Global Journal of Management and Business Research: A Administration and Management
Volume 19 Issue 7 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4588 & Print ISSN: 0975-5853

Automotive Sector, Assembly Plants and Productive Articulation in Cd-Juárez, Chihuahua, Mexico - El Paso, Texas, U.S.A., Business Intervention Consequences and Challenges

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Summary- This article is the second of the field research carried out during 2015, in the automotive sector of Ciudad Juárez, Chihuahua. In this locality in the North of the Country, On the border with El Paso, Texas, it is one of the most economically driven and job-generating sectors in the State. The main objective of the work is to establish the characteristics of productive articulation between assembly plants in the automotive sector, the educative and government sector, as well as the coordination and relations that the supplier Plants at Level 1 (Tier1), which they maintain with the general offices in the countries of origin as well as their subsidiaries in various parts of the World.

Despite the complexity of the characteristics of this inquest for confidentiality and security issues, by the background already known that affected Cd. Juárez in previous years, it was difficult to conclude interviews with the general managers, Responsible for human resources or in charge of production of automotive suppliers, however it was possible to conduct interviews with nine companies, 7 at level One (Tier1), and 2 at level Two (Tier2), as well as a responsible for industrial and competitive policies in the State of Chihuahua.

Keywords: automotive sector assembly plants productive articulation enterprises intervention.

GJMBR-A Classification: JEL Code: M10

Strictly as per the compliance and regulations of:

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The results allow to define the general situation that presents the automotive Sector through some of the most important assembly plants that operate in the area of Cd. Juarez-El Paso, Tx., however it is necessary to insist on obtaining information from a greater number of Companies that have an important participation of supply at national level with international impact for the implementation of greater coordination and integration among the diverse actors involved in the sector, which will allow to establish guidelines of Action and collaboration of each one of them and to provide economic projection with significant impact on the living conditions of the collaborators and consequently their families.

Keywords: automotive sector assembly plants productive articulation enterprises intervention.

I. Introduction

The research carried out on the northern border of Mexico, particularly in Ciudad Juarez-El Paso, Tx., It analyses the characteristics of the productive articulation of some Tier 1 and Tier 2 supplier companies in the automotive sector, in particular establishes the relationships between these, the education sector, government sector and other smaller companies, As well as the existing coordination with its general offices in the countries of origin and other plants in different locations of the world.

The strategic location of the automotive companies in the border line, facilitates the linkage of these organizations with the OEM´s[1], because through the warehouses and distribution centers located in El Paso, Tx, it is possible through the logistics to deliver level 1 suppliers directly to the automotive plants located in the U.S.A. or send them to the five continents, According to the dimensions and fragility of the equipment to be delivered, so this article will address the description of the type of relationships presented as well as the details of the operations that these companies carry out to fulfill its task, and to be more efficient regarding the delivery of spare parts or supplies for the assembly of automobiles in the world.

The Previous research carried out in the Central-Western region of the country, where there is an important concentration of automobile assembly plants, in the States of Aguascalientes, Guanajuato, Jalisco and San Luis Potosí, It allows to have a reference of the operation of the companies supplying with the OEM´s as well as their linkage with the educative and government sector, as well as their contribution to the local economic development and the improvement of the living conditions of the collaborators in the Automotive plants.

The research presented extends the field work that has been done already in two regions of the country, Central-West and North, it allows little by little, when traveling the country to have a clearer idea of the operation of the automotive sector, and to evaluate the advances but also the barriers that prevent a greater growth of this industry, and later to recommend to the

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[1]OEM´s Original Equipment Manufacturer, Original Equipment Manufacturer

creators of public policies of the Federal, State and Municipal Government, education and research institutions in which way they have to intervene to achieve greater integration of the actors with the productive groupings to maximize their results and achievements.

The objectives of the research were:

1. Establish the characteristics of the productive articulation of some assembly plants in the automotive sector in Cd. Juárez, Mx.-El Paso, Tx.
2. Define the relationships of assembly plants in the automotive sector with other sectors, governmental and also educational
3. To Determine how the model of assembly plants of automotive sector contributes to Cd. Juárez, Mx-El Paso, Tx., and the benefits for collaborators and their families.

Hypothetical Scenarios Were Suggested

H1: The productive articulation of the assembly plants of the automotive sector in Cd. Juarez, Mx.-El Paso, Tx, It is presented from the relations of these with its general offices, plants in other continents, but mainly with the OEM´s for the delivery of original spare parts or the design of new automotive applications.

H2: The relationships of assembly plants in the automotive sector with other sectors, governmental and educational, is scarce, is limited to the provision of public services or as a source of human resources at the technical and professional level, there is no real relationship of Exchange between sectors to promote development and technological innovation.

