Brazilian industrial complex of Camaçari: the challenges of industrial decentralization

Caio van Engelshoven do Lago

Centro Estadual de Educação Tecnológica Paula Souza-São Paulo-Brazil

saara_magreb@hotmail.com

José Martino Neto

Centro Estadual de Educação Tecnológica Paula Souza-São Paulo-Brazil

Hellen Xavier das Chagas

Centro Estadual de Educação Tecnológica Paula Souza-São Paulo-Brazil

Valmir Moura

Centro Estadual de Educação Tecnológica Paula Souza-São Paulo-Brazil

Marcelo Paranzini

Centro Estadual de Educação Tecnológica Paula Souza-São Paulo-Brazil

Abstract This article aims to discuss the challenges of industrial decentralization and car industry in Camaçari, Bahia by exploratory research methodology. The results indicate the adoption of tax relief contributed with decentralization however, the distance between suppliers is harmful to environment

Keywords: Industrial Ecology, Green Logistics, Ford

INTRODUCTION

Some contemporary historical processes as the exponential world population growth, increased agricultural areas, also increasing urbanization and the spread of industrialization contribute to instability of humankind permanence on planet earth. Natural elements responsible for human survival like fresh surface water and arable land are scarce and concentrated in a few regions. On the other hand, considering other aspects, the Industrial Revolution started in the eighteenth

century in the European historical context increased exponentially the emission of polluting gases into the atmosphere.

Environmental concern in production processes began to be discussed holistically, around the world, from the early 1970. The industries are largely responsible for the spread of toxic pollutants across the globe consequently was imminent streamline the processes of the various production chains. The Industrial Ecology emerged as a new approach in a systematic way, because it analyzes the industrial system, products, waste and the interaction of these with the nature (Almeida and Giannetti, 2006. Our translation).

In the 1980s come declarations of international scope in favor of the environment. The United Nations (UN) chaired by Gro Harlem Brundtland established the World Commission on Environment and Development. In 1987, the commission recommended the creation of a new Universal Declaration on environmental protection and sustainable development.

As for sustainable development, a definition currently accepted is "the development to meet the needs of the present generation without compromising the ability to meet the needs of future generations. Development does not exhaust the resources for the future "(World Commission on Environment and Development - WCED 1988 (Akabane et al. 2013. Our translation).

Logistics was also influenced by environmental issues in recent decades. This activity enables integration between consumers and producers in various global supply chains. For Ballou (2006) activities such as planning, implementing and controlling the efficient flow and economically viable of raw materials and products are just a few points of the logistics universe. The concepts of sustainability also came to logistics, being very comon the use of the new terms like Green Logistics or Sustainable Logistics.

The externalities of logistics operations such as the emission of gases like CO_2 becomes part of the daily lives of managers from different production chains. Green Logistics is not based on new logistic activities, but the choice of the best mode of transportation or also the most efficient route to be used.

In the case of car industry in Brazil, the dependence on road transport is huge. Perhaps is not unique in this production chain, but of the entire national economy. Tangible alternatives circulation of supplies and goods could be coastal shipping and railroad transport.

The national political environment also influences the geography of Brazilian car industries. Federative units of the Brazilian Federation fought for productive investments from automakers in the 1990s. Some regions that were not covered with automakers plants, such as the Central-west and Northeast, won automobile productive investments in this historical context.

In the 1990s, an intense and aggressive competition for foreign investment took over the Brazilian automotive sector. States and municipalities have articulated - sponsored by the central government , federal agencies , state funds and official banks - such as BNDES - and offered to return the tax collected (or because of) the companies themselves , through various forms of financing if the most generous rates than the market. (Arbix 2002. Our translation).

Green Logistics and Industrial Ecology are essential principles and practices to which humanity use natural resources more rationally, thinking of the future generations. However, not always in the political or business plan the environmental impacts of production and logistics processes are weighted.

LITERATURE REVIEW

The theoretical principles of Industrial Ecology and Green Logistics and its correlation with the Brazilian automotive industry are the starting point for the literature review of this article. Another important theoretical aspect to be addressed is the discussion of the fiscal war between units of the Brazilian Federation. This triple analysis encompasses areas such as production processes, logistics and public policy.

The preservation of nature in its various biomes and the choice for production systems cleaner, until the mid-twentieth century, it was rare. This theme was not present on the political agenda of most countries. Economic development was a priority of governments in this historical context. Environmental concern in production processes began to be discussed holistically, across the world, from the 1970s.

The industries are largely responsible for the spread of toxic pollutants around the globe. Rationalization of the emission of pollutants of processes of the various supply chains is essential concern for engineers, managers and politicians to the present time. The metabolic system serves as inspiration for the production processes.

