



Kaunas University of Technology

School of Economics and Business

Improving Added Value Income in the Lithuanian Automotive Industry

Master's Final Degree Project

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Supervisor

Kaunas, 2022



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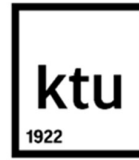
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Improving Added Value Income in the Lithuanian Automotive Industry

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Summary

Added value income in the Lithuanian automotive industry remains low compared to countries with similar capabilities and characteristics. The export data of the Lithuanian automotive industry was analyzed and it was observed that country's position remains at the medium which correlates to the fact that participation in the supply chain is not significantly improving throughout the years. There are only four businesses in the country that operate only in the automotive industry. The governance type of Lithuania's supply chain companies of the automotive industry remains captive or hierarchy which leads to low to medium added value income. In such a way global value chain companies extract more value-added outside the Lithuanian borders. In order to understand where the most added value lies it is necessary to divide the supply chain into several stages and identify areas where added value is the highest. To achieve participation in the highest added value supply chain stage it is necessary to understand the country's characteristics that lead to such distribution. Given the fact that Lithuania's exports are improving it is necessary to set up a development plan to be able to step up into supply chain areas that would be the most beneficial for the country. Due to this reason analysis of Lithuanian characteristics is made and a qualitative analysis of expert surveys is conducted. Data provides a comprehensive look of standpoint and the ability to absorb added value in terms of participation in automotive supply chains. Conducted analysis has identified the gap indicators which must be further developed to increase countries' competitiveness and participation in international trades in the automotive industry. Furthermore, it was identified that Lithuania has to develop its workforce in a way that would satisfy leading countries' requirements. In addition, the country must invest in certain areas that shape countries' ability to participate in the further stages of a supply chain. Moreover, as leading countries are evolving, supply chains evolve at a certainly similar pace. Due to this reason, it is important to analyze automotive industry trends which could lead Lithuania to upgrade its added value income and a better position in the supply chain. It was observed that Lithuania is currently struggling with social, economic, and environmental factors that would improve the country's participation in the supply chains. Therefore, recommendations on improvement areas and paths were conducted and provided in the research.

Marius Eitutis. Pridėtinės vertės pajamų didinimas Lietuvos automobilių pramonėje. Magistro baigiamasis projektas / vadovas doc. dr. Egidijus Rybakovas; Kauno technologijos universitetas, verslo ir ekonomikos fakultetas.

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Santrauka

Lietuvos pridėtinės vertės pajamos lyginant su panašių pajėgumų ir charakteristikų šalimis automobilių pramonėje išlieka labai žemos. Išanalizavus Lietuvos automobilių pramonės eksporto duomenis, buvo pastebėta, kad šalies eksportas kyla, tačiau lieka tarp vidutinės ar žemos klasės šalių. Tai koreliuoja su faktu, kad dalyvavimas tiekimo grandinėje per keletą dešimtmečių reikšmingai nekinta. Šiuo metu Lietuvoje yra tik kelios įmonės, kurios teikia paslaugas tik automobilių pramonei, kas parodo šalies pajėgumos savarankiškai veikti automobilių pramonėje. Lietuvos automobilių pramonės tiekimo grandinės įmonių valdymo tipas išlieka “nelaisvas” arba “hierarchinis”, o tai lemia mažos ir vidutinės pridėtinės vertės pajamas. Tokiu būdu pasaulinės vertės grandinės įmonės išgauna daugiau pridėtinės vertės savo šalyje nei jos lieka Lietuvoje. Norint suprasti, kur slypi didžiausia pridėtinė vertė tiekimo grandinėje, tiekimo grandinę reikia suskirstyti į kelis etapus ir nustatyti sritis, kuriose sukuriama vertė yra aukščiausiam lygyje. Norint dalyvauti aukščiausios pridėtinės vertės tiekimo grandinėje, būtina suprasti šalių ypatumus, lemiančius tokį pasiskirstymą. Atsižvelgiant į tai, kad Lietuvos eksportas auga, būtina sudaryti plėtros planą, kuris suteiktų galimybę žengti į tiekimo grandinės sritis, kurios būtų naudingiausios šaliai. Dėl šios priežasties atliekama Lietuvos charakteristikų analizė ir kokybinė ekspertų interviu analizė. Duomenys pateikia visapusišką apžvalgą ir būdą įsisavinti kuo daugiau pridėtinės vertės dalyvaujant automobilių pramonės tiekimo grandinėse. Atlikta analizė nustato rodiklius, kuriuos būtina toliau vystyti siekiant padidinti šalies konkurencingumą ir dalyvavimą tarptautinėje automobilių pramonės prekyboje. Toliau nustatoma kaip Lietuva turi kelti savo darbo jėgos pajėgumą ir kompetenciją, kad ji atitiktų pirmaujančių šalių reikalavimus. Atliekant tyrimą toliau buvo pastebėta, kad Lietuva turi investuoti į tam tikras sritis, kurios formuoja šalių galimybes dalyvauti tolesniuose tiekimo grandinės etapuose. Reikali turėti uomenyje, kad vystantis pirmaujančioms šalims, tiekimo grandinės vystosi panašiu tempu. Dėl šios priežasties svarbu analizuoti automobilių pramonės tendencijas, kurios galėtų padėti Lietuvai padidinti savo pridėtinės vertės pajamas ir užimti geresnes pozicijas tiekimo grandinėje. Tyrime pastebėta, kad Lietuva šiuo metu stringa ties kai kuriais socialiniais, ekonominiais ir aplinkos veiksniais, kurie stipriai pagerintų šalies aktyvų dalyvavimą tiekimo grandinėse. Toliau tyrime pateikiamos išsamios charakteristikos trūkumų analizės, išvados, bei rekomendacijos Lietuvos automobilių pramonės tiekimo grandinių vystymui.

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Introduction

Relevance of the research: Implementation of a Global Value Chain (GVC) became essential to provide businesses with a sustainable way to increase profitability and reduce costs of operations. By distributing distinct functions as a manufacturing, big companies set new development steps for countries which can execute in a lower-cost way and additionally learn required skills, standards, technologies. The positive impact of this globalization process is often seen in countries that become a part of a supply chain but yet there are many examples of nations stuck in the environment of lower or medium-level additive value propositions. With accelerated international trade, the impact of such phenomena became more critical as even developing countries are still significantly behind the leading countries.

Issues: Lithuania as a participant in the automotive industry supply chain has its added value which is not significantly changing over the years. There is still unclarity in what factors shape this type of stagnation and how to set up a sustainable way to overcome “lower added value income.”

The aim of the paper is: to identify a relevant GVC characteristics gap between foreign countries and Lithuania and to provide what improvements can be implemented on a systematic development in the automotive industry supply chain.

The goals of the paper are:

1. to define the most impactful characteristics which reveal the difference in added value income between countries;
2. to analyze relevant literature in order to understand influencing factors and possible theoretical improvements on value-added income;
3. to provide recommendations on development areas of Lithuanian characteristics to improve added value income in automotive GVC participation;

Research methods are: review of a countries characteristics of secondary data; qualitative analysis of expert surveys.

1. Problem analysis

1.1. Lithuanian productivity and added value in supply chains

Internationally trading companies have opened a new era of globalization where different added-value products and intermediates are distributed among supply chains. Supply chains added value varies due to complexity of manufactured products. GVC companies choose the most convenient locations by taking into consideration cost and quality in order to keep their best competitive position between other market players. By sourcing intermediates or even final goods companies can re-export or manufacture more expensive goods keeping prime costs at minimum. There is a high focus from countries to step in a supply chains due to mostly stable domestic income and trading taxes, together with increasing intellectual capital of country work force. Focus is especially relevant if countries does not have the right knowledge in industries (Durand & Milberg, 2020) which helps countries to develop and increase its competitiveness. Together with the positive impact on economics participation in such trades led countries into a complex issue where added value income stagnates and the workforce cannot overcome the growth trap while leading companies develop the added value gap even further. For example, phenomenon could be found in diverse types of GVC's as foreign-controlled enterprises. Foreign controlled enterprises concentrate on locations where partial or final products could be produced and shipped back to the origin country to be sold or re-exported again. Here, Germany as a leader of export in Europe (exported value in 2020 equals 1,378,031 billion US dollars from which the automotive industry comprises 64.2% of exports) has established various foreign supply chains and holds most turnovers of value added at factor cost in foreign-controlled enterprises (Eurostat, 2021), see Graph 1. The graph provides a clear picture of the country's

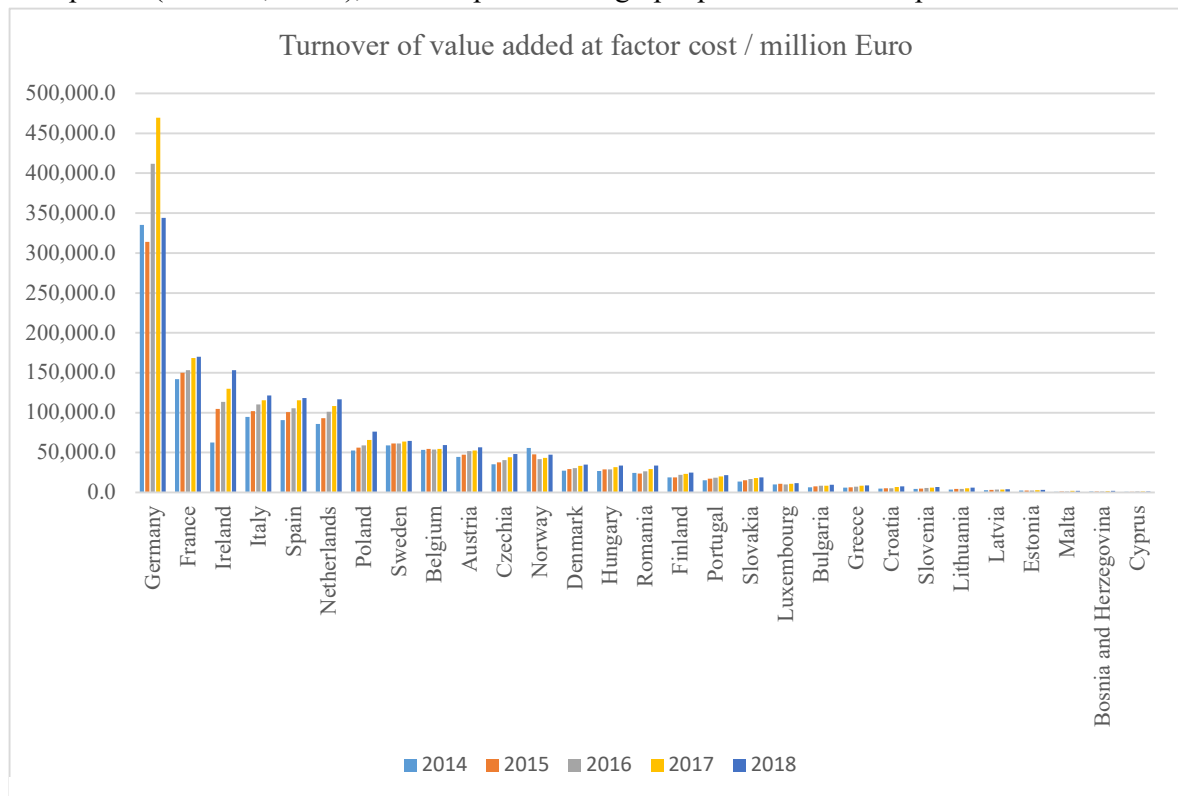


Figure 1 Foreign control of enterprises by economic activity and a selection of controlling countries (from 2008 onwards) by Eurostat [FATS_G1B_08], data coverage 2014-2018

dominance over the others without any chance of catching up in a near future. France as the closest

competitor to Germany has approximately two times lower turnover at the same time following countries as Ireland, Italy, Spain, and Netherlands hold positions near France. Here, Lithuania together with Baltic states countries has one of the lowest turnover of added value. Turnover has a direct relationship between the amount of labor hired in foreign countries and added value created at the country location, which contributes to the final product. By this more people working in the foreign controlled location with low value income creates a higher turnover at the controlling country after a final good export or internal sale. It is important to mention that capabilities of countries vary due to productivity, demographic, and geographic situation – low productivity, lower number of residents and lower area meaning lower capability to create successful business units. Under these circumstances countries concentrate to become more competitive and improve their created value by producing more valuable solutions and be a part of a supply chain as a final good provider. Lithuania as a small country has a limited amount of labor resources and area, which leads to less capability to provide sufficient resources to participate in supply chain as a big contributor. In recent years manufacturing apparent labor productivity (ALP), which shows the added value at factor cost by the employee. It brings Lithuania (score in ALP 25) to the five lowest added value countries including Latvia (score in ALP 23.9), Romania (score in ALP 19.5), Bulgaria (score in ALP 15.4), and Bosnia and Herzegovina (score in ALP 13.5) in 2019 see Graph 2.

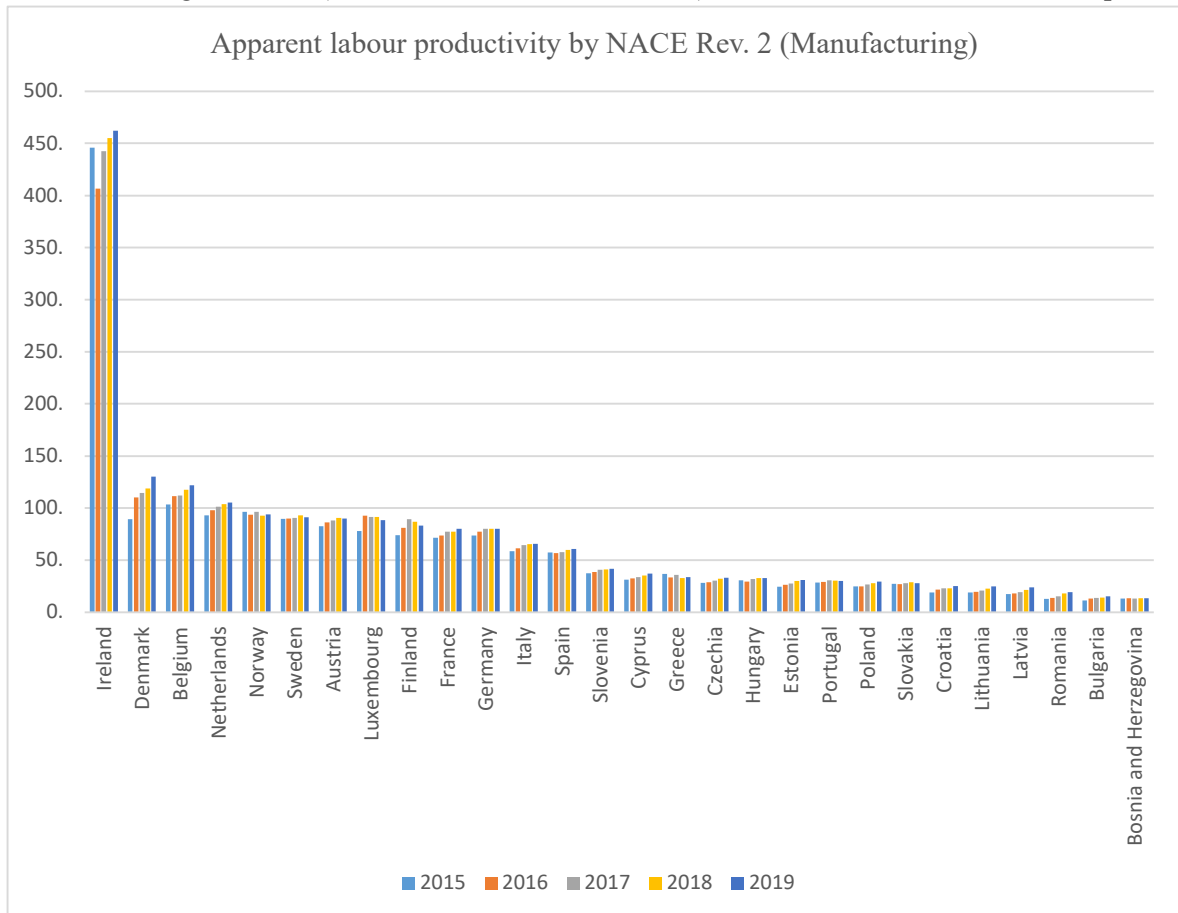


Figure 2. Apparent labour productivity By NACE Rev. 2, Eurostat [TIN00152], data coverage 2015-2019

The gap among European Union countries apparent labor productivity in the manufacturing sector remains extremely high and does not significantly change over the years. There is a clear indication that countries with higher capabilities and higher skilled workforce leads APL score. Small countries

as Ireland, Netherlands, Luxemburg that positions themselves among leading countries provide an example of setting the right priorities on countries capabilities development. Most productive countries have a certainly different approach than simply generally participate in supply chain. Starting with an exceptionally high complexity production countries characterizes with a high effectiveness, high intellectual properties utilization, and their production is further exchanged with services where there is no physical good is manufactured but an “addition” of a final good added. “Addition” can be explained as a design, functionality, or other services that no other party can perform autonomously. Looking from other perspective productivity is related with innovations,

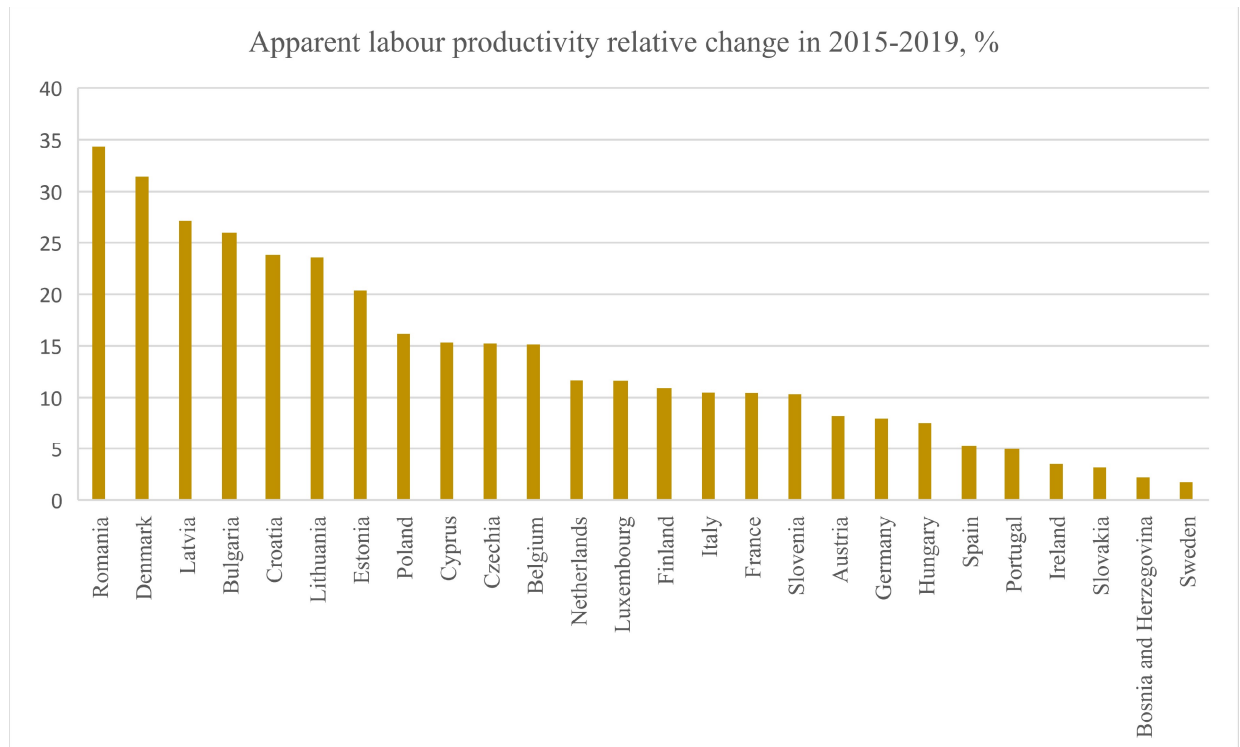


Figure 3. Apparent labour productivity relative change in 2015-2019, %, Eurostat [TIN00152], data coverage 2015-2019

technologies and investments utilized on certain areas. Lithuania remains very weak in manufacturing technology development and currently available capital is low compared with advanced countries. Nevertheless, Lithuania is on a positive trend and country's ALP is developing fast (see Graph 3), which visualizes a relative change of APL. Further, leading countries in APL tend to remain more stable due to excelled system and remaining principles whereas investments must be huge to achieve better productivity especially during economic recessions, which significantly impacts APL development. Considering positive trends there is still no close competition in productivity as relative growth does not provide a possibility to exceed leading countries. For example, Lithuania’s ALP growth exceeds 23.6% while Germany’s growth is equal to 8% (2015-2019) which means that growth is higher in Lithuania, but score-wise Lithuania gains less score due to ~3 times smaller initial apparent labor productivity. This means that countries must adapt and change by increasing characteristics, which lead to more added value production. Furthermore, countries improve their intellectual capital, which is required for more complex solutions in order to increase participation in the supply chain.

1.2. Exports of automotive industry in Lithuania

APL is closely related to the automotive industry, which is one of the biggest modern Global Value Chain contributors. Among European countries this industry holds one of the most valuable and biggest quantity-wise export, which is produced out of various intermediates distributed among the world. Lithuania in the face of globalization had its struggles to join the automobile sector, which were caused by historical reasons and started its participation in the supply chain middle of the 1990s. According to Trademap (2021), Lithuanian automotive industry exports exceed 1.63 billion US dollars in 2020, which contributes by 4.9% to total country exports and claims the fourth biggest exporting industry. The highest value trade partner is Germany where most exported goods indicated in **HS87** group (Vehicles other than railway or tramway rolling stock, and parts and accessories thereof¹). Here, 85% contribution comes from main three groups: **HS8703** (Motor cars and other motor vehicles principally designed for the transport of persons, incl. station wagons and racing cars (excluding motor vehicles of heading 8702)), **HS8716** (Trailers and semi-trailers; other vehicles, not mechanically propelled (excluding railway and tramway vehicles); parts thereof)¹, and **HS8708** (Parts and accessories for tractors, motor vehicles for the transport of ten or more persons, motor cars and other motor vehicles principally designed for the transport of persons, motor vehicles for the transport of goods and special purpose motor vehicles of heading 8701 to 8705)¹. To see a comprehensive view on Lithuania's position among other automotive supplier countries Germany imports can be revised. Germany is the largest automotive exporting country with 209,668 billion US dollars exports and country shapes supply chain trends in automotive industry. Germany's supply chain comprises imports, which value is 123,657 billion USD whereas in **HS87** group dominates **HS8703**, **HS8708**, and **HS8704** sections. Furthermore, countries were selected according to APL similarity and data from Germany's imports listed in Table 1. More than a half of the similar APL countries have traded more value with Germany in 2020, which indicates yet a very weak participation in supply chain and income of Lithuania. Nevertheless, Lithuania is heavily increasing exports to Germany, see Table 1.