H3: The assembly plants model of automotive companies in Cd. Juárez, Mx-El Paso, Tx., does not give benefits to collaborators and their families that contribute to improve their human development and the economic growth of the localities where they live.

The research questions related to the objectives and hypothesis were:

1. What are the characteristics of some of the assembly plants in the automotive sector in Cd. Juárez, Mx.-El Paso, Tx, and how are they articulated with their general offices and automotive assemblers in other continents but especially with the OEM´s?
2. How are the assembly plants linked to the automotive sector of Cd. Juárez, Mx-El Paso, Tx. With the government Sector and the education Sector?
3. What benefits do the assembly plants in the automotive Sector give to collaborators and localities where they are particularly in Cd. Juárez, Mx-El Paso, Tx.?

II. Research Method

The research was carried out with a qualitative-exploratory approach, in the natural environment of the automotive sector in Cd. Juárez, Chihuahua; Its design is non-experimental, ethnographic-type specifically a case-to-depth study, established the operating characteristics of assembly plants and their relationship with other companies, government academic agencies and investigation. As studying the population, its sample unit is the automotive and auto parts companies in the extension of the border area of northern Mexico. To define its number, an examination of the registry of companies or databases of different sources was carried out:

Ministry of Economy of the Government of the state of Chihuahua, Asociación de Maquiladoras A.C./Índex Juárez and linkage area of the Autonomous University of Ciudad Juárez.

The elements or unit of analysis of the population are key actors of the assembly plants of the sector, managers, heads of human resources, heads of innovation and improvement.

For qualitative research with case-to-depth study design, a sample was taken at convenience with those companies that agreed to participate in the research, for which the area of linkage of the Autonomous University of Ciudad Juárez intervened, Taking into consideration existing conventions to obtain information, 10 representative companies of the sector were to this effect, Delphi, Oelav y Legget & Platt, Lear Corporation, Nidec Motor and Actuators, Federal Mogul, Johnson Control´s, Key Safety Systems and Nexteer; We used the strategy of selection of chain sampling, from networks of informants.

The data collection method was divided into three parts: (a) Obtaining secondary documentary sources by conducting a content analysis from publications related to research in the international automotive Sector database and specific studies of related organizations Directly to the automotive sector, like the Asociación Mexicana de la Industria Automotriz (AMIA), Industria Nacional de Autopartes (INA), Asociación Mexicana de Distribuidores de Automóviles (AMDA), Cluster Automotriz Nacional; (b) Visits to plants and original equipment manufacturers were carried out to know their operation, Direct observation of their processes in the facilities of the companies and automotive plants also (c) With the support of a guide, interviews were conducted in depth, consisting of questions grouped in four sections: I. General information of the plant, II. Manager's data, III. Development and relations of the plant, and IV. Innovation and technology, in total 32 questions were made.

The transcription of interviews was carried out for analysis and later as part of the results, maps of

integration of the productive groupings of the automotive sector were elaborated from chains and business networks and their relations with other Organisms and their interaction with automotive plants in other countries.

III. Theoretical Framework

The essential aspects that are analyzed from the theoretical perspective are: Export assembly plants, automotive Sector, productive articulation and business intervention to later relate them to the empirical findings resulting from the field research carried out in Ciudad Juarez Chihuahua.

a) Assembly Plants

The assembly plants are foreign industrial plants that own, control or subcontract operations that temporarily produce imported components in Mexico that become export products. (INEGI, 1994). The export assembly industry is a group of companies or establishments that are engaged in performing some or more of the stages of the production process. The assembly activity is destined to the transformation, elaboration and repair of goods of foreign origin, imported temporarily for their later export, (INEGI, 1994). One of its main characteristics is the intensive use of labor, which generates a lot of jobs in the places where they are established.

For the first time in 1965 the program to boost industrialization of the northern border was officially approved, which consisted basically of the installation of fragments of the productive processes of American industrial companies that required an intensive use of labor. The concept of "twin plants" emerged, where a single management could manage a high-tech intensive-capital plant in the United States and an intensive-labor plant in Mexico, (Madison, 1990).

In the 80 ´s, the assembly plants recovered greatly, after two consecutive crises, That has been booming in Mexico since it is linked to the trends of the International Labor Division (CEPAL, 1996), That together with the restructuring of the urban labor market, high technology, and the emergence of a specialized flexibility are the causes of proliferation along the northern border of Mexico. The transition from the primary sector to a secondary or industrialized economy with a great deal of work and low investment, led to the involvement of the private sector and the government, allowing the creation of infrastructure and demonstrating the potential that they had for the attraction of capital for the assembly of plants.

