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Challenges of Supply Chain Management in Brazil

Case: Company X

LAHTI UNIVERSITY OF APPLIED SCIENCES LTD
Faculty of Business and Hospitality Management
Degree Programme in International Business
Bachelor's Thesis
Autumn 2017
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Bachelor's Thesis in International Business, 73 pages, 1 page of appendices

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ABSTRACT

Nowadays, supply chain management (SCM) is essential for businesses due to high complexity of supplies, production and distribution. It enables companies to organize their processes and eliminate wastages making them efficient. It optimizes resources – money, material and information flows – to cut costs because, typically logistics costs account about 20-30% of car manufactures' expenses. There are many researches, books, strategies and concepts related to SCM because this truly can change a whole company's performance.

The objective of the thesis is to examine the challenges of SCM that companies of automotive industry face in Brazil. The study was handled under inductive research approach and qualitative methodologies were used. The secondary data was extracted from reliable and up-to-date written and electronic sources. The primary data was collected from semi-structured interviews with five employees of Company X. The gathered information was analyzed what allowed to make conclusions based on both types of data.

The results of the research show that companies operating in Brazil have many challenges related to logistics and supply chain management. Overall conditions for supply chain processes are rather complicated, especially in comparison with European and North American markets. Main external challenges are poor infrastructure, prevalence of road transportation, economic and political instability. They cannot be fully avoided. Therefore, there is a need for companies to adapt and develop their risk management. Main internal challenges that companies have are related to cultural aspects that lead to stressed environment and poor communication, need for technology and qualified labor. There are many other challenges that companies should work on to improve their operations and succeed.

Key words: automotive industry, Brazil, car industry, challenges, logistics, supply chain management

CONTENTS

1 INTRODUCTION

This chapter includes basic information about the thesis work. Firstly, it tells about the research background and why the author has chosen this topic. Furthermore, it introduces thesis objectives, research questions and limitations to the reader and the theoretical framework after that. Moreover, the chapter explains research methodology and data collection followed by thesis structure.

1.1 Research Background

In each country annually, companies spend a large amount of money on logistical activities. They have a big impact on countries and their societies. For example, 8,5 percent of whole GDP of USA for 2011 or US $1.28 trillion were accounted for logistics operations. Similar situation with European Union's GDP in 2008: 7,2 percent or €850 billion were spent on logistics. (Grant, Trautrims & Wong 2015, 10.) Therefore, efficient logistics is essential for businesses.

The origins of logistics come from military nature. The discipline arose to guarantee the correct supply of troops with food, fuel, and ammunition. Logistics was applied only in a military content until the end of Second World War. (Ghiani, Laporte & Musmanno 2013, 1.) Nowadays, logistics is the management of all activities like planning, implementation and control regarding movement and storage of goods, services and information between the point of origin and the end user. It is positioning of resources at the right time and cost, in the right quantity and place. (Farahani, Rezapour & Kardar 2011, 11.)

Globalization and strong competition have led companies to search for more efficient logistics. From 1980s, logistics moved from "operation-oriented" towards "strategy-oriented" becoming "supply chain management" (SCM). Nowadays SCM plays an important role in the decision-making process of the companies and many businesses decide to have a supply chain, instead of traditional logistics. SCM includes all the

mentioned above activities of logistics plus it searches for alliance and cooperation between organizations where risks and rewards are shared between participants. (Morana 2013, 1-2.)

Therefore, SCM describes the management of the flow of materials, funds, and information across the entire supply chain, starting from suppliers and going to component producers to final assemblers to distributors and to the end consumer. Often it includes after-sales service, returns and recycling. Actions of one member of the chain influence the profitability of the others which leads to thinking of competing not against individual companies, but against other supply chains. (Farooqui 2010, 13.)

It was decided to make research about SCM in Brazil as the author of the thesis had an exchange semester at the Federal University of Ouro Preto. Brazil is very different from European countries. It relates to culture, people, life style and affects business as well. This thesis aims to understand better and explore the country, people and business life as it is something new to the author. Below are some facts about Brazil and its current situation.

The Federative Republic of Brazil is the biggest country in South America and the world's fifth largest country by population and geographical area: 190 million people and 8,5 million sq.km respectively (Philander 2012, 148-149). It is one of the emerging countries and last decades brought certain improvements to the country. The economic and social progress between 2003 and 2014 let 29 million people to go out of poverty and inequality decreased significantly. The poorest 40% of the population got increase in their income level by 7,1%. (The World Bank 2017.)

However, the rate reduction of poverty has stagnated since 2015 due to a deep recession the country has. The fall in commodity prices and inability to make the necessary policy adjustments as well as the political crisis in the country jeopardized the confidence of investors and consumers and brought the economic crisis and decline in annual growth. Currently, one of the essential challenges is to increase productivity and competitiveness

in the country that would bring growth in the future. Therefore, the future of the whole country depends on how well adjustments and reforms will be done to boost the economy. (The World Bank 2017.)

In Brazil, production growth is threatened by lack of infrastructure related to transportation system. The process of its modernization has started in 1970 when the country experienced economic growth. (Crocitti & Vallance 2012, 395-397.) The aim was to connect regions in Brazil and to build proper roads across the country. But in the result many constructions were left behind and still unfinished. Now, according to National Confederation of Transportation, 69% of roads are in bad conditions. (Novais 2012.)

The aim of this research is to analyze the current situation of SCM in Brazil in the automotive industry. Although many problems exist due to economic and infrastructure situation in the country as quality of roads and amount of investments, there are many other challenges affecting the supply chain of businesses. The Case Company X, described in this research, is a large automobile manufacturer and started its production at the turn of the 19th and 20th centuries. The company came to Brazilian market in 1970-s and has a lot of experience in this country. (Company X 2009.) Therefore, it was decided that the company is a great case for this research, to analyze SCM and future trends in Brazil.

1.2 Thesis Objectives, Research Questions and Limitations

The main objective of the thesis is to analyze SCM in the automotive industry in Brazil and at the case company and to see on that example the whole situation of SCM in the country. The thesis aims to evaluate SCM in Brazil with its advantages and disadvantages, to determine the key elements an effective supply chain should have and to see the future trends. Moreover, the thesis gives an overview on the automotive industry in the country and its features. The case study aims to gain opinions from the Case Company X concerning their operations, SCM in Brazil and its automotive industry to have deep insight about the supply chains in the country.

A research question is important for the planning and writing process of the thesis. It helps to clearly determine the research topic and problem in order to reach the objective of the thesis. The research question in this thesis is:

- *What are the challenges of supply chain management in the automotive industry in Brazil?*

To fully answer the research question, sub-questions are needed. They help develop the topic and understand it deeper. In this work, the sub-questions are:

- *What are the key elements of an efficient SCM?*
- *What are the characteristics and future trends of SCM in the country?*
- *What are the features of the industry in Brazil?*
- *What are the internal challenges the case company face?*

This research has certain limitations. Firstly, it is limited to the country as the object of the work is Brazil. Secondly, it talks about the supply chain management through the eyes of the case company operating in automotive industry. Next limitation is related to the company itself, as other companies in Brazil could have different experiences. Moreover, the researcher is not a native speaker of the English language as well as the people interviewed, therefore there is a risk of miscommunication. The result of interviews also content subjective opinions of the interviewees and may not apply to all cases.

1.3 Theoretical Framework

As was mentioned, the aim of the thesis is to analyze SCM in Brazil in automotive industry and come up with the main challenges. For this purpose, overview of SCM concept and situation in Brazil are presented. Chapter 2 focuses on the concept of SCM. It tells about SCM on the global level with its advantages, challenges, different types, and future trends.

Chapter 3 contains information about Brazil. It is important for this research to understand not only economic aspects about the country, but cultural aspects as well. It plays an important role in the development of the country and businesses. Therefore, the chapter contains information about culture in Brazil, economic and political situation and overview of the country. Of course, main attention is given to logistics and SCM and the automotive industry.

Chapter 4 has information about Case Company X and its operations. Altogether, Chapter 2 brings the theoretical background to this work. Chapter 3, 4, 5 and 6 make the empirical part of the research. All the gathered information is used to give recommendations to the country, industry and Case Company X.

1.4 Research Methodology and Data Collection

After the thesis objectives, the research questions and limitations are defined, as well as theoretical framework, next step is to explain research approach, research methodology and data collection methods. Figure 1 shows the previously mentioned elements.

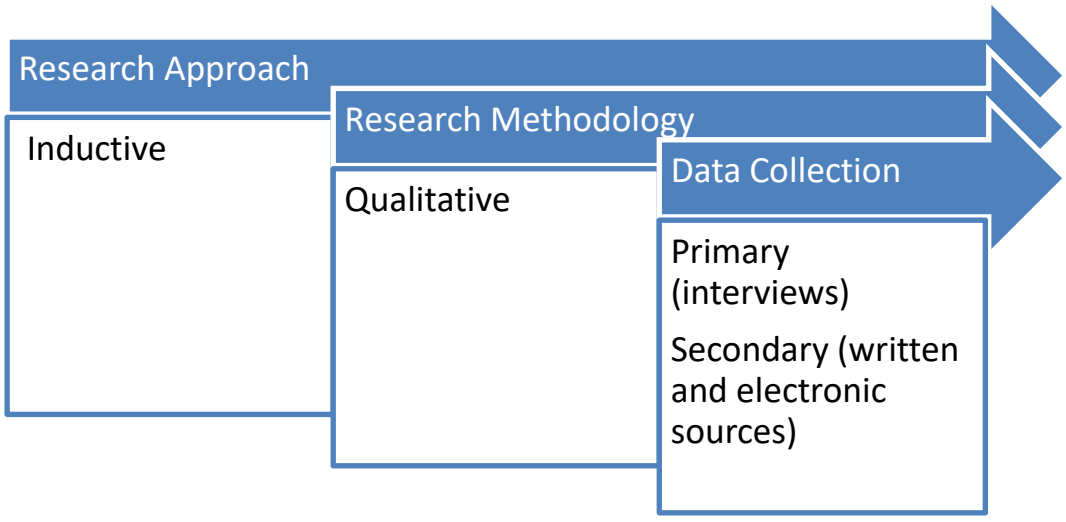

FIGURE 1. Research approach, methodology and data collection

Deduction method tests and develops the theory. It starts with the hypothesis and, during the research, information is gathered in order to support or refute the theory. On the other hand, inductive method starts

with gathering data and then coming up with conclusions. (Saunders, Lewis & Thornhill 2009, 124-6.) Considering the topic and the objective of the thesis, inductive research method was chosen.

Next is the research methodology. Quantitative method involves analyzing numeric data and commonly gathered by questionnaires and includes graphs and statistics. In contrast, qualitative method uses non-numerical data and commonly obtain by interviews. It allows to research deeply the question, especially when where is a very specific question and company, as in case of this thesis. (Saunders, et al. 2009, 151.) Thus, qualitative data is more suitable for this study.

The research contains both ways of data collection: primary and secondary. Primary data is collected with personal interviews of workers at Company X to obtain the information about the operations of the company. The secondary data involves written sources such as published books and electronic sources such as as articles and statistics.

1.5 Thesis Structure

FIGURE 2. Thesis structure

Figure 2 above shows the structure of the thesis. It starts with the introduction part that tells the reader about the topic of the research, background, methodology, and structure of work. After the introduction, the thesis is divided into theoretical and empirical parts. Chapter 2 will tell the theory behind this research, specifically about the concept of SCM.

Chapters 3-6 contain the empirical part. Chapter 3 describes the case country and Chapter 4 discusses the case company. Furthermore, Chapter 5 includes the empirical research and data analysis. In Chapter 6 the data is analyzed and reworked into recommendations. Chapter 7 contains conclusions about the work and answers the research question and gives suggestions for further research. Summary is the last part of the thesis.

2 SUPPLY CHAIN MANAGEMENT

This chapter will discuss the concept of SCM on a global level. It starts with definitions commonly used and shows the concept from all sides. Further, different types and structures of a supply chain are described as well as rules and strategies needed to set up an effective supply chain. Also, main challenges they face are defined. Latest and future trends and some facts about the automotive industry close the chapter.

2.1 SCM Concept

SCM is a wide concept and to have a clear understanding about it, some subchapters are needed. First subchapter presents different views on the concept through definitions given by independent people or organizations. Moreover, the structure of a supply chain is presented including the flows it has. The last part explains key elements each supply chain should have in order to be efficient.

2.1.1 Definition

There are many ways to describe SCM. Lowe (2002, 236) in “Dictionary of Transport and Logistics” gives this definition to SCM:

> *Supply chain management is the organization of the overall business processes to enable the profitable transformation of raw materials or products into finished goods and their timely distribution to meet customer demand.*

According to this definition, SCM organizes processes in the company in order to produce and distribute its products cost-effectively. It is a very basic explanation and many people would agree with it. However, next definition made by Jespersen and Larsen (2005, 12) shows a different part of the process:

> *SCM is the management of relations and integrated business processes across the supply chain that produce products, services and information that add value for the end customer.*

The definition stresses the important role of the relations and integrated business processes between companies because SCM is a collaboration between organizations and the aim is not only to supply products, but to bring the highest efficiency and improve operations of all members in a supply chain. Another definition made by CSCMP (Council of Supply Chain Management Professionals 2017) provides a full picture of SCM:

> *Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies.*

According to this definition, SCM is much more complex and involves not only the transportation of supplies and commodities, but also planning and collaboration between members. It meets supply and demand management across a supply chain.

Nowadays it is widely recognized that SCM has become a matter of strategic importance for firms. With high competition and globalization, it optimizes processes, reduces the cycles of production and delivery, and helps organizations adapt to market changes. Moreover, SCM goes along many innovations – organizational and technological, that brings many advantages to companies. (Morana 2013.) Supply chain management became important for organizations as a strategic concept. It affects long-term performance and competitive position of companies and brings

fundamentally inter-organizational orientation. (Koster & Delfmann 2005, 1.)

2.1.2 Structure

In Figure 3 below, there is a representation of the supply chain where each link can connect to several others. It can be seen as a number of processes that extend across organizational boundaries. The “inside” operational processes must coordinate with other parts of a chain.