Table 1. Germany automotive industry imports among similar Lithuanian country ALP, Trademap. (2021)

Exporters	Imported value in 2016	Imported value in 2017	Imported value in 2018	Imported value in 2019	Imported value in 2020	Relative import value change 2016-2020, %
Poland	6743644	7337875	8840372	8772838	8038646	19.20
Hungary	6649338	6580869	6711755	7611772	7667532	15.31
Slovakia	5497111	5620341	7774347	8962059	7615246	38.53
Portugal	725472	848624	1129127	1797647	1332626	83.69
Bulgaria	263818	278292	426186	459627	541309	105.18
Croatia	118562	171021	248612	266328	207259	74.81
Lithuania	89814	100024	152323	218042	193140	115.04
Latvia	57544	70539	72064	64853	69269	20.38
Estonia	30903	48613	57077	52519	53272	72.38
Bosnia and Herzegovina	22776	19377	30680	32178	34202	50.17

Greece	30161	18632	21395	23341	19985	-33.74
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Table 2. Unit value difference between Lithuania and competitor countries in exported goods and corresponded goods

	Bulgaria	Portugal	Estonia	Croatia	Slovakia	Latvia
Unit value difference between Lithuania¹, %	295.3293	187.0659	149.5808	126.9461	118.3234	105.6287
Dominating HS sections, marked corresponding sections with Lithuania	8711, 8708, 8703	8703, 8708, 8712	8703, 8716, 8708	8703, 8708, 8705	8703, 8708, 8716	8708, 8703, 8705

Even exports are growing Germany has a small imports from Lithuania, which indicates certain characteristics gaps in Lithuania as an automotive supplier. Countries as Bulgaria, Portugal, Slovakia, and Hungary are similar in GDP but comprises by times more exports to Germany leading to more income from automotive sector. Therefore, the growing Lithuanian market must ensure that products unit value would be competitive and as high as possible to gain higher income. Unfortunately, relative competitors most exported goods¹ to Germany unit income have moderate to high-value gap, see Table 2. Table analyzes exported units price per exported quantity and provides comprehensive look as most exported HS sections are mostly the same. It is important to mention that countries as Latvia and Estonia, which do not export as much as Lithuania has a higher unit price. Unit price has a relationship with added value as bigger unit price means higher income from a certain good. Furthermore, general situation of Lithuania's export to biggest exporting country Germany remains growing and yet a new branch of development. If positive trend will remain Lithuania should overcome many of other countries in term of export to Germany. As quantities rising Lithuania must improve unit value and by this gain a better position in added value income.

1.3. Summary of problem analysis

According to analyzed data, Lithuania's participation in automotive industry supply chain has many challenges to overcome. Firstly, country does not have a foreign controlled locations to control and adjust costs along supply chain, which leads to less flexible production and more strict cost structure. Additionally, foreign controlled enterprises create new intellectual capitals and synchronizes with supply chain business logic. Logic is an essential part of understanding how to act and what standards are necessary to follow to remain in a sustainable position. Further, country is only dependent on internal capabilities and resources and by this sector is extremely sensitive to Lithuania's economy. For example, minor changes in a labor cost can disturb positive incomes significantly. At the current moment, Lithuania struggles with foreign enterprises and there is no positive sign that country will expand its scope and will step internationally, which weakens a possibility to gain a better added value income and gross margins. Otherwise to foreign enterprises, country must be productive to provide a certain level of possibilities to remain cost competitive. Analyzing apparent labor productivity revealed that there is even deeper problem in Lithuania's participation in manufacturing GVC's. There are significant gaps in productivity and most productive

¹ Evaluated three highest quantity exported automotive branches in quantity to Germany, average unit value by Thousands USD per ton. (Trademap, 2021)

companies step in service businesses instead of manufacturing which provides more added value income. Under these circumstances, Lithuania remains a new player in automotive manufacturing, which delays any short term added value breakthroughs. Even productivity is improving country is still decade apart leading countries and in case of economic recessions time period might increase even further. There are several characteristics as technology, innovation, and intellectual capital, which can be indicated as a tools to increase productivity but yet there is no clear solution. On the other hand, Lithuania has increasing exports towards biggest automotive exporters globally, which indicates a positive step to increase of added value income. At the moment, exports do not contribute significantly to importers general demands and unit price is even lower than countries below Lithuanian exports but it is clear that rising quantities provides more flexibility to increase added value. Automotive industry has a huge history and products transformation which is an opportunity for countries as Lithuania to establish functioning sustainable supply chain. Since there are no significant investments done into automotive industry Lithuania can follow new industry trends without a need to change old equipment, facilities, or mentality. In conclusion, thesis will concentrate on a such problems:

1. Countries low exports towards automotive industry and low participation in GVC;
2. Added value income and productivity of labor force remains comparably low;
3. Countries characteristics gaps are not attractive to supply chain business environment;

2. Theoretical solutions

Global Value Chains (GVC) has a distinguished added value distribution among the supply chains. There are supply stages where added value income is considerably high and it is followed by stages where added value income is absorbed at minimum. Countries and companies are focused to find a branches and characteristics to increase its competitiveness in terms of added value income. Therefore, there are many theories which discuss how to achieve designated results. Lithuania as a small developing country has a weak participation in such trades, especially in automotive industry. Automotive industry is one of the oldest and arguably the founder of a supply chains. As industries evolve GVC evolves together. Early literature by Gary & Humphrey John (2005) suggests a different types of governance which shape further development of the supply chains. Considering the governance type countries and companies can establish more concentrated business units towards GVC demands and increase participation by following authors suggestions. Furthermore, added value income can be found in a various productions steps from services such as R&D to manufacturing and aftermarkets. This concept is followed by Timmer et al. (2014) which is dividing supply chains into separate stages which gives a more comprehensive and less chaotic overview. There are clear trends that workforce and service type shape the added value income where low-medium workforce and least complex services has limits value absorption. Here Meng et al. (2020) provided a systematic approach to distinguish supply chains by upstream and downstream supply chains. Upstream supply chain provides initial materials and services to make production stage possible, whereas downstream supply chain distributes products towards the customer markets. Analyzing downstream and upstream curves dynamics of added value distribution it was identified where most of added value lies. At the upstream and downstream curves starting and ending positions added value has its highest points, leaving production stage with harsh competition and less added value income. Further, this phenomenon can be assimilated with intellectual properties of the countries and companies. Durand & Milberg (2020) called such effect as “Intellectual monopolies” where a high-income countries can utilize its knowledge as an added value engine by policies that prevents further usage of innovations and technologies. Nevertheless, there are yet much research done on how to increase added value despite the high-cost developments on competence and lack of partnership between GVC countries. Social factors plays huge role in terms of sustainable supply chain development which clearly indicates various criteria for the countries to be more attractive and competitive among others. Hutchins & Sutherland (2008) have already introduced a new model of countries evaluation to a decision making for GVC companies easier. Here authors discuss on how to assess important economic, environmental, and social factors to establish long-lasting and performing supply chains. Research was followed by Farole & Winkler (2015) where competitiveness indicators were stated as “performance” indicators for a supply chains. Nevertheless, there are still gaps on technological development and link between supply chains utilization and adaptiveness. Technologies are the main driver of the supply chains but there are no clear statements and research concentrated towards such developments. Further, literature does not provide an examples of social factors and distribution among innovation concentration which would help to understand how to design a development path for emerging countries. This literature review will structurize different aspects of supply chain added value income in industries and will touch upon an automotive industry peripheries. Analysis will concentrate on finding a comprehensive study that would consider social factors and development towards increased added value income by assesing available competitiveness indicators that would reveal development gaps of a country in automotive industry supply chain management and added value income.

2.1. Identifying added value

Differentiation of the countries which provide high added-value products is not related to where every physical good is located and produced but how big companies manage their supply chains, and how cost-effective and productive they are. Currently, the majority of industries outsource lower to medium added value components, services, and development from various locations in the world to soak maximum profits. This creates new possibilities for countries to step into trading chains but the highest added value income products are usually exported from the origin controlling country leaving a significant gap between value incomes throughout supply chains. This phenomenon occurs because intellectual capital covering relationships, technology, standards, and quality requirements are located in founding companies. To better understand this concept GVC can be assimilated as a network that collects small pieces of data from diverse sources. Pieces of data are originally built and shared with other network locations where each location adds the data on top. Different add-ups can be considered as an added value that will be transferred and reproduced to create even more value. This addition was calculated by the difference in import-export price. According, to Koopman et al. (2012) as official statistics are calculated in gross terms, value flows are overstated as intermediate goods across international borders more than once. Under these circumstances, Koopman et al. (2012), created a new system that does not account for “doubled” values that are generated by the goods crossing international borders several times. New calculations revealed even bigger added value gaps already created between the countries and led to further developments to account for data more precisely.

Table 3 Factor shares in Global Value Chains of Manufacturing, by region. Source: Timmer et al.(2014)

Factor Shares in Global Value Chains of Manufactures, by Region

<i>Value added in value chains of manufactures</i>	<i>1995</i>	<i>2008</i>	<i>2008 minus 1995</i>
In high-income countries (billion US\$)	\$4,863	\$4,864	\$1
By:			
capital (%)	35.9%	38.7%	2.9%
high-skilled labor (%)	16.8%	21.8%	5.0%
medium-skilled labor (%)	33.3%	30.3%	-3.0%
low-skilled labor (%)	14.0%	9.1%	-4.9%
In other countries (billion US\$)	\$1,723	\$3,820	\$2,097
By:			
capital (%)	55.2%	58.4%	3.2%
high-skilled labor (%)	5.4%	7.1%	1.7%
medium-skilled labor (%)	15.6%	17.0%	1.4%
low-skilled labor (%)	23.8%	17.5%	-6.3%
Worldwide (billion US\$)	\$6,586	\$8,684	\$2,098


Furthermore, with a new methodology to calculate the added value, GVC researchers were able to

acquire more precise calculations of added value areas, and characteristics. Here Timmer et al. (2014) diversified added value relationship between high, medium, and low skilled workforce by analyzing high income and other exporting country's supply chains, see Table 3. At this point, high-income countries had a factor cost increase only in the high-skilled labor force while other countries were stuck with a decline in low-skilled and slight medium-high skilled increase in factor share. The author proved that big companies strategically distribute low added-value functions to lower-wage countries and increased factor share for both – home country and exporter countries. Nevertheless, it created a problem where value-added by low-skilled workforce was declining in emerging countries meaning that demand for such functions was declining as well. The author concludes that such events might be related to unskilled technologies fall which together cause unskilled labor force wage inequality problem. Additionally, it is concluded that even opening to trade has a positive trend in increasing income but it is highly related to what position in supply chain country will take – if a position is not favorable workforce might face a bigger inequality threat. Furthermore, researchers developed added-value calculations even more. Johnson & Noguera, (2017) have concluded that gross value is highly misleading added value calculations whereas empirical applications must be used for characterizing quantitative models. Due to changing trade regulations, it was impossible to precisely map value-added by calculating trade gross data. Together with this, the authors emphasize their new calculations with the developed model and state that regional trade agreements have negatively impacted (by 15%) value-added trade. Further, Soo (2018) carried out research on added value calculation where the only deviating factor between final goods is the labor force. The workforce is used to produce intermediates and final goods depending on the trading country. The research concentrated on the relative size of trading companies whereas small countries gain more comparative advantage from a division of the labor while big countries have a comparative advantage and contribute less from a division of labor. There are different cases taken where the origin country produces intermediates together with the final product and a case where international trade takes place. When producing a final good completely from scratch distribution of the labor force is very distinguished. There are many fields where a low-skilled workforce is needed but unavoidably medium and highly skilled must be used. This creates a fraction of different type of functions and gains of added value which distributes resources to certain categories and limit the capabilities of large countries meaning that comparative advantage is not fully utilized which limits added value income even if all the production is carried out internally Parida et al. (2019). On the other hand, small countries that do not have a comparative advantage contribute more added value by participating in supply chains. As there are no significant capabilities to manufacture final goods in small countries or consumption of such products is low trades must be done to compensate for resource utilization Mosso et al. (2014). Here small countries do not have a comparative advantage until their workforce is fully concentrated on narrow areas of manufacturing and finds its demands abroad. This creates added value essence which can be explained in two different cases. Bigger countries that control GVC enterprises gain the most added value from comparative advantage which is generated by final good exports and highly skilled labor-created solutions. On the other hand, the right division of labor force can be interpreted as the success of the small country's added value income. Additionally, there are policy influence which greatly shapes international trade. There is still not clear definition of correct added value calculation proposition which would provide comprehensive view on international trade supply chain added value income.

2.2. Governance types of supply chains

Looking from a different perspective, GVC companies have their reasons for added value distribution among companies and countries. Countries that do not participate in industries cannot have explicit knowledge about specific technologies, quality, and requirements. This leads to capability-based risk analysis of complex manufacturing steps that can be performed in foreign countries. Opening a new supply chain with countries that have no experience brings a high risk of failure and a decline in the sales of certain products or even a decline in businesses. Under these circumstances, it becomes difficult to build a sustainable trustworthy supply chain that brings expected added value. For this reason, Pietrobelli & Rabellotti (2010) suggested that it is crucially important to transfer industry, standard, production, and technology-specific knowledge to countries by establishing a learning process. The learning process frequently is pushed due to a lack of compliance with GVC company standards and unless compliance is reached mutual growth is nearly impossible. Depending on dedicated foreign supply chain functions companies it is suggested by

Table 4 GVCs and their Interaction with Innovation Systems. Source: Pietrobelli & Rabellotti (2010)

	Governance type	Determinants	Innovation Systems	
1	Market	Low complexity		<p>A well-structured, complete, smooth system makes 1-2-3 more likely to occur.</p> <p>4-5 may prevail with weaker, more fragmented systems. The chain leader may compensate for system weaknesses but upgrading is restricted.</p> <p>Possible Dynamics</p> <p style="text-align: center;"></p> <ul style="list-style-type: none"> ▪ From 5 and 4 to 2: Thanks to improvement in MSTQ ▪ From 5 and 4 to 3: Thanks to improvement in “local” systems ▪ From 5 and 4 to 2 and 3: Thanks to IS supporting the co-evolution of suppliers and GVC competencies
		High codification	MSTQ organizations matter	
		High supplier competence	Education, training organizations matter	
2	Modular	High complexity		
		High codification	MSTQ organizations matter	
		High supplier competence	Education, training organizations matter	
3	Relational	High complexity	“Local” systems and complementary knowledge matter	
		Low codification	MSTQ organizations are perhaps less crucial	
		High supplier competence	Education, training organizations matter	
4	Captive	High complexity		
		High codification	MSTQ organizations matter	
		Low supplier competence		
5	Hierarchy	High complexity	Local R&D organizations may benefit from interaction	
		Low codification		
		Low supplier competence	GVC is expected to improve human technical skills	

Pietrobelli & Rabellotti (2010) for GVC companies to dedicate governance type that complies with effectiveness which would gain value “flexibility” in distributing functions among supply chains, see Table 4. There are five different governing types indicated, which create different relations between business units. Firstly, the market governance type occurs when the country can provide intermediates that are already competitive in the market. In this case, businesses compete with other businesses in terms of competence, price, lead time, or quality, depending on customer demand. This relation characterizes by an own business's responsibility for further development and competitiveness meaning low complexity of trading relationship but certainly high competence in the business area (Kersan-Škabić, 2019). Furthermore, depending on product complexity different added value amounts can be extracted from such a system. Higher complexity products remain more profitable and gain more income while low complexity products lead to less income. In terms of country relationship, such a type of trade generates direct incomes as the governance of the companies remain internal. Further, the authors conclude the modular type of governance where flexibility and sustainability are the keys to modular solutions development (Kang, 2021). Such trades remain in close relationship with the end customer which enables companies to develop solutions in which development direction is agreed with purchasing party. Governance type provides guidelines that must be followed in case of success in sales. Here complexity between trading partners is very high followed by high codification and high supplier competence. Added value in such a system is similar to market governance type whereas modular solutions added value varies due to the complexity of solutions and ability to adapt to current needs. Country-wise such a governance type provides the possibility to remain competitive with other countries as products are developed and sustainably revised with purchasing parties. In the middle of governance types, there is a relational type identified. Relational governance meets international trade directly with the relationship between businesses. Bonatto et al., (2020) concluded that such a type must contain trust and there is no official agreement between parties and mainly sustains on gain trust. Trust remains characterized by capabilities, competence, and lead-time between parties. Additionally, one of the most important factors for developing countries is a power that is characterized by the capability to make changes in supplier production, products portfolio, and influence general relationships (Antràs & Gortari, 2020). Within such a system added value fluctuates due to mostly unstable solutions or personal ambitions of businesses. There are no guarantees that companies synchronize in a correct way which creates challenges as contextual factors that shape the performance of a supply chain . Further, the two least competitive types of governance are captive and hierarchy. These types of governance are similar in terms of supplier competence where the governing company must intervene in the production occasionally due to complexity and lack of capabilities to produce quality goods. Here Gereffi & Humphrey (2013) stated that such systems are the most complex but most beneficial for supplying companies. As there are many technical specifications and a lack of competent specialists and experts from the governing company must support to achieve the required quality. In most cases companies do not have sufficient standards to comply and end-customer must introduce it for supplying company. Captive governance type differs from the hierarchy of codification where governing company focuses more on technical specification but supplying company takes care of most of the production, whereas the hierarchy type has a huge gap between competence as well as codification. Added value income in such cases remains low as the cost of supervision is there. Depending on the complexity of the products income might vary and a trend of more complex products gains more added value remains the same, thus governing company mostly charges or cuts the prices in case of support (Crane et al., 2019). It is clear that competence and codification shapes governance types and supplying companies together with countries must shape itself to become more and more competitive.

In order to achieve required knowledge countries and companies mostly start with most super visional types. Further, by gathering experience and knowledge companies move forward. When foreign enterprises exceed required knowledge there can be shifts towards activities that can lead to an upgrading of processes, products, functions, and interactions with innovation systems in lower-cost countries. Further, supplying companies must be adaptive and react to market changes while governing the supply chain. Adaptiveness brings more added value share but at the same time opens a new service trade niche meaning that even R&D activities can be executed at a lower cost base where countries benefit more by themselves (Ketchen & Hult, 2007). This can be assimilated with the shift of trading goods to services provided which are executed by higher-skilled labor. Similar assumptions can be observed by Bell & Figueiredo, (2012) where innovation capabilities were leveraged between technological advancement and human resources. Authors indicated that added value is brought by a ramp-up from specialization in manufacturing and shifted towards R&D activities in latecomer companies which assimilates with participants in GVC as participant countries mostly specialize in manufacturing and establish their businesses later than origin enterprises. When human resources are compliant with technological advancements companies step into the transition phase where higher added value activities might occur, see Figure 4.

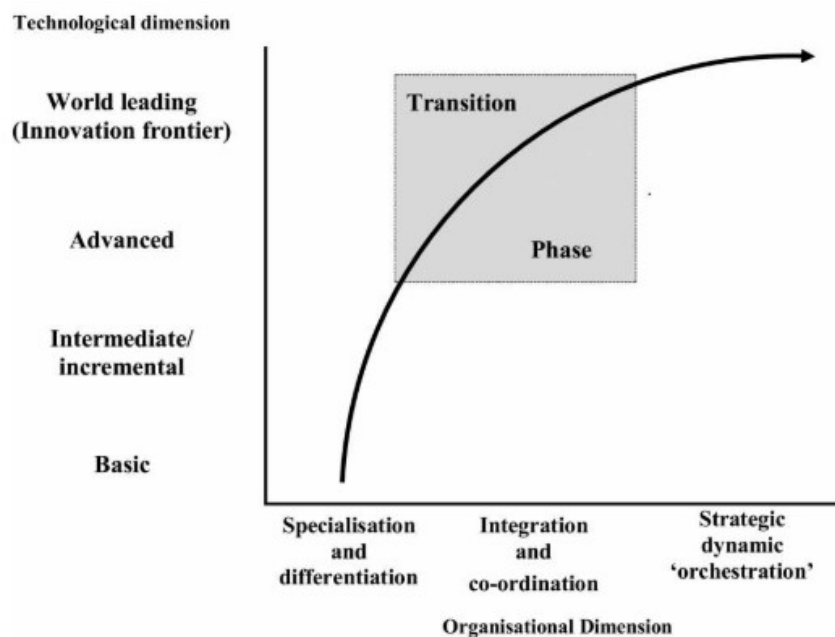


Figure 4. Innovation capability accumulation: changing emphasis on ‘technological’ and ‘organizational’ dimensions. Source: Bell & Figueiredo, (2012)

Figure provides two dimensions – technological and organizational that contribute to the development of a supply chain. Firstly, the technological dimension is considered as a capability to autonomously produce complex products without any intervention of GVC governance. Dimension is then distributed according to maturity criteria from basic to world leading. Development of such a dimension requires a lot of resources and many companies that step into the supply chain depend on basic knowledge and capability to increase it. In most cases improving customer-focused technological dimension requires a close governance type which is mostly a captive or hierarchy type. Such a supply chain development model cannot be successful without the organizational dimension which is another criterion of capability accumulation. With increasing technological capabilities

organizational dimension must evolve to increase its competitiveness and create a trustworthy strategic system that would be followed with smooth operations and further development of the company (Chan, 2003). Foreign partner businesses that participate in GVC can play a significant role as most of the manufacturing data is gathered locally with an internal labor force. It is important to mention, that yet activities abroad are governed by companies and it is not always possible to overcome such governance. Nevertheless, as suggested by Lema et al., (2018) to stay competitive companies must endure in close relationship with GVC companies to avoid market governance relationships that bring low-added value production. Due to developed infrastructure and digitalization possibilities nowadays, it is more probable that close relationships will bring more added value. GVC companies have their own goals to get higher value products at lower cost by this participant companies get even more possibilities to claim diverse types of governance. In case of such events, supply chains claim high-skilled labor force utilization and participate in high added-value activities. In addition, the authors state that GVC companies might actively participate in manufacturing processes on how it can be executed leaving an especially important knowledge footprint that could lead to closer relationships and partnerships.

2.3. Smile theory of GVC

Despite supply chain modeling and governance type, it is necessary to map added value areas to understand which supply chain position brings the most income. Previously discussed high-skilled labor force brings the most added value activities, nevertheless, to step into the industry as a latecomer company is extraordinarily complex and requires specialized knowledge. Additionally, Koopman et al. (2012) stated that gross value calculations monitor trade value imprecisely and by this upstream/downstream measurements are necessary. Due to participation in the supply chain goods are transported across the international border several times impacting imports as well as exports. Here, added value can be mapped with the “smile” curve. According to Meng et al. (2020), to measure the upstream and the downstream value proposition it is necessary to have two fundamental measures and a conceptual GVC setting. One of the measures proposed is the size of benefit–gained income of

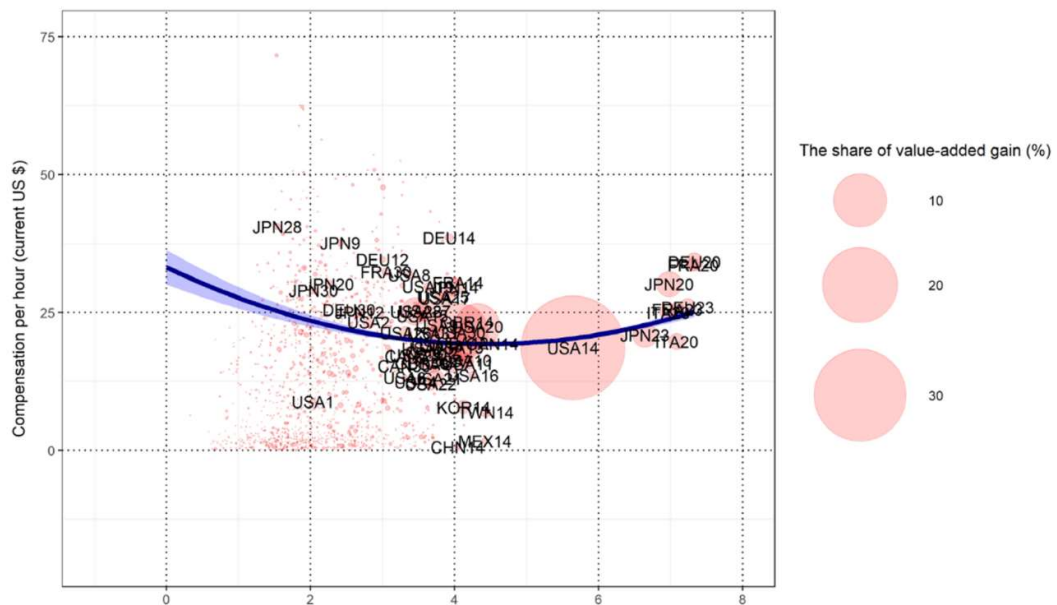


Figure 5. Value-added gains in the US' information and communications technology (ICT) exports-related global value chains (GVCs) (1995). Source: Meng et al. (2020)

chain. Such stages of a supply chain distribution create a comprehensive view of added value income. Countries that have a lower compensation per hour must concentrate on the general economical situation and how to shape their economy to absorb as much value as possible. Here as in Figure 5 upstream begins in Japan where compensation is quite high and almost exceeds downstream supply chain compensation. This leads to less created value but more finances absorbed by the country. Production stages, in this case, remain very dense and create more competition towards production stages which is transferred to less cost strict areas where labor compensation is even lower than the upstream stage. On the other hand, if upstream compensation of hours is lower production stages shifts to more competent and more cost strict regions. It brings a conclusion that upstream flow has a profound influence on technology dynamics for further production stages. A less skilled labor force that brings the least added value challenges further partners to reproduce its goods with higher competence which is visible in compensation of hours cost. Further, these dynamics affected the high-skilled labor force that gain more job opportunities which follow high compensation of hourly rates. Here the author analyzes ICT industry-related workforce added value gains by yearly series, see Figure 7.