Currently there are in several regions of the country, assembly industries grouped in specialized industrial clusters: Automotive industry, aerospace, production of molds, medical devices and machinery; Concentrated in the regions: Northeast, 198 Plants; Bajío, 142; Center, 101; y Northwest, 70, In the automotive sector, the entity with the largest amount of exporting assembly plants is Ciudad Juárez, Chihuahua, (Tovar, 2015).

b) Automotive sector

The automotive Sector is one of the three most important economic development around the world, followed by biotechnology, food and medicine, and the electronic sector, information and communication technologies, ( ), in Mexico's case it's the second largest industry after the food industry, (AMIA-INEGI 2016); regarding the automotive sector which sets the guidelines in the business development and technological innovation, therefore the economic spill that is generated around the assembly plants is evident propitiating better living conditions for the workers and their families as well as for the residents in the area.

The Mexican automotive industry concentrates in the central region, bajío region and in the Northern region 18 assembly Plants and basic components, suppliers level Tier1, Of the brands Kia, BMW, General Motors, Toyota, Ford, Fiat-Chrysler, Volkswagen and Honda, There are at least other five plant opening projects in the following years; In 2015 the national production reached 3 ´ 565,469 units between light and heavy vehicles; Labor costs have favored Mexico's trade and treatment agreements with other countries;80% of the cars manufactured in the national territory are destined to the international market, United States of America, Canada, Germany, Colombia and Argentina, mainly; Mexico is the seventh-largest world-class vehicle producer (AMIA, 2016); The brands with the most market share are Nissan 25.9%; General Motors, 16.8%; Volkswagen Group, 16.16%, Fiat-Chrysler, 6.8% and Toyota, 6.5%., (AMIA, 2016).

The manufacturing Clusters: Automotive and auto parts are present in at least 11 states in Mexico, (ProMéxico, 2016), With a total of 20 productive groups distributed in 14 states, among the most important are Baja California, Sonora, Chihuahua, Coahuila, San Luis Potosí, Puebla, Aguascalientes, Guanajuato, Jalisco, state of México, Morelos and Nuevo León, It performs various assembly and armoring activities also the metal casting and stamping of vehicles and engines.

Of the most successful cases is the automotive Cluster of Nuevo León, founded in 2007, as a civil association comprised of first-level T1 manufacturers, the automotive industry , academic and governmental institutions related to the industry, these seven Companies are: Amecom, Ficosa, Grupo IMSA, Metalsa, Navistar, Nemak y Vitro; Representatives of the Technological Council Of Monterrey and the Autonomous University of Nuevo León And by the Government, the secretariat of Economic Development and the Institute of Innovation and Technology transfer. (Montoya, 2014). Likewise, automotive Cluster initiatives are already in operation in the states of Guanajuato,

Puebla, Baja California, State of México, Sonora, Chihuahua, Aguascalientes (restart), Morelos, San Luis Potosí and Coahuila, (INA, 2016).

Particularly in Ciudad Juarez, Chihuahua, there are 164 assembly plants, of which 42 belong to the automotive sector, mostly suppliers Tier1 and Tier2, followed by the electrical and electronic sector with 28 and 24 units respectively, table no. 1. Among the most important are Automotive Lighting, BRP de México, Bosch Sistemas Automotrices, Continental, Delphi Centro de Diseño, Eagle Otawa, Federal Mogul, Johnson Controls, Lear Manufacturing, Legget & Platt, Strattec, Tyco, Valeo, Visteon.

Table 1: Assembly plants per sector in Ciudad Juarez

Sector	No. Companies
Aerospace	1
Automotive	42
Call Center	3
Sewing	6
Electric	28
Electronic	24
Packaging	9
Medical	11
Metal -Mechanical	9
Other (various sectors)	31
Total	164

Source: Directory AMAC-Index 2014

c) Productive articulation

The concept of productive articulation has received several names such as cluster, business network, production chain, supply chain among others., (Huerta, 2013), recently value chain, Sankaran and Suchitra (2006); The importance it has had in the last decade of the TWENTIETH century and the first two decades of the 21ST century, it is important that the Cluster initiatives that we find now in Europe, (Mads, 2013), They point to the importance of clusters in stimulating economic growth, such as AluCluster In Denmark and Medicon Valley In Copenhagen, Holland.

The productive articulation represents according to various authors, among them, Porter (2003) The capacity of large companies, but also medium and small to interact with other organizations in the Government and education sector, thereby creating the Concept of the Triple helix, Etkowitz, et, al. (2005), shareholders like consultants, complementary services, outsourcing and other types of integrated companies are able to obtain joint benefits in projects focused on supply, logistics, design, innovation and technology, which benefits All participants from their horizontal and vertical integration, OECD, (1994).