“Buy side” on the left is a material or upstream flow, when “sell side” is on the right and it is downstream flow. If the system works correctly, only the end consumer on the extreme right to the chain is able to place the order and then the system takes over and starts the production. (Harrison & Hoek 2008, 9.)

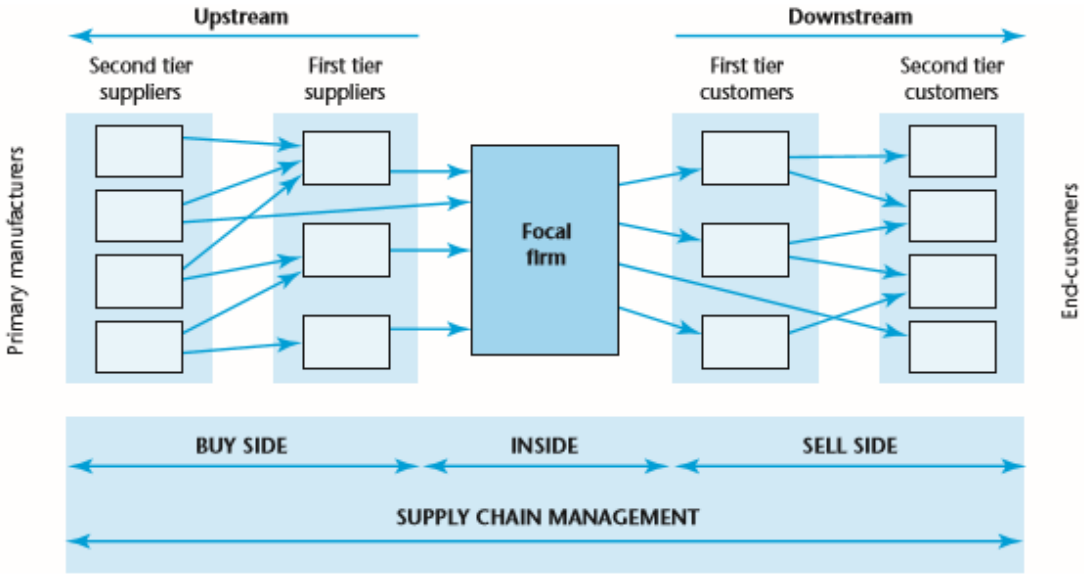

FIGURE 3. SCM Flows (Harrison & Hoek 2008, 9)

Moreover, we can organize supply and demand sides into groups of partners. Then the assembler is in the middle, as the focal firm in Figure 3. For example, if we choose a car plant as the focal firm, buy side involves Tier 1 suppliers of major parts and subassemblies which deliver directly to the plant. Tier 2 suppliers deliver to Tier 1 suppliers and so on. On the sell

side, the plant's supplies to the national sales companies as Tier 1 customers, who supply to main dealers as Tier 2, etc. (Harrison & Hoek 2008, 9.)

There are three flows going through the whole network. Materials, information and money flows are very important in a supply chain; looking at them allows companies to see value in creating partnerships and working together to achieve best results. All of them are equally essential for SCM and a failure of one of them means a failure for all. None of these three resources exists in isolation as they always work together. (Plenert 2006, 8).

The material flow goes from the left side starting with very first suppliers right through the focal company to the end users. The aim within a supply chain is to keep materials flowing from the left to the right. Parts are moved through the supply chain as quickly as possible and in order not to build up the inventory, everything must be arranged so parts move in coordination. (Harrison & Hoek 2008, 12.)

Information flows involves demands of end users. By sharing this demand information across the supply chain, it creates a demand chain. Material flows responds exactly to this information and the process of production starts its work due to information technology that enables the rapid sharing of demand and supply data. The aim is to integrate demand and supply data so that the accurate picture is obtained about the markets, the nature of business process, and end customers. (Harrison & Hoek 2008, 14.)

Money or financial flow goes in direction opposite to material flow: from the end customer to raw material suppliers. Consumers are the only source for this flow. This single source led to a concept of "single entity" view of a supply chain. Therefore, sharing and distribution of financial flow fairly across a whole supply chain bond all the members and improves their alignment. This is essential for supply chain collaboration and integration. (Lu 2011, 11.)

2.1.3 Key Elements

There are certain key elements that each supply chain should have in order to be successful and efficient. In many cases global supply chains have strategies which bring them that efficiency, there are listed several of them in the second sub-chapter. However, all effective supply chains have some characteristic in common, for example, they pay attention to communication and improving their operations, working together and overcoming challenges. Here are listed and explained several key components.

Communication

Communication is critical in SCM, although it is one sectors that needs improvement. Many professionals admit that it is difficult to communicate with employees from other departments. When there is a need to cooperate with people outside of the company like suppliers, it is getting even more difficult. With good communication between members of a supply chain, there are more ideas, that improves the process and it gets better managed as well as it decreases challenges and conflicts. (Oxford College of Procurement & Supply 2017.)

Collaboration

Collaboration is a significant element of supply chain management. Collaborative practices in supply chains allows their members to work together on planning and implementing the operations. Increased collaboration between members of a supply chain leads to improved performance. Moreover, organizations can increase their reactivity to the competitive market through collaboration. (Botta-Genoulaz et al. 2010,1.)

Optimization

As it was said before, each supply chain has movement of three main resources: materials, money, and information. The effectiveness of a supply chain depends on how it manages these movement steps. Many supply chains require the optimization of the resources in order to be

competitive. It allows companies to have best functioning of manufacturing and distribution processes in a supply chain. (Plenert 2006, 4.)

Integration

Empirical research has shown that the structure of processes inside and between organization is a foundation to create superior and unique supply chain performance. SCM in order to be successful requires integration of business processes with main members of a supply chain. In case if a supply chain is not integrated, properly managed and streamlined, significant resources are wasted. (Farooqui 2010, 8.)

Flexibility

Nowadays for companies is necessary to have an ability to design and later implement responsive and flexible supply chains in order to enlarge their value in dynamic markets (Gattorna 2003, 25). Flexible supply chais are able to react to surprises that impossible to avoid in the market like demand fluctuations, capacity, human, and material resources changes. Even supply chains with the best designs can be disrupted by those changes that is why flexibility brings supply chains to the next level. (Sabri & Shaikh 2010, 4.)

Risk Management

To date, risk management become a critical element of an efficient supply chain. There are many challenges that companies face, several of them are listed in sub-chapter 2.3. Man-made and natural catastrophes seem to be progressively common, therefore all world's leading corporations have risk management aligned to their strategies. There are many ways to increase efficiency of a supply chain, but supply chains are vulnerable and without risk management they easily can failure. (Manners-Bell 2014, 1.)

2.1.4 Push vs Pull Models

Push model is very traditional supply chain model and has existed for decades. In this kind of model, the raw material suppliers are at the end of the supply chain. There is a connection between them and manufactures, to distributors, to retailers and the end customers. Even though consumers are the source of profit, they are only a part of the supply chain equation in this model and suppliers, manufactures, marketers, and distributors have most of the power. Companies decide how much of what to produce and then use promotions to sell their products. Therefore, they literally push commodities to customers. (Farooqui 2010, 25.)

Most organizations use the forecast approach in a push system. They do it to feel confident that the commodities they order will find buyers and not run out too soon. Therefore, the decision points appear at every reader when companies need to decide how much and how often to purchase. The problem of this model is that it is based on the forecasts which quite often are wrong as it is impossible to predict everything correctly. In many cases actual demand is different to the forecast and looks more like a guess. Wrong forecasts bring excess money investments and smaller profits. Moreover, problems like high carrying and inventory costs, shortages, lost sales, weakened consumer loyalty, rescheduled production and discounting. (Pittman 2015.)

Nowadays many companies are moving from traditional push model to a customer-driven pull business model. New business model is less product-centric and focuses on the individual consumer that was possible due to eCommerce’s capabilities to empower customers. In the pull model clients use electronic connections to pull whatever products they need out of the system. E-commerce can create a more efficient supply chain with benefits both to manufactures and clients. (Farooqui 2010, 25.)

Pull model uses demand data to manage production as well as supply. It is driven by actual consumption at the store and with forecasts. This gives much more accurate data to predict demand. One of the ways to use this

model in a supply chain with expensive objects is establishing a reorder point where if one item is sold, you should order a new one. For other cases it is more effective to use a min/max inventory ordering method with DOS (disk operating system). (Pittman 2015.)

The choice between the push and pull methods is often situational. Some industries are more successful with push SC and some with pull SC. Nowadays most of firms have a mix of both models, especially ones using an ATO (Assemble To Order) strategy. They use both methods: to produce the standardized components – push method, and pull method to satisfy the consumer's request for a specific combination of the components. (Krajewski, Ritzman and Malhorta 2013, 300.)

2.2 Strategies to Increase Efficiency

This chapter contains information about some strategies to improve a supply chain and make it more efficient. It will help the reader become familiar with concepts of SC optimization, SC integration, SCOR Framework, Lean SCM, and Green Supply Chain as the most common strategies many companies implement.

2.2.1 SC Optimization

Supply chain optimization is the utilization of processes and tools to ensure the high quality of manufacturing and distribution supply chain. This involves the optimal location of inventory within the supply chain, cutting down operating costs including costs for manufacturing, transportation and distribution. (Farooqui 2010, 273.)

Typically, supply chain managers are trying to increase the profitability of operations in their manufacturing and distribution processes though minimizing total operating costs, maximizing profit of products distributed or maximizing ROI (return on inventory) invested. SC optimization's objective is to solve a general supply chain problem of delivering goods to consumers at the lowest costs and highest profit. Therefore, it can be

applied to any industry distributing or manufacturing products. (Farooqui 2010, 273.)

In most of the cases a supply chain can be optimized in order to spend as little as possible on delivery and manufacturing costs. There are many ways to do so. Marion (2016) suggests few steps, described below, which companies could do to optimize their supply chains.

1. Tier 2 Supplier Management

   Many businesses pay close attention to their Tier 1 suppliers. But what about Tier 2 suppliers who are responsible to deliver raw materials, components and services to Tier 1 suppliers? A focal company should be aware of all the members of a supply chain and understand how products are supplied. Negotiation with a Tier 2 supplier might lower prices or lead times.

2. Supplier Inventory Management

   If a company does not share demand information with its suppliers, there is a risk no caring enough inventory or caring too much. Both cases it costs a lot. Better way to manage it is to share demand information and let suppliers do their own demand planning that allows them to have better inventory management as well.

3. Inventory Control

   Every company should have a goal 100% inventory accuracy and the only way to accomplish it is to conduct regular and systematic counts and physical inventories. Without this inventory accuracy, companies are buying components they have or may not have needed amount of a product to ship to clients. (Marion 2016.)

These are three steps each company can make to improve their operations. There is much more about supply chain optimization and it was just a few simple examples to show how a supply chain can reduce costs and get efficient.

2.2.2 SC Integration

An integrated supply chain can be defined as an alliance of suppliers and customers who work together to optimize their collective performance, using management techniques, the creation, distribution, and support of a product. Participants are like divisions of a large corporation with vertical integration, although in a supply chain independent companies are bound together only by shared goals, trust, and contracts arranged voluntarily. (Committee on Supply Chain Integration & et.al. 2000, 27.)

Supply chain integration encourages partners to become more established members of the network and assure a sense of belonging to the supply chain. In the integrated supply chain, it becomes easier to build trust among the members. In its turn, trust promotes decision delegation and collaboration, and reduces “second guessing” and irrational behavior among partners. The aim of integration is not just to resolve exciting conflicts, but recognize and avoid potential disagreements. (Jespersen & Larsen 2005, 27-8.)

A survey research was conducted by Frohlich and Westbrook (2001) for companies working with metal products, equipment and machinery. The research measured eight variables of integration as follows:

- Access to planning systems
- Sharing production plans
- Joint EDI (electronic data interchange) networks
- Knowledge of inventory levels
- Packaging customization
- Delivery frequencies
- Common logistical equipment
- Common use of third party logistic

The research showed that improved integration leads to improved performance for the supply chain as a whole. The broadest integration strategies brought the highest rates of significant performance

improvements. Broader supply chain integration reduces uncertainty of material flow though the supply network and it improves efficiency and reduces production time. (Harrison & Hoek 2008, 235.)

2.2.3 SCOR Model

Supply Chain Operations Reference (SCOR) model is far the best-known and most detailed performance metrics, which was created in 1995. The SCOR model is aligned with an organization's operational strategy, work, material, and information flows. It provides an approach that became an industry-standard to analyze, design, and implement changes to improve performance throughout five processes: plan, source, make, deliver, and return. (Blanchard 2010, 35.) These five processes are presented in the Figure 4 made by Bolstorff and Rosenbaum (2007, 2) and below are explanations of what is included in each of the phases according to the authors.

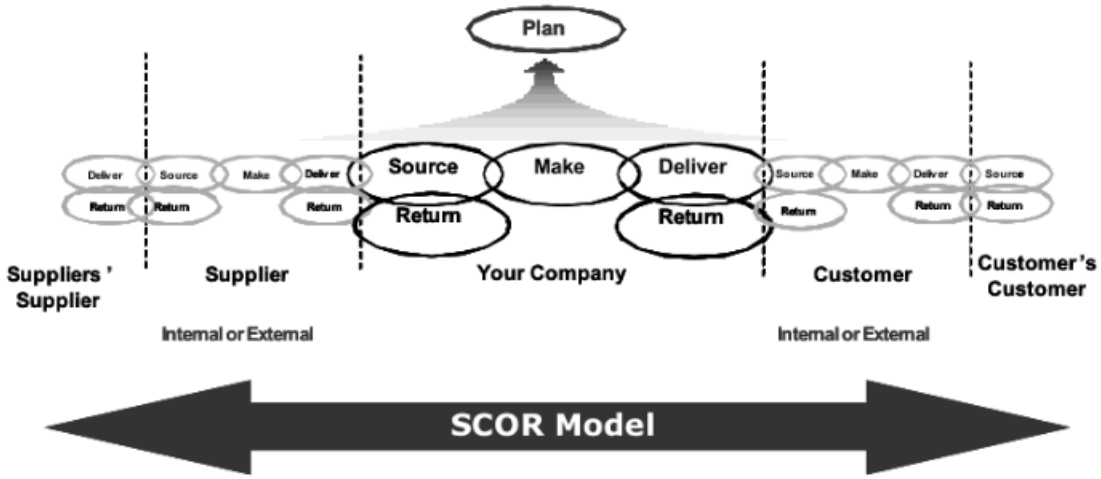

FIGURE 4. The SCOR Model (Blanchard 2010, 35)

Plan: Assess supply resources; plan inventory for distribution, material requirements, and production; aggregate and prioritize demand requirements; plan rough-cut capacity for all products and all channels.