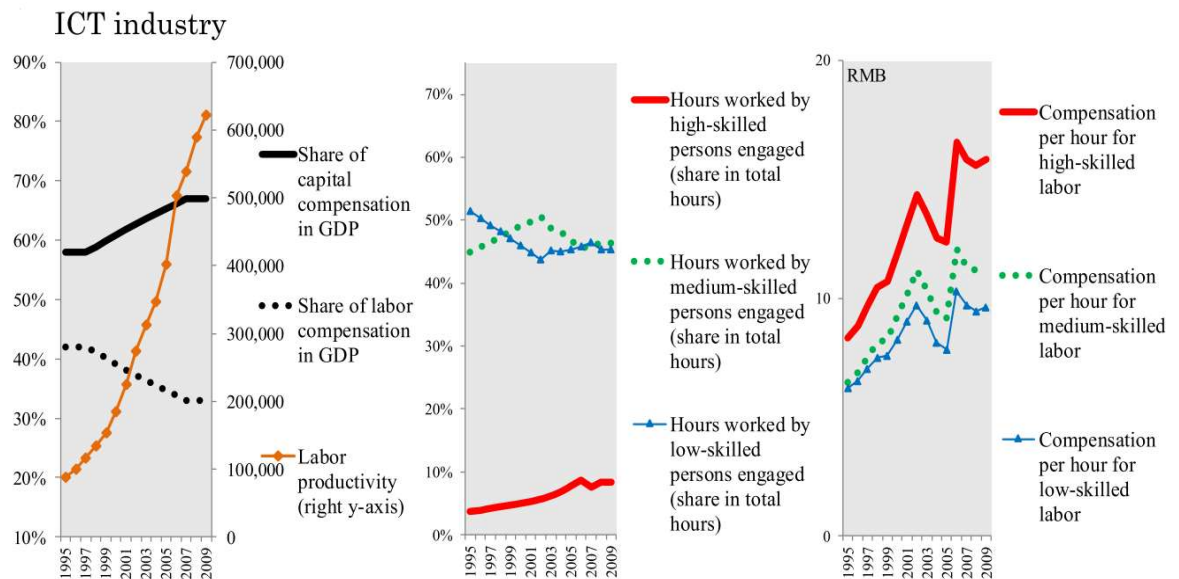


Figure 7 Labour productivity and income distribution for China (RMB, 2009 base) Source: Meng et al. (2020)

Figure provides visualization of how China’s labor market evolved while participating in GVC with the United States. The graph on the left provides how participation in supply affects labor productivity. There is a correlation between the most successful period and the growth of the highly skilled labor force which provides the highest relative change compared with medium-skilled labor force growth. Nevertheless, the compensation of the labor force did not have such a positive effect. By the data, it is assumed that stable growth of productivity compensates for the capital but does not compensate for labor. The phenomenon occurs due to strict competitiveness and a shift towards less workforce needed to produce more value. Hours worked by China’s labor force evolved together with productivity where even slight changes had significant growth meaning that there is a need to gather experience and knowledge to increase competitiveness in terms of productivity. Further, stagnation of added value income can be visible in the medium and low-skilled labor force. Considering the growth of all workforce sections compensation per hour for skilled labor grew most for the highly

skilled labor force. The medium and low workforce did not match the growth of highly skilled labor and its compensation had an influence on general compensation in GPD. Moreover, labor income was raising where highly skilled employees gained the most. To conclude, participating in the upstream supply chain lead Timmer et al. (2014) to describe phenomena, where the highest added value created, remains in the final good exporting country. In addition, China as a huge participant in GVC has evolved even further nowadays. It is seen that with increased experience country gained intellectual capital and competition among other countries is very rough. When a highly skilled labor force grows productivity follows which makes a country more attractive for external GVC companies due to its return on a factor. Further, the governance type of supply chains evolves together with changing social factors of the country. A situation that was shaping China in 1995 year is only the beginning of intellectual property gathering. Intellectual property has led the country to empower its labor force to conduct more complex tasks which then positively affected general indicators of countries' competitiveness however the effect is not yet close to competing with origin GVC countries.

2.4. Intellectual capitals of GVC

Added value mapping curve reveals a significant problem which is naturally founded by the high-skilled workforce located in its origin country. These phenomena create a platform where countries that do not have specific skills and knowledge cannot challenge leading countries with the highest added value income. Here participation in supply chains, foreign investments, and the establishment of business partnerships become particularly important to develop a country's income. These events were described as “intellectual monopolies” (Durand & Milberg, 2020). It has a link between the “smile” curve theory where added value distributes at the beginning of upstream and ending of downstream stages, see Graph 5.

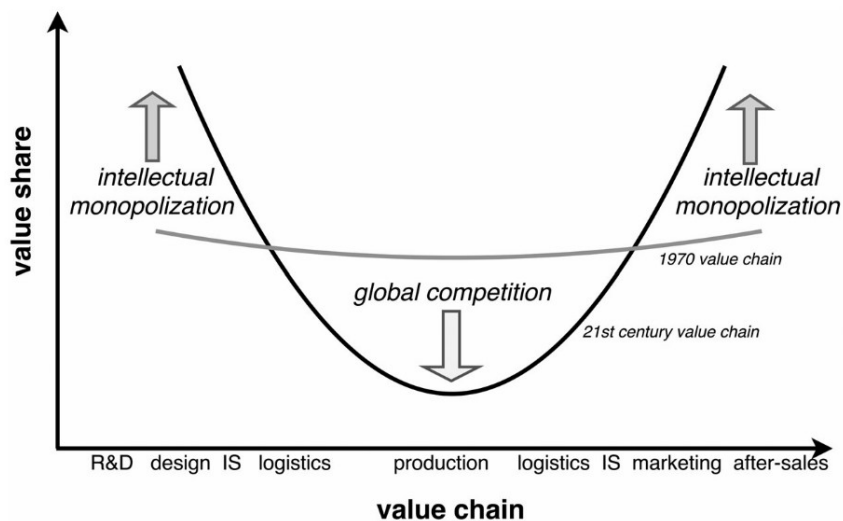


Figure 8 Intellectual monopoly versus global competition in the smile curve. Source: Durand & Milberg, 2020

The curve contains two dimensions value share and value chain. Here value chain visualizes added value distribution towards product stages among a supply chain. The supply chain is divided into sections such as R&D activities, design, IS, logistics, production, marketing, and aftersales whereas value share visualizes where most of the added-value income can be generated. Two curves provide the difference in value share between the 1970 year and 21-st century supply chains. There is a notable

change towards absorbed value in production which directly assimilates with smile theory where the density of suppliers and competition became very tense. Authors have concluded that in upstream and downstream curves most of the intellectual properties are extracted and obtained. This phenomenon creates a significant inequality between countries competing in supply chains. Additionally, to protect country's income, new policies which protect intellectual capital were released which make it even more difficult for countries to catch up with leading countries. Accelerated globalization has detached the possibility to compete against bigger GVC countries due to expensive development activities which would lead to capitalization of intellectual properties. As time passes intellectual monopolization has pushed production value added to the lowest limits, although, this can be impacted by harsh competition and cost pressure. The value remains in countries where ideas are generated and rolled out as a downstream supply chain, see Figure 9.

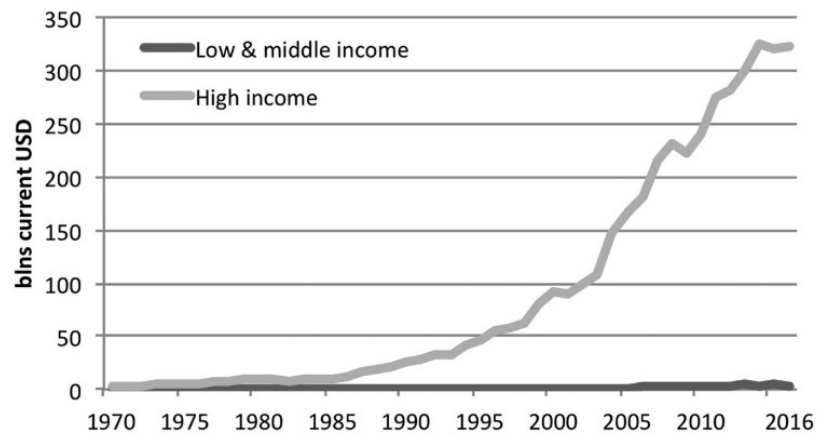


Figure 9. High income and Low and Middle-Income countries receipts from the use of the intellectual property (1970–2016) Source: Durand & Milberg, (2020)

Data reveals the core issue of globalization added value distribution among countries – capitalizing on the intellectual property led countries to sustain their highest added value income. Here high-income countries have developed a way to use intellectual property as a comparative advantage which generates rights to claim most of the added value due to copyright policies whereas low and middle-income countries are sustained in low capital which limits their ability to develop intellectual needed to catch up with leading countries (Amendolagine et al., 2019). The gap between added value income in GVC has a great reflection on the automotive industry. Considering upstream and downstream stages automotive generates an enormous contribution to GVC trades. As automotive originally exports automobiles from intellectual properties holding countries most of its final added value comes from supply chain management (Mordue & Sweeney, 2020). The Czech Republic which is located around 1000 km away has its automotive contribution higher and even had its own automobile brand Škoda. Here, according to Pavlínek & Ženka (2015), the Czech automotive business can be distributed into three supplier tiers, see Table 5.

Table 5 Shares of individual supplier tiers on selected indicators of the total Czech automotive industry in 2008–2010. Source: Pavlínek & Ženka (2015)

Tier	Number of firms	Employment	Production	Value added	Wages	Corporate tax revenues	Tangible assets	R&D expenditures
All firms	475	157,950	677,797	128,812	49,054	5051	199,138	9458
Assembly	9	20.9%	40.0%	33.4%	25.1%	52.6%	35.0%	59.2%
Tier 1	49	25.3%	24.4%	24.6%	26.6%	14.6%	25.5%	17.5%
Tier 2	148	26.4%	18.2%	21.3%	24.2%	15.3%	22.1%	10.9%
Tier 3	269	27.4%	17.5%	20.7%	24.2%	17.6%	17.4%	12.4%

The classification of Czech-based automotive firms into assemblers and three basic supplier tiers illustrates its hierarchical structure, in which the number of firms in individual tiers performs trades. According to the author, Tier 1 suppliers produce the most complex components, for example, parts of engines, transmissions, and brakes, whereas Tier 3 suppliers produce the least complex solutions such as car bodies, and their parts, metal or plastic housings, etc. and Tier 2 covers rest of the exported goods which can be related with medium complexity products. The Czech Republic covers production from the smallest added value products to final assembled products. Due to this reason, the Czech Republic has higher added value in common trades. Furthermore, it has been stated that the following capital intensity depends on manufacturing. Nevertheless, the country seems strongly positioned Tier 1 companies are foreign-controlled and mostly require highly skilled labor. In addition, the automotive industry in the Czech Republic outsources intermediates to its country where it absorbs added value from other countries as it positions itself in a downstream supply chain. Due to this reason the country has a strong position in productivity and characterizes among higher added value counties. Intellectual capital gathered in the country provides a possibility to extend its added value income. Nevertheless, the country remains challenged by the competition and internal resources. Further, Pavlínek, (2016) analyzed Slovakia's automotive sector where intellectual capital is low. It is important to evaluate that the location of both countries remains closer to middle Europe than Lithuania. Higher added value income is related to the complexity of products and governing parties – again highest added-value products are governed by foreign companies and require a highly skilled labor force. Slovakia, according to the author has more potential to increase its export added value and there are characteristics specified with the positive and negative effect that shapes the current situation in the country, see Table 6.

Table 6 Evaluation of state economic and industrial policy by automotive firms in Slovakia, 2011-2013.
Source: Pavlínek, (2016)

	Total answers	%	Foreign	%	Domestic	%
<i>Negative</i>						
Weak educational system	12	32.4	9	42.9	3	18.8
Inflexible labor laws	4	10.8	3	14.3	2	12.5
Investment incentives for large foreign investors	3	8.1	1	4.8	2	12.5
High taxes	3	8.1	1	4.8	2	12.5
Bureaucracy	2	5.4	1	4.8	1	6.3
No help to small firms	1	2.7	1	4.8	0	0.0
Euro	1	2.7	0	0.0	1	6.3
Corruption	1	2.7	0	0.0	1	6.3
<i>Positive</i>						
Investment incentives to large TNCs	5	13.5	5	23.8	0	0.0
State subsidies for specific projects of domestic firms	4	10.8	0	0.0	4	25.0
Euro	2	5.4	2	9.5	0	0.0
Stable country	1	2.7	1	4.8	0	0.0
Highway construction	1	2.7	0	0.0	1	6.3
<i>No opinion/no influence/no answer</i>	6	16.2	2	9.5	4	25.0

Data provides more information about general countries competitiveness concerning supplying chain development. Here Slovakia has negative effects of a weak educational system, inflexible labor laws, investment incentives for large foreign investors, High taxes, bureaucracy, no help to small firms, currency, and corruption. These factors are related to the social and governance characteristics which influence possibilities to improve the current situation. It can be concluded that the most negative factor remains the educational system which must ensure high skilled labor force. In terms of this gap, the country struggles to compete with other countries and stagnates in terms of productivity in the automobile sector. On the other hand, positive characteristics were identified. Out of the biggest influencing factors investments, subsidiaries on specific project firms, and Euro were identified. These factors do not contribute to positive sustainable development as the main gap is yet not focused which is the educational system. Further, Pavlínek, (2018) identified that Slovakia has its supply chain links weak and will not have any improvements which will lead to overcoming added value stagnation. According to the research, having fewer intellectual properties brings relevance to linking its supply chain to gain a comparative advantage. Furthermore, according to Mordue & Sweeney (2020), the transition between production and R&D activities must occur to ensure stable growth of added value income and absorb intellectual capital which leads to ensuring stable growth supply chain participation.

2.5. Sustainable supply chains characteristics

Sustainable development of supply chains has its peripheries and shapes GVC relationships. The sustainable value chain is considered when all parties get their customer orders fulfilled in time, cost, and quality. This assumption led to trustworthiness between supply partners which is necessary to develop a long-lasting high added value income supply chain. Here trust can be obtained by close supervision by governing body, long-lasting relationships, and skillful professional delivery of

services. Hassini et al., (2012) state that governance of the supply chain must cover operations, resources, funds, and information to gain maximum profits while yet delivering excellent customer demand fulfillment. Further, supply chain drivers are indicated which reveal focus areas for emerging global economy countries. Transportation, facilities, pricing, sourcing, inventory, and information are the most impactful catalyst for product manufacturing diversification. As each of the characteristics varies among countries and sectors, it is yet not possible to precisely indicate which of these must be decision breakers. Criteria might vary between countries enterprise's availability of raw materials or the possibility to outsource, transport, reuse certain products (Stöllinger, 2019). To be more precise study concludes principal areas that must be investigated to map the most sustainable supply chain indicators are industry-specific research, pricing, inventory management, firm size, and sustainable supply chain metrics. Furthermore, these indicators shape nowadays understanding of GVC and impact decision modeling on the supply chain. Under these circumstances, emerging countries must provide their taxation methods which would lead to a more favorable environment to remain indicators progressively positive. If indicators are low, it is a low probability that high added value income will be generated from supply chains. Further research on sustainable supply chains by Seuring (2013) conducted sustainability dimensions and equilibrium models which greatly describe a measurement of expectations that indicates reliable GVC implementation. Here four different supply chain modeling groups are suggested: life-cycle assessment-based models, equilibrium models, multi-criteria decision making, and applications of the analytical hierarchy process. Further, researchers shifted the development of sustainable supply chain assessments toward social, environmental, and economic characteristics. Galal & Abdul (2016) provided a review of existing sustainability assessments and concluded that the indicators used are not sufficient to provide a comprehensive outlook of a sustainable supply chain. Through this economic indicators such as product diversification, added value, and delivered products were added to the scope of development of a sustainable supply chain. Added value as a performance of a labor force provides an overview of how skilled the labor force is and how effective it can deliver results in a supply chain. This index has a relationship with the complexity and value of the products that shape the export income of the country. Here fewer complex products, middle stage among supply chain provides identification of which countries can be diversified towards GVC companies. A sustainable supply chain must be adaptable, flexible, and deliver expected results workforce plays a huge role in the characterization of a country. Further, product diversification shapes the countries distribution of available capabilities to produce various products which can be distributed among supply chains. Less product diversification has two main effects on the competitiveness of a supply chain. Narrow concentration on products can bring high expertise level to production and development activities which increases the intellectual property of a country, therefore, increasing competitiveness in certain product fields of the supply chain (Borin & Mancini, 2019). Otherwise, it indicates that country does not have intellectual capital, capabilities, or resources in the designated business area. Products delivered indicator provides a summarizing overview of the country's capabilities in production where added value and product diversification can be diversified. Further, the authors concluded environmental factors as the essence of capabilities to operate in the countries or develop sustainable supply chains. Characteristics such as energy, water, and raw materials are used to assess a country's flexibility to sustain a stable supply chain. As natural resources became more relevant for the business and in case of economic recessions it can bring up loosen cost pressure (Fernandes et al., 2021). This indicator provides the ability to assess countries by the focus areas on sustainability. Nevertheless, each of the indexes has a different weight on a final assessment. Social factors introduced in the study provide a

broader view of a country's competitiveness. All of the mentioned indicators can be found in Figure 10.

Sustainability dimension	Indicator	Sub-indicator
Economic	Added value	
	deliverable product	
	product diversification	
Environmental	energy	renewable energy
		energy intensity
	water	recycled
		hazardous
		waste
	emissions	direct
indirect		
Social	gender equality	
	labor development	
	healthcare delivery	
	employment opportunity	

Figure 10. Proposed sustainability assessment indicators. Source: Galal & Abdul (2016)

Social indicators introduced in the research provided by the authors propose a new view towards competitiveness and what are other factors than economic to sustainable supply chains. Gender equality remains an especially important part of an assessment that provides an overview of a country's capabilities to stabilize the internal situation in a labor market. Further, labor development remains one of the heaviest assessment indicators which shows the adaptability of the workforce towards new trends, innovations, and technology development by investment towards competence development. Indicators can provide broader aspects of supply chain development. For example, low labor development is perfect for GVC companies that do not intend to develop governance types of supply chains (Cenamor et al., 2017). This means that country will mostly produce low added-value products or will be forced to remain in a certain position without a possibility to extend its added value income without new developments or other business opportunities. Healthcare delivery provides a stable indicator of how vulnerable the country is in terms of health issues. Better health care means a lower risk to lose significant amounts of the labor force unexpectedly. Furthermore, employment opportunity is discussed as a heavy indicator to evaluate the workforce market. Labor flexibility has a profound influence on the decision-making of supply chains due to its importance to maintain businesses running (Crane et al., 2019). If there is no possibility to find and replace labor companies might struggle to maintain employees and the supply chain can become problematic and do not deliver required results. Previously, social sustainability in supply chains was discussed by Hutchins & Sutherland (2008) where authors have already foreseen the importance of social indicators to assess sustainability and development. It was stated that social indicators are the

profound model for corporations to deal with decision-making on long-term supply chain establishment. The research was conducted with a broader variety of indicators, see Figure 11.

Theme	Sub-theme	Indicator
Equity	Poverty	Percent of population living below poverty line Gini index of income inequality Unemployment rate
	Gender equality	Ratio of average female wage to male wage
Health	Nutritional status	Nutritional status of children
	Mortality	Mortality rate under 5 years old Life expectancy at birth
	Sanitation	Percent of population with adequate sewage disposal facilities
	Drinking water	Population with access to safe drinking water
Education	Healthcare delivery	Percent of population with access to primary healthcare facilities Immunization against infectious childhood diseases Contraceptive prevalence rate
		Education level
	Literacy	Adult literacy rate
	Housing Security	Living conditions
Crime		Number of recorded crimes per 100,000 population
Population	Population change	Population growth rate Population of urban formal and informal settlements

Figure 11 Indicator list of sustainable supply chain development. Source: Hutchins & Sutherland (2008)

Here sub-themes and indicators were taken to provide a view of a country's performance in terms of sustainable supply chains and its development. Constructed model have provided a connection between the monetary and social aspects which shapes business decision making and moving to sustainably. There is an increasing trend to move toward green solutions and social responsibility of GVC companies which incorporate such models to easily assess the most critical areas. Hence, such sustainability assessments shape competitiveness between a country's capabilities to step into supply chains. Further research on supply chain development on sustainability is linked with a productivity of a country on domestic exports and performance. Here Farole & Winkler (2015) highlights a slightly different view on supply chains. There is a relationship between foreign direct investments (FDI) and the development of labor productivity which is analyzed from the different indicators of supply chain performance. Different countries were discussed as a reference point for decision-making on FDI which is closely related to social indicators. The usage and knowledge of technologies were identified as one of the most significant factors for the attraction of countries. It is important to mention that the relationship with the benefits of the supply chain participant country is high when the country does not have the capabilities to utilize needed innovation. This creates progress possible for a country that further positively affects labor productivity. Nevertheless, as the indicator is critical huge gaps mean a risk to establishing supply chains. Additionally, R&D activities can be attributed to FDI spillovers if a domestic country has lower wages than the origin country. Development activities reveal the country's innovation capabilities that are necessary to establish supply chains. Further, the educational

system is considered as a more qualified workforce that can absorb technologies easier and create a positive impact on the productivity of large or small companies. The authors concluded that such research is more applicable for low-productivity countries as social factors in most of the developed countries are high and do not contribute more than available capital or domestic exports.