The idea of describing the materials and energy flows inherent in industrial processes as a metabolic system was introduced by Robert U. Ayres with the "industrial metabolism" expression. The concept is based primarily on the application of mass balances the movement of materials and energy balances over the production processes. (Almeida and Giannetti, 2006. Our translation).

The life cycle of materials and energy in nature is maintained by three groups: producers, consumers and decomposers, which should be emulated by production processes. The geographical proximity between the three groups cited living things is a favorable factor for recycling (decomposers) and the reuse of virtually all matter (producers). (Almeida and Giannetti, 2006. Our translation).

On the other hand, human processes do not have a closed circulation materials such as natural. Many industrial processes produce are irreversible and / or pollutants and toxic waste being classified as "open loop" by industrial ecology. Accordingly, only nature present processes "closed-loop" in which all residues are raw materials for other processes. These theoretical concepts presented were summarized in Table 1.

Table 1 - Comparison between biological and industrial metabolism.
Source: (Almeida and Giannetti, 2006. Our translation).

Ecosystem	**Industrial system**
Living being	Company
Reproduction	Production
Population	Industrial park or cluster
Proximity producer / recycler	Variable distance between producer and recycle
Closed cycle of matter	Open cycle
High recycling rate	Low recycling rate
Regulated by the amount of material reservation	Regutated by product demand
Concentration and waste reuse	Spread of waste
Competition for available resources	Competition for available resources
Interact with the environment	Change the environment

There is a fundamental activity to human well-being and competitiveness of countries among the industrial processes and consumption of the population. Logistics is this strategic activity for the whole country, company or family. Transportation is the most expensive activity and polluting in logistics, varying in proportion to the chosen modal. For Akabane et al (2013) “For the current management of shifts, managers should use more sustainable as possible operations in this sense arises Sustainable Logistics and Green Logistics ".

Politically, tax incentives in the 1990s decentralized the automobile industry in Brazil. Brazilians states struggled to attract automakers to their respective territories. Until the 1990s, the states of São Paulo, Minas Gerais and Paraná and Rio Grande do Sul concentrated all the nation's car industry plants. This period is common known as fiscal war, when happened political dispute between the states by massive investments of international carmakers. The figure 1 in next page shows the concentration of car industry in that time.

The fiscal war is focus on the game with the revenue and future tax collection. It involves, however, different rates and financing for working capital and infrastructure, including earthwork, saw access, port, railroad and bus stations, as well as communication grids and even the reduction of electricity tariffs. (Arbix 2002. Our translation).

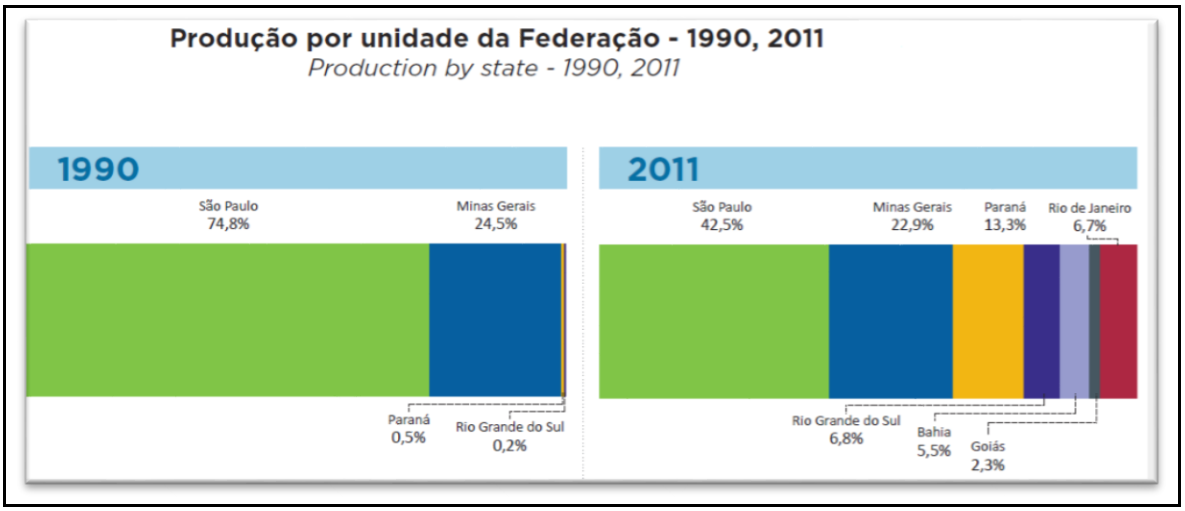

Figure 1- Production for unit of Brazilian federation
Source: (Anfavea 2014).