Source: Obtain, receive, inspect, hold, issue, and authorize payment for raw materials and purchased finished goods.

Make: Request and receive materials; manufacture and test product; package, hold and release product.

Deliver: Maintain product and price databases; create and maintain customer database; execute order management process; configure product; generate quotations; manage accounts receivable, collections, credits, and invoicing; execute warehouse processes including pack, pick, and configure; consolidate orders; create customer-specific packaging/labeling; ship products; manage transportation and export/import; verify performance.

Return: Defective, warranty, and excess return processing, including authorization, scheduling, inspection, transfer, warranty administration, receiving and verifying defective products, disposition, and replacement.

The SCOR model provides a scorecard that organizations can use to set and manage supply chain performance goals across the whole company. It helps companies to measure the impact of the supply chain on the financial performance and how well all processes are doing that is essential for development of a firm and excellent supply chain. Therefore, one of the aims of SCOR model is to provide a consistent set of metrics to businesses that they can use overtime and measure their performances. (Blanchard 2010, 36.)

2.2.4 Lean SCM

Philosophy of Lean Supply Chain Management is a Westernization of a Japanese concept. Also, it is known as Toyota Production System, Pull Manufacturing, JIT (Just in Time), TQM (Total Quality Management) and other names. Each of the names incorporates some aspects of Japanese philosophy. Nowadays we determine lean as a collection of tools and methodologies which improves operations of a company through eliminating waste, reducing cycle and flow time, reducing inventories,

increasing capacity and customer satisfaction, elimination of bottlenecks, and improving communication. (Plenert 2006, 145-6.)

Most of managers likely have a basic understanding of the lean concept, but only few organizations have truly achieved it, because lean is constant improvement and a never-ending journey. It is not just a set of tools and techniques, but rather a business philosophy. It started with being manufacturing oriented, but nowadays almost everything could be lean relating to production or operations including lean SCM. (Trent 2007, 3-4.)

In Japan, there is a special term for this approach – kaizen. The key to kaizen as process improvement is understanding that excess inventory or capacity hides problems of the process producing goods or services. Lean systems present a management mechanism to disclose problems by systematically lowering capacities and inventories until problems are visible. (Krajewski, Ritzman and Malhorta 2013, 297.)

There are few steps and tools that can help a company to improve its operation within lean philosophy. One of them is Value Stream Mapping – a process that identifies waste and improvement opportunities. It focuses on working smarter looking at the entire system. VSM shows the connections that exist throughout the system and challenges the current state of activities. Further it becomes the base for developing an improvement plan. VSM can be used to establish a vision for desired future. (Plenert 2006, 235.)

2.2.5 Green Supply Chain

Green Supply Chain management (GSCM) has appeared as a main approach for companies searching to make their business environmentally sustainable. The concept of GSCM is to apply environmental criteria within the context of decision-making of the traditional SCM. Nowadays GSCM has become a key strategic subject for enterprises of all sizes and types as society fully expects companies to be responsible for the impacts of their actions on the environment. (Emmett & Sood 2010, 3.)

Green is not just something companies do to look good and hope that it pays off later. Green is the way to grow, design, build, work, manufacture, and live because it is simply better. It is the most efficient, smartest, and lowest-cost manner to do things. Although many companies get involved in eco-friendly initiatives to follow government or other regulations, second reason is the pressure from customers, the third reason it is an opportunity to reduce costs. (Blanchard 2010, 204.)

There are many benefits of Green SCM. One of them is positive impact on financial performances despite the myth that green means additional expenses. A positive long-term net impact on financial performance has been proven. Furthermore, GSCM brings sustainability of resources to companies. Moreover, in the result green supply chain has lowered costs and increased efficiency through reducing wastes and production costs, recycling and reusing raw materials. It also brings competitive advantages to companies to get more consumers and overall improved quality of the products. Finally, it reduces some risks including the risk of being prosecuted for unethical practices. (Emmett & Sood 2010, 6-7.)

There are environmental practices including actions and programs for companies to improve their environmental performance. One of them is environmental certification when organization follow some steps to get eco-labels, nowadays there is plenty of them. Moreover, companies can prevent pollutions within supply chains including pollution control projects. Another way is reverse logistics when the flow is reversed and there is a collection of used products, so the packaging could be recycled. Design for the environment is very effective way to decrease harmful impacts as well as life-cycle assessment. (New & Westbrook 2004, 234-9.)

2.3 Challenges

SCM as a complex system has many challenges that affect the efficiency and success of a supply chain. The operating environment has become complicated, therefore for companies it is essential being competitive and being able to minimize the risks in order to achieve good results. In this

subchapter, there are listed some major challenges of SCM. One can divide them into internal and external, also challenges could be separated to different departments of a supply chain as procurement, production, logistics etc. Nowadays, risk management is essential for supply chains.

2.3.1 External

Natural Disasters

One category of challenges is natural disasters and how they can impact on supply chains. They can result from meteorological (storms, tornados, blizzards, hurricanes), geo-physical events (earthquakes, tsunami), climatic (droughts, heat waves) or hydrological (floods). Natural disasters around the world bring huge economic loses to the countries. Tohoku earthquake and tsunami in Japan in 2011 involved $309 bn of total cost of loses; in 2005 losses from Hurricane Katrina in North America were $200 bn; the Sichuan earthquake in Chine in 2008 - $146 bn. Natural disasters can easily affect supply chains and stop production for days or weeks as in case with Tohoku earthquake when plants of Toyota, Nissan, Honda, Ford in Asia were shut down for weeks and Chrysler and General Motors had shortages. (Manners-Bell 2014, 79-80; 87-88.)

Economic Risks

There are plenty of economic risks supply chains can face. For example, supply shocks. They happen then an unexpected event results into a material shift in the aggregate supply curve. It could be some natural disasters, increases in taxes or labor wages, oil prices and trade restrictions and others. The impact is unique to each specific situation, but typically customers are more affected. Supply shocks create money inflations, rise in price of the product and its inaccessibility when customers cannot reach it. (Ross 2015.)

According to Lu (2011, 19) and Manners-Bell (2014, 109), another significant risk is demand shocks and volatility – the upswing or collapse in demand for services and products as well as market uncertainty. Demand

shocks are notable risks for a supply chain due to complexity of forecasting their beginning and impact, even if it is positive, on production and supply. The crisis of 2008 had the biggest negative demand of recent years that brought collapse in production in many countries. A sharp decrease in demand arises a crisis throughout the supply chain that brings supplier failures and decreases customers' loyalty. (Manners-Bell 2014, 109-110.)

Corruption

Moreover, there is corruption in the logistics industry that brings many challenges. The phenomenon of globalization lets companies take advantages of low cost labor markets, especially in emerging countries. Emerging economies can be very unstable, have a fragile security situation and weak judicial and legislative systems, the factors that allow corruption to become part of society and government. High percentage of multinational corporations have lost contracts due to corrupt practices of competitors. (Burnson 2015.)

Crime and Piracy

Furthermore, there is a challenge of cargo crime and piracy as well as theft from trucks and warehouses. Billions of dollars are stolen each year and sold to the black market. It influences companies' health and taxes revenues. Talking about commodities, the most popular target in the United States is food and drinks, a fourth part of crimes and aimed on vehicles. Pharmaceutical goods are also a common target. In other countries, the most common products stolen can differ. Theft from trucks and warehouses is rising around the world, about fifth of drivers were attacked in a five-year period. (Manners-Bell 2014, 210-212.)

2.3.2 Internal

Choice of Partners

There is a challenge to choose partners. There is always a risk to lock-in with the wrong partners that will not bring a good cooperation and desired results. Entering into SCM cooperation is a strategic decision and should be dealt accordingly. For successful agreement, it is significant that expectations and objectives among the companies are clarified and fit each other. (Jespersen & Tage 2005, 150.)

One of the examples is in supplier management. Many companies face these issues dealing with their suppliers: lead times are longer than desired, suppliers are not always able to provide accurate information on orders and reliable in fulfilling those orders on time and complete, they are not always willing to meet guidelines from manufactures. (Blanchard, 2010, 169.)

Opportunistic Behavior

Another internal risk is risk of opportunistic behavior. It can arise in situations where one member of a supply chain suddenly finds the potential for a large profit here and now and if they “go for it alone”. Then the company does not coordinate with other parties that can bring damages to the whole supply chain. The same situation when a firm decides on a crisis plan with a short-term action to increase an annual result. (Jespersen & Tage 2005, 149.)

Security Risks

Moreover, there are certain security challenges every supply chain has. They relate to some event affecting intellectual property, information, human resource security, and physical goods. The risk comes from a third party who may or may be not a member of the supply chain. It can be system hackers, a leak of vital information, freight breaches, tampering for criminal purposes, and many others. (Manuj, Dittmann & Gaudenzi 2007, 323.)

Lack of Coordination

One of the common challenges is lack of coordination between members of the supply chain brings many negative effects. It appears because of different stages of a supply chain have conflicts in their objectives or because information moving through a chain is delayed or misstated. In that cases members do not take into account the impact of actions they make on other parties. It can increase manufacturing, labor, inventory and transportation costs, replenishment lead time, decrease level of product availability and jeopardize relationships across the chain. One of the possible effects is the bullwhip effect. (Chopra & Meindl 2010, 467-468.)

The Bullwhip Effect1

The bullwhip effect appears even because of small fluctuations in demand of the final company in the chain that are distributed and increased throughout. The reason could be not fully or partially finished information about what other members need and in the result, it brings disproportional extend in inventory levels and therefore even larger fluctuations in demand to others down the chain. It can result into inefficient production, excessive inventory, poor customer service and lost sales. (Farooqui 2010, 82.)

Strategic Challenges

There are a lot of challenges in implementing strategies to increase efficiency of a supply chain described in the previous chapter. Strategies as SC integration, SC optimization, SCOR model, lean and GSCM all require a lot of effort from each company to succeed. Especially when talking about global supply chains as they face more challenges than domestic ones including physical distances, cultural differences, difference in time zones, infrastructural constraints, availability of logistical resources, and lower visibility in the supply chain (Manuj, Dittmann & Gaudenzi 2007, 323).

2.4 Latest and Future Trends of SCM

Globalization

According to Bowerox, Closs, Cooper and Bowersox (2013, 25), 90 percent of global demand is not fully satisfied by local supply. The range of services and products varies greatly between industrialized and emerging economies. Customers in less developed countries have less purchasing power, but demand for basic products is huge. Therefore, many companies adapt a global strategy to enter markets of other countries. Moreover, they are able to strategically source components and raw materials, locate factories in countries with cheaper labor costs and favorable tax laws. (Bowerox, et al. 2013, 25.)

Transportation, communications, information technology, and the idea market have enabled globalization. The old business model “the big eat the small” is not of current interest anymore. Today “the fast eat the slow” business model dictates success of companies. Of course, markets are separated by great distances and it adds complexity to run a global organization, but the globalization of supply chains has significantly increased the level of information and technology transfer as well as productivity. (Lee & Katzorke 2010, 12-13.)

Outsourcing

One of major business challenges nowadays impacting SCM is the dramatic increase in outsourcing. In domestic market, many companies source logistics functions, as using logistic service providers decreases costs. Other companies on the global market adapt offshoring (outsourcing from other countries, especially low-cost ones). They move some parts of their operations to different countries, typically to decrease manufacturing costs. In both cases it brings many challenges. Outsourcing decisions are crucial because they influence the level of effectiveness and responsiveness the supply chain can reach. (Mentzer, Myers & Stank 2007, 34-39; 373-374.)

Collaboration

SCM is fundamentally about how companies are able to “integrate, coordinate and control the supply chain”. Although coordination and integration should happen not only on the level of tools, systems and techniques, but the hearts and minds of people”. (Emmett & Sood 2010, 256.) In business, there is always a desire to cooperate, but within a competitive framework. Therefore, competition remains the dominant model of free market economies. As it was mentioned previously, nowadays supply chains compete with each other for consumer loyalty. (Bowerox, et al. 2013, 16.)

Agile

The fundamentals of Lean SCM are very valuable for businesses and can bring a supply chain to the next level, but for some time there is a new concept called “Agile”. If lean is about eliminating wastes, agile is about a supply chain that is able to move quickly and easily. Therefore, lean works better with predictable market and smaller variety of products with longer life cycles. Agile is stronger with a volatile market, managing a big variety of products with shorter life cycles. Nowadays with globalization and customization of products, many supply chains need to be nimble to compete in a market. (Farahani, Rezapour & Kardar 2011.)

Digital Supply Chain

Digital supply chain management is a big concept that aims to improve a supply chain via Cloud-based systems, monitoring and analytics of commodities, vehicles and other assets. According to MHI’s 2017 annual survey on next generation supply chains, about 80% of participants assume that the digital supply chain will be the dominate model in the next five years, there 16% think it is happening today. For sure, digitalization will change supply chains, but for now it is difficult to predict how exactly. Probably technologies like robots in warehouses and distribution centers, better visibility over the movement of goods, and predictive analytics will play a role in digital SCM. (Michel 2017.)