2.6. Overview of literature review

The literature review has provided a clear overview of added value income distribution among supply chains and key factors which influence countries' ability to participate and absorb added value. First of all, supply chain companies are characterized by a governance-type structure. Governance type provides companies characteristics such as competence, level of participation in supply chain competition, and added value type. To assess countries' standpoint in the supply chain it is necessary to understand what governance type is dominant. More independent companies remain the most flexible and can absorb added value income by various methods. If a country has only a captive or hierarchy type it means that it is not experienced in the industry and does not participate in a supply chain as an independent party. Therefore, added value income can be mostly generated by the workforce which limits companies' ability to increase it. In addition, countries must focus to absorb as much experience knowledge technologies, and standards to be able to step into the supply chain as an independent party. Further, by participating in a supply chain countries must understand which stage of production it will represent. According to smile theory, most of the added value lies within upstream and downstream stages leaving the manufacturing stage with very dense competition and very low added value income. If countries do not have enough environmental resources or intellectual capital, they must concentrate on increasing workforce skills to step up in a supply chain that contains more complex solutions. Nevertheless, there are limiting factors such as intellectual capital which is gathered throughout years of experience. There is a clear indication that countries that participate in supply chains from an early age have a higher intellectual capital which is protected by policies to prevent other parties to copy or duplicate certain technological design manufacturing solutions. To overcome such limitations countries must establish new unique value propositions that are not present in the market or increase their competence until no other more cost-competitive country can produce such goods or services. To be able to achieve those countries must establish sustainable supply chains which are directly related to countries' social, economic, and environmental factors. There are few methods to assess such factors to increase the competitiveness of countries' participation in the supply chain and upgrading of added value income. As time passes methods became more flexible and countries can identify characteristics gaps that lead to a less attractive global value chain business environment. To upgrade countries' supply chain participation and absorb benefits such as technologies, innovation, knowledge, and skills countries must set up development plans with the most critical characteristics gaps that can be observed in leading countries. However, economic and environmental factors can be difficult to overcome. There is still a relationship between countries' location, policies, available capital, and resources to play a significant role in a supply chain. If the country is small, with fewer resources it must concentrate on getting the most skilled workforce that would create solutions that do not require physical investments in equipment, facilities, or otherwise, a lot of human resources to produce. Furthermore, depending on the industry supply chains may differ. It is necessary to assess what industry supply chain the country wants to participate in. More strict profit margins require more flexible policies quality and productiveness of personnel. Here Slovakian and Czech Republic research provided an overview of how the automotive industry's added value income is distributed. The highly skilled labor force in such a supply chain dominates as added

value income generators and if there is no progress observed lower-skilled labor force will stagnate and countries' added value income will decrease as time passing. In conclusion, added value income and participation in supply chains remain closely related. To assess' capabilities of creating high added value income, it is necessary to indicate governance types with supply chain stage. In addition, social, economic, and environmental gaps between leading countries shapes general capabilities to create the value. By identifying gaps, countries can increase their attractiveness toward business environments and increase their added value income field by following a clear development path to synchronize with leading countries' requirements. According to these findings in the literature review conceptual framework is created, see Figure 12.

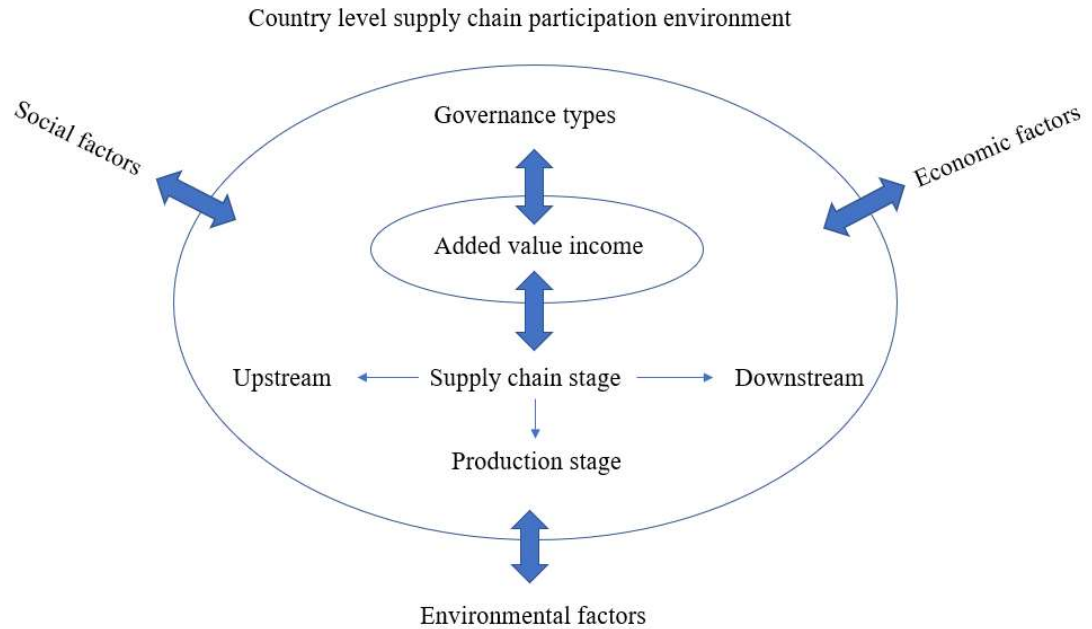


Figure 12. Conceptual framework of added value income constructed from literature review. Source: personal visualization.

3. Research methodology

The methodology of the research is constructed to support solutions for issues on the topic, research objectives, and literature solutions provided in a previous section. The methodology reflects an analysis that provides Lithuania's characteristics gaps and automotive companies' standpoint for constructing high added value supply chains. Comparison between countries must be analyzed to conduct the most critical improvement areas on a supply chain. Here analysis will reveal Lithuania's characteristics gaps that must be improved in terms of improving added value income in the automotive industry. Further, the analysis will cover focus points on improving added value income provided by the experts from the industry.

The research object is to improve the development of Lithuania's participation in automotive supply chains and upgrade added value income;

The aim of the research is: to provide a comparison of leading countries' characteristics that leads to the most critical development areas and discuss possible improvements in the Lithuanian automotive industry's added value income;

The goals of the research are:

1. To review and compare relevant competitiveness characteristics of Lithuania and indicate gaps between leading countries;
2. To reveal improvement areas of countries' participation in an automotive supply chain and improve its added value income by conducting a qualitative analysis of interviews with experts from the automotive industry;
3. To provide recommendations and proposals on the development of participation in the supply chain and upgrading added value income;

3.1. Review of Lithuania's gap characteristics in the automotive industry

In order to understand Lithuania's position in terms of participation problems in an automotive supply chain social, environmental, and economic characteristics will be analyzed. Data will be conducted from the World Economy Forum database Global Competitiveness index 4.0 (2019) and then sorted according to Hutchins & Sutherland (2008), Farole & Winkler (2015), and Galal & Abdul (2016) provided model. Sorting of indicators will be done in accordance to supply chain requirements and automotive industry requirements. Research concentrates on indicators that are below selected countries' average and compared by visual information followed by an explanation of how it influences automotive industry supply chains and added value income. Further, countries were selected based on participation in trades with Germany provided in the problem analysis section including Germany and the Czech Republic to have a reference point for leading original equipment manufacturing countries.

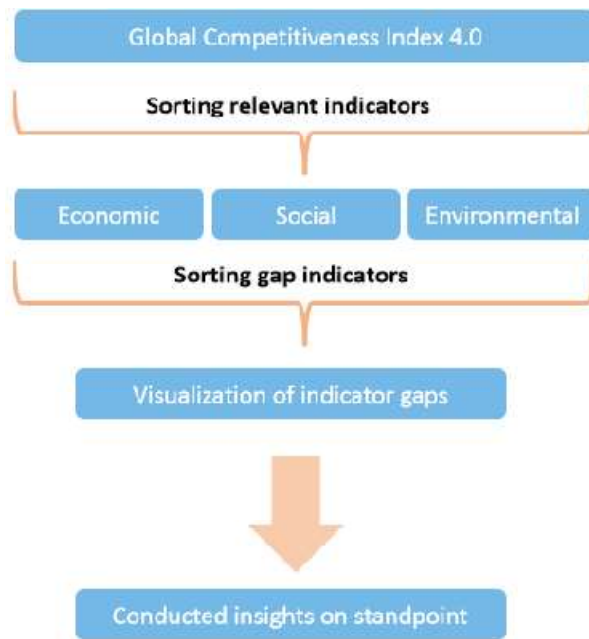


Figure 13. Lithuania's characteristics review methodology. Source: personal visualization

3.2. Qualitative analysis of field experts interviews

The questionnaire of the interview which consists of ten open questions was designed to reflect the problematics of the topic and provide solutions on the added value income and supply chain development in the Lithuanian automotive market. The goals of the discussion are to receive relevant information that would prove or decline findings in the literature review and provide a broader view of experts' experience on added value income development. Experts chosen for the interviews represent Lithuanian and German standpoints on added value development.

Table 7. Expert participants in the interview

Name and Surname	Function	Representative country
Dr. Petrik Lange	Vice President Operations Processes	Germany
Dr. Justinas Račkauskas	Head of Internal Factory	Lithuania
Maxim Zakletskiy	Managing Director	Lithuania

Furthermore, interviews should provide a possible verification of the review of the characteristics analyzed in a previous section. Discussions with experts will be transcribed and coded to link open answers with theories provided in a literature review. Qualitative analysis will be conducted and followed with additional findings that would provide information that was not found in the literature review. Further, conclusions and recommendations will be drawn out of the collected data from both analysis methods and further recommendations for the studies provided.

4. Results and discussions

The automotive industry characterizes by highly innovative solutions and an enormously wide supply chain that contains components from simple screws and plastics to artificial intelligence integrated autonomous driving software. To participate in such a supply chain countries must wisely choose priorities and development paths which is necessary to set up expected added value income. There are main factors that are applicable in most supply chains such as education level, financing, tariffs, and trade regulations. These factors are closely related to the automotive industry as the industry is one of the oldest in terms of international trade. Further, automotive industry companies rely on comparably small margins which greatly shape locations set up for the supply chain. Even the smallest regulations that cut profit by percent parts can significantly change the company's expected financial results. Furthermore, added value income is mostly set up by governing type of the supply chain companies, meaning that intermediates that do not hold a significant amount of added value will be market type. Otherwise, inexperienced companies will not produce complex products due to safety and quality requirements which prevent companies to establish a market competitiveness governance model that leads to more close monitoring governance types. To understand general countries' position in the industry it is necessary to understand what biggest automotive companies there are local and what type of governance is established. Due to that Lithuanian automotive companies' governance types were identified.

Table 8. Governance types of Lithuanian automotive companies. Source: Invest Lithuania, personal visualization

Company	Origin country	Governance type	Company age in LTU
Continental	Germany	Captive/Hierarchy	4 years
Forvia-Hella	Germany-France	Captive/Hierarchy	4 years
Schmitz Cargobull	Germany	Captive/Hierarchy	31 years
Littlefuse	USA	Captive/Hierarchy	27 years
AQ wiring solutions	Poland	Captive/Hierarchy	20 years
CIE Automotive	Spain	Captive/Hierarchy	25 years

The table provides a clear picture of the Lithuanian automotive sector's standpoint. All of the companies remain in a foreign-controlled enterprise leading to added value income generated from the workforce and taxes from Lithuanian policies. Furthermore, part of companies generated added value income goes to the controlling countries which leads to improvements and development needs in Lithuanian productivity and social, economic, and environmental factors. Due to this gap indicators that represent participation in a supply chain were selected, see Table 9.

Table 9. Sorted gap economic, environmental, and social indicators for the research.

Indicator	Section	Weight	Relevance
Trade openness	Economic	0,08	Trade openness is a general supply chain participation indicator which contributes to countries possibilities to trade internationally and countries attitude towards it.

Financing of SMEs	Economic	0,08	Financing of SME's directly relates with countries attitude towards sustaining and establishing new companies which can increase countries intellectual property and extent expertise in the markets.
Venture capital availability	Economic	0,08	Venture provides countries available capital for startup and possibility to finance it. It has a direct relationship of what complexity or what business is possible to create.
Transport infrastructure	Environmental	0,11	Transport infrastructure provide a countries transportation advancement in terms of smooth logistics and ability to transport good in the country and abroad
Border clearance efficiency	Environmental	0,05	Boarder clearance remains very important factor which provides overview of how good boarder control is operating which is critical in terms of a supply chain sustainability and unexpected delivery delays avoidance
Healthy life expectancy	Social	0,05	Healthy life expectancy contributes to workforce availability which is crucial to sustaining the supply chain running without unexpected turbulences. Here automotive industry remain very strict as production is planned in a matter of second - minor production stoppages can lead to huge financial losses and costs.
Scientific publications	Social	0,1	Scientific publications contribute to highly skilled workforce and countries attitude towards scientific approaches to businesses and technologies
Innovation ecosystem	Social	0,06	Innovation ecosystem relates to countries ability to create and environment country has to establish innovation-based enterprises. Factor is relevant due to constantly progressing automotive supply chain and availability to flexibly absorb new innovations.
Skillset of graduates	Social	0,02	Skillset of graduates show relative skill set of graduates and their talent availability for future workforce
Patent applications	Social	0,06	Patent applications provide information about countries innovations that should not be copied by other parties. Policies prevent intellectual capital to be transferred to other countries.
Ease of hiring foreign labor	Social	0,08	Ease of hiring foreign labor show how country is able to integrate foreign talent if needed.
Ease of finding skilled employees	Social	0,12	Ease of finding skilled employees show how country is able to hold workforce fluctuations and how company can quickly find new employees to established businesses or replace current employees. Factor provides sustainability measures of a supply chain in terms of workforce.
R&D expenditures	Social	0,1	R&D expenditures provide information of how country invests in research and design which is directly related with ability to invent new solutions, show workforce distribution in the country in case of need to provide such a services.
International co-inventions	Social	0,08	International co-inventions show country ability and participation in international teams and invention process. As supply chain requires ability to cooperate with international workforce it provides information about standards, quality, and ability to integrate with teams abroad.

Furthermore, indicators are compared with countries provided in the problem analysis section and added the Czech Republic with Germany to understand the most significant gaps to overcome the

low-medium added value gap. The automotive industry remains its distribution cost-strictly which brings Lithuania, not as a cheap labor force country which means that country can only integrate into providing services that do not require huge capital investments or otherwise production of complex solutions. This leads the country to set a clear path of development to be able to provide needed skillset, economic, and environmental factors to overcome similar level countries.

4.1. Economic indicators analysis

Relevant gap environmental factors were sorted out and visualized to indicate where Lithuania stands in terms of comparison with other trading countries. This section will provide an analysis of each indicator with an explanation of what Lithuania must focus on to improve its position in terms of the automotive industry.

4.1.1. Trade openness

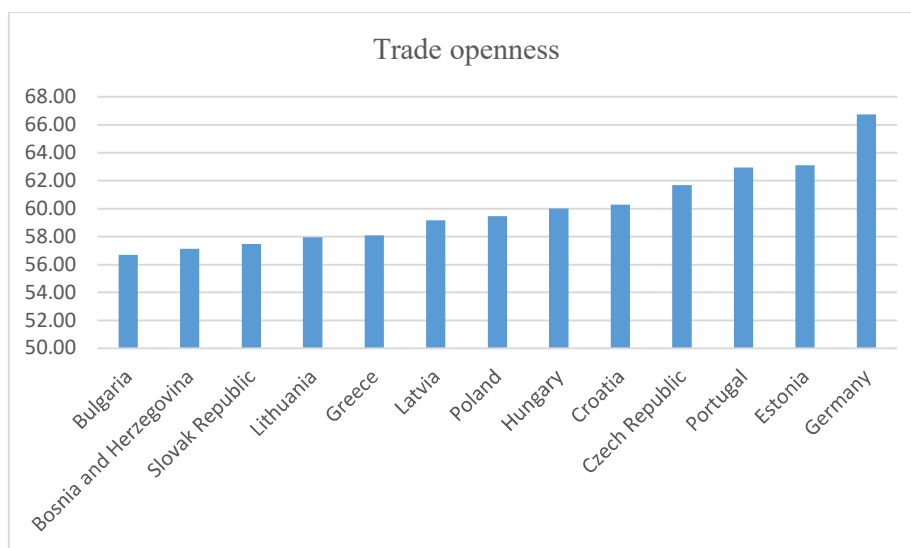


Figure 14. Trade openness indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

Trade openness indicator bring Lithuania to 4-th lowest open country among trading countries and leading countries. Here Bulgaria, Bosnia and Herzegovina, and Slovakia remains below Lithuania. Further, Greece has a same score with Lithuania following by Latvia and Poland leading by several points. Leading countries in such an economic indicator remain as a better supply chain participants with mostly higher exports of automotive industry towards Germany. Germany as a leader in automotive industry exports remain absolute leader of the dimension which proves that country is adapdet well in terms of trading openness. On the other hand, Estonia as a lower exports country do not resonate towards given hypothesis of such factor influence on automotive industry participation in supply chain. Nevertheless, indicator provides a clear picture of countries attitude towards trading with other countries. Lithuania is not significantly below countries with a higher exports but it influences attitude from GVC companies point of view which can influence partnership decision making. Furthermore, as indicator has not significant gap it is concluded that influence is low towards automotive supply chain and it should not be a priority of country to change indicator. In conclusion, trade openness provides countries attitude but does not contribute to hypothesis significantly which

leads indicator to be improved however not as a priority to improve participation and added value income.

4.1.2. Financing of SME's

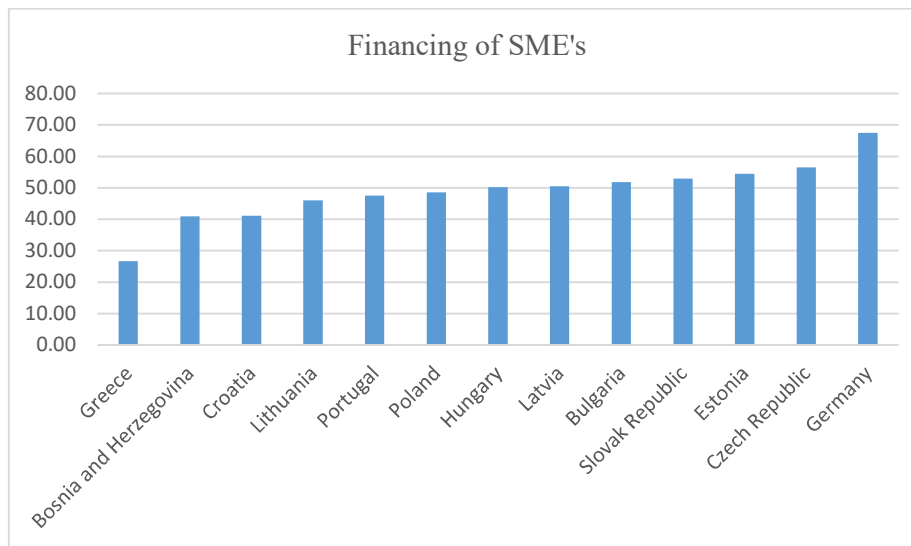


Figure 15. Financing of SME's indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

Financing of SME's remains without significant gaps among the countries however there are clearly leading countries as Czech Republic and Germany. Lithuania remains fourth lowest financing country out of exporting countries to Germany with countries as Greece, Bosnia and Herzegovina, and Croatia below Lithuanian level. Portugal, Poland, and Hungary positions itself above Lithuania with a higher financing of a small to medium enterprises which represents data out of problem analysis section which leads to a higher exports and higher participation in a supply chain of automotive industry. Financing of SME's influences countries participation in a supply chain and exports to external countries. Considering a supply chain stages, there is a clear indication that countries which has a low financing of enterprises will remain as a captive of governing type, which leads to lower added value income. Here the Lithuania must contribute and develop its financing if country wants to develop a higher value income. Financing of SME's has a direct relationship with capital which is available in the country. if the capital is low country is limited to create innovative solutions which requires a lot of investments towards new companies and startups. Such countries as Bulgaria and Estonia is a good example of increase of exports towards Germany and increasing the value which is then Leads to ability increase at value income inside the country. In addition, the most added value income lies within service providers or high skilled labor force which has to be utilized inside the country otherwise most of the added value is transferred to controlling countries enterprises. this phenomena is crucial for countries that wants to increase automotive value income. Nevertheless, it is necessary to take into account that automotive industry is one of the oldest and one of the most strict industries in the world which means that financing has to be significant and continuous towards such sector. here government must foresee the path off subsidiaries that must bring required results and together synchronize it with future talents and workforce capabilities which will be revised in further analysis section of social indicators.

4.1.3. Venture capital availability

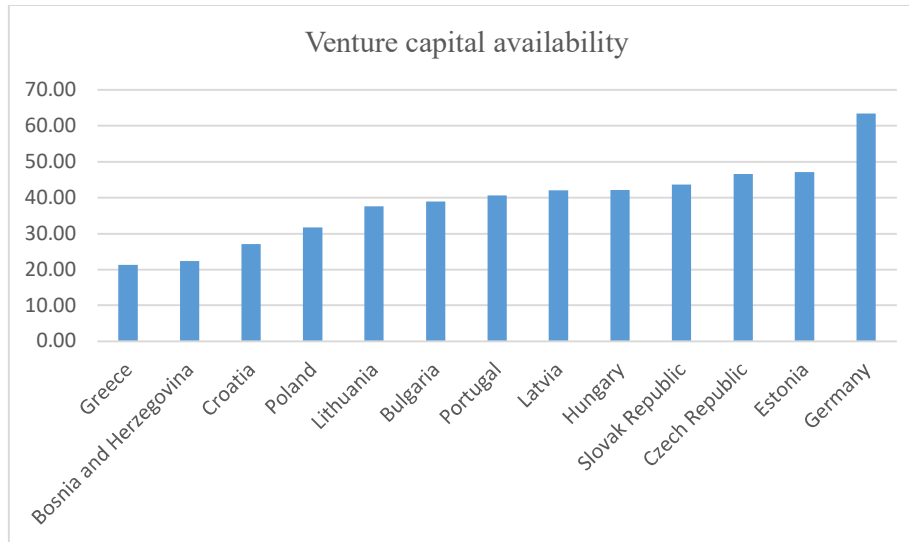


Figure 16. Venture capital availability indicator distribution by country. Source GCI WEF index 4.0, personal visualization

Venture capital availability is closely related with country's GDP and generally generated income. Indicator contributes not only to automotive industry but most of the industries and countries capabilities to make investments on certain areas of businesses. Venture capital availability brings Lithuania to fifth lowest capital availability country. Here Poland, Croatia, Bosnia and Herzegovina, and Greece remains below Lithuania. Further, Bulgaria, Portugal, Latvia, Hungary, and Slovakia have a higher score and available capital to invest towards businesses. there is a clear indication that leading countries has almost double of capital to be able to invest which means to quicker progress towards countries businesses and added value income. Venture capital availability brings countries to flexibly react and adopt towards necessary supply chain changes. here Lithuania must concentrate and try to increase availability of venture capital to be able to set up a clear development pathway for new automotive businesses that could be opened in Lithuania to have a gap between manufacturing supply chain stage and service provider stage. Generally, indicator is not favorable in Lithuania overview towards global value chain companies due to low possibility to integrate new businesses internal infrastructure of service companies to sustainably run supply chain businesses. Automotive manufacturing companies require a lot of services to keep its business running and did not disturb further supply chain which can bring a lot of losses and financial fines for not following companies obligations. For example, manufacturing equipment has to be maintained and correct service provided on yearly basis. In terms of recent Corona crisis many manufacturing companies that do not have internal service providers for manufacturing equipment had struggles to do simple a calibrations of manufacturing equipment and it led to no possibility to produce on standard quality requirements. This remains one of critical areas for Lithuania to improve and empower new businesses to be established towards sustaining supply chain companies especially for the industries as automotive.