Bahia and Rio Grande do Sul intensely disputed Ford's investment in a new industrial complex in their respective territories. The hand of relatively cheap labor and the Camaçari Petrochemical Complex were some factors that encouraged Ford to migrate to northeastern Brazil. Data on tax incentives offered by Bahia were considered confidential and classified as top secrets documents during the dispute with the southern state.

Currently the modern industrial complex of Camaçari is a model for integration between suppliers and Ford, which share the same plant. Several productive functions were outsourced to partners considered important. However, despite the generous tax incentives, the geographical distance of input suppliers and consumers markets going in the opposite direction to the principles of Green Logistics and Industrial Ecology.

METHODOLOGY

To initiate research on the interaction of Green Logistics and Industrial Ecology with the Brazilian automotive industry, from literature review and consultation of the Brazilian Automotive Industry Yearbook 2014, in Anfavea (2014), the Camaçari Industrial Complex, located in the metropolitan area of Salvador. It drew attention to the isolated geographic location and complexity of the logistics supply and car distribution operations. The research is exploratory and descriptive, from the first contact with the theme. The spatial and temporal cut the Ford complex in Bahia, focusing on their production and logistics processes, from 2002 to 2014. This article has mixed nature, with some quantitative and qualitative analysis of the selected problem.

GEOGRAPHY OF BRAZILIAN AUTOMOTIVE INDUSTRY

The study of the implementation of the industrial complex of Camaçari by Ford, located in the metropolitan area of Salvador will be objective of this study. Evolution of the automobile industry in Brazil have some facets that go beyond simple economic development in other regions of the country.

The Brazilian automotive industry began operations in the 1950s, in the current Greater São Paulo (RMSP). President Juscelino Kubitschek encouraged the flow of multinational for the production of durable consumer goods. Sao Paulo seconds Arbix (2002) benefited from this new national productive phase with the installation of six automakers in 1957 to 1959 (Ford, GM, VW, Toyota, Mercedes and Scania).

Fiat and Volvo were pioneers in the RMSP exodus in the 1970s. This Italian company set its production in Minas Gerais state at 1976, and the Swedish in Paraná state at 1979. Since then, the industrial decentralization of the sector is growing and spread all over the country. According to the Brazilian Automotive Industry Yearbook 2014, in Brazil there are 61 production plants of vehicles, agricultural and highway machinery, engines and componentes. The figure 2 below shows all Brazilian regions are covered with automakers. The concentration of the automotive industry in the South and Southeast regions of the country is 90.16 % of the entire automotive industry.

The Northeast region in 2014, according to the same yearbook about automotive industry owned two auto plants in the states of Bahia and Ceará. These two units belong to Ford Company.