2.5 SCM in Automotive Industry

The automotive industry is the largest manufacturing activity in the world. It uses 40% of world's rubber, 15% of steel, 25% of glass, and 40% of the oil output. From 1951 to 1972, the production growth rate for automotive industry was very have on the level about 5,9% annually. After 1973, the growth was declining and reached 1% in 2002, since 2003 the growth stopped. (Suthikarnnarunai 2008.) Since 2013, car production has been on the rise again. In 2016, there were produced 96,1 million units of motor vehicles around the world with 77,7 million units of passenger cars. (ACEA 2017.)

Despite the size of the industry, in reality car making is a very risky business. It is not sustainable and lacks resilience. Yet, this industry is essential as it represents a significant part of economies of many industrialized countries as well as newly industrializing economies like China. The automobile industry has managed to hold in the pressures for economic and environmental changes rely on the long-standing business model of the mainstream vehicle manufactures. (Nieuwenhuis & Wells 2015, 3.)

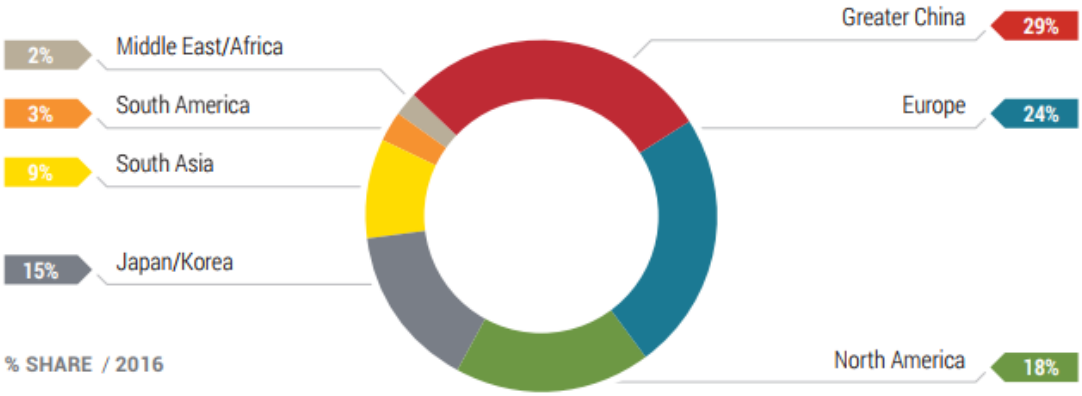

FIGURE 5. Passenger cars production (ACEA 2017)

Figure 5 shows the percentage each country has as a part of global production of passenger cars. Leaders are China (29%), Europe (24%), and North America (18%), Japan/Korea, South Asia, South America, and Middle East/Africa have 15%, 9%, 3%, and 2% percent respectively. (ACEA 2017.)

Due to the nature of the products, the automobile industry has complex supply chains. A single car can have up to 15,000 individual parts and in case if it is not possible to deliver just one piece, it can slow down or stop a production line. Nowadays, many vehicles put together in Europe and North America involve high-tech components produces in Asia Pacific. In 2015, they accounted for 40 percent of a car's costs in comparison with 10 per cent in 2004. (Manners-Bell 2014, 49.)

In the mass production vehicle industry, the key sectors of production focus on the integrated steel body structure and powertrain (engine and transmissions). They obtain the highest level of investment for product development and capital investment in manufacturing. These areas characterized the key to economies of scale in the automobile industry and also the principal barriers to better agility in terms of response to consumer requirements. (Nieuwenhuis & Wells 2015, 49.)

The common practice in many supply chains of automobile industry is that they are tied to forecasts. The manufactures must meet their demands with supplies from the initial raw material providers, to the last part of the chain – car buyers. The uncertainty of demand or its variations due to forecasting transfer from one member to another that causes the bullwhip effect. To minimize that effect, companies started to base their operations half on forecasting and half on the responsive supply chain with a strategic emphasis and the logistics operations. (Suthikarnnarunai 2008.)

One of the top challenges for supply chains is visibility. About 84% of automotive executives have implemented real-time supply chain information transparency inside and outside the company, only 13% have done it widely. The most essential barriers to that are organizational,

rather technological. (IBM Corporation 2009.) Supply chain visibility (SCV) is the ability of products, components, and parts in rest or motion to be tracked. The goal is to make data readily available to all stakeholders. Especially is important to companies outsourcing parts of their supply chains. (Banker 2016.)

A supply chain of a car manufacturing company has high inbound and outbound logistics costs. Total costs for inbound logistics can reach ten per cent of the plant manufacturing costs. First reason is due to suppliers shipping out many parts and components. Secondly, assembly plants usually require smaller lots with much higher delivery frequency. Costs for outbound logistics are extremely high and could be 30% of total costs. The main reason is that there are too many franchised dealers, who want to form its own individuality. The operating cost per car of a smaller dealer is comparatively higher than of a large dealer. (Suthikarnnarunai 2008.)

3 CASE COUNTRY BRAZIL

This chapter discusses Brazil. Firstly, it contains a short history of the country to understand better the current situation. Secondly, it gives an overview on the infrastructure, transport preferences, and logistics in Brazil. Moreover, the last part explains the car production in Brazil and existing market.

3.1 Overview

Brazil was discovered by Portuguese in 1500 and was immediately claimed. During three centuries Brazil was a colony and a part of Portugal Empire. The territory was used for extraction of natural resources and sugar production as main activities in the 16th century. For years, Portuguese were trying to enslave native people who have formed more than 2,000 tribes and nations as a labor force. After many attempts, they started bringing people from Africa to be slaves on plantations and extraction of resources. (Philander 2012, 148-149.)

Slavery ended only in 1822 as part of the construction of Brazilian society process. Brazil got independency from Portugal and became a monarchy. The Empire of Brazil lasted until 1889 when a republic government was established. The “Old Republic” (1889-1930) replaced sugar with coffee as the main export in the end of 19th century. This attracted many foreign people to immigrate to Brazil and was start of the development of agriculture and expansion of industrial activities. After the country’s history was marked with military dictatorship (1964-1985) and few financial crises. (Philander 2012, 148-149.)

In the twentieth century, Brazil experienced many transformations. Figure 6 below shows few areas the country experienced growth. One of the easiest indicators to measure is evolution in population. In period of 1890 to 2000 it has grown from 14 million to 166 million of people (Sachs, Wilheim & Pinheiro 2009, 2). In 2017, Brazil has more than 200 million of inhabitants according to IBGE. Moreover, urbanization reached the

country: in the beginning of twentieth century, less than one of five people lived in cities. Nowadays, nearly four out of five Brazilians live in urban areas. Furthermore, we can see the growth in economic sector. GDP, number of television sets and automobiles have grown rapidly as well. (Sachs, Wilheim & Pinheiro 2009, 3; 7.)

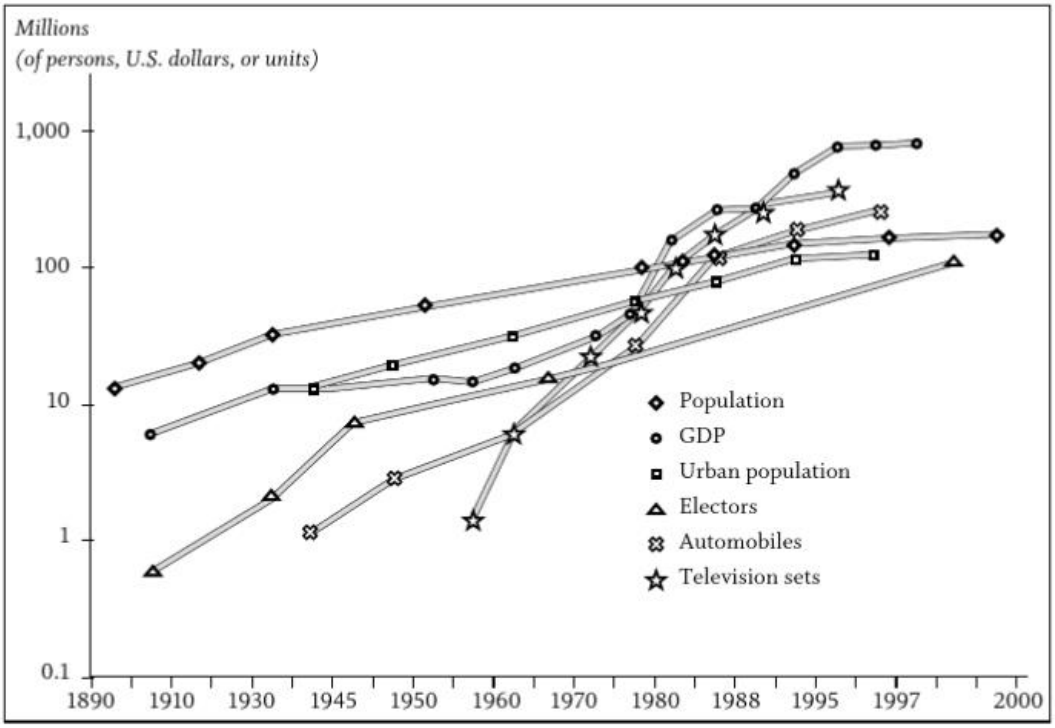

FIGURE 6. Areas of growth (Sachs, Wilheim & Pinheiro 2009)

Across the century Brazil moved from and agrarian and rural society with very little political participation and ability to read and write to the profound urban and industrial country with very high levels of political participation and literacy. Nowadays Brazil and its citizens are wealthier, healthier and better educated by far in comparison with the beginning of the 20th century. (Needell 2015, 15.)

The country's size gave significant variations to five major areas: Amazonian North, Northeast, Southeast, South and Centre-West. Although Portuguese is the official language and is spoken everywhere, there are differences in the pronunciation, that creates accents. (Crocitti & Levine 2004, 3.)

Brazil has many natural resources making it potentially one the wealthiest countries. The world's famous Amazonian rain forest covers almost half of the territory that allows to produce pulp for paper, rubber, charcoal, firewood, hardwoods, and waxes. There are many places to extract iron, bauxite, manganese, tungsten, nickel, tin, uranium, semiprecious stones, industrial diamonds, and gold. The climate promotes agriculture in Brazil and it has many plantations of coffee, soya, sugarcane, corn, different fruits, rice, and cacao. (Crocitti & Levine 2004, 2.)

Therefore, the biggest challenge to Brazil for the past two centuries has not been economic, but on the contrary social and political. Like much of Latin America, the country has been marked by deep and constant inequalities. These inequalities were created and maintained for centuries due to the enormous power of economic, bureaucratic, political, ecclesiastical, and military elites. Extremely hierarchical and crooked class structure in Brazil has been one of the greatest barriers to the shaping of the nation state and its success. (Needell 2015, 17-18.)

3.2 Infrastructure

Infrastructure is the key to sustainable economic development, the integration of domestic and international markets, and the possibility to use all economic activities. Investing in infrastructure is seen as a way to reawaken economic growth to give support to incomes and employment and to expect high returns. However, investing is complicated, and it succeeds only being a part of comprehensive development strategy. (Raiser et al. 2017, 1.)

Brazil has a slow development of infrastructure. Nowadays it needs to invest hundreds of billions to upgrade its infrastructure. First reason is the country's geography that makes it more complicated and costly to provide infrastructure and transportation than in other countries, for instance in United States. Another reason is shocking corruption in public sector. The bureaucracy in Brazil is bloated and ponderous as in Italy. (Davidson 2012, 274-275.)

Brazil is characterized by a continental dimension, high population and economic regional imbalance, yet fast-growing country-wide economy. Its model of economic development has led to continuous deconstruction of the railway system in favor of a dependence upon its highways for industrial production and people. In the result, it became unevenly distributed in quality and quantity. (Adamatzky & Oliveira 2012, 93.)

Since the 1980s, investments in infrastructure in Brazil has declined from over five percent of GDP to just under two percent of GDP. In the result, a significant infrastructure gap has appeared. Brazil was not able to raise the total rate of investments or to improve the quality of the services therefore it brought empty stadiums, incomplete urban rail tracks and airport terminals, many corruption scandals involving largest construction companies and a big share of political elite – the signs, that the country has failure to effectively manage infrastructure problems despite increased public spending. (Raiser et al. 2017, 2.) The World Economic Forum ranks Brazil 120 out of 144 for the quality of the infrastructure (Faria & Endo 2016).

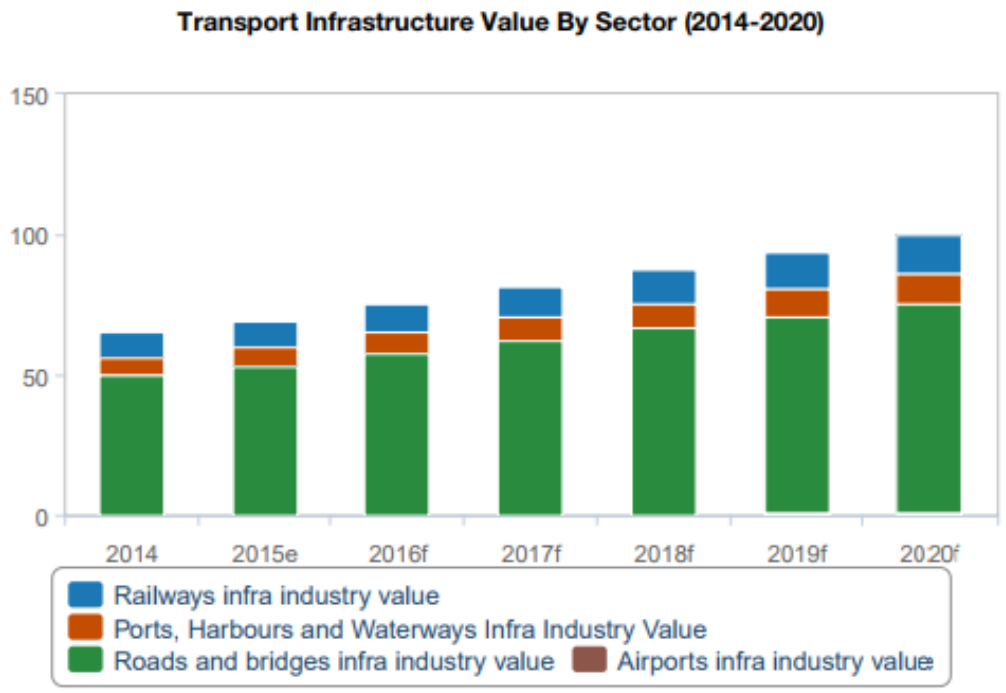

FIGURE 7. Transport infrastructure value by sector (BMI Research 2016)

Figure 7 shows the transportation preference for the last few years, nowadays and estimated forecast in the future until 2020. Even if the projects succeed and infrastructure in Brazil will have a better quality, the ratio between usage of different transportation modes expected to be about the same. (BMI Research 2016.)