4.2. Environmental indicators analysis

Relevant gap environmental factors were sorted out and visualized to indicate where Lithuania stands in terms of comparison with other trading countries. This section will provide analysis of each

indicator with explanation what Lithuania must focus on to improve the position in terms of automotive industry.

4.2.1. Transport infrastructure

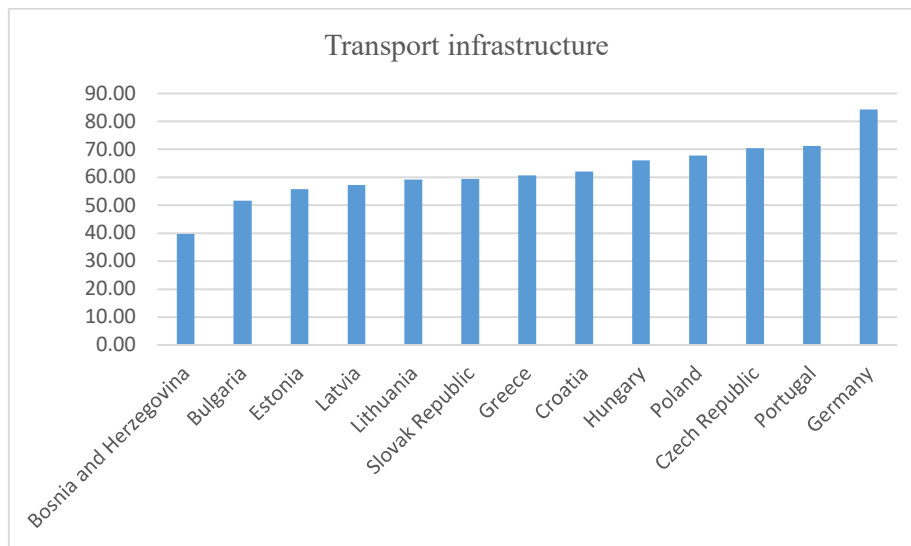


Figure 17. Transport infrastructure indicator distribution by country. Source GCI WEF index 4.0, personal visualization

Transport infrastructure remains one of the key factors in case of supply chains. Automotive industry supply chains require huge transport infrastructure to be set up to be able to produce complex solutions. here are two main factors takes place: internal manufacturing companies supply chains and further exports. if transport infrastructure is not compatible with supply chain requirements or transferred policies and taxes are too high to be able to keep logistics on certain amount of price companies tend to choose different countries which has a better infrastructure. Here Lithuania remains fifth lowest transport infrastructure country after Bosnia and Herzegovina, Bulgaria, Estonia, and Latvia. Further countries remain with higher exports to Germany which directly correlates to problems analysis section. Here it can be conducted that more foreign controlled enterprises country has the better infrastructure is set up. In addition, participation in the supply chain greatly shapes the indicator and here Lithuania has to keep focus on setting up road rail and air infrastructure. automotive industry characterizes by low margins which leads to high quantities of products. high quantity of products needs a lot of logistics and services to be provided. if logistic costs are too high then companies are working only on low margins which brings to a option to move to the other country which would have less costs on logistics and would bring more margins for their companies. add the value improving can be related with the infrastructure due to participation in supply chain. lower margins mean lower motivation to open new business units in countries and this leads to lower exports and less flexibility to extract and absorb added value income inside the country. in addition, it can be foreseen that geographical location has influence on the factor as more to Europe center countries tends to have higher transport infrastructure and easier logistics for global value chain companies. this indicator remains a very important for establishment of a sustainable supply chain companies which leads to more priority needed on a country level to increase country's competitiveness in transferred to infrastructure. even there are some projects in Lithuanian as via Baltica it does not

contribute enough to provide a sustainable proof that Lithuania will be more developed in terms of infrastructure and it requires further decisions to be made to develop such indicator

4.2.2. Border clearance efficiency

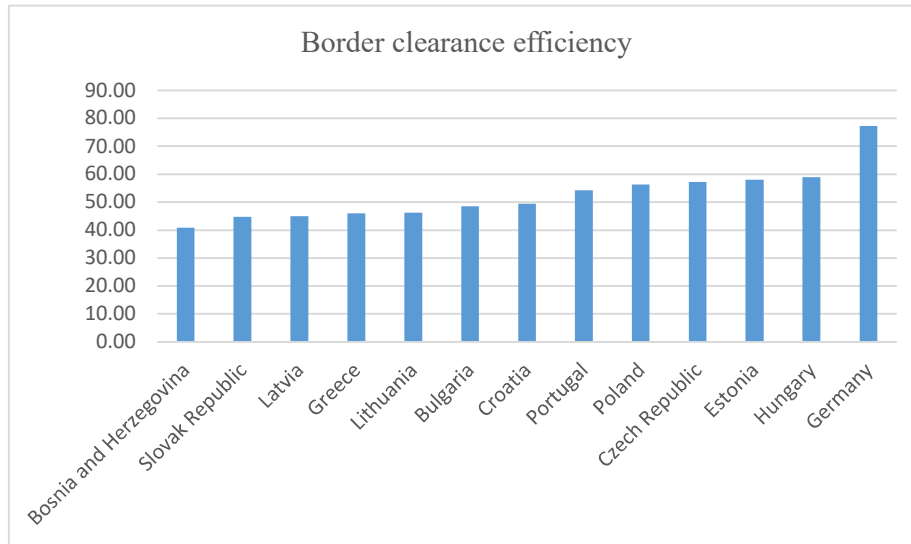


Figure 18. Border clearance efficiency indicator distribution by country. Source GCI WEF index 4.0, personal visualization

Border clearance efficiency indicator provides information about countries availability too efficiently manage traffic towards foreign countries and effective crossing of the borders with products. in case of disturbance global value chain companies risk that their products will be stuck on the border and delay could be days weeks or even months as it was conducted by corona crisis effects. indicator provides Lithuanian performance in fifth lowest country of border clearance efficiency. Here Lithuania overtakes Bosnia and Herzegovina, Slovakia, Latvia, and Greece. further countries remain with higher exports to automotive industry in Germany. Germany has a leader of below clearance efficiency proves hypothesis that supply chain countries must contain high efficiency of border clearance. Hear Estonia as a lower expert Germany has a higher position in border clearance efficiency and together with Lithuania remains growing country in exports which can sustainably manage its border utilization. In terms of added value income such indicator remains very important and priority has to be made to make Lithuania more competitiveness in such dimension to be more attractive for foreign investors that would establish more supply chain companies which would increase intellectual capital and workforce skill set and export towards leading GVC countries.

4.3. Social indicators analysis

Relevant gap social factors were sorted out and visualized to indicate where Lithuania stands in terms of comparison with other trading countries. This section will provide analysis of each indicator with explanation what Lithuania must focus on to improve the position in terms of automotive industry. Social factors have a great influence on added value income which is provided by workforce and here they were indicated that Lithuania has the most gaps among other exporting companies toward Germany in automotive industry. due to these circumstances, there is a necessity to analyze such dimension work closely and as mentioned in the literature the review higher skilled labor force

brings higher added value due to this reason this section will analyze more indicators than economic and environmental indicators analysis sections. Social environment is not only important due to its impact on labor force but towards stability of a country's residence which has a direct relationship with countries capabilities and resources to keep supply chains sustainable. as a sustainability is one of our most important criteria to run automotive businesses it has to have a high priority in terms of development and general wellbeing of a country.

4.3.1. Healthy life expectancy

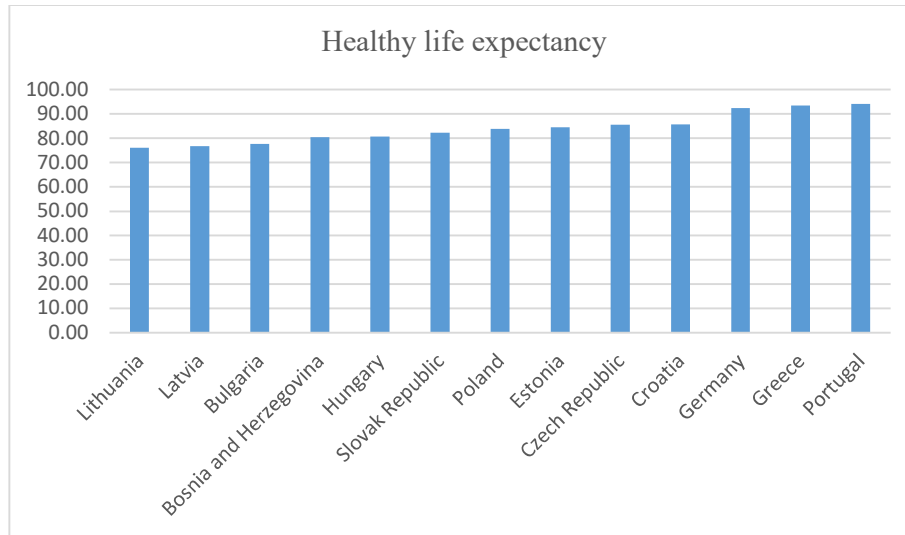


Figure 19. Healthy life expectancy indicator distribution by country. Source GCI WEF index 4.0, personal visualization

Healthy life expectancy provides information about countries workforce ability to continuously contribute to internal and external businesses. In addition, it provides a clear indication of how stable workforce is and indicates possible risks to disturb supply chains. Lithuanian Saturday mention remains the lowest healthy country out of countries that we are compared and problem analysis section. The sustained supply chain surrounding workforce has to be stable and there should be no gaps that would increase the risks of not delivering obligated products. Leading countries in the indicator dimension are Czech Republic, Croatia, Germany, Greece, and Portugal. data partially proves hypothesis that indicator has a direct relationship with supply chain participation and added value income therefore such indicator should not be taken as a priority to have short term improvements on Lithuanian exports towards automotive industry. leading companies as Czech Republic and Germany in terms of automotive industry is leaning not by a significant amount of score meaning that small improvements will not bring added value income improvements and such dimension should not be treated as significantly important.

4.3.2. Scientific publications

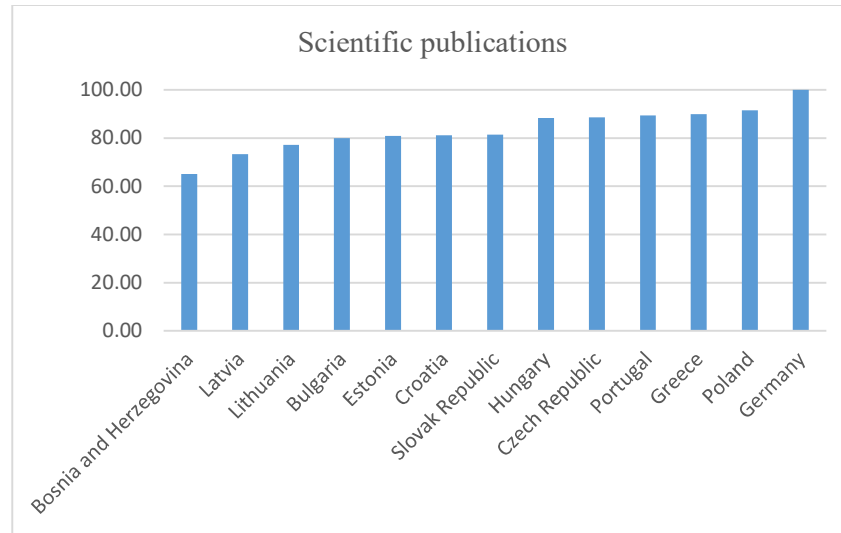


Figure 20. Scientific publications indicator distribution by country. Source GCI WEF index 4.0, personal visualization

Scientific publications have a direct relationship with the highly skilled labor force - more scientific publications mean more R&D activities and more capabilities on analysis. Automotive industry as one of the most innovative industries has a high requirement for be able to analyze and have an intellectual capital if high added value income is expected. Lithuania and such dimension remain third lowest country which publish scientific articles and researchers. Here only two countries are below such as Bosnia and Herzegovina and Latvia. Further countries that even do not lead by exports to Germany has a higher scientific articles publications score. Indicator leaders remain Germany, Poland, Greece, Portugal, and Czech Republic. These countries have a direct link towards exports in automotive industry and such indicator can be characterized as important in regards of supply chain establishment. Lithuania must improve its educational system and popularity of scientific researchers. This would provide more information about Lithuanian capabilities to make analysis, invent new theories, and products to continuously improve on businesses and technology. If there are no improvements in scientific publications Lithuania might fall upon the added value income trap which occurs when country is specified as only manufacturing country that cannot provide services or R&D activities. Further automotive industry requires quality analysis that exceed high standards in order to provide safety for customers. Quality is one of the main characteristics that Shapes automotive industry to be one of the most complex industries in the world. On the other hand, there are other fields which require high expertise in analysis and science such as finances, logistics, automation, technology, purchasing, and management.

4.3.3. Innovation ecosystem

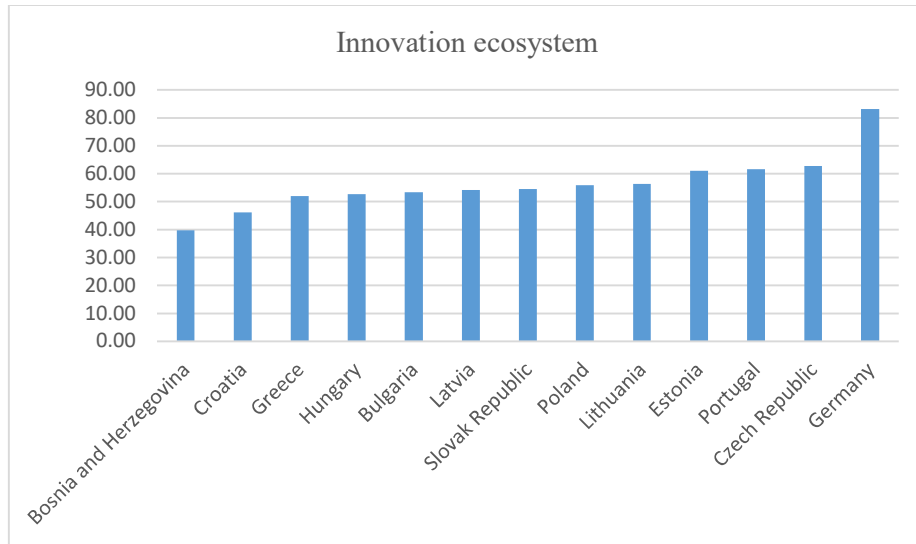


Figure 21. Innovation ecosystem indicator distribution by country. Source GCI WEF index 4.0, personal visualization

Innovation ecosystem shapes countries abilities to create new solutions together with social and economic environment for such and activities. Here the Lithuania is one of the leading countries among Germany, Czech Republic, Portugal, and Estonia. Lower tier companies in this indicator are Bosnia and Herzegovina, Croatia, Greece, Hungary, and Bulgaria. Dominating country Germany has a gap which is significant and provides an overview of how Germany remains leaning country in terms of foreign control enterprises and leader of exports in Europe. by providing innovation ecosystem which is sufficient to create new businesses and realize new ideas countries has the benefit of add the value income. Innovative ecosystems require high R&D involvement which brings most of added value in the country. automotive industry is evolving throughout decades and cars which people bought 20 years ago has a different value distribution than now. previously cars were made of hardware and manufacturing of hardware was the densest added value distribution towards supply chain. Nevertheless, these days how did the value in the car is mostly of the software and design of the car. here even innovation ecosystem is a high in Lithuania it does not correspond to scientific research score which boost the establishment on new innovation solutions which would increase added value income in Lithuania. This indicator provides information that the Lithuania is on a good path to create innovation environment which is positive towards supply chain companies establishment and increase a chance to create a higher added value and development of highly skilled employees. further developments of innovation ecosystems should be followed by other indicators development which are social gap indicators. In addition, automotive industry requires a lot of new technological innovations and solutions towards nowadays trends such as autonomous driving, personalization, digitalization, and sustainability. Lithuania can realize it's untapped potential and software solutions where high skilled workforce are already included in many of IT service companies which represents foreign controlled enterprises. This indicator does not comprehend with hypothesis to be a highly influencing factor for supply chain establishment and export towards Germany. Due to this reason indicator is treated as not priority indicators to be developed to have a short-term improvements on added value income.

4.3.4. Skill set of graduates

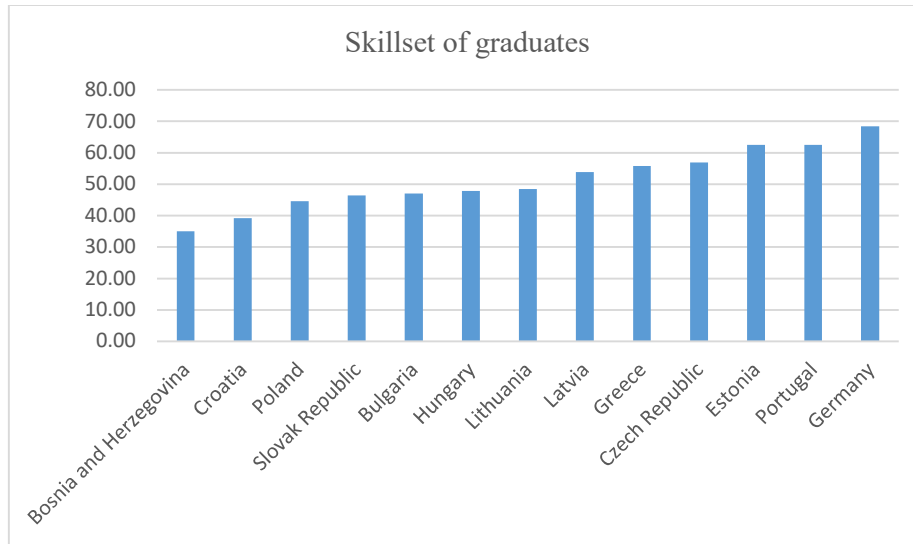


Figure 22. Skillset of graduates indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

Skill set graduates provide future information on countries talents and workforce potential which can be realized in companies. higher skill set of graduates provides more potential to get high added value income in supply chain companies and as well internal countries companies. Here Lithuania remains in the middle of the countries which means that Lithuania has a great potential on the future workforce. Graduates has to be developed in the right way to absorb he requires further education and be able to step in required areas of a supply chain. leading countries in this indicator are Greece, Czech Republic, Estonia, Portugal, and Germany. This indicator does not prove synchronize analysis gathered data but it has a correlation between relative value change in exports towards Germany. Furthermore, indicator does not provide short term outlook of the country's current workforce and due to that it cannot be treated as priority indicator but it is very important to ensure future talents to be able to join complex and highly standardized supply chain companies.

4.3.5. Patent applications

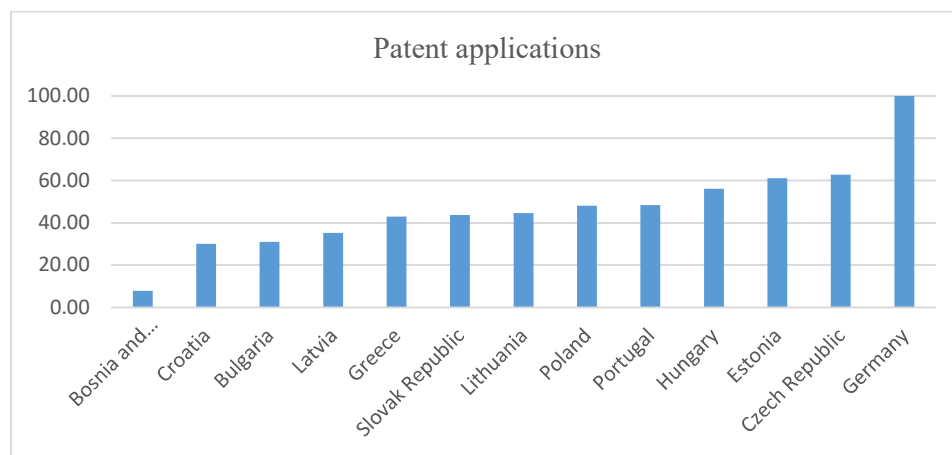


Figure 23. Patent applications indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

Patent applications indicator characterizes countries in terms of innovations and solutions which are protected by policies that no other parties could copy or use in any business favor. less patent applications means that countries have a low potential on becoming R&D or service providing countries which means that at value income out of supply chain will mostly be absorbed by manufacturing. Lithuania in such dimension remains in the middle of countries surrounded by Latvia, Greece, and Slovakia from behind and Poland, Portugal, Hungary, Estonia, Czech Republic, and Germany leading the patent applications. Here Germany as a leader has a huge gap between other countries which can explain Germany's capabilities to control huge global value chains and be a leading country in foreign controlled enterprises and innovations. Patent application has a direct relationship with enterprises operating inside the countries which can be transferred towards external countries that can produce such solutions in lower costs structure and bring added value income to controlling country. Automotive industry in this indicator is highly protected by other countries who are already historically participate in this sector. There is a very low probability that other countries who started participating in supply chains will establish successful businesses that would be competitive among already existing businesses. this scenario can only occur if huge investments are made towards narrow branch which is not developed by bigger automobile manufacturers or component suppliers. Here Lithuania as a low capital country has no competitiveness and should concentrate on solutions which do not require actual physical equipment or facilities such as software or other services that provide less of a physical good than intellectual capital. this would as well increase added value of income as there are no physical goods to be transferred or manufacturer in the country.

4.3.6. Ease of hiring foreign labor



Figure 24. Ease of hiring foreign labour indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

Ease of hiring foreign labor indicator remains closely related with supply chain participation and added value income improvements on a country by transferring intellectual property from external countries to local workforce. it is necessary to make policies that do not contradict with ability to hire foreign labor in regards of global value chain companies. companies require a smooth process for their highly skilled employees if there is a need to travel and work for foreign companies established

in lower cost countries. here's the way near remains one of the leading countries in regards of hiring foreign labor and do not hesitate to absorb intellectual capital which is seen by a companies established in Lithuania in five years period. Automotive industry requires a lot of standards and competence is to be transferred from local companies towards unexperienced countries as Lithuania. there are clear trends that highly skilled countries have an ease of hiring foreign labor at its best and tries to absorb as much intellectual capital as possible. In addition, hiring foreign labor can lead to more flexible cost structure which then increases the competitiveness of the country in regards of participation in a supply chain. these factors can lead country tips or more added value income even out of foreign control enterprises. Portugal Hungary Germany Greece and Bulgaria has a lead of this indicator and provides a direct link between problem analysis data gathered from imports into Germany in automotive sector. Lithuania should be more open to hire foreign labor especially when economic situation is not stable and do not provide a stable base ground for automotive companies to be established. automotive Design and manufacturing projects can last up to 10 years which leads to complex monitoring of costs inside the country. if country is not stable it has to provide the possibility for companies to be flexible in terms of labor cost. as current trends Lithuania is not stable economically and inflation together with productivity shapes labor force to be expensive but not productive and under these circumstances if companies choose very closely whether to establish businesses in countries that will not have any other alternatives on labor force. In terms of added value income Lithuania must concentrates on developing this indicator which would increase capabilities of our country and resources for businesses to be established.

