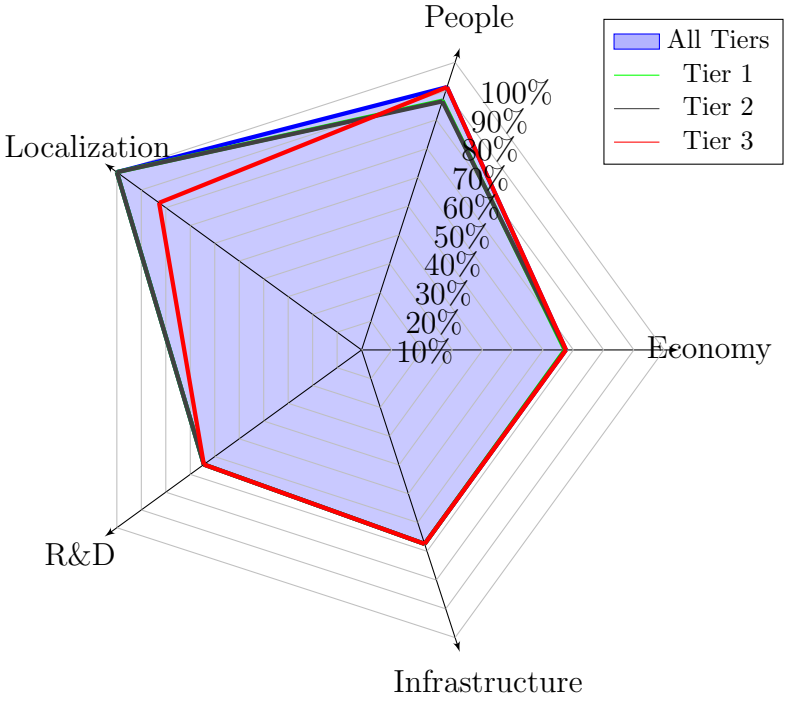
Data source: Czechinvest 2015b

FIGURE 10: Competitiveness model; region Plzeňský



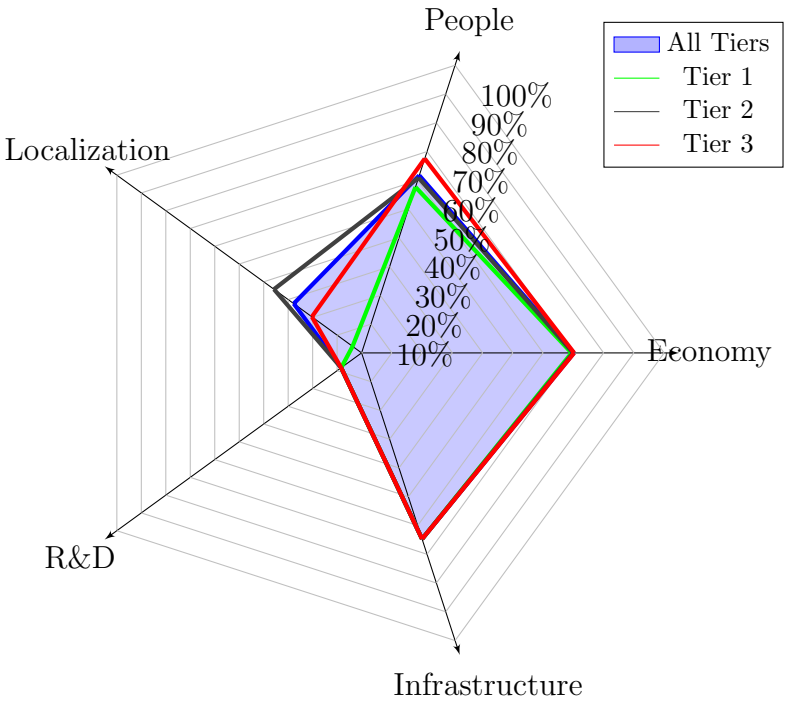
Data source: Czechinvest 2015b

FIGURE 11: Competitiveness model; region Liberecký



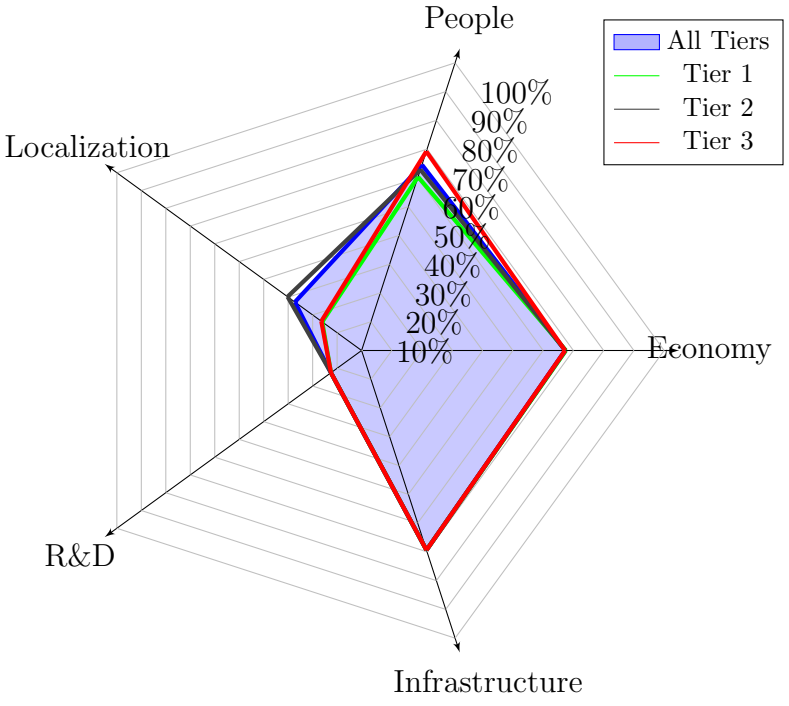
Data source: Czechinvest 2015b