In 2016, the President of Brazil Michel Temer established Investment Partnership Program (PPI) also known as “Projeto Crescer” to raise US$14.4 billion to invest in infrastructure as building and operating roads, railways, port terminals, and power transmission lines. This program is an essential part of the strategy to restore business confidence. (ITA 2017.)

3.2.1 Roads

Highways constitute more than a half of all public transportation infrastructure in Brazil. In the country, 61 percent of total freight is transported by roads. (ITA 2017; Manners-Bell 2017, 89.) Brazil has the third largest road network in the world. It amounts approximately 1.6 million km, but only 196,000 km (12%) are paved. The federal road network covers about 58,000 km and it is almost all paved, 70% of all goods in the country are transported by them. (Rebelo 2010, 31.)

Brazilian roads have high imbalance in quality and quantity, depending on the region (Adamatzky & Oliveira 2012, 100). Thus, this network is highly concentrated in the eastern part of the country, as major industrial activities and urban settlements are located there (Figure 8). The poor quality of roads reduces the efficiency and reliability of freight transportation within the country, increasing operating costs by 10-30%. At the same moment, companies try to save money and put the maximum amount of goods to trucks and in the result those overloaded trucks damage roads. (Rebelo 2010, 34.)

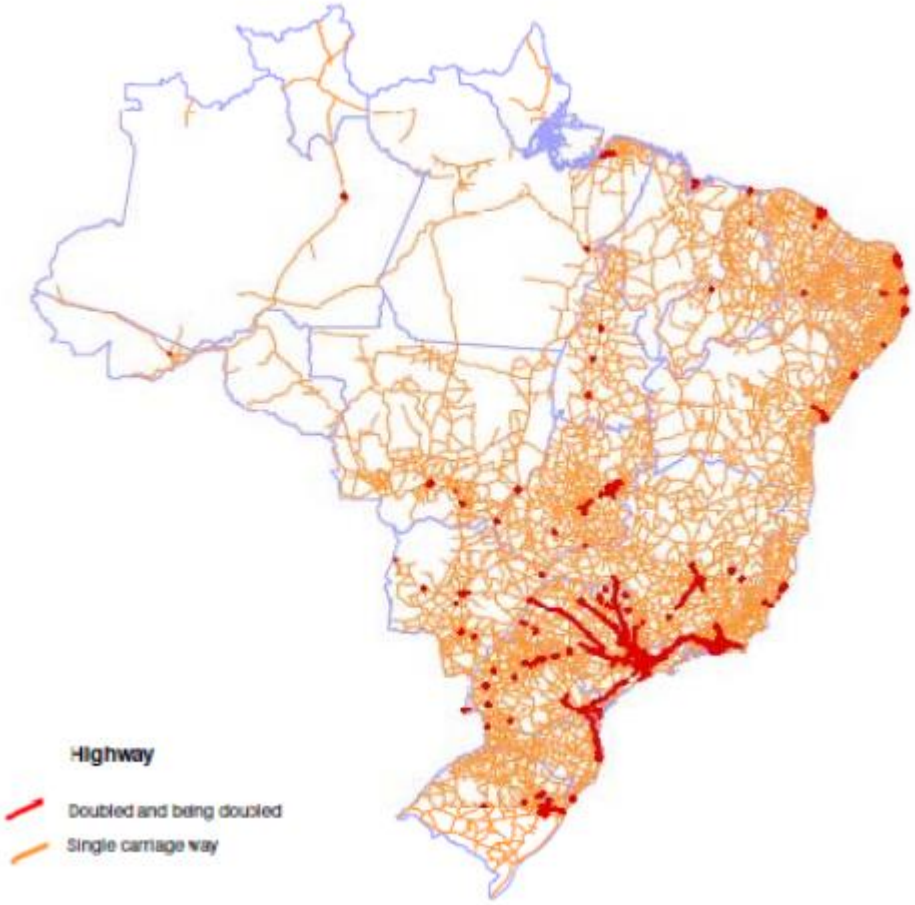

FIGURE 8. Highways in Brazil (ITA 2017)

3.2.2 Railways

Railways have 25% of public transportation infrastructure. Transportation by railways represents 21% of total freight although it has been proven that rail transportation is up to thirty percent cheaper and more efficient than roads. (ITA 2017.) The total length of railroads in Brazil is 29,500 km (Figure 9). The railroad network is insufficient in terms of its capacity and extension in some high demand areas, what increased road development. Overall quality of railroads is bad: the system is fragmented because of the usage of different track gauges in different lines, poor signaling, 2,500 critical intersections, slow operational speed. (Rebelo 2010, 37.)

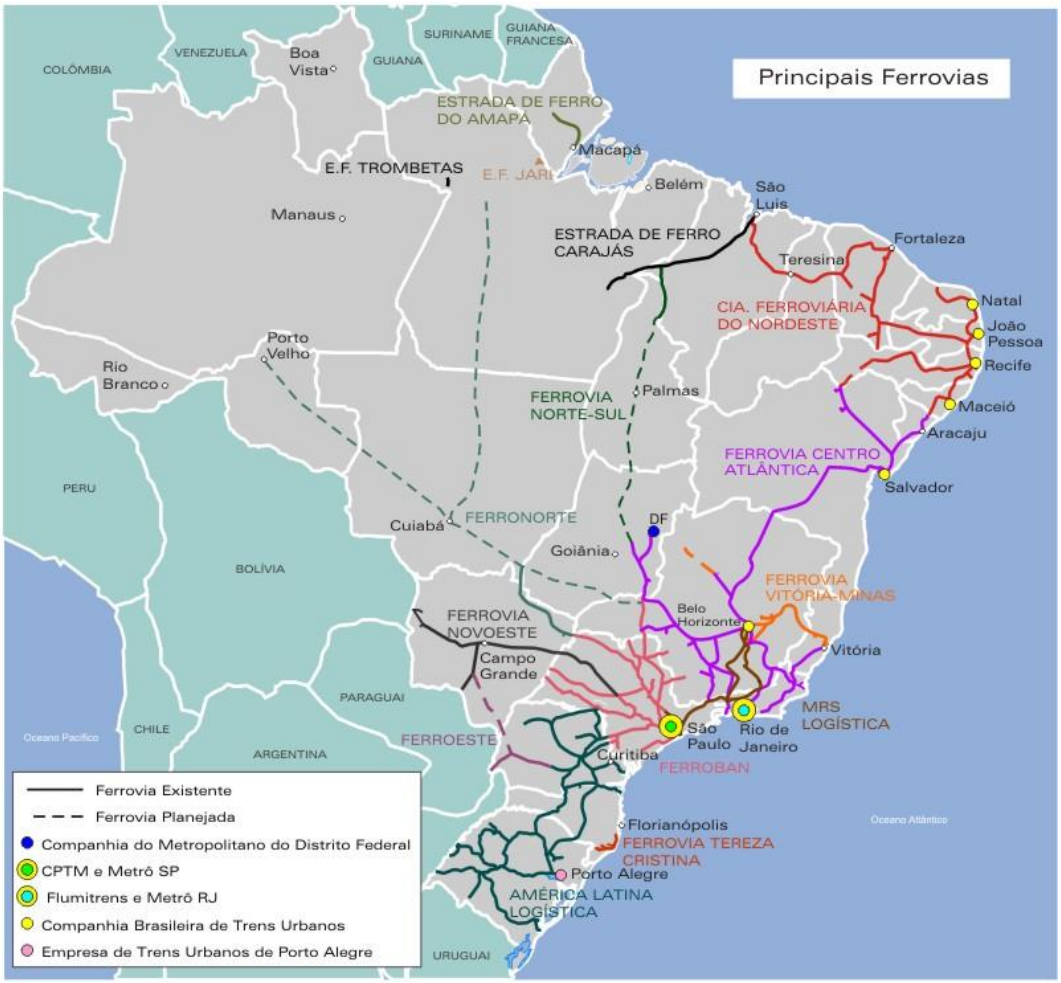

FIGURE 9. Railways in Brazil (ITA 2017)

3.2.3 Ports

In Brazil, 70 percent of the exports are transported by ocean vessels (Manners-Bell 2017, 89). Therefore, ports conditions are essential for efficient trade. The government of Brazil has launched a very aggressive program of port concessions in few states of the country. The base for new leasing contracts for terminals at ports is a fee-based concession paid by operating the facilities organizations. The aim is to increase the competitiveness and trade of the country, modernize ports, reduce barriers to entry and high costs. (ITA 2017.)

Ports are the key asset of the country's logistics system, supplying the entire coast line that is one of the longest in the world (Figure 10). The port system suffers from few critical problems as equipment obsolescence, inefficiencies in labor development and allocation, and lack of harbor capacity. While ports in Brazil handle on average 34 containers per hour per ship, ports in Hamburg and Singapore handle 66 and 100 containers respectively. Moreover, they have long waiting times and sometimes ships need to wait more than 12 or even 24 hours. (Rebelo 2010, 41.)

FIGURE 10. Ports in Brazil (ITA 2017)

3.2.4 Waterways

Waterways compose 17 percent of public transportation infrastructure in Brazil. The country has enormous potential for river traffic with about 63 thousand km of rivers and lakes, of which navigable are 45 thousand km

(Figure 11). However, in Brazil usage of transportation by waterways is comparatively little to other countries as it transfers only 14 percent of cargo by waterways. When in USA it represents 25 percent and 35 percent in Canada. (ITA 2017.)

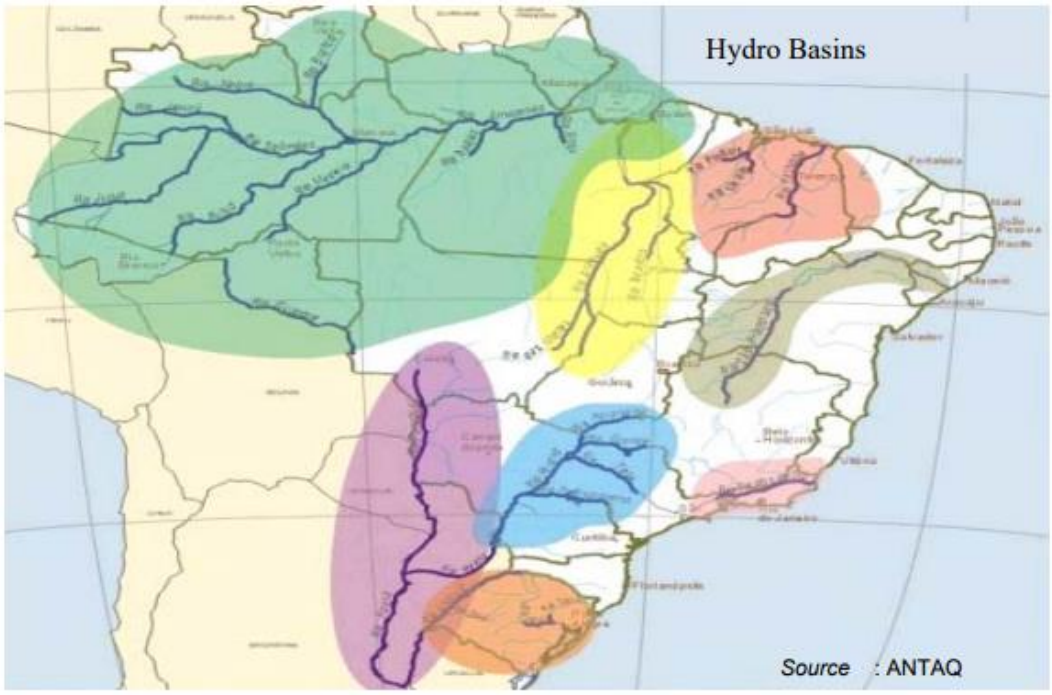

FIGURE 11. Inland waterways in Brazil (ITA 2017)

3.2.5 Infrastructure SWOT

SWOT analysis of infrastructure in the country according to “Brazil Infrastructure Report” of BMI Research (2016):

Strengths

- Largest infrastructure sector in the Latin America
- Significant oil resources
- Strong agriculture sector creating demand for infrastructure
- Extensive mining industry of bauxite and iron ore creating demand for infrastructure and brining private investments
- The government’s growth acceleration programs

- The significance of the export market brings investments
- A wide range of domestic construction companies with experience
- Regional economic powerhouse with strong demand for the infrastructure

Weaknesses

- Poor infrastructure has affected exports and the distribution of goods in Brazil
- Scarcity of skilled labor
- High level of corruption
- Bureaucracy and complex regulations
- Poorly made in the past concession changes
- Scarcity of long-term financing for infrastructure projects
- Regulatory changes are not frequent

Opportunities

- The country’s public ports are opened to private sector concessions
- Investments in airports with a concession program, attracting private operators
- Significant investments in power sector – hydropower and wind projects

Threats

- Corruption scandals push away contractors and investors
- High costs and scarcity of skilled labor affect ROI (return on investment)
- Protest in response to social welfare
- Hydropower projects in the Amazon bring international criticism
- The government cuts the budget because of falling revenues and excessive spending (BMI Research 2016**.**)

3.3 Logistic Challenges in Brazil

In Chapter 2 it was stated that companies face many challenges including external and internal ones. External challenges involve those risks that come from outside the company, from the environment the organization operates. Brazil has many challenges mentioned in the Chapter 2, although not all of them are equally relevant.