4.3.7. Ease of finding skilled employees

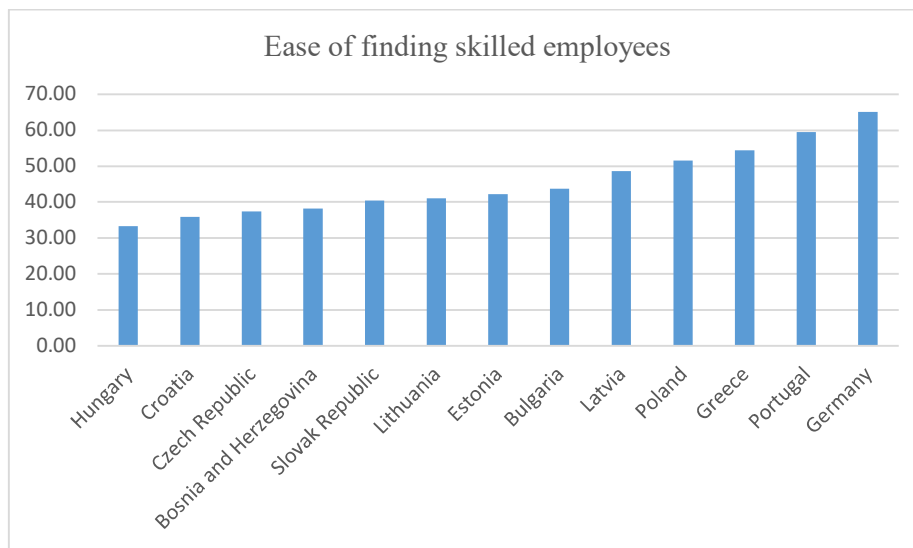


Figure 25. Ease of finding skilled employees indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

Availability of skilled employees has a great influence on supply chain and automotive industry establishment inside the country. Indicator shapes attractiveness in terms of higher added value income activities and business establishments. To improve at that value income in automotive industry is necessary to have skilled employees who can create an innovative solutions and provide services that would create sustainable Supply chains and manufacturing and as well services. Here

Lithuania positions itself at a medium among compared countries. Hungary Croatia Czech Republic Bosnia Herzegovina and Slovakia are slightly behind Lithuania which correlates to relative import change in Germany provided in problem analysis section. leading countries such as Germany Portugal Greece and Poland Has more availability of skilled workforce which leads to mostly higher added value income activities. On the other hand, Greece, a declining country has employees that do not participate in automotive industry. In addition, automotive industry is very sensitive in terms of skilled workforce. to improve at value income this Lithuania must concentrate on providing more skilled employees to the market who would be with the right skill set to increase productivity and added value income in participation over supply chain. this can be only done with developing educational system that would be compliant with automotive requirements. this indicator can be treated as one of the most priority indicators that would bring it away near to more added value income and with shape position of a supply chain forward to providing services and higher added value activities.

4.3.8. R&D expenditures

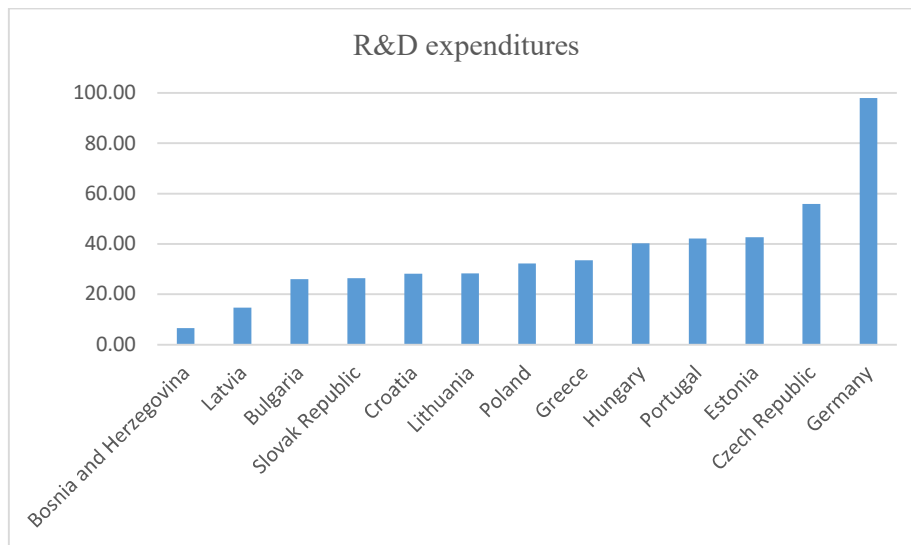


Figure 26. R&D expenditures indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

R&D expenditures has a direct link towards innovations new business establishments and added value income in supply chain companies. R&D activities remain one of the most added value income generating services. in terms of supply chain of automotive industry such activities are closely related with end customer which produces a car. customer creates demand on what components and what designs they are necessary to produce a car. indicator provides clear overview of countries ability to invent and design new solutions which can be realized in the market. here Lithuania positions itself at 6th lowest R&D expenditures country among chosen countries. countries as Bosnia and Herzegovina Latvia Bulgaria Slovakia and Croatia remains below Lithuanian level in terms of our R&D expenditures. Further countries as Poland Greece Hungary Portugal Estonia Czech Republic and Germany are above Lithuania. here Germany and Czech Republic as original equipment manufacturers our leading indicator without a close competition. indicator provided a link with problem analysis data on exports to Germany whereas Greece and Estonia remain exceptional cases which do not comprehend with the hypothesis. in terms of improving added value income in Lithuania

in automotive sector Lithuania must develop more financing on R&D to increase competence on activities which would generate more added value income inside the country. together with increasing the competence country would be able to open new enterprises which would provide quality services for the leading countries as Germany or Czech Republic. indicator remains very important in case of add value income development as it clearly characterizes countries capabilities on innovation and technology. In case of country is not able to develop and create its own designs add value income might stagnate due to only capability to produce products which is at lowest added value curve provided in literature review. Nevertheless, Lithuania has a very young participants in automotive sector must ensure R&D expenditures to be at the highest level if country wants to step in the sector. The limiting factors are available capital and general economic situation of Lithuania Discussed in previous social indicator sections. Furthermore, Lithuania must ensure smooth participation in manufacturing to absorb as many technologies intellectual capital as possible to be able to provide sufficient and unique value proposition R&D services.

4.3.9. International co-inventions

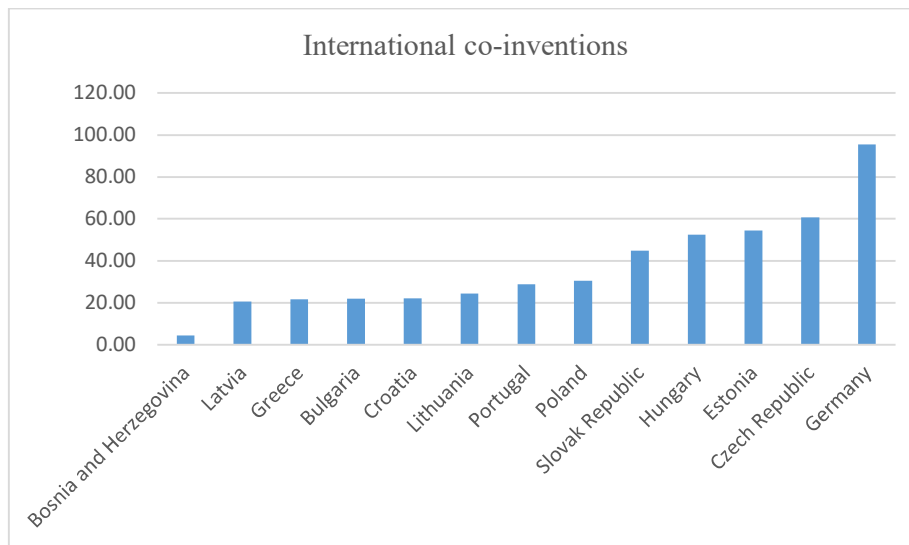


Figure 27. R&D expenditures indicator distribution by country. Source: GCI WEF index 4.0, personal visualization

international co-inventions shapes ability of a country to proceed with R&D activities with collaboration together with other countries. global value chain structure a requires such activities to be done in a country too participate in high added value activities. this indicates her closure rates with automotive industry where international teams are characterized as a strength of the companies. with the wenya has not a good result on international co-inventions which brings Lithuania to 6th lowest collaborating country in terms of inventions. countries that are below Lithuania are Bosnia and Herzegovina, Latvia, Greece, and Bulgaria. leading countries Germany and Czech Republic remains most innovative countries in terms of development outside the internal teams. further countries ask Poland Slovakia and Hungary which are leading in terms of exports to Germany has a higher score approximately twice. this means that if Lithuania wants to improve added value income it must concentrate on highly skilled employees working on international teams and designing new products and solutions. to participate in automotive industry Co invention activities countries must participate in manufacturing of certain product areas which are most likely related with components production.

as experience of our country is lot sufficient to provide services to organizational equipment manufacturers first experience and highly skilled workforce has to be generated. to make a development easier countries government must ensure smooth communication between business units and countries goes to bring workforce on a level where efficient and smooth cooperation could take place.

4.4. Overview of indicators analysis

Indicator’s analysis have provided an array of relevant indicators which influences the supply chain participation and added value income upgrading in automotive industry. Conducted research provides top five indicators which must be improved to upgrade Lithuania’s standpoint in automotive industry supply chain:

1. Ease of finding skilled employees;
2. Transport infrastructure;
3. R&D expenditures;
4. International co-inventions;
5. Scientific publications;

Given indicator analysis provide most of important gaps that Lithuania must improve. In addition, to provide a comprehensive overview of how Lithuania is performing at the stage in terms of supply chain establishment in automotive industry, indicators were distributed with a relevance weight to calculate general average indicator that would help to understand Lithuanian competitiveness of added value and supply chain participation, see formula below:

$$AI = \sum_i \alpha \cdot iS$$

Where, AI - average indicator, S – score, α - weight of the indicator, and i is indicator. See table below.

Table 10. List of Concluding indicator calculated values by country.

Country	Average indicator
Germany	86.19336081
Czech Republic	64.03441752
Portugal	63.0510847
Hungary	60.05426412
Estonia	59.81789304
Poland	57.13839051
Slovak Republic	54.25537853
Lithuania	51.8778281
Bulgaria	51.56910834
Latvia	50.75407496
Greece	50.43214584

Croatia	48.8722543
Bosnia and Herzegovina	38.71767991

Concluding indicator brings Lithuania to 8th position between compared countries and reveals significance of social economic and environmental factors influence on supply chain participation. Here Germany as a leader of export in automotive industry has a highest score followed by Czech Republic which represents OEM country. Furthermore countries as Portugal Hungary Poland and Slovak republics which positions above Lithuania has a direct relationship between exports to towards Germany. Relative import value change has revealed similar trend that is conducted in indicators analysis. In addition, this Lithuania must improve its standpoint in terms of competitiveness to be able to participate in a supply chain more actively and increase its added value income. It is necessary to mention that indicators provide information not only on automotive industries and it can reflect other industries.

4.5. Results of qualitative analysis of experts interviews

Qualitative analysis interviews revealed more information towards added value income improvement Lithuanian current standpoint and automotive industry in terms of a supply chain participation. Coding of information was concentrated on density of information towards received data. The main three categories were obtained. Furthermore, subcategories were identified which were obtained by analyzing data. All of the subcategories concentrate on more detailed view on provided main sections.

Table 11. Qualitative analysis categories and sub-categories

Added value income		
Identification of added value	Improving added value income	Influencing factors
Lithuania's characteristics		
Identified gaps	Improvement areas	Perspective of current status
Automotive industry		
Industry specifics	Current trends	Lithuania in automotive

These categories have links in regards of aim of the research. in order to understand upgrading of lithuania's characteristics and standpoint in the supply chain added value absorption main sections were obtained. first of all to be able to identify what is needed for improvement it is necessary to understand the concept of added value income and establish a further link with identification improving and influencing factors. further research object is Lithuanian country in automotive industry. to understand Lithuanian standpoint it is necessary to identify gaps improvement areas and actual status. together with information on added value and lithuania's characteristics additional information towards automotive industry must be provided. in terms of improving and upgrading supply chain and added value more of industry statics current trends and recognition of Lithuania is needed.

4.5.1. Results and discussion on added value income group data

Automotive industry experts have provided details on identification of added value in automotive industry. Each of the subcategory main sorted the data will be provided in the tables below.

Table 12. Identification of added value data

Identification of added value	
Interviewee	Citation
Dr. Petrik Lange	<i>„I think in the past it was mainly hardware, but now it's more and more software.“;</i>
Dr. Petrik Lange	<i>„The high value added which would be everything connected to the brain storage.“;</i>
Dr. Petrik Lange	<i>„Today, I would say hardware is only 50% maximum and the rest are engineering added value.“;</i>
Dr. Justinas Račkauskas	<i>„On the other, in automotive industry the biggest added value gives not the materialistic side, but the R&D and intellectuality.“;</i>
Dr. Justinas Račkauskas	<i>„Production only adds as much as we use force labour so only salaries are left in that country from automotive industry“;</i>
Maxim Zakletskiy	<i>„To understand added value you start from design and development and then basically go into the supply chain“;</i>
Maxim Zakletskiy	<i>„They even have a target to sell minimum 50% of the bill of material from their own company to be used in this product“;</i>
Maxim Zakletskiy	<i>„Income and out of progress which countries make mostly when you are captive then you gather the experience you get the added value from what origin company will provide you also competence salaries for the persons“</i>

According to interviewees, added value identification in the automotive industry can be conducted different production stages are analyzed. First of all, added value income starts with the development of the products and further distributes among production stage and sales. it is highlighted that intellectuality activities can bring the most of added value and if looking into historical perspective previously added value lied in a hardware of the products. However, nowadays situation has completely changed and most of the added value comes from engineering and software. additionally automotive industry provides a possibility for countries to gather competence and salaries throughout participating in a supply chain which positively impacts general development of the country's characteristics and workforce. gather data proves theoretical models of added valley income which is mostly absorbed through high skilled labor force and services such as R&D engineering or software creation. Furthermore, depending on governance type of companies there are cases when production use labor force and what's left in the country from added value is only salaries paid by the companies. in conclusion identifying of added value in automotive industry provides an overview of activities that will bring countries income to the highest possible income and development of countries

characteristics. Here workforce remains the key indicator which shapes participation in the supply chain and standpoint of country's ability to absorb added value.

Table 13. Improving added value income data

Improving added value income	
Interviewee	Citation
Maxim Zakletskiy	<i>“Is there really a need to eliminate the captive model?”;</i>
Maxim Zakletskiy	<i>“You need to think about the unique value proposition”;</i>
Dr. Justinas Račkauskas	<i>“Yeah, technology it's positive”;</i>
Dr. Petrik Lange	<i>“Better establish yourself as the service thinking of the unique value proposition”;</i>
Maxim Zakletskiy	<i>“Would not need to rent the office as such big connected to some premises where you”;</i>
Maxim Zakletskiy	<i>“Need to invest so maximum value add with the lowest investment”;</i>
Maxim Zakletskiy	<i>“You need to have localized suppliers as much as you can”;</i>
Dr. Justinas Račkauskas	<i>“Service team brings bigger added value to the country than the employees who work directly with the line”;</i>

Interviewees insights on improving added value income distributes along social economic and environmental factors. There were statements that for such country as Lithuania captive governance model is the only choice which country has. By establishing capital governance mode, it is essential to concentrate on as complex solutions as possible to gain high added value income. Nevertheless, country must find its unique value proposition which can be shaped through technology or at the services that would provide intellectual capital which is not present at other countries. Economic factors that shapes upgrading added value income I related with investments which has to be concentrated on services that do not require physical equipment or facilities. further investments have to be made in a such way that minimal investment would generate the maximum value meaning that the cost has to be minimized as much as possible. further absorption of added value can be performed by a different way than actual participation in the supply chain. by creating a local suppliers for services can bring more added value income inside the country. In addition, improving added value income strongly relies on a workforce that is present at the country. Improving skill set of workforce improves added value in the same way. Meaning that literature solutions and characteristic analysis complies with experts provided opinion.

Table 14. Influencing factors data

Influencing factors	
Interviewee	Citation
Dr. Justinas Račkauskas	<i>“Production for the country added value is very limited”;</i>
Maxim Zakletskiy	<i>“Is a country a stability of economic situation”;</i>
Maxim Zakletskiy	<i>“Need to have a very flexible supply chain”;</i>
Dr. Justinas Račkauskas	<i>“The bigger intellectual production you have, the bigger added value it gives”;</i>

Maxim Zakletskiy	<i>“You need to have a very transparent lead system of enterprise resource planning”;</i>
Dr. Justinas Račkauskas	<i>“I think only through teaching system”;</i>
Maxim Zakletskiy	<i>“Last but not least for all of these you need to have skilled people”;</i>

Further, most influencing factors for added value is the stage of supply chain and country’s stability of economic situation which shapes participation in automotive supply chain. Infrastructure of a country has a direct relationship with flexibility of imports and exports which can lead to smooth operations of production plants or R&D centers. Ability to provide flexible supply chains remains one of important factors mentioned by interviewees. In addition, countries capabilities to implement new industry related methodologies such as lean, kaizen, and 5S can shape countries competitiveness in terms of attractiveness towards automotive industry. Nevertheless, most frequently conducted factor was human resources. It is necessary to have a good educational system, able to plan and manage country’s resources, and provide a possibility for labor force to grow into high skilled workforce. In conclusion, added value income in automotive industry strongly relies on operations which are proceeded in the country, available capital, social characteristics, and countries development of workforce.

4.5.2. Results discussion on Lithuania’s characteristics group data

Lithuania’s characteristics greatly shapes possibility to upgrade and improve added value income. even Lithuanian exports are growing country must sustain its continuous development and due to this reason qualitative data was gathered, see tables below.

Table 15. Identified gaps data

Identified gaps	
Interviewee	Citation
Maxim Zakletskiy	<i>“You don't have sufficient development companies”;</i>
Dr. Justinas Račkauskas	<i>“What touches energetic resources we are still dependent”;</i>
Dr. Justinas Račkauskas	<i>“If we are too expensive to hand-produce wires it is the outcome of Lithuania’s economy evolution”;</i>
Maxim Zakletskiy	<i>“We already not in the winning stage because of the distance”;</i>
Maxim Zakletskiy	<i>“Lithuanians move for the better lives”;</i>
Maxim Zakletskiy	<i>“First of all, not enough people, not enough resources”;</i>
Maxim Zakletskiy	<i>“People vote for these countries because they're the social environment”;</i>
Dr. Justinas Račkauskas	<i>“I think a very good direction would be improving teaching systems”;</i>
Dr. Justinas Račkauskas	<i>“I think electric plans are promising something good, but it needs time to grow”;</i>

Interviewees have identified the most relevant gaps for automotive industry and its added value. Several factors were conducted from Lithuanian social, economic, and environmental standpoint. First of all, experts have agreed that natural resources of Lithuania have to be improved. Country is

still dependent on foreign countries to provide the energetic resources which leads to not flexible cost structure in the country. This factor influences attractiveness of participation in a supply chain of automotive industry. Further, geographic location is not the most convenient to provide supply chain services as production. Considering that automotive industry characterizes by huge quantities upstream supply chain must perform in a way to provide flexible cost structure. Social factors gaps concentrate on available human resources. Experts identified that one of the most critical problem is emigration which is not compensated by immigration. Social environment for automotive business must ensure stable availability of workforce which has to be prepared for narrow skills needed for the industry. It was identified that Lithuania has educational system gap which then leads to less skilled labor force that could provide quality results. Furthermore, Lithuanian economy is growing and evolving and such participation as low added value becomes more and more unrealistic due to high cost of labor which limits the growth of competence in the field.

Table 16. Improvement areas data

Improvement areas	
Interviewee	Citation
Dr. Justinas Račkauskas	<i>“Let’s say we don’t do R&D but we need more factories in that case they need to designate finances and support students in related study fields”;</i>
Maxim Zakletskiy	<i>“I wanted to say that all decisions especially related to salary and development and the age they have to be pre-discussed with the business”;</i>
Maxim Zakletskiy	<i>“Training on the next level comparing to the other countries”;</i>
Maxim Zakletskiy	<i>“Government needs to help companies to keep the people in the country“;</i>
Dr. Justinas Račkauskas	<i>“It's let's say improving the other social aspects”;</i>
Maxim Zakletskiy	<i>“You have to invest in R&D”;</i>
Maxim Zakletskiy	<i>“You need to build an infrastructure”;</i>
Dr. Petrik Lange	<i>“Publicity, marketing, seems to be not so visible”;</i>
Maxim Zakletskiy	<i>“You need to think about the unique value proposition”;</i>

Improvement of Lithuanian automotive industry mostly concentrates on gaps identified in previous section and some interesting insights from current situation of country. First of all, experts have identified the lack of R&D activities. country is limited in terms of creating new solutions which provides less attractiveness for automotive services to be established in the country. Such activities lack investments from government side and attention from local educational structure. Here government was mentioned in regards of helping countries residents to develop, remain in the country, and help manage communication between companies In terms of the workforce. further country has to follow other countries development in terms of supply chain of automotive industry. this is followed by improving the social aspects of the country infrastructure and unique value proposition. Interestingly, interviewee from Germany has stated that Lithuania lacks marketing on its capabilities to participate in supply chain of automotive which leads to less exports and less knowledge about countries motivation to step into supply chain as more active participant.

Table 17. Perspective of current status data

Perspective of current status	
Interviewee	Citation
Dr. Justinas Račkauskas	<i>“We have a huge potential to grow fast if we will correctly control our resources, intellectual development, and growth”;</i>
Dr. Justinas Račkauskas	<i>“Country is definitely turning into the medium cost position”;</i>
Maxim Zakletskiy	<i>“Lithuanian and German Chamber of Commerce which has the power of the speaking in public have workshops and sessions actively”;</i>
Maxim Zakletskiy	<i>“They did a very nice first step by creating the organization called investment Lithuania”;</i>
Dr. Petrik Lange	<i>“Nevertheless, my view of Lithuania is very positive as your people are very well educated, have high IQ, and are closer in their thinking, discipline, and culture to Germany”;</i>
Dr. Petrik Lange	<i>“I think you are relatively highly industrialized and proposing a lot of smart things for the rest of the European market”;</i>
Dr. Justinas Račkauskas	<i>“The good side is that we took care of gas supplying and here we are quite safe”;</i>
Dr. Petrik Lange	<i>“As I mentioned intellectuality is very high in your country”;</i>
Dr. Justinas Račkauskas	<i>“For example, currently colleges are preparing services specialists but for some reason, they make the production line workers”;</i>

The perspective of current status of Lithuanian automotive industry added value remains not pessimistic. There is a huge intellectual potential and capabilities which has to be managed in the right way to upgrade added value income. Country is developing from low to medium cost country which shapes possibility to participate in certain stages of automotive supply chain. Countries government is actively communicating between leading countries to improve its recognition in terms of stepping into industry more actively. Lithuania has made a few good steps to ensure stable growth of exports but it must sustain established methods. There are still some aspects which does not make sense for the experts in terms of educational system. It must evolve together with the perspective of Lithuania to provide required skilled workforce. In addition, some of energetic resources Infrastructure is already built as a sustainable and reliable in terms of running supply chains. Furthermore, the Lithuania is characterized as very intellectual country with discipline and attitude which is close to Germany’s culture. It brings to the conclusion that Lithuania has a great untapped potential in automotive industry which has to be developed in a right way. Country is respected for its capability to be industrialized and it's highly skilled workforce which in some cases replace leading countries workforce. Nevertheless, such workforce must be ensured to remain in its way to increase its added value and participation in services of automotive industry. With the right development of the country’s social, economic, and environmental factors country can ensure its added value income upgrades and participation in supply chain of automotive industry.