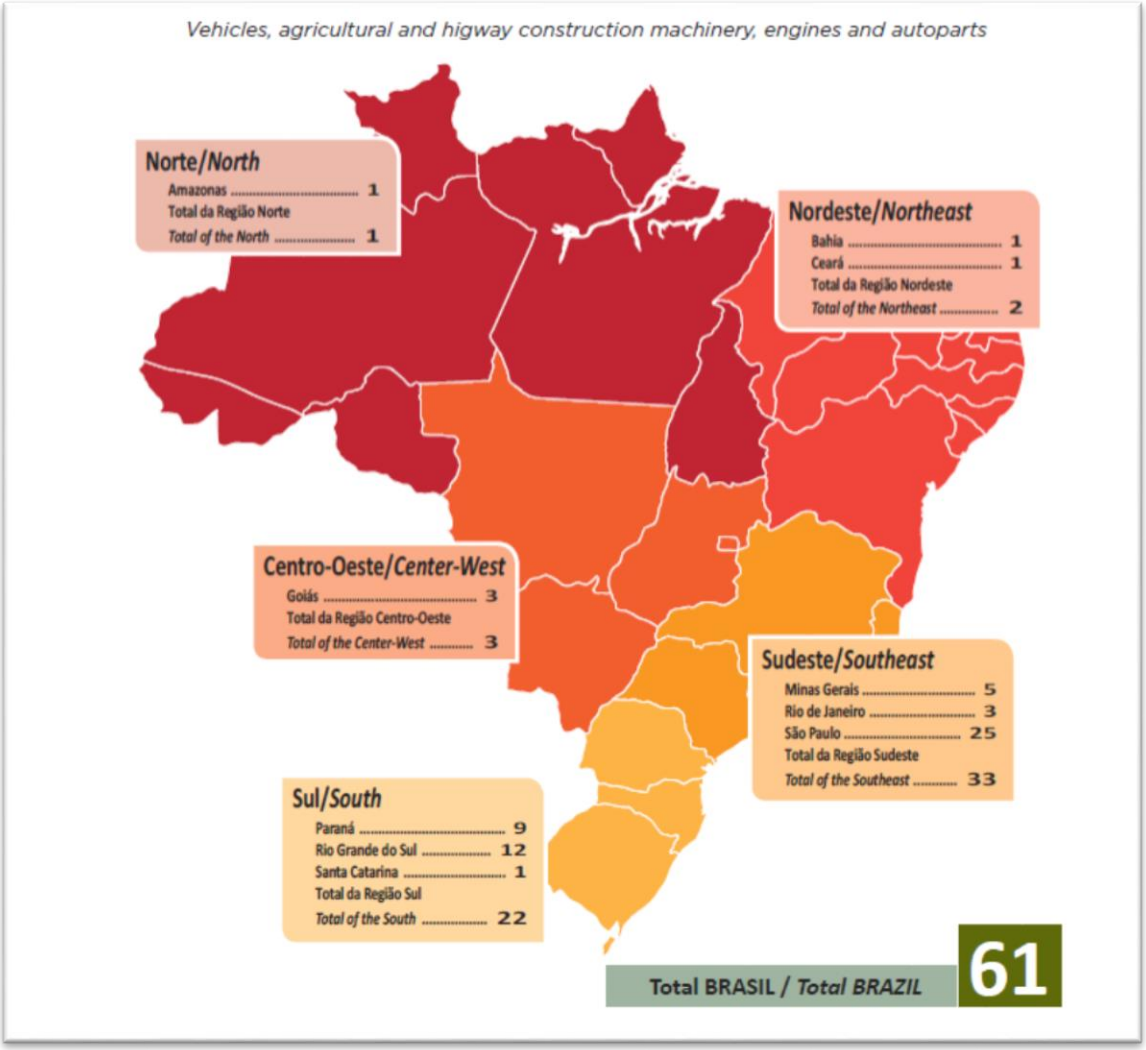

Figure 2 – Map of automotive industry plants in Brazil at 2014
Source: (Anfavea 2014).

THE FORD MOTOR COMPANY AT CAMAÇARI-BAHIA

The Ford Motor Company was founded in 1903 by Henry Ford in Detroit area, Michigan, United States. The company popularized the automobile market through relatively efficient and cheap production processes, in the early twentieth century. Ford arrived in Brazil 1957, specifically in the state of São Paulo, along with VW and GM. The Big Three domestic automakers dominated the market until 1976, when Fiat started industrial operations in Minas Gerais. In 2002, Ford opened a new production plant in the Northeast.

The company inaugurated the Camaçari Industrial Complex in Bahia in 2002. After years of dispute with the Rio Grande do Sul by a large productive investment of US automaker, the metropolitan area of Salvador won their first automobile industry. According Sako (2006) the Ford

Industrial Complex in Camaçari, in Bahia, is a condominium with suppliers, some of which installed under the same roof as the Ford. This new spatial organization over and regulates the production processes in units called modules.

Different niches of partner companies activities are allocated in the industrial complex of Camaçari. Input suppliers to the production line as auto parts and provider of logistics services, maintenance and development of products share the same physical space in Camaçari. The outsourcing of production allows you to share overhead costs and the fixed ones.

The project called Amazon designed the development of an economy car platform- B, using Ford's product architecture with 19 modules. The new Fiesta began production in Camaçari in 2002, and the EcoSport was released then in 2003. From the beginning, the idea of the Amazon project was to push the outsourcing to the limit and save on overall and fixed costs, by dividing them with suppliers. (Sako 2006. Our translation).

The Ford system performs the milk run in their logistics operations. The milk run system is widely used by domestic auto industry. In this system, the collection of parts from various suppliers is programmed according to market demand. The system reduces inventories and allows for greater integration with supply vendors. The modern industrial complex of Camaçari is the only automobile industry of Bahia, located approximately 2000 km of the RMSP. Every day dozens of trucks of 25 tons realize the path between the two metropolitan areas. This distant and peculiar milk run conducted by Ford between two metropolitan areas is one of the most distant Brazil. The scheme of milk run is below at figure 3.