Natural disasters in Brazil are not that common. According to INFORM 2017 Risk Index Brazil has value of 3.4 that accounts as low and the country is ranked 104th among all the countries. Between 1990 and 2014 58.4 percent and 33.6 percent of economic loses to the country brought events as drought and flood respectively. Other events as storm (3.8%), extreme temperature (3.4%), and others (0.9%) are shown in the Figure 12 as well. For a 10-year period from 2005 until 2014, Brazil had economic loses of 1,089,750 thousand of US$ with deaths accounted for 205 lives (mostly from floods and landslides). Typically, drought is dangerous to agriculture market, when floods can affect production and logistics in the country. (PreventionWeb 2017.)

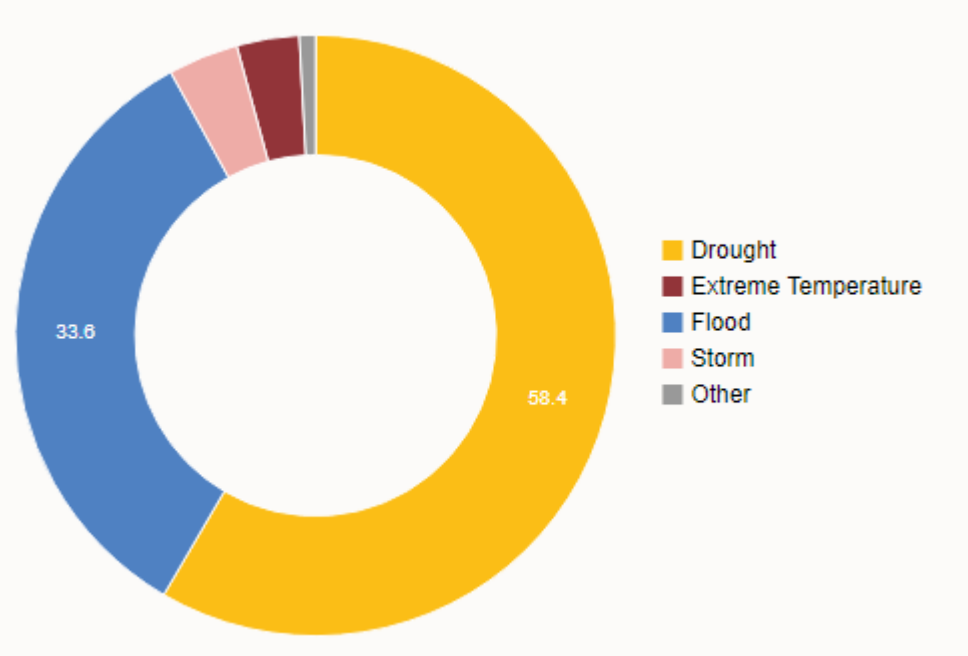

FIGURE 12. Natural disasters affecting economics (PreventionWeb 2017)

One of the existing problems is cargo crime. In the past decade, more than 10 thousand cargos were stolen and reported in Brazil. In comparison, Mexico counts for six thousand cargo crimes and South Africa with 800 reported. The cargo crime is so widespread in Brazil, that they tend to be more non-confrontational. Drivers see robbery as a routine and rarely resist. Organized crime gangs employ experienced distribution networks for stolen goods. Often, they compete with legal supply chain networks in terms of efficiency and complexity. (Manners-Bell 2014, 210;9.) So far, the most common products to steal are food and drinks as they tend to have less security. They count up to 61% of stolen goods in Sao Paulo. (Marle 2016.)

As was mentioned in the sub-chapter 3.2 about infrastructure in the country, Brazil has a very high level of corruption. For the past three years, Brazil is caught up in a scandal which started with a state-owned oil company that reached top of business and government. It involves millions of dollars and more than 80 politicians and members of the business elite. (BBC News 2017.) Corruption in the country creates many boundaries to the businesses and affects negatively their development, especially when it is tight up with bureacracy. One of the challenges in Brazil is taxation that includes both of them.

In Brazil, taxes are high and complex. They influence network optimization in the country as they account for a much higher cost than logistics. For example, a company can spend about seven percent of sales on logistics, but 17 percent on taxes. Each of 26 states has its own tax structure, which varies by category of commodities and origin and destination. For instance, if a company in São Paulo ships its product to Rio de Janeiro, it needs to by about twelve percent of VAT (value-added tax). In case, if the destination state was Goiás, the tax would only seven percent. Moreover, the Brazilian tax system allows state governments to engage in fiscal wars to tempt large manufactures to their states. (Takey et al. 2017.)

Moreover, current economic situation in the country is under deep recession. That affects the demand on products and increase of prices.

Nowadays, Brazil has one the highest logistics costs in the world. The distribution costs make up about 31.8 percent of whole logistics costs. It includes warehousing, management, legal requirements, inventory, and transportation costs. Overall it represents in average about twelve percent of Brazil's GDP. The objective of PPI is to provide the country with a transportation system covering its continental side. (ITA 2017.)

3.4 Car Production

Brazil was keen to develop an automotive industry. However, local expertise was limited, and the country needed new talents in this area. For this reason, from 1950s the government of Brazil started a policy of attracting investments by foreign vehicle companies, but requested to involve local content so an automobile supply sector would develop. Moreover, the country hoped, that it will help to establish local car producers. (Nieuwenhuis & Wells 2015, 181.)

Brazil has all the ingredients to have a successful car manufacturing industry: energy, labor, and metals are extremely cheap and accessible. (Lee & Katzorke 2010, 20.) To establish the automotive industry, in the country were developed the chemical industry, steel and iron melting, manufacture of plastic and rubber. Therefore, the development of automobile industry gave opportunities for other directions as machinery sector and metalworking. In the result in Brazil were established many manufacturing industries: airplane, motorcycle, ship, tractor, and others. (Sachs, Wilheim & Pinheiro 2009, 80-81.)

By the 1960s, car industry in Brazil were dominated by Volkswagen, DKW-VEMAG, Simca, Willys-Overland and Alfa Romeo. Later, Toyota, Chrysler, Ford and GM played an important role. Fiat was a late entrant, but it became quickly an essential player in the 1990s. In the result, due to globalization, Brazil become a part of global networks of a few manufactures, especially Fiat and Volkswagen. The truck industry was dominated by Volvo and Scania with VW as a secondary player. (Nieuwenhuis and Wells 2015, 180-181.)

Nowadays, Brazil is the largest car producer in Latin America. The country has strict protectionism policy in order to prevent an invasion of low cost brands from China. At least 65% of a vehicle content should be local or coming from South America's countries to be produces locally. Otherwise the government puts additional taxes as on imported cars adding more 30% on top of an import duty. However, companies get tax benefits if they invest into R&D (Research & Development) as the country aims to boost investments in this area. From 2013, the government expects at least 0,15% of the gross revenue investment, however, in 2017 the investment was risen to 0,5%. (Fujikawa Nes 2012.)

There are few brands that stand out in the Brazilian market. Number one producer is Fiat: it has the highest volume of sales in Brazil and in 2014, four out of 10 of sold car were produced by Fiat. Next company is Chevrolet with the widest variety of "flex" automobiles in the market. Volkswagen has third place and four factories in Brazil, in 2014 it sold 576,626 cars. Further, Ford has 4 factories, when Hyundai on the 5th place has only 1 factory, with the HB20 model, that is the sixth most sold car in the country. Moreover, in this list are Renault, Toyota, Honda, Nissan, and Mitsubishi. (Possato 2015.)

Brazil has failed to establish car brands, although there were few attempts as Romi, Puma, Miura, VEMAG, and Gurgel. Today Brazilians are too used to international brands and it would be very difficult for local manufactures to build a brand than will fulfill the expectations of customers. The best-selling cars in Brazil are typically compact and economic. The models are rather simple but functional and usually have small engines 1.0 or 1.4 and flexible fuel usage. (Fujikawa Nes 2012.)

Car production in Brazil developed a lot for the last decades (Figure 13). From 1990s, when the government opened the market, it was growing. After the crisis in 2008, the automotive industry faced many difficulties and significant fall in the production. Few years later, the industry has started recovering and reached an all-time highest amount – 352,531 units in April 2013. Since that there was a downturn movement in the production, but

since 2016 it is rising. Vehicle production in the country rose to 224.8 thousand units in July 2017 – 5.9 percent higher than in previous month. Compared to the previous year, output increased to 17.9 percent. (Trading Economics 2017.)

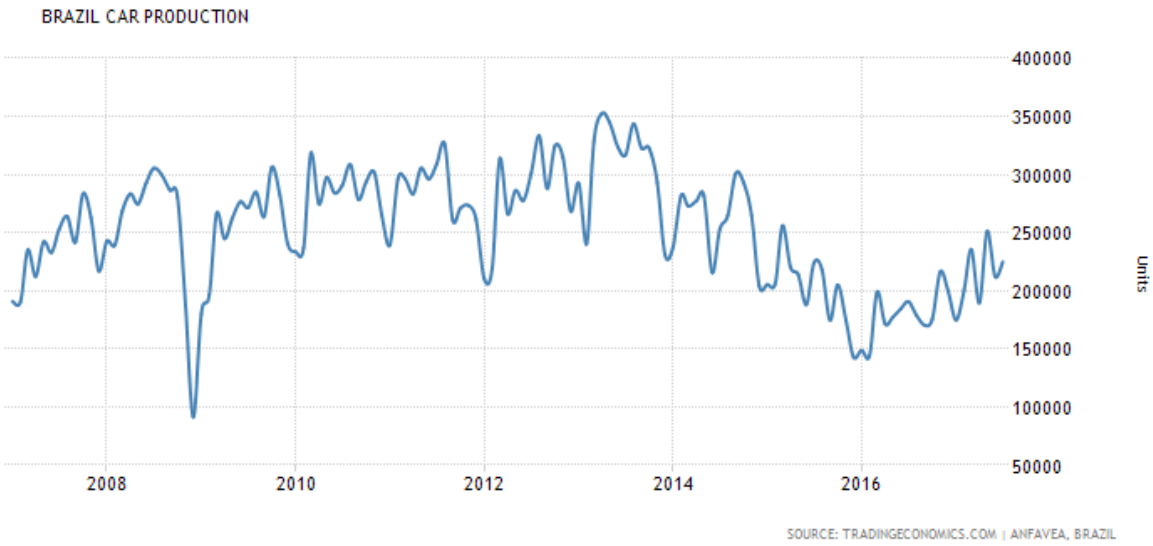

FIGURE 13. Brazil car production (Trading Economics 2017)

Brazil exports cars to other countries, mainly to neighboring Argentina. These days, the car manufactures are pushing to increase access to different markets, as Colombia and Peru. Exports for the first two months of 2017 amounted to 104,000 vehicles, that is 73 percent higher, than for the same timeframe a year earlier. (Alegri 2017.) According to OEC (2017), in 2015 car exports brought about $5.01B.

One of features of automotive industry in Brazil is its expertise in bioethanol. The government promoted use of bioethanol from 1970s, as a substitute for expensive oil imported from other countries. It made oil, sugar and car industries cooperate and it was successful. Bosch and Magnetti Marelli developed “flex-fuel” technology so cars could sense which fuel was used and adjust engine accordingly. Nowadays majority of cars in Brazil are able to run on ethanol and petrol, or their mixture. Ethanol makes cars perform better, but the consumption is higher. (Nieuwenhuis & Wells 2015, 181.)

4 CASE COMPANY X

Case Company X was established in the end of the 20th century. In the beginning it produced around 24 cars per year. Nowadays, Company X is not a small producer anymore. It is part of a major car manufacturer and includes many popular car brands. (Company X 2017.)

4.1 Presence in Brazil

Brazil has one of the largest the case company's production unit in the world. It has been operating since 1970s. The company consolidated a complete supply park around its facility. Since that the factory has manufactured over 13 million cars and light commercial vehicles, including over five million of FlexFuel (that can use both ethanol and gasoline). (Company X 2017.)

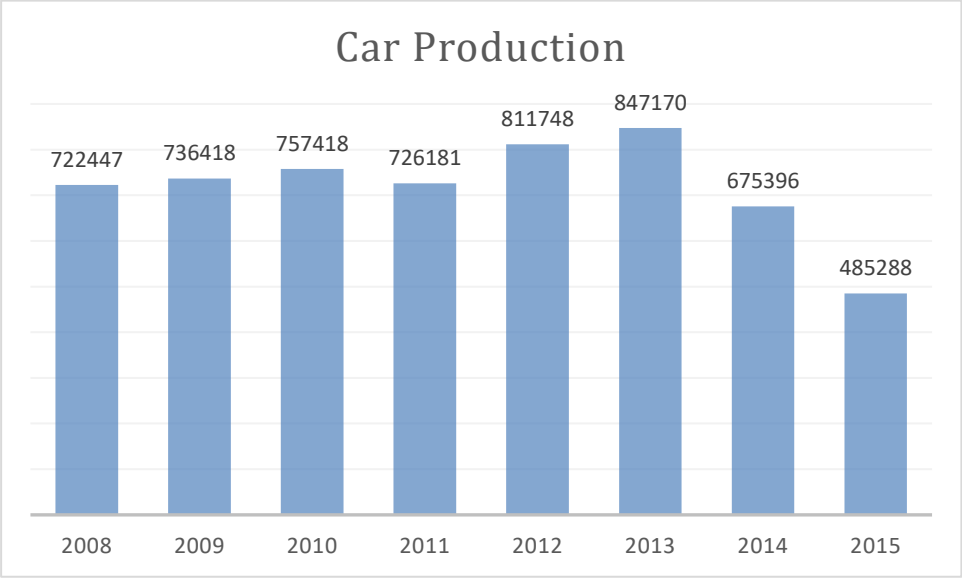

FIGURE 14. Car production in units (Company X 2017)

The company has a great success in Brazil. Figure 14 shows car production of the company from 2008 until 2015. As one can see, the production was increasing until 2013 (847,710 units), with slight decrease in 2011 (726,181 units). Since 2013, production was decreasing rapidly and reached only 485,288 units in 2015. According to the latest data, car

production in Brazil is recovering and 2017 is expected to have increase in production. (Company X 2017.)