4.5.3. Results and discussion on automotive industry group data

Automotive industry is one of the biggest industries in the world and has a great potential to provide a stable added value income to Lithuania. As industry is not highly developed in the country, deeper understanding of industry is required. In terms of added value income industry has a huge influence which can be seen in leading countries that has strongly developed automotive industry. Here qualitative data on industry will be provided to understand where Lithuania must concentrate in the future and current time according to field experts.

Table 18. Industry specifics data

Industry specifics	
Interviewee	Citation
Dr. Justinas Račkauskas	<i>“About the automotive industry investments if you analyze the relationship between investments and the capital return for the government it brings way more profits than let’s say the production of wooden pallets”;</i>
Maxim Zakletskiy	<i>“Well, there is the thing let’s say in medicine you have a quality but not the quantity, in automotive you have quantity and quality”;</i>
Dr. Justinas Račkauskas	<i>“When you increase production amounts, your line is getting cheaper because you put the workload on it”;</i>
Maxim Zakletskiy	<i>“As the new player tier one and started to deliver it to the OEM's they will not listen to you in the first five years”;</i>
Maxim Zakletskiy	<i>“20 years ago, it was very easy model all design and development has been on the side of the customer”;</i>

Automotive industry has a higher margins than most of fewer complex industries. Countries government can profit a lot more in terms of establishing a sustainable supply chains inside the country. It was indicated by the experts that industry requires quality and quantity meaning that countries resources and skill set must be adapted towards requirements of the market. Previously in the history of automotive industry development it was a lot easier to establish supply chains as most of the added value came from hardware leading to distribution of added value comparably stable in regards of nowadays. As a cost pressure is increasing countries lose its competitiveness to establish supply chains and gain specific knowledge. If the right business environment is not set up for automotive industry. Nevertheless, as industry have evolved there are more possibilities to step in a supply chain as customers are not setting up they designs for manufacturing and more companies can participate in a supply chains. Further, supply chain has a new additive such as software of the car. As Lithuania has established a very good base ground for IT specialists it can be one of the pathways to succeed in upgrading added value in the automotive industry. On the other hand, industry requires generally highly skilled work for us to bring more added value. It is not easy to step in as a newcomer to search industry and due to that Country must develop step by step to gain recognition as trustful partner of automotive supply chain. This is the only way how to evolve Lithuanian captive governance open supply chain companies to market governance according to the experts.

Table 19. Current trends data

Current trends	
Interviewee	Citation
Maxim Zakletskiy	<i>“If you are a small local supplier, you won't be respected but you will never win the quote”;</i>
Maxim Zakletskiy	<i>“As we know in automotive is a competitive field and it doesn't let you to stay in one place”;</i>
Dr. Petrik Lange	<i>“Do you know how many software people are in German OEM's? It's a war, a battle of a number of software engineers at the moment”;</i>
Dr. Petrik Lange	<i>“Germans invest billions of euros in this operating system”;</i>
Maxim Zakletskiy	<i>“Nowadays there are so many requirements that they end customers is put into the card that it should be connecting to all your social networks”;</i>
Maxim Zakletskiy	<i>“Now the majority of the parties in the automotive is going in the sequence so the customer is not willing to have a lot of stock in their shells”;</i>
Maxim Zakletskiy	<i>“Everything now moves into this carbon footprint reduction and it goes into the autonomous driving and all the efforts to get rid of the diesel cars and then the petrol price and remain with first hybrids and then fold electric at least this is the road map which has been announced”;</i>

Current trends of automotive has set up the environment where newcomer companies cannot achieve high value orders until it has proven to provide stable required quality and safety standards for automobile manufacturers. Yet to expect that once country or company has achieved required competence level is not a right path for developing a sustainable high added value supply chain. Industry is evolving ask quickly as other high-tech industries. There are many requirements to meet and comply with which leads to a constant need of development of workforce and business environment in the country. There has to be social networks establish which guarantees quick and flexible reaction from both upstream and downstream supply chain parties. Further, supply chains have established a very quick capitalization of components and intermediates as warehousing costs are very high. By holding up huge stocks of materials companies lose capabilities to utilize finance is to bring the most added value for the businesses. any small disturbances of supply chain can bring huge losses upon companies which increase a need for a sustainable and reliable participants in international trade. on the other hand, automotive industry has evolved from production industry to software industry which is visible in a high skilled labor force needs as a software engineers. currently in Germany which is a leader of automotive exports in the world there is an actual crisis of skilled workforce which would produce operating systems and software solutions. this brings a new possibilities for such countries as Lithuania to step in as a service provider and absorb a high amount of add value income. Further, as industries are moving to more sustainable way automotive tries to reduce its carbon dioxide footprint by this creating a new branch of business market of a green in normative solutions there are many other possibilities to extend added value in come through automotive industry trends but to comply with requirements countries must gather experience and competence to flexibly adapt to automobile manufacturer requirements. In conclusion by industries

evolving development path which complies with newest industry trends can provide tremendous results in terms of added value income.

Table 20. Lithuania in automotive data

Lithuania in automotive	
Interviewee	Citation
Dr. Justinas Račkauskas	<i>“Apart from Hella and Continental who work purely with automotive in Lithuania I think there were only two companies, Cargo Schmitz Bull and LittleFuse”;</i>
Maxim Zakletskiy	<i>“In the automotive you need to be in the medium to low-cost country”;</i>
Dr. Justinas Račkauskas	<i>“In Littlefuse we have a R&D center and there was a joint project between the selected companies”;</i>
Maxim Zakletskiy	<i>“I would say the advantage would be if you have a production maybe after 5-8 years of production you could offer services of development, supply chain etc.”;</i>

In terms of Lithuania's participation and automotive supply chain internal industry must evolve together with increasing technology and social requirements. Lithuania is a very new country which stepped in automotive business which do not have significant amount of business units that operate 100% on automobile solutions. There are only several companies that operate in captive supply chain governance type which limits countries ability to absorb other value income. Automotive production countries must remain on medium to low-cost structure to gain experience on component and intermediate productions which brings Lithuania to not favorable position where labor force is does not develop its productivity on such a high level to be an attractive country for automotive business. Nevertheless, there are companies which has R&D centers running in Lithuania which brings a positive overview in terms of workforce development with future perspective to absorb more added value. experts have identified that to step into market governance type countries must work on production at least five to eight years to be able to understand and serve quality solutions for original equipment manufacturers. Lithuania must still improve its social, environmental, and economic factors to be more attractive country as a supplier of automotive industry and provide reliable relationship between governments and businesses.

4.6. Overview of qualitative analysis

Provided qualitative analysis concentrates on three main categories value added income, Lithuanian characteristics, and automotive business. These three categories establish a clear overview on improving the added value income in Lithuania in automotive industry. It was found that Lithuania has a great potential to absorb more and more added value income by increasing exports towards global value chain companies. in order to achieve higher exports and absorb more added value country must concentrate on providing more attractive business environment for a supply chain of automotive industry by increasing its social, economic, and environmental factors. There are several areas of governance impact on participation in a supply chain. Country must establish more effective educational system which provides more specific skill set workforce to the market. Additionally, country must concentrate on R&D activities and investment towards specified industry. On the other hand, country does not have a lot of human and natural resources which would provide a huge benefit

in terms of manufacturing stage of automobile sector supply chain. There are yet a lot of infrastructure gaps which leads to less attractive supply chain and environment. In terms of developing supply chains further country must concentrate on stabilizing its economic situation, increasing its intellectual capital, establishing new specialized suppliers, empower technology development, and contribute more to increase amount of high skilled labor force. there are some obstacles that country cannot overcome in a short-term period such as a lack of experience, emigration and immigration, natural resources, and lack of unique value proposition. Nevertheless, experts had identified that Lithuania has a great potential in terms of its intellectual people, ability to create software solutions, culture, and discipline to develop its supply chain further. automobile industry is evolving fast and new trends are coming into place very quickly. If the development path we will comply with future requirements of the industry Lithuania can increase its added value income absorption significantly. Qualitative analysis has a link in regards of Lithuanian characteristics review and literature solutions which proves that experts in the field has a great understanding of how to approach challenges and how to understand automotive industry from inside of it.

Conclusions

1. Lithuanian automotive industry supply chain companies are governed by captive type which leads to limited absorption of added value income and requires a new development on a supply chain participation.
2. The main Lithuanian gap social, environmental, and economic indicators were found, such as ease of finding skilled employees, transport infrastructure, R&D expenditures, international cool inventions, scientific publications. These indicators should lead Lithuania's development in terms of automotive supply chain participation and added value income upgrading;
3. Average indicator was calculated to assess all of the relevant gap indicators of Lithuania's characteristics. among compared countries Lithuania remains 4th lowest competitive country among other countries which exports towards biggest automotive exporter Germany;
4. Qualitative analysis has provided a perspective of improving added value income in automotive industry. Here Lithuania's further limiting added value gaps were identified, such as natural resources, lack of R&D activities, lack of investment towards industry, lack of skilled labor force, not stable economic situation, and transport infrastructure. Furthermore, as Lithuanian economic situation is evolving country becomes less cost competitive with other production countries which leads to necessity to more proactively seek for higher added value production or services that country could provide for leading automotive countries.
5. Automotive industry is evolving and new branches of business are occurring that could bring Lithuania to more comfortable position in terms of absorbing added value out of the industry. Country must develop its social, economic, and environmental characteristics provided in the research to reveal its full potential in automotive industry. Country characterizes by high intellectuals that are currently not utilized in the right way boost growth of industries generated income

Discussion and Recommendations

The research has been conducted to see Lithuania's potential on improving add the value income in terms of automotive industry. Given that Lithuania 's not a big country with limited resources, it shows a great development of exports toward leading countries. Nevertheless, it is necessary to oversee what path does country go not to be stuck at low to medium added value income trap. For this reason, Lithuania's Automotive industry characteristics were revised. data has provided Lithuania standpoint among countries that compete in this market. it can be concluded that Lithuania is not at the best position currently but the development is taking place which has a positive effect on trading quantities. identified gaps reveal some indicators that cannot be influenced in a short term and it requires a long-term planning to succeed in upgrading added value income. Furthermore, Lithuania lacks a capital to invest into businesses R&D activities and science field. There are factors which cannot be changed. Factors such as location of Lithuania, amount of people living in the country, and experience which was limited due to historical reasons of development of the country. Moreover, automotive field experts were questioned to provide more information about upgrading this supply chain and recommendations towards development of country and industry specific areas. Here Lithuania's strengths were identified as intellectual capabilities but not the property which is existing in the country. Interestingly, such observation was given by experts who is originally from Germany leading country in automotive industry. However, Lithuanian government together with educational community must revise plan of the development of the workforce because Lithuania is transforming from low-cost country to medium cost country which leads to less attractive business environment for supply chain companies. this means that if there is no sufficient knowledge and experience gathered, Lithuania might be stuck with the low added value production which will not evolve through the time. Furthermore social, economic, and environmental factors where identified which correlate to the conducted characteristics review that leads to lack of a focus on certain areas which could improve countries supply chain attractiveness for GVC companies. Automotive industry is evolving and if in the past car was mostly valued by the hardware, nowadays it is completely changed where software contributes about 50% of the value. This leads to more possibilities for Lithuania. For example, creating software solutions does not require a huge initial investment on equipment or physical facilities. By exchanging knowledge and experience with leading countries Lithuania would be able to step in software supply chain of automotive business which would generate the more added value income than production. Otherwise, country must increase its competence to produce more complex intermediate solutions which would be cost attractive for GVC companies. In addition, country cannot let its resources stick with the current competencies and must ensure the empowerment of development to the labor force. If country will be able to establish such development plan which leads to the requirements from the leading companies, country will ensure its competitiveness in terms of participation in a supply chain of automotive businesses and added value income absorption to internal budgets. Nevertheless, country must ensure stable economic and social environment for companies to be established. For further research on automotive business in Lithuania it is necessary to analyze the progress of Lithuania's indicators and more concrete added value calculation in the industry. It is not clear how country is developing identified gap characteristics which leads to less understanding on present relative changes in the exports and only provides retrospective information on given topic. Further, it would be beneficial to measure Lithuanian supply chain performance in terms of logistics speed, ability to absorb technology ,and technology development in terms of supply chain companies innovations.

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Appendices

Appendix 1. Transcripts of the interviews

Dr. Petrik Lange interview

M: Are you aware of what is added value in the businesses and how it works? What do you think what activities may be services give us the most added value in an automotive industry? What grades the most added value in automotive business?

P: I think in the past it was mainly hard ware, but now it's more and more software. Then when you'll buy a car but if you're gonna have done that 20 years ago I would say the value of the car was 80% hard ware production added value. Today I would say it's only 50% maximum and the rest are engineering added value. It is more and more concentrating on the software. If you'd buy a car today for 20,000 euro the hardware itself and also our production and so on also hard ware and material contribution maybe is 10,000 euros and 10,000 euros you will pay for engineering and engineers. Sometimes you must to undertake the number of employees. Do you know how many software people are in German OEMS. It's a war, a battle of a number of software engineers at the moment. It is in the range of 5 to 10,000 people prior German OEM. There is a company Kagia. Directly reporting to miss Sothys and they are at the moment 8,000, I think. Also, Hella are clients with Kiago, which are directly working with projects and currently they bought 100 Hella software employees. Hopefully it will change in the future.

M: I think Elon Musk when introduced Tesla focused more on Software solutions rather than hardware.

P. You have to be careful as you cannot compensate the weaknesses of hardware by using software. Also there is a big difference between a Tesla and BMW. It differs by the market. What is really big advantage by Musk is that he already had a 05:15? operating system. It is also interesting economy point. Germans invest billions of euros in this operating system. At the moment there are big delays for new car platforms for examples Porsha Macan is already one year too late because operating system, which comes from Volkswagen is not ready yet. Also, Mercedes has very big issues. BMW is a little bit 06:02? Of open software like home office. First car platforms are based on google operating system. As Google is an enemy of Apple. Now you can connect your phone by Apple car or by Android car. It gives you a lot of opportunities, for example synchronise your phone completely with your car. On the other hand, you car must be supporting your phone operating system, therefore as apple users are growing they tend not to choose car brands like Fiat, Chrysler, etc because their smartphone is not supported. You can see what big policy is behind.

M: These are big things to overcome as it is getting more and more complex.

P: Yes, I see that there is a lot of competition in the market and Microsoft is losing their market because of their complexity and pricing.

M: How do you currently assess the relationship between Lithuanian and Germany as a trade partner?

P: I would say Lithuania is not so well known in Germany. I only knew that Lithuania was a part of Russia and that nowadays you are nervous because of current tensed relationships with Russia. Nevertheless, my view to Lithuania is very positive as your people are very well educated, have high IQ and are closer by their thinking, discipline and culture to the Germany than for example Romania. That is why I think Lithuanian have very good chances to come to the same level as West European countries. Also, when you ask German about what comes from Lithuania, what does it trade mostly

they cannot answer. They would agriculture because of your history. I think you are relatively highly industrialized and proposing a lot of smart things for the rest of European market.

M: Lithuania is still doing agricultural exports but we are shifting and emerging on software solutions, but not automotive yet.

P: I remember your history and know that the whole ex-Russian area had a very high IQ. I know companies who have software centres in East Europe for example Lithuania. In silicone valley I've met experts of silicone companies. These experts were never American. They are always Polish, Russians or Lithuanians. As I mentioned intellectuality is very high in your country.

M: Moving forward what do you think we must improve as a country to be better at these services concentrating on automotive industry?

P: Publicity, marketing, seems to be not so visible. I think you are now in the beginning phase, like companies Hella, Continental. It is also important to have your own activities. To have Lithuanian founded companies. It could be hard as you are only in the beginning and you would need a lot of funding for example from the Government. In Germany and other countries, the government is sponsoring the electromobility. In Norway for instance there is a big competence in battery production. They have very big giga plants. It would be very useful to include government and intellectual people to research different fields in automotive, maybe its software, maybe batter production, maybe electronics. Set your government and universities to research these fields so that Lithuanian would be known for particular competencies. This is a big chance to be seen by big players like Germany. Such socialization and focusing by the government, by education by university in order to make it attractive for such big companies, big plants etc. This is probably good strategy for Lithuania.

M: How many years would Lithuania need in order to sufficiently operate in automotive industry?

P: 3-5 years.

M: What do you think are the key factors that would lead from low to high skilled labour force?

P: It depends what kind of business are you establishing. For example, Romania was in the begging only a production plant, but now we have transferred a lot of development and services. The competency comes with the requirements. If you work in agriculture sector then you will be competent in agriculture. If you want to establish semi-conductor factory then you'll certain competence in that field and highly skilled people. China doesn't want to be a low-cost country; therefore, they are stopping imports of the certain goods. China is pushing people to design such products inside of the country by increasing specialist competences and skills.

Dr. Justinas Račkauskas interview

M: Do you know what is added value in industry? How to create added value income?

J: Not only in industry we create added value. On the other in automotive industry the biggest added value gives not the materialistic side, but the RND and intellectuality. That gives improvement added value. For example, if you take production for the country added value is very limited. It only adds as much as we use force labour so only salaries are left in that country from automotive industry. The bigger intellectual production you have, the bigger added value it gives. A very good example is us. Take added value that we create from production and production workers, which are not many who directly work directly with the product. It shows that we are not producing some simple plastic gadgets. We make products who have intellectual value and it shows that we need higher skilled specialists. Service team brings bigger added value to the country than the employees who work directly with the line. Of course, for example of our company employees, who creates logistics'

services, the only investment is computer but when you work for another country you bring bigger added value because need more people. For example, Hella will create logistic centre in Lithuania, but Romanians have taken IT and other things.

M: What do you think what position do we take in-between Germany and Lithuania as a supply chain participant? How do they see us?

J: I would say we are still perceived as a cheap manufacturing labour. We look like we are at the back, not many know us. Apart from Hella and Continental who work purely with automotive I think there were only two companies, Cargo Schmitz Bull and LittleFuse. We are not very well known. They know that there is Lithuania but they tend not to look to us as a specialist. In the market we are very small looking from the supply chain perspective. We are a small country, very hungry and we have a huge potential to grow fast if we will correctly control our resources, intellectual development and growth. Coming back to your question, from Germany perspective I think each time we look more and more as a competitor to them.

M: How do you think what do we need to change in order to improve our participation in the supply chain and increase added value?

J: I would say it is not a quick achievement. I think a very good direction would be improving teaching systems. We should direct and guide universities and colleges to prepare students for automotive industry. For example, currently colleges are preparing services specialists but for some reason they make them production line workers. If we would make the right steps, I think we would see the right results and we would have an intellectual work force. The government should be taking a part in this. For example, if they say that automotive industry is their priority then they should control it. Let's say we don't do RND but we need more factories in that case they need to designate finances and support students in related study fields. What we have now is that we have growth potential, opportunities are endless but we are lacking of specialists.

M: How do you think what social, economic or environmental factors affects supply chain development?

J: Well it is great that we have a sea port. It gives us possibilities but at the same time sea port gives a very small added attraction to make supply chain for export. Possibly it could be used only for import from other countries than Europe because if we do not want to work with Russia, we have to be fast for Germany, as you mentioned, and Europe. We are making the right steps in railway development but we definitely need an improvement. Lacking of railway transportation probably will always keep us away from big products. Because of certain causes we have different rails, therefore we are separated from the rest of the Europe. Therefore, we should give our attention not only for the internet but for the railway development too. It is the cheapest transportation options and also one of the most flexible as well. For example, ships are only convenient for the long-distanced transportation. It would not really make sense to use a ship from Klaipeda to Holland or Germany.

M: Well also mixing transportation. From the truck to the ship, then from ship to the trucks again and that would really increase costs.

J: What touches energetic resources we are still dependent. Many years ago, we probably made one of the biggest mistakes to not build an atomic plant and somebody else did it. The good side is that we took care of gas supplying and here we are quite safe. I think electric plans are promising something good, but it needs time to grow. About the automotive industry investments if you analyse the relationship between investments and the capital return for the government it brings way more profits than let's say the production of wooden pallets. If there is a government strategy, they are supporting financially those economical zones. Automotive is not excluded. All companies are getting similar capital return. Currently I am not able to say if this relationship should changed. Well

there is the thing let's say in medicine you have a quality but not the quantity, in automotive you have quantity and quality. In littlefuse we had an RND centre and there was a joint project between the selected companies. They had to make same products but just they could change only the lid. When you increase production amounts, your line is getting cheaper because you put the work load on it. They put the same sensor in different cars. In my experience there was an agreement between Bentley, Porsha, J1, Kajani and Panomera. The sensor itself with the housing were identical. Soft were slightly different but in production they used different lids and they got different products.

M: How do you think how technological flexibility affects supply chain in the country?

J: I think it should have a very positive affect. If you can be technologically flexible and adapt to dynamics. As we know in automotive is a competitive field and it doesn't let you to stay in one place. Probably product cycle life is up to 10 years. Of course, maybe in the cell phones it is shorter around 3 years but there are different requirements and different quantities.

M: How do you think how much production we have to produce in the country to step up from manufacturing to offering services in automotive industry?

J: I would say the advantage would be if you have a production maybe after 5-8 years pf production you could offer services of development, supply chain etc. Yes, maybe after 8 years without stopping the manufacturing. It means you could transfer your manufacturing experience and sell it to others. Now the biggest problem is that those who create our product distanced themselves from the manufacturing and think that they have lab not a manufactory.

M: What do you think are the key factors that would lead from low to high skilled labour force?

J: I think only through teaching system. Generations change. If we are too expensive to hand-produce wires it is the outcome of Lithuania's economy evolution. Same in teaching. If you start educating and improve their knowledge, you will start to see growing specialists' numbers. I think it will take around 20 years, because we generations need to change. You have to start from the early days, as early as from the kindergarten.

M: How do you think what factors influence the transformation from captive market to market?

J: I would say we need to create our development, our product. Agree what we could get, then there would appear sales function and then we would have a possibility to offer something.

M: What are the current Lithuania's weaknesses and what we could do to further develop automotive industry?

Develop railway transportation, improve teaching systems and there should appear government's influence.

Maxim Zakletskiy interview

MZ: Cancel the fixed costs. Because we we need to do the value add on. Certain investment, yes, and we cannot avoid it. And this goes one and one. This goes in hand with. Development of economy and what's going on around so if if the salary is growing, we have to take it, of course we will be thinking of the internal compensation measures such as increase the efficiency and balance out the merit increase every year or so. But sometimes you simply you're not able to compensate everything and then. The customer will not be interested in this and the only chance you will be reducing your gross margin, you will reducing your EBIT. And at the end of the day, the question is like why we do the business in that way, yes. This is applicable to any other country, by the way. It's not just Lithuania.

M: So I have several questions prepared for you. I think you are the right guy to give this comprehensive look on this one. I don't want for you to be a positive negative whatever it takes just be realistic.OK so I will move to the first question maybe then it sounds like this So what creates the

most added value in automotive business so you can do a let's say explicit explanation a short explanation whatever is comfortable for you.