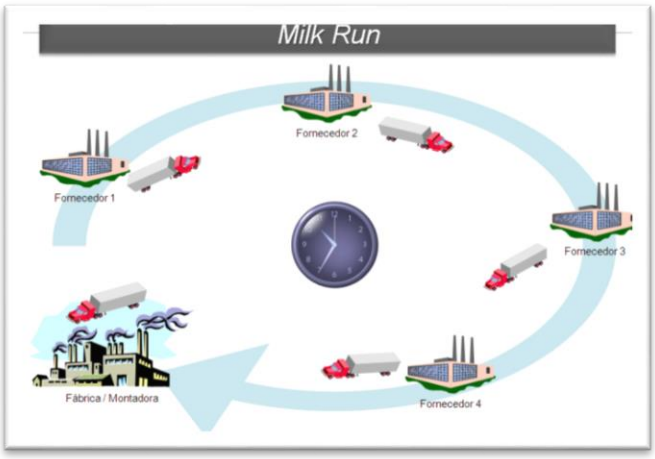

Figure 3 - Logistics operation scheme: milk run
Source: google images.

The high emissions of greenhouse gases this operation logistics by road transportation by Ford is one of the negative points of the geographic decentralization of automobile production in Brazil. Despite the supplies and logistics services providers share the same ground in Camaçari, the inputs needed to produce travel over 2000 km by Brazilian roads. A comparative study of the logistics operations of Ford, conducted in 2013 by Akabane at al (2013) argues that road transport emits into the atmosphere around 116 kg of carbon dioxide (CO_2) in a transport of a thousand ton of

cargo per kilometer. Nevertheless, in the same time, the coastal shipping modal emits 20 kg (CO_2) in the same condition.

The hypothesis of this paper is that the principles of Sustainable Logistics and Industrial Ecology are far from the reality of the industrial complex of Camaçari. Political factors such as the fiscal war in the 1990s influenced the geographic decentralization of the auto industry. A major national dependence on road transport and the low quality of Brazilian logistics infrastructure results in a chain of polluting supplies. Industrial ecology advocates the geographical proximity between industrial plants as in Kalundborg, Denmark. This proximity allows greater exchange of material, energy and information between companies. In the case of Ford in Camaçari, the distance of their supplies suppliers is a big issue in Green Logistics.

For vehicles to consumer markets, according to the Automotive Industry Yearbook Brazilian 2014, Bahia had only 3.3 % of the national fleet. The four largest fleet in Brazil in 2013 were respectively from São Paulo, Minas Gerais, Parana and Rio de Janeiro. These states jointly own 60.8 % of the national fleet. It can be seen in the figure 4 below about Brazilian fleet. The Northeast has a small share of the in the national fleet. Some populous states in region how Pernambuco and Ceará have just 2.5 % and 2% respectively of Brazil fleet.

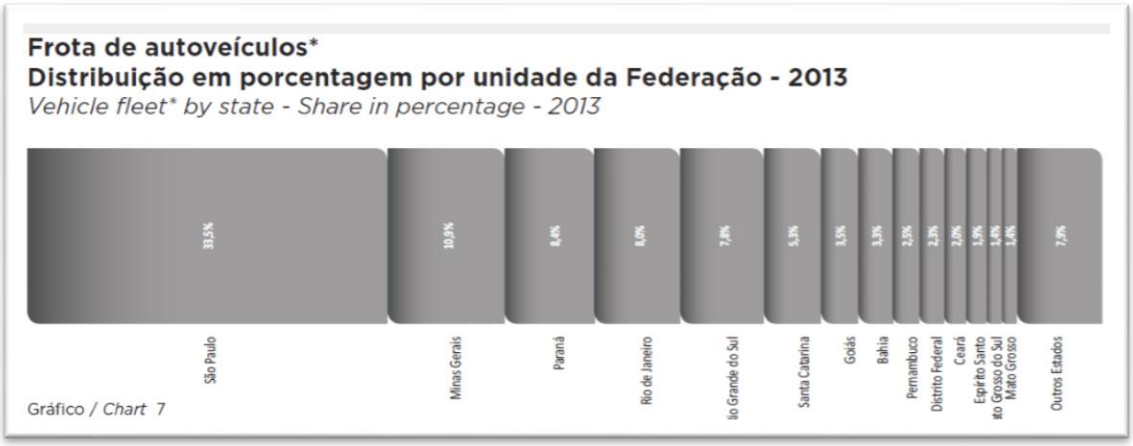

Figure 4 - Vehicle fleet by state
Source: Anfavea (2014).

FINAL CONSIDERATIONS

The industrial complex of Camaçari operates since 2002 in Bahia. Is synonymous of technology and regional development in automotive industry. However, since then, the fiscal war spread among Brazilian states. Their logistics operations are complex due to the fact be far from the Southeast, the main automobile market and supplier of production inputs. Modern principles of Green Logistics and Industrial Ecology can not be fully applied to the complex dependence of the “pollutant " road transport and productive isolation with other automotive plants in the country.

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