The company invests to expand its production capacity and the factory and to obtain new technologies and solution to modernize and increase efficiency. Production capacity of the plant is 800,000 vehicles per year, the company plans to increase to 950,000 units per year. Also, there is the construction of the second factory in different state. (Company X 2017.)

4.2 Production Process

Each product has responsibility of representing one of the largest industries in Brazil. The responsibility exists in each detail, from the development to strict quality tests. The entire production follows the World Class Manufacturing (WCM) model, a system adopted by Company X globally to eliminate losses and wastage and increase efficiency. It allows to obtain maximum quality in production while satisfying needs of customers. (Company X 2017.)

World Class Manufacturing is a collection of concepts, which set standard for manufacturing and production for organizations to follow. Japanese (lean) manufacturing is credited to be a pioneer in this concept. Mainly this system is applied for automobile, steel and electronic industries. WCM has three main principles:

- Implementation of Lean Management and Just In Time reduces wastages and costs.
- Implementation of Total Quality Management (TQM) reduces the defects and encourages zero tolerance towards defects.
- Implementation of Total Preventive Maintenance prevents any stoppage of production due to mechanical failure. (MSG 2017.)

Moreover, there are various techniques that are used in this system (MSG 2017):

- Make to order
- Smaller lot sizes
- Streamlined Flow
- Collection of parts
- Group manufacturing
- Doing it right first time
- Total preventive maintenance
- Collection of parts
- Zero Defects
- Increased consistency
- Cross Functional Teams
- Multi-Skilled employees
- Statistical process control
- Higher staff involvement
- Visual Signaling
- Just in Time
- Quick replacement

WCM concept combines best practices to achieve the best results. It includes several aspects of strategies described in Subchapter 2.2. For example, it has common ideas with SC Optimization, SC Integration, and Lean Management. It is not specialized in Green SCM but there are some initiatives in the company that eliminate wastage, reduce emissions and support recycling. Several of them are mentioned in the production process that has few steps.

4.2.1 Engines and Transmissions

The engines are produced at the factory. Company X is also supplied by the engine factory – the most modern midsize engine producer in Latin America (located about 1,000 km from the factory). It produces many flex and gasoline versions. (Company X 2017.)

At the two factories, production is divided into two main steps: machining and assembly. Machining includes the entire process of forging and finishing the engine block, crankshaft and cylinder head is done. In the second phase, components are assembled and tested. (Company X 2017.)

Some transmission models are manufactured at the company’s plant. It involves three steps: forging gives dimensions to products; thermal treatment ensures durability and resistance, that proceeds 23 tons of steel per day; after grinding process, products are ready to be assembled.

Approximately 60,000 parts are processed internally to produce 2,480 transmissions daily. Each part is submitted to the maneuverability test and sent to the assembly area where engines are joined with transmissions. (Company X 2017.)

4.2.2 Press Shop

At the Press Shop, steel plates are transformed into different parts that create the vehicle body frame such as sides, roof, hood, doors, and fenders. In the factory, there are 19 large-scale press lines with total 130 machines with pressure that ranges between 400 to 2,400 tons. Two of those lines are high speed flexible transfer line presses (HTLs) with high-quality automation. The material used is cold rolled steel and it is supplied in reels or cut sheets. This material goes through many cutting, mounting and bending operations. The metal waste during the production is totally recycled in other processes. (Company X 2017.)

4.2.3 Body in White Shop

In White Shop, steel parts are welded, and the body frames start taking shape. On average, the body frames are given 70 weld spots to ensure geometry, by the special machine. After they are sent to welding complementation line. In this phase, doors, fenders, the rear of the vehicle, and the hood are assembled. In the result, the frame receives 3,500 weld spots. In this unit, 250 robots provide quality and agility to the process. (Company X 2017.)

4.2.4 Paint Shop

The painting process is crucial for body frame embellishment and durability, it combines quality and aesthetics. The body frames go through many stages on a route that amounts 18 kilometers. It starts with cleaning and de-greasing when the frames are dipped into a tank with an aqueous solution to remove the protective oil. After that the phosphate conversion

coating is applied to prepare the frame for the first coat of paint. (Company X 2017.)

Further, the bodies receive their first coat of paint through electroplating. The first coat provides ant-corrosive protection. Next step is use of sealant caulk to protect bodies against dust and water. After that the second coat of paint is applied followed by the final coat. In the end, each frame is coated with varnish for shine. Company X was the first car manufacturer in Brazil to completely eliminate all solvent emissions in the atmosphere. (Company X 2017.)

4.2.5 Final Assembly

Each vehicle contains over 19,000 parts which are put together in the Final Assembly step with 45,000 logistical movements to supplying the lines. There the body frames receive an identification that links them to orders of customers. Each vehicle receives a label from Brazilian Vehicle Labeling Program (PBEV) with fuel consumption information. All assembled parts undergo electrical testing, headlight adjustment, wheel alignment, and ABC break testing. Every minute, three finished cars go out of the Final Assembly unit. (Company X 2017.)

4.2.6 Test Track

Before cars go to customers, they have a track test. Moreover, waterproofness is tested in water chambers. The car needs to get a seal of approval that certifies the product quality at each phase of final testing. (Company X 2017.)

5 EMPIRICAL RESEARCH AND DATA ANALYSIS

This chapter narrates the information about the empirical research and data analysis of the thesis. The objective of the research is to present accurate answers to the research questions by gathering and analyzing of data.

5.1 Data Collection

This subchapter represents the process of data collection for the empirical research. Figure 15 below shows the schedule of acquisition process of secondary and primary data.

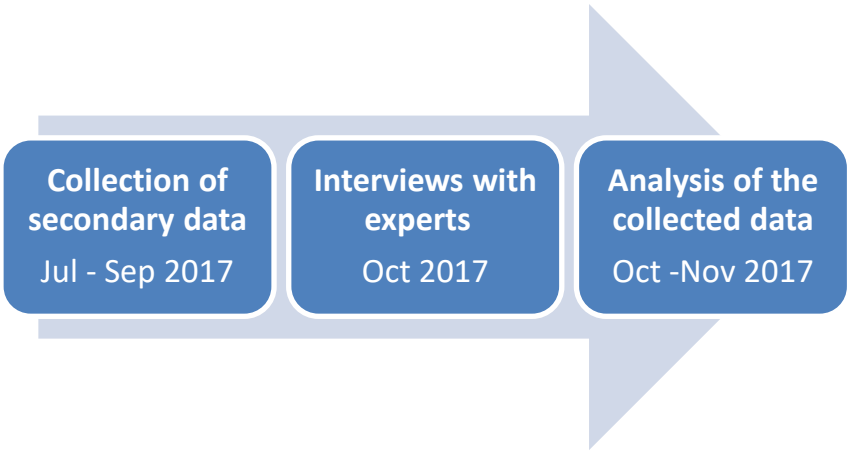

FIGURE 15. Data collection process

It was decided to collect qualitative data to have better insight into SCM in Brazil and discover challenges that companies face on the example of Case Company X. There are three common ways to collect data for qualitative research: observation, interview and focus group (Mack et al. 2010). For this work, the author has chosen to use interviewing method as it would give in-depth opinions of different people in short period of time. Therefore, the collection of data includes series of interview conducted with experts from Company X.

Interviews tend to include two people: one informant and one investigator. The style of interview can be different and vary from highly structured to completely open-ended. It depends on a situation and the topic as

informants need to feel as comfortable as possible and many of them have different expectations. Nevertheless, interviewers need to prepare for interviews. It includes establishing goals with knowledge that needs to be acquired, creating questions matching skills of both participants so during the conversation they will understand each other. Questions should be order in a way to make the conversation flow without any difficulties and have a logical structure. (Walle 2015, 69-70.)

There are three types of interviews: unstructured, semi structured, and structured. Its type affects the cost of interview, the amount of time needed for preparation, skills and knowledge required by interviewer, and process of interview. Unstructured interviews give a great freedom to respond in any way. Both participants feel freedom and flexibility therefore diverse and unexpected information can be gained. They are very useful then there is a need to explore beyond the routine. Semi-structured interviews provide informants with freedom to respond, however the flow of conversation is more controlled by interviewer as he/she is more prone to guide the interview in needed direction. Structured interviews often are similar to surveys. Subject do not have a big freedom to respond as there is a rigid script to seek for specific information. (Walle 2015, 71-74.)

In the research, the semi-structured type of interviews was selected for several reasons. Firstly, this type allows to adjust the interview according to the interviewee as it has open-ended questions. Secondly, often this kind of interviews brings new ideas and aspect to the topic, that were not expected to appear. It gives a deep understanding of a problem when at the same time the interviewer has control over the conversation.

In this thesis work, there were conducted interviews with five employees of the Company X. Due to bureaucracy of the company and busy schedules of interviewees, meetings were organized through video-calls in Skype. The objective of interviews was to find out opinions about the automotive industry and SCM in Brazil as well as to learn more about Case Company X and its SCM operations. The interview questions are listed in Appendix 1. Figure 16 below presents the schedule of interviews.

FIGURE 16. Schedule for interviews

All interviews were recorded in order not to miss any information. Furthermore, the author has made some notes concerning key information, some interesting or unexpected answers and her own ideas. Each interview took from thirty minutes to an hour depending on interviewees' knowledge and way of answering. Interview questions were sent beforehand to be sure that the interviewees understand properly all questions.

5.2 Data Analysis

In this sub-chapter, data collected from interviews is carefully analyzed. The aim is to find the answers for research questions and determine the features of the automotive industry in Brazil, challenges in SCM as well as future trends, and find out more about processes in Company X.

All interviewees are employees of Company X of its main office in Latin America in Brazil. They were chosen according to their knowledge about the subject and their experience. They have different level of experience, including 1,3, 7, 12 or 20 years of work in the company. That allowed to

gain really deep insight on topics and, on the other hand, see a fresh point of view from interviewees who are rather new in the company and they are more likely to see some challenges. Interviewee 1, Interviewee 3, Interviewee 4 and Interviewee 5 are Brazilians, but Interviewee 2 is Mexican. Moreover, all interviewees had good English conversations skills and could answer questions in detail, except Interviewee that had more restricted language skills and the answers were rather limited. Nonetheless, everyone contributed so the author could obtain all needed information.

The interview questions are separated into three topics:1) questions 1-3 about the automotive industry in Brazil, 2) questions 4-7 about SCM in the country, and 3) questions 8-13 about SCM in Company X. First three interviews (Interviewee 1, Interviewee 2 and Interviewee3) were conducted mainly to receive information about last two topics (SCM in Brazil and in the company) as interviewees have a lot of experience in area of SCM. Other two interviews (Interviewee4 and Interviewee 5) were directed to gain answers mostly for the first topic questions (about automotive industry in Brazil) as interviewees have a lot of knowledge about the industry. Therefore, data analyses also include three steps according to the topics.

About automotive industry in Brazil

Both respondents (Interviewee 4 and Interviewee 5) mentioned that Brazilian car market has characteristics as preference of cheaper cars and fuel efficiency through flex-fuel technology or smaller volumes of engines. Interviewee 4 said that Brazilian people prefer cheaper cars due to limited amount of money they could spend on the car, from another side cars show social status and richer people who can afford more expensive cars usually choose them. Interviewee 5 noticed increase of automated transmissions in cars and “stop/start” systems because of Brazilian traffics and economy of fuel. Brazilians are more likely to install an alarm system on their cars to ensure safety.

Regarding to the challenges of the industry, Interviewee 4 mentioned that social inequality in Brazil makes many cars manufactures focus on cost-efficiency. Moreover, big culture differences and tax complexity also bring difficulties. Interviewee 5 also said about cost efficiency as the challenge is to keep old prices using new technology and the competition is very high especially for entry level cars. There are other challenges as globalization, high taxes, logistics, material and labor costs. There are many specific car models made for Brazilian market and the challenge is to become a global player and to align to the global production. Moreover, many car factories need renovations, but it is very costly and there is low productivity in the country as well.

Interviewee 4 said that connectivity of different services in the cars (like GPS) is one of the trends. Another is semi-automated features like automated parking, or even self-driving cars or special software to avoid accidents. Interviewee 5 commented that Brazil is a potential market and the trend is to increase car production and distribution to other countries. Another aim is to achieve the European level in terms of safety and services as the same car costs much cheaper in Europe. Moreover, probably in the future Brazil will be more opened market for imported cars and there will appear new players as Chinese companies that will create even higher competition due to their low costs.

About SCM in the country

According to the respondents (Interviewee 1, Interviewee 2 and Interviewee 3), there are several key elements that should be in any efficient supply chain. All of them highlighted integration, communication, and collaboration. Moreover, Interviewee 1 said that data analysis and digital interface play important role, so all employees are connected. Interviewee 2 added that there should be a strong leader that employees follow and that SCM should be strategic and aligned to companies' strategies. Interviewee 3 expressed that supply chains should be coordinated and flexible especially in such unstable market as Brazil with its economic and political crises.

Concerning characteristics of SCM in automotive industry of Brazil, all respondents (Interviewee 1, Interviewee 2 and Interviewee 3) noticed preference for road transportation. It connects to the next questions about challenges, as all interviewees said that the biggest challenge in Brazil is infrastructure. Roads are in bad conditions; rail roads are not developed, and ports are old. Interviewee 1 mentioned globalization, market growth and industrial digitalization as challenges. Interviewee 2 said that due to protectionism politics in the country raw materials can be very expensive and it is not allowed to use a lot of imported components. Moreover, political and economic crises play a significant role as nothing is stable in the country. Interviewee 3 expressed that many companies have stressed environment inside and bad communication, not enough of tools and often work needs to be done manually.

All respondents (Interviewee 1, Interviewee 2 and Interviewee 3) concluded that digitalization is definitely a trend. Interviewee 2 told that Company X has already some technologies to tract cars while being stored at warehouses or transported to the sales centers. They use QR codes that they put on ready cars and have them till the moment car reaches final destination. It allows track and find a car among thousands of cars being stored or transported.