FIGURE 12: Competitiveness model; region Karlovarský



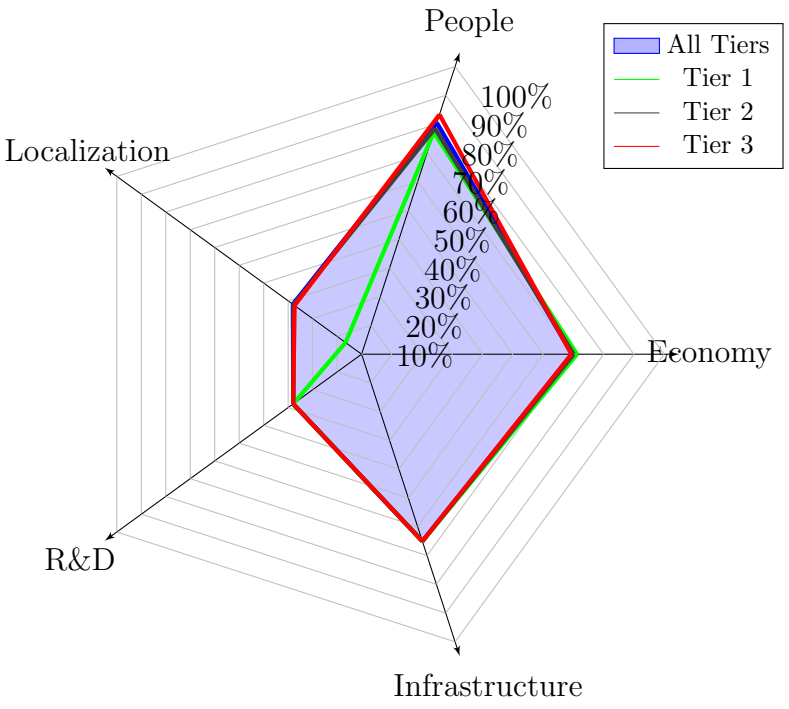
Data source: Czechinvest 2015b

FIGURE 13: Competitiveness model; region Ústecký



Data source: Czechinvest 2015b

FIGURE 14: Competitiveness model; region Olomoucký



Data source: Czechinvest 2015b