MZ: I think when you speak about the value add in the automotive you should break it into the product because if you look on the complete supply chain yeah you start from design and development and then basically go into the supply chain which will be the front end with the purchasing and the suppliers then the plant and which is facturing and then you will have the outbound logistic which will connect your products with the customer and a long time ago maybe some 15 20 years ago it was very easy model all design and development has been on the side of the customer so basically this is so called bill to print a producer subcontractor contract manufacturing they were given everything so they were given drawings they were given the bill of material with a list of suppliers switch we have to use and then your task was to basically ensure that you will get parts on time and you will be building up your technology based on the drawings and the requirements which you get from the customer they will on time and you will be building up your technology based on the drawings and the requirements which you get from the customer they were also responsible for engineering change implementation and in most of the cases they also organized the transport which would bring the goods from your warehouse today warehouse because they were developing their supply chain and they found the synergies between countries between regions to optimize let's just stick posts with the time moves basically they start to realize that it's not optimal for them and the markets became more aggressive from the cost perspective because also the competition in the think about the passenger price dictation also grow and the demand which was generated by the customers by the consumers has been increased year on year and also the meaning of the car has changed so some 20 years ago it was still the tool which will bring you from A to B and it was treated like this but nowadays as you said there are so many requirements that they end customers is put into the card that it should be connecting to all your social networks and you know have a nice tablet laptop in front and then the whole society become lazy and it it wants to be a self driven or the automation driven so they changed and to do all these of course the customers started to look into their supply chain they were doing the proper value stream mapping and then at the end of the day the expectation completely changed so now the customers are looking to the partners who will do everything for them bottled water supplier which would in combination with of course customer because they still know what they would like to see as the final product in the car so they would like to designed and developed in collaboration and this is very recently used when your design and development seats at the customer site and together with at the customer site and together with customer engineers they designed the product together and then it is given to their subcontractor in our case or maybe some other company doesn't matter and then they are starting to build the concept from this by chain from the model by even the design and now as I said in the past that were given the so called guided materials topped what to use and now it's a competition because the big companies they have a huge vertical integration and they are producing the materials for themselves yes so if we will take for example this cable it's producers they will be producing most of the connectors and counter points by themselves in the other plans so they even have a target to cell minimum 50% of the bill of material from their own company to be used in this product yes OK and for the customer of course it's easy if you can deliver quality and secure all the tests of course for them it's nice and easy yeah because it will be still included into the sales price and if this is matching the project and the expectations and all the reliability tests and approvals passed the pub side no problem let's kidding they need less people yeah and by this the problem goes away to that supply and then of course the other important thing which has been done in the past most of the parts has been delivered in the batch we had the stocks I would say he has been equally split between the customer and the supplier and now the majority of the parties in the

automotive is going in the sequence so the customer is not willing to have a lot of stock in their shells because this is frozen money invented and it's strange basically a stop of two maximum three days at the customer side and the rest is at the supplier or in transit doesn't it and these drains additional pressure into invented cycles because you have to be in a certain range logistically to the customer location otherwise your open window of the orders will not allow you to deliver on time you're finished product to the customer location and you know by all these going through this you know value add in the automotive you need to be in the medium to low cost country you need to have the certain amount of the automation if you cannot be in the low cost country and but here we have a problem that some of the components some of the parts they have a return of investment time longer than the product lifecycle and by this and because most of these things they are designed to products nobody will spend this party because the customer will not compensate and then you cannot carry over this to the new family or new generation because most likely the design will be completely different and you cannot be sure that you will win still this business because the product lifecycle in the automotive it's from 6 to 10 years so maybe now starting racing between yeah you don't know how the cost and how your competitiveness will develop in six to 10 years of course you will try your best and you will introduce everything but at the end of the day you don't know where you're gonna be with your post and your levels maybe you will need to close the plant and maybe six to seven years because of the circumstances you don't know and then of course nobody is willing to take additional yeah so yeah you need to have a very flexible supply chain you need to have localized suppliers as much as you can and you need to have a very transparent lead system of enterprise resource planning so it should be absolutely flexible data driven and of course all your safety stocks inside they have to be adjust to the absolute minimum but not go beyond the risk last but not least for all of these you need to have skilled people yeah and this this is where we come to the biggest issue in in the automotive in general because the new generation of its it's not even the said people it's millennials they have absolutely difference view in life and how do they understand the life and by this all our classic concepts of the manufacturing are not working any longer so we are not able to manage them based on the models of the manufacturing that we get used to because they were developing in the 90s and the 2000 were still there all generation were able to teach the new generation in the same way and they were accepting this but now the world around is so changing with a lot of influencers who is telling how beautiful the life is if you don't work and you know this new generation they simply cope with this yeah they're watching this YouTube and the instagrams and the tick talks of this you know golden people who is not working and already have everything and discounts to the mindset on dope actually have this nice companies like IT and similarly industry where they have significantly better margins than automotive and this allows them to basically create 2 friendly environments with basically you got whatever you want yes and of course we in the automotive will try to be the best partner for the people who are working for us but we will not be able to give that much as the gifts yeah the orange juice the bar so I was still working on the veil being of our employees and they will be providing the knowledge that training promotions interesting work but it will be absolutely different range yeah what do you think about countries inputs here at least what we we spoke you know about the the changing situation in six to 10 years and then there is a country a stability of economic situation so as well as inflation and so on this has a lot of influence there as well

M: So what do you think about the government let's say role in this and development of added value?

MZ: the government needs to help companies to keep the people in the country uh because to pay people money it's not enough we need to have a partner in starting from finishing the government they need to make life of the people social life of the people in the highest standard because at the end of the day why people moving between the countries now it's easy because there is no borders

OK for me it's slightly more difficult but OK we're not talking about me people would not be willing to leave from the circles they get used to you know they love to speak the same language they loved to be in the company in the town seeing the parents seeing the relatives and do the things together but what is pushing then it's probably not even the salary because if you compare the ducks amounts across the Europe OK that when you has been recently increasing the tax but so if you look in Germany if you look in England Ireland they all go at about 50% of the tanks so the better payment will be you know pay but still people vote for these countries because they're the social environment is at the absolute the way higher level that here we meant this pace when you're getting older when you have your family when you have your kids and then you look around and you basically see that I gotta take care about my kid because I cannot get any kindergarten you need to enter the queue since the kid is born I cannot get the medical service or let's say a good medical service because I either need to wait six months yeah you can appoint you know I need to go private clinic and you know it's not compensated by the tax which I'm paying so I am paying the tax then yes and sometimes you even come to the appointment there is no specialist whom you need in the country so and this makes people scary because I mean we're growing and we're not getting killed here risk is increasing the other point which I could bring from basically the business should go hand in hand so if the company comes to the town and create the jobs and create the workplaces you got some support from the local authorities so now it's just that you're getting people you start paying them but if people cannot spend their money this is also good for nothing so if you don't have an opportunity to I don't know go shopping mall go fear the cinema restaurant to buy the things which you would like to have because now you have income the people would move anyways because they they have better life condition but they cannot spend it I mean they cannot fill it we all I mean we want to leave not opposite yeah and by this you know all this I would now put a little bit criticism on the 20th government if I'm allowed yes because they did a very nice first step they created the organization called investment mania which is taking care about the investors who are coming who are willing to come to the country and you have all the support yeah they will give you a business advisor they will help you to find the spot they will make a connection between you and the local authorities and the economic zones and they will help you to make the study between employment rate what is the level of education level available people logistics and you will get a report and then you could make a decision and then you can groundbreaking event you build up your plant you move production and then you start but here is the problem as long as you are in you still need support from the government because it should go hand in hand but out of my six years experience with the investors as long as you're in your forgotten you would be still you know they will pick up the phone from you but you will be training them as your mobile phone operator yeah customer service you know yeah it's like you have problems but we are very sorry we cannot do anything they will probably show that to you even that you are doing something but if we speak the result achievement orientation yeah maybe and this is very bad it's not unique the other European countries over less hope is the same but this needs to change because the business still have the chance to move away yeah it would be painful it will be harsh it will be very difficult for everyone but if we have the strong CEO who says it's enough and then yeah all the investments all the compensations which you've been paid and during the cooperation with this invested fine yeah it's good for nothing because people leaving and then again the unemployment rate will increase and so on and so forth and this is not good for the people about whom basically the government should take care first yeah good OK

M: then let's move for the other one but this is a really comprehensive outlook actually about investor especially because I see a little bit criticism out of my sight as well when you go to the site of there's you know you have really nice overview yeah we have highly skilled people education and so on and

so on but where is the the actual you know yeah where is the actual things which you do you gather the information So what is the progress I mean they they don't show data on C trans they don't say where they work what are the actual tasks they do except showing on the website you know that we have this so for me it was yeah a little bit strange out of the marketing side when you market the country how do you do this because I don't see anything

MZ: first of all not enough people not enough resources and if you keep fitting this will open the bond because at every new company which comes they would like to take the best and then they will increase the salaries per proposal and you know they would collapse the whole market here I have seen the cases in Russia back in 2005 2007 I have seen the case in um Czech Republic in 2010 2012 so you need to be very careful because at the end of the day when you try to put all the eggs into the one basket it has an opposite effect Miller and probably for the height developed countries in European Union such as Germany or Czech Republic it has an effect that the locals they're not even willing to apply for the lowest paid jobs yeah they say we would rather stay home but you know we're too high to take this kind of jobs because they have a lot of immigrants from the third countries they could manage yeah because you know the migration of the labor goes from the east to the West so the Czech people go to Germany because they could double their income then the place of the checks is replaced by the slovaks and the place of the slowest replaced by Ukrainian or Russian just follow the floorboards yeah the problem of Lithuania in this case we can also think of the way that OK lithuanians move for the better lives and these could be replaced also I've statuts by the people from the third country such as Ukraine Belorussia Russia whatsoever but here is the problem that the migration laws in the 20th the most unfriendly that I have ever seen in my 15 years travels around the European Union I know this yeah you know when you are Lithuanian you like being treated by other countries

M: well because we have a possibility you know to travel to a lot of countries with our passport but when the foreign guy comes we don't have any competence you know we don't have immigration problem we have immigration problems so everybody is taking care about how to lower down the immigration but nobody takes care about immigration which would be a little bit a partial solution to to immigration so yeah mixed feelings about this here

MZ: this will not help I mean even if you will bring all the twins back all those 2.8 million stay as it mania it's not enough for the amount of business that you are planning to have in that way yes just enough you will not be able I mean the problem will be that in every new business will come and increase the salaries then the others have to increase as well because otherwise they cannot get any people from the market and then it will be a point of no return when it will be a group of businesses which will come to see you even and then they will say what are we doing here and this happened to Romania a couple of years ago where basically the government has the same idea Romania has the huge immigration so lots of Romanians works and all the other European Union countries and then the government count with a fantastic idea let's increase minimum wage device keep people yes it kept people from but then they have the massive exodus of the business from Romania because with the new minimum wage immediately all the costs all the services all the salaries it went through the roof yeah and but the productivity of people it's not growing stays the same exactly and then you know the business says oh OK yeah and it's Romania was cheap and because of this we have lots of companies which operate there with minimum value at yeah where they have work labor intense production constantly end up in yeah because you you can't or in money with this new gauges and then the government was stretching the head and wonder you work with it wrong or we will make life good we will increase minimum wage almost twice so why people are unemployed but because you country is not the tractor for business any longer stupid not stupid but I wanted to say that all

decisions especially related to salary and development and the age they have to be pre discussed with the business community at least with the biggest industry players we have to be in the game we need to know what government is planning because if we don't and they do it will be painful for people to whom we should be taking care of both the government by primary and us because you know we help them earn the money and have a light yeah and then if there is no dialogue it's like you know we don't have a crystal ball to say like OK government what's your what's your next steps yes this would be my main message from here it should be a dialogue constant dialogue hello the levels starting from 2 what we can do together to have people well being in the community and second is with the government with eventive ministry like OK guys where we're going how do you see it because they run all this methodology on the minimum wage inflation GDP and so on and so forth so we need to talk to each other because we're in the same boat even the voice we will go out to some other country but you will stay very good

M: OK then we will move further because then we will discuss until the midnight. this one is gonna be more of a uh current situation about Lithuania and Germany as there are two continental and Heller moved four years ago the previous automotive companies which still remain in Lithuania the latest one was 20 years ago which was out of a different country you came here to do automotive business

MZ: as long as we're still working together I could say it's it's fine great good I mean definitely better than Lithuania has with China. I mean I could only speak from the weight of this Lithuanian German Chamber of Commerce which has the power of the speaking yeah in public and in the ministry this is I think one of the most powerful organizations they still continue I was not a part of them always topics was communicating but I think I will have the chance to get to know them and yeah we still have discussions if we will be treated as a German company with this new shareholders and apparently looks like we will be still like a German company OK but I have to say yeah they have workshops and sessions active position then recently minister of minister of economy was coming from Germany and they have some discussions so I have to say that yeah I mean if he's at least active in the live OK but nothing much I could commend more right so it's

M: OK then we will move further because yeah OK now this is more of a social factors maybe or economic factors what do you think is necessary to improve the added value development are we talking about the uh automotive industry or in general you can give both well

MZ: in general I think that would still need to go the way of uhm this high value at which would be everything connected to the brain strange word and some minimum capital investments so they the companies which would be able to operate from this or questions and shared offices and would not need to rent the office as such big connected to some premises where you need to invest so maximum value add with the lowest investment because the country is definitely turning into the medium post the vector would be to the high cost so as much as you could reduce the non value added cavities and this could be everything metal work insufficient estimation um one of the important things would be the outsourcing because sometimes you keep it in the house because you don't have a sufficient development companies who could give you a proposal for the outsourcing yeah the other thing for the automotive is if we speak now about the automotive I think that suppliers localization yeah this one of the topics logistically it depends if we will be target oriented to European customers which is located in the central Europe and. further we already not in the winning stage because of the distance and because we have only vehicle ticket here and to be honest with you everybody who is now praising the real political high I don't think that it will be a success story time will tell but this will not significantly increase the transit time and this is the key so if you would like to reduce your frozen inventory if you would like to reduce your stocks you have to speed up your supply chain to have no cycles and in the current model simply the environment is not supporting the location of Lithuania

against the other countries where potentially you have your customers and suppliers yes so suppliers you could localize so at least you will reduce the incoming branch but customers they will stay where they are right so they will not move here as I said the only thing that you can do is localize your suppliers to have enough options and follow the motive places where the painful because we do quite a lot of expectations from the requirements from there was and yeah it's not always successful business case for this Tories would like to come I have really the same the same actually approach of course railroad would be good if we would have really high quantities to transport then OK the time might be not so fast but at least it will get cheaper by the time but I'm not really sure yeah because the rail transport is always more expensive than the truck always but and in the beginning maybe to attract the customers they have to dump the prices or to offer really good things but I mean is not enough you need to build an infrastructure around rail but yes just to put rails and build the station is not enough you would need to turn your logistics into the more favorite way to support the rail because now really have a good rail terminals no you still need to know to hire A truck go from your side through all the paid roads not paved roads the roads are most likely will not be you know comfortable for truck to drive here maybe even some you know a restrictions to go with the truck and then until you get there until you will have this loading of from the track to the rail it it's getting even more costly I mean this will happen best case in maybe 6-7 years from now and the question is do we really have seven years yeah OK yeah same faults OK going further

M: how do you think the flexibility in technology influence the development of the participation in the supply chains

MZ: yeah obviously it's positive if you are you can absorb the technologies if you can really quickly adapt to the to the needs but in case of Lithuania and our technology base ground and I am trying to understand here actually our standpoint because from one side we will look like at technology flexible because for example programming IT services and so on they are actually quite on a high level other than that I really doubt this guy is a don't really care to whom to do the code to whom to make the call center so yeah I hear it's fine but for the others I would say you need to listen to your customer that's it so if you are able to print you need to follow what the market is offering and what the customers are looking for and it's not only today but it's also for tomorrow in the automotive you know everything now moves into this carbon footprint reduction and it goes into the autonomous driving and all the efforts to get rid of the diesel cars and then the petrol price and remain with first hybrids and then fold electric at least this is the road map which has been announced by the mainly apps right and then of course the governments are also supporting for example like in in the commercial vehicles transparent they look into the two direction, direction number one they were trying to make a truck electric by you know putting the same via like a trolley bus state have been really doing this the other idea was to make the top truck trains like in the US and Australia where basically the driver is only in the first tool truck and then other is on simply connected through either heart connection or through all this you know wireless and Bluetooth technologies but the problem is that the European road infrastructure is not ready for this it was not considered to be a truck train compatible so again we're coming back into this collaboration with the customers from the design and development point and if we're active if we're listening to them also the customers they you know you could clearly see that the amount of the models or the car lines from the OEM's is is shrinking because in the past if you will take me serious yeah so eight last big glossy glass yes my book has a separate gene and then of course they have this sprinter craft story this is also so sprinter then it was Vito viano and vans and they simply see that they are not able to diversify so many models to be successful in the market in the past you know you have to be in Asian every niche to be successful now with Mercedes did one of the most important things they started to focus on the young generation

because they see the sales in the past I remember 20 years ago you said it was the car for the retirement of rich people yeah so now they are trying for this new level of technology and new models to attract the young generation and also put them into this needle of the investment to buy overpriced a or big ones the other let's say optimization which they did yeah they start to see that maybe the luxury is not that much needed in general and they remove the my book has separate product line so now my bill is only an option with the S class so it is and in general you know I don't know how this developed now but 20 years ago people were trying to run away from the towns and live in the countryside or a little bit outside and this were creating the need to buy the cars yes so each and every family has minimum two better three different colors for the different reasons no it's an option so the young generation would like to live in the downtown because they do have everything there and basically they value their time they don't want to waste it and commuting and in all this European modern capitals and the big towns the public transport and the social network is so developed that you don't actually need the car and this is reducing the demand or let's say this is converting the demands of what the customers needs to do in order to still be effective in achieving their gross margins exactly and further I will have the key here is up girls who steps beyond your customer and try to predict what would they like to have or sometimes even come and ask the question sometimes good sometimes positive but uhm in most of the cases even people don't recognize that this is helpful So what do we expect people still Live Today for today there is not that many companies which has a reasonable a road map to the future or past to the future I do understand though that in the current circumstances it is very difficult to do some kind of the planning because you see call it then word now covered in China again so of course this reduce your long term planning and make it a little bit of the smallest icles and here the success is it you still need to have your vision and the long term goal but then your strategy should be choked into the small pieces and all of them should be so flexible that you can build up the labor puzzle still within the reasonable time in order to navigate not that fast but still get to go yes and the company which will have the maximum flexibility bring over no I don't remember universe create because I have to can't help it behind themselves from the I'm sure you don't know how far they've gone help driving demand my father transmission of one man truth isn't the whole truth it's complicated

M: Nevertheless let let's go further uh this one is how many to do actually we have two main questions maybe 3 so um I will go through the ones which we which I really matter one will be really fast so uh what do you think are the key factors that lead low medium skilled labor force to become highly skilled or labor force?

MZ: willingness, willingness to learn or yes I mean it's all about the people you cannot well you could you could be lead by example yes you could be a great coach you could be an influence but at the end of the day that's his fucking life yes he needs to wish it yes if there is no wish of course we can talk about the different motivation models how to make him wish but still it is ultimately depends on the people mindset and here by the way government also played the role because the government is influencing the peoples minds and through the social media and TV yes they have to help they have to create the environment which would make people interesting in increasing their value at because I mean that that's the problem of the health of the population you know this thing if you can't get what you want try to want what you get yeah and it's a lot of people who is basically telling me how great they live but when I started and they earn it off yeah it's enough for my needs but when you start to ask him what's where you needs are the level and at the end of the day the discussion goes I cannot change anything it's you I mean this is the biggest bottleneck and the biggest block it's point it's you I mean here is the problem and especially if we speak about the 20 and mentality even if at the company level we will be the best ever influencers and we will tell people to consider and change the

mindset and through this way and that way it will come back to the family and families that don't and they will be listening to the family because of national future and this is the problem so it's too late to change for the others because they become the older generation yes and the cycle goes on through history I mean there was Aristotle I think or I don't remember who was the philosopher but I II got really good thing in his writings you know he was complaining about the new generation you know like our mentality and how our parents raised us completely contradicts and then they were blocking you know this new generation and their ideas basically to remain on the same pathway which they were treated before they didn't want to change the green days so basically the progress is always you know this oldest oldest generation they didn't they shouldn't even care actually they have to end their days and happily some way you know sometimes I mean everybody has different motivation but The thing is when you reach your first level you need to go to the next levels you cannot and this is how the mindset is converting right and there is a moment of time when it's not only euros which matters yes then you suddenly realize

M: OK two more questions I will give you 1 certain which shouldn't be long so let's see along what weaknesses Lithuanian mark and has to develop supply chain further

MZ: you need to think about the unique value proposition out of the country because you will not be able to develop everything equally it's not enough time not enough effort and not enough investment you need to find something which would be this really unique value proposition which foods list the training on the next level comparing to the other countries

M: and then the other one is uh yeah we are now so called captive market players as this fly chain so basically if the company opens up the plant in the other company it's free control enterprise and then according to what kind of relationship you have then it's here are he captive

MZ: I'd like to ask you a question first is there really a need to eliminate the captain no it's not that there is a need but out of the income and out of progress which countries make mostly when you are captive then you gather the experience you get the added value from what origin company will provide you also competence salaries for the persons they have some things there and if you are a market player then you have to invest in R&D you have to invest in some other things which brings you a little bit more of a progress so it's let's say improving the other social aspects I would say in the automotive industry in this globalization there is no way OK because you could you could become a Tier 2 for Tier 1 well you could become a tier 3 to Tier 2 and this is where the local business should be focusing to because if you would like to declare yourself as the new player tier one and started to deliver it to the OEM's they will not listen to you in the first five years yes whatever yes and you you really have to understand that it's nothing wrong with you it's just the business model and it crossed the risks and the other marker economical factors if you are a small local supplier you won't be respected but you will never win the quote yes I mean there is nothing wrong because in this global market there is an issue for everyone if great should have ambitions but you know it's better to have it's better to be an excellent Tier 2 supplier and have your customers that you will be shitty to let's say 0 tier one with a lot of foundations but basically nothing to provide no I mean you will lose all your starting capital or you will spend all the investors money and trying to position yourself and then you will sail especially the automotive you have more chances if you start doesn't Tier 2 you will establish yourself you will get your first customers this will help you to understand your value your mission your vision understand where the wind blows how it market is developing and then maybe is the second step you would get not only some Tier 1 customers but you will have a chance to open the door to the OEM's just automotive this is very small company like company yeah and everybody is talking to each other so for example before BMW goal and ask for the bid from there I don't know companies there will be calling wolkswagen now and say hey guys what do you have collaboration

with this dude yeah what do you think about and they will tell all the truth and then basically the top players will already have all the information all the cards and they will be able to play it's not in the favor of this new guy who is trying to open the door to be a supplier like I said yeah the successful strategy here would be like you better establish yourself as the service provider or tear tool right from the small you know again thinking of the unique value proposition for example show we don't want to claim that rate ourselves we would outsource this and then a company which have some free money so cash they would say OK we could be a supplier for calico will be cleaning and washing the trays then you have your unique value proposition of course before you go you look around going to do need to clean your boxes and the kilties little kids run do you need to clean anything because we will be anyway establishing the cleaning company so yeah if you need to I don't know laundry the garments or I don't know clean some other shit we can do it for you so we can outsource so these kind of things so how do you know

M: I don't blame the why I ask this question most likely because when Lithuania has really a certain amount of people and resources so if you give people too mold plastic you will not have people to build electronics so as now we are growing in automotive industry as a country so a pathway not to be you know stuck because what theory shows in the supply chain countries if you provide some kind of manufacturing value proposition right so then it will be 10-20 years stuck on this one so if you want to shape it in a different direction you have to shape it from the beginning so this was more or less where I was I know

MZ: I am realistic to this question I mean again you should be seeking for the things which is needed when your internal customers and by the international customers but like make realistic plans