About SCM in Company X

Interviewees explained the structure of a supply chain Company X has and there are factories and main facilities placed. It was important as the author could gain from internet only some pieces of information and this question allowed to get a better understanding. Interviewee 2 said that 60% of components are from local producers, although they have an engine producer that is placed 1,000 km away. Each car includes components from about twenty providers. Company X has many Just In Time deliveries to avoid excess inventory. The factory has three production lines for 10 different models. There is one vertical yard near the factory that accommodate 12 hundred of cars and another in different

state with capacity 20,000 cars – the main distributor center. After cars go to distribution centers of other 5 regions and then to sale centers.

Next question was regarding to the ratio of push and pull models the company has. Interviewees responded that as many other car companies, Company X has more a push model as car production takes a long time and it cannot deliver the products at immediate desire. Typically, it produces number of cars according to the forecasting and demand planning and then searches for customers. Interviewee 3 mentioned that forecasting plays a big role and forecasts are produced every month for the year ahead. Most of the time total productions is according to forecasting, but there can be change in models.

Interviewee 2 expressed WCM is owned by a private company and there are many members from different industries. Together they made a research on each other premises to gain knowledge what works better and what tools are the most effective. Together, they developed WCM concept in 2005 that the company implemented many years ago. This concept allows collaboration with other corporations and sharing of best ideas. Moreover, it brings commercial benefit to the members. However, there is no prove that the system is the best for car producers, as the world leading car manufacturer Toyota has a lean production that combines quality and fast speed. Interviewee 5 added that there was an objective to upgrade factories and processes without huge investments (to do as much as possible using less) and WCM allowed that. WCM brought visible results to the company and now factories produce more with less money and every year the production is even improving.

All respondents (Interviewee 1, Interviewee 2, Interviewee 3 and Interviewee 5) said that lack of communication is the biggest challenge in Company X. Interviewee 1 also mentioned availability of data to make decisions as a challenge. According to Interviewee 2 not all employees are opened to innovations and can fight with certain changes. Other challenges as lack of collaboration, defensive behavior or delegations of problems and responsibilities also are present in the company. Interviewee

3 highlighted lack of coordination, problems with understanding of direction board and need for established processes as the company tries to be very flexible so sometimes it does not have proper instruments for certain situations. Moreover, Interviewee 2 and Interviewee 3 had an idea that some problems exist because of cultural aspects of Brazilian people such as stressed environment, leaving things until the last moment, not fulfilling promises, a lot of talking and not so much doing. Interviewee 5 said that the challenge is to use the same component for production of different models across the company brands (standardization). Another common challenge is maintenance of employees and brining best talents as there is lack of them in Brazil.

The interviewees (Interviewee 1, Interviewee 2, Interviewee 3 and Interviewee 5) said there are some solutions Company X tries to implement to solve the challenges, like creating a website to share ideas, sending materials to learn about some useful topics. Moreover, Interviewee 5 mentioned HR programs for employees, creation of digital mindset, development of global projects, creating programs as WCM to increase competitiveness: WCL (World Class Logistics), WCD (World Class Distribution) and WCE (World Class Engineering).

The last question relates to spending of Company X on logistics. Normally it accounts to 20%, however in some months due to bad planning it can be up to 30%. For the last years this amount has lowered. Company X is undergoing some changes in SCM processes as World Class Logistics (WCL) concept is implementing in Europe and North America, expected to be implemented in Brazil next year. It will conduct reviews of calendars, planning methods and efficiency. The employees are positive about this as they believe it will bring more structure and innovation and eliminate not efficient processes.

6 RECOMMENDATIONS

To the country:

Government of Brazil needs an effective strategy to overcome economic recession to stabilize markets and rearrange the production. Moreover, it should develop new infrastructure projects and attract investments in order to be make other modes of transportation (not only road) popular and convenient. Another important step is developing strategies to minimize social inequalities. Tax reforms should be also considered as the country established high taxes on labor, materials, product and other services considering incomes of people. Moreover, to boost potential of labor market, there should be some projects directed to education of population. One of the essential steps is establishment of safety in the country.

To the companies (especially in automotive industry):

Companies that operate in automotive industry in Brazil are exposed to instability because of the industry's and country's characteristics. Nonetheless, there are several steps that would help to build a successful supply chain. Firstly, each supply chain should have certain elements that allow to operate in full potential. For example, good communication channels, collaborative environment, coordination between member, optimization of resources, flexibility, risk management and strategic alignment make supply chains strong and efficient. Therefore, companies should make sure that their supply chains include all these aspects.

Moreover, there are different strategies and concepts that embrace the key elements and bring improvement of processes and other benefits. There are plenty of concepts as SC Optimization, SC Integration, SCOR frameworks, Lean SCM, Green SCM, WCM and WCL and many others. All of them use specific techniques to reach one objective: make a supply chain efficient, to produce more using less.

Furthermore, there are many challenges that companies face in Brazil and all of them are listed in the next chapter as the answer to the main

question. The aim is to have them in considerations and find the solutions, so a supply chain is prepared to any events and it would not bring giant loses, because it is impossible to avoid everything. It is more difficult to deal with external challenges as it is impossible to completely eliminate many of them, but risk management helps to minimize the effects. On the other hand, many internal challenges can be handled, but sometimes they are more problematic to find as often employees cannot notice that usual for them processes can be not that effective. In this case outside consulting can help a lot to see what can be improved.

To Company X:

One of the visible challenges that Company X needs to work on is the communication inside the company and between members of the supply chain. Moreover, stressed work environment jeopardizes the productivity and efficiency. There could be done seminars, talk with external/internal speakers or team building sessions to make people hear each other, not being defensive, not give empty promises or put responsibility on the colleagues, to be open to innovations and changes.

Moreover, employees should be aware of strategies and objectives for the future for one year and one month ahead, data should available as it will reduce errors. Also, there could be done some projects to motivate staff and make an environment they want to work in to reduce labor leakage. Furthermore, there should be some updates of processes to decrease manually done work and remove unnecessary activities.

7 CONCLUSIONS

This chapter sums up the information collected throughout the theoretical and empirical parts of the research. Firstly, it presents answers to the main question and sub-questions stated in this thesis. Furthermore, it has a sub-chapter dedicated to reliability and validity issues and finishes with further research suggestions.

7.1 Answers to Research Question

The research has studied and evaluated supply chain management in automotive industry of Brazil. To gain a deep insight into the topic, four sub-questions were created to support the main question. Therefore, the author decides to provide the answers for sub-questions first and finish this sub-chapter with the answer for the main question.

The first sub-question is stated here:

What are the key elements of an efficient SCM?

SCM is a wide concept and it includes many aspects. Each industry has its own characteristics affecting its supply chain. Therefore, there is no ready recipe that would suit perfectly to all companies. Nonetheless, there are certain elements that many efficient supply chains have: good communication, collaboration and coordination inside the supply chain; integration with supply chain members; optimization of resources; flexibility in fast changing markets; risk management to minimize threats; alignment of supply chain strategy to strategy of a company; strong lieder; data analysis and digital interface. Moreover, many big corporations implement supply chain concepts as SC Optimization, SC Integration, SCOR model. Lean SCM, Green SCM, WCM as the case company or other concepts that increase the efficiency.

Next sub-question is:

What are the characteristics and future trends of SCM in the country?

One of the main characteristics of SCM in Brazil is preference of road transportation as 61 percent of total freight is moved by road transportation. There are few trends that dominant in Brazil as in many other countries like globalization of supply chains; outsourcing to reduce prices; collaboration between bigger companies; “agile” concept that promotes flexibility, and digitalization of supply chains.

Third sub-question is:

What are the features and trends of the automotive industry in Brazil?

Car manufactures in Brazil are tied to forecast as many other companies in the world. Their supply chains are complex due to number of components each car needs. In Brazil, there is no strong local brands and the market is dominant by few large car producers. Although the country has all needed raw materials for car production, they are expensive. Moreover, the government has established protectionism policy to promote local production and return of tax for companies if they invest in Research & Development. Moreover, compact, cost and fuel-efficient cars with smaller engines are popular in the country as well as bioethanol and “flex-fuel” technology. Nowadays there is increase of automated transmissions and “stop/start” systems to save fuel and alarm systems to protect the cars. Trends are connectivity to services, semi-automated functions, increase of production, higher competition and opening of the market.

The last sub-question was following:

What are the main challenges the case company face in SCM?

As was mentioned before, the company has a push model therefore it is tied to forecasts. Moreover, there is lack of communication and coordination, not availability of data to make decisions, not all employees are open to changes and innovations, presence of defensive behavior and stressed environment. Another challenge is standardization of the

components to use in different model across the brands. Lastly, there are high costs and the leakage of workers.

The main question of the research is:

What are the challenges of supply chain management in the automotive industry in Brazil?

As it was mentioned in the theoretical part, challenges that companies face can be divided into two parts: external and internal. Brazil is rather unstable market therefore supply chains have many challenges. Many of them have economical character as the country is currently under deep recession, there could be demand and supply shocks, volatility, money inflations, there is not enough money to invest into infrastructure: road are in bad conditions, railways are not developed, waterways are not used in full potential, ports are old and need reconstruction. Moreover, the country has high labor, material and logistics costs and very high and complex tax system. Also, there is not enough of skilled labor, corruption, bureaucracy, piracy and crime. Deep inequality in society and cultural difference make companies to produce cost-efficient cars constantly cutting costs. Furthermore, challenges are a big size of the country, protectionism policy, market growth, globalization and industrial digitalization that need big investments.

Internal challenges are choosing right partners, opportunistic behavior, security risks, lack of coordination and the bullwhip effect. There are strategic challenges to align companies' strategies to supply chain strategies, visibility, dependence on the forecasts and alignment to global production. Moreover, many factories need renovations and investment in innovations and there are not enough tools, so many processes are done manually what is time consuming. Furthermore, there are cultural challenges as stressed working environment, empty promising, bad communication and other challenges included to the answer for the previous question that Case Company faces.

7.2 Reliability and Validity of the Research

Concept of reliability concerns the consistency of research findings through data collection techniques and analysis processes. Research can be called reliable if the measures show the same results in different events, when similar observations can be collected by other observers, and when it is visible how raw data was processed. (Saunders et al. 2009, 156.)

The outputs of the research work can be considered highly reliable in this time frame in case country Brazil. Due to fast changes of economic and political situations in the country, the results may be different if the same study would be organized later or in another location. Moreover, interviewees might have been biased to some extent. However, the author insisted on answering honestly in order to receive truthful information. As it was said before in introduction, the research includes study of the case company X that is a car manufacturer in Brazil and the results may vary in other supply chains of the country including other car producers.

Validity shows the quality of the conclusions and interpretations made after examining the collected data. It checks if findings are really about what they look like to be about. (Saunders et al. 2009, 157.) In this research were used both secondary and primary data. Secondary data includes academic and semi-academic books, reports of companies, and articles. Primary data was collected using semi-structured interviews with five Company X's employees. The responds showed similarities of the opinions and no confronting answers. Moreover, information gathered from secondary source matched in many aspect information gathered by interviews.

The objective of this thesis was to come up with the challenges that car manufactures face in their supply chains based on the case company X. The outputs of the desk research and empirical research were used to gain a deep understanding of SCM in Brazil and what companies face in daily activities. The results of analysis of theoretical and empirical parts

have helped to reach the main objective of the research, therefore, the research can be considered valid.

7.3 Further Research Suggestions

The research shows the challenges of SCM in the automotive industry of Brazil using Company X as a case study. Therefore, there could be additional research involving other company or companies. Moreover, further researches can be directed to other industries of the country as all of them have specific characteristics and differences in supply chains.

Furthermore, it was noticed that cultural aspects influence the way business is done and create additional challenges, that could be studied deeper. As was mentioned, the country was under deep recession for the past few years. Now the situation has started to slowly change, although with not a big progress. Therefore, it would be suitable to conduct an additional research in the long run to analyze and evaluate supply chains for further details.

8 SUMMARY

The objective of the research was to find out what are the challenges in SCM in automotive industry of Brazil, and give some recommendations to the government, companies in Brazil, and Company X. SCM is very crucial to businesses as it has strong impact on whole companies' operations.

The research started with theoretical part - the introduction to the concept of supply chain management, explaining structure of supply chains and model as well as key elements. Moreover, the chapter includes information about strategies to increase efficiency, challenges many supply chains have, trends and attributes of SCM in global automotive industry.

The empirical part starts with chapter 3 that is dedicated to the case country Brazil and its background, infrastructure and logistics characteristics. Next chapter tells about the case company X, its position in Brazil and production process. Following chapter contains empirical research: data collection and data analyses processes. Chapter 6 has some recommendations given to the government, to the companies in Brazil and Company X. The results of the study and answers to the research questions are presented in the conclusion of the thesis.

The research shows the analysis of supply chain management in the country and presents several recommendations to suggest improvements and steps that can be followed in order to develop potential od SCM in Brazil. The thesis reached it goal by finding answers to the questions that were stated for the research. The limitations are that not all companies of the industry in Brazil and outside the country face the same challenges. There are topics suggested for further research to investigate other companies of the industry or SCM in different industries of Brazil, cultural aspects affecting the business and SCM of car industry in the future.

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APPENDICES

APPENDIX 1. Interview questions

About the automotive industry:

1. In your opinion, what are the characteristics of automotive industry in Brazil?
2. What are the challenges companies face?
3. What do you think are the future trends in the industry?

About SCM in Brazil:

4. In your opinion, what are the key elements of an efficient SCM?
5. What are the characteristics of SCM in automotive industry in Brazil?
6. What are the main challenges?
7. Is there any specific future trend?

About Company X:

8. Please describe the structure of the supply chain of the company.
9. What ratio of push and pull models is used? What role does forecasting play?
10. Why has the company decided to implement WCM system? What are the advantages of the system comparing to other concepts?
11. In your opinion, what are the internal challenges of SCM in the company?
12. Are you aware of any solutions the company tries to implement?
13. Out of all expenses the company has, what is the percentage spent on logistics costs?