According to Solvell, (2003), Most productive articulation initiatives starting as Clusters are manifested in the industrial sector, with a lower presence in the agricultural, livestock, aquaculture, primary and services sectors, Maggi (2004); The creation of geographic groups in different areas of Mexico are increasing, With productive complexes in 15 States, in the north, low and central regions, mainly linked to the automotive industry actinver (2015).

d) Context

One of the most important norther border cities in the country is Ciudad Juárez, Chihuahua, Its proximity to El Paso Texas, U.S.A. gives it a competitive advantage to place its products on the other side of the dividing line; through its three Bridges, Americas, Santa Fe y Zaragoza, on a daily basis around 44,000 individuals pass walking or by car(Diario de Juárez, 2017), Its recognition at the national level is located as the city with the largest number of assembly plants, so it is known as the Harness Valley, the strategic sectors located in the locality are: Automotive, construction products, electronics, Metalworking, machinery, equipment and agroindustry (INADEM, 2013).

Ciudad Juárez shows that its demographic indicators place its population close to 1 ´ 600,000 inhabitants (INEGI, 2014), It is the largest city in the state of Chihuahua and the eighth largest city in Mexico; Altogether El Paso, Texas, U.S.A. and Ciudad, Juárez, Chihuahua, Mexico, make up the second largest transnational metropolitan area(cities) in Mexico and the United States with about 4 ´ 500,000 inhabitants jointly. The economy is based on the assembly plants formed by more than 345 companies, (Así estamos Juárez, 2013), Strategically located near the border bridges and fast access areas. Most production inputs are coming from the United States To take advantage of the labor cost and lower freight and logistics costs as well.

The number of companies in Ciudad Juárez are increasing year by year mainly in two sectors trade and services 16.917 and 15.918 respectively (Así estamos Juárez, 2013), With a lower percentage of sustained increase in the assembly plants; Similarly, the number of jobs generated by these companies, has had a

significant decrease, in 2007 from 217.778 to 2012 with 190.031 jobs, a figure that coincides with the period of crime and violence in Ciudad Juárez.

IV. Research Results

In order to achieve a greater number of interviews with companies linked to the automotive Sector, We contacted representatives of Delphi Automotive Systems, Oelav y Legget & Platt, Lear Corporation, Nidec Motors and Actuators, Federal Mogul, Johnson Control´s, Key Safety Systems y Nexteer, table No. 2. The intervention of the area of linkage of the Autonomous University of Ciudad Juárez was relevant to facilitate the access to its facilities or to carry out interviews in depth to the directors, managers and executives of the plants, representatives of other Governmental organizations and education sectors.

The interview was supported by a question guide grouped into four sections: I. General plant Information, II. Manager data, III. Plant development and relationships, y IV. Innovation and technology, in total 32 questions.

Table 2: Companies investigated in the automotive Sector of Cd. Juarez, Chihuahua

No.	Company	Equiptment	Person interviewed	Job position	Tenure of the company	University	Career
1	Delphi Automotive systems	Sistemas electrónicos y de seguridad, tren motriz, sistemas térmicos	Francisco J. Sánchez A.	Dirección de Relaciones de Gobierno Operaciones México	18 años	U.A.CH.	Ingeniero Industrial
2	Oelav (Valeo)	Limpiabrisas, Sistemas de enfriamiento	José Manuel Bautista Avila	Gerente de desarrollo organizacional	8 años	U.A.C.J.	Lic. Rel. Industriales
3	Legget & Platt	Aplicaciones de control remoto y electrónicos para asientos	Elizabeth Saenz Córcega	Gerente de Recursos Humanos	10 años	U.A..C.J.	Lic. Admon. Empresas
4	Lear Corporation	Arneses eléctricos, vestiduras. Esqueleto del asiento	Juan Manuel Padilla	Gerente Regional de Entrenamiento y Desarrollo de Personal	15 años	I.T.C.J.	Ingeniería Industrial Eléctrica
5	Johnson Controls	Vestiduras automotrices	Jorge Leopoldo Jiménez Terrazas	Gerente de operaciones	17 años	U.A.C.J.	Ingeniería Industrial y de Sistemas
	Johnson Controls	Vestiduras automotrices (área de innovación y mejora)	José Ramón Ceniceros Escobedo	Gerente Regional de Ingeniería Hardware y Software	18 años	I.T.C.J.	Ingeniería Industrial Maestría Ingeniería Admva.
6	Nidec Motors & Actuators	Motores eléctricos. Frenos ABS, vidrios eléctricos, motores transmisión	Ernesto Ortiz	Superintendente de cadena de suministro	10 años	U.A.CJ. U.A.CH. I.T.CJ U.A.CH.	Lic. Admón. Pública Mtría. Comercio Internal. Mtría. Admón
7	Nexteer	Columna de dirección automotriz	Karla Orozco	Jefe de Desarrollo Organizacional	3 años	U.A.C.J.	Lic. en Admon. Empresas
8	Federal Mogul	Arneses eléctricos, limpiabrisas y frenos	Guadalupe Porras	Gerente de Recursos Humanos	5 años		Contador Privado
9	Key Safety Systems	Bolsas de aire	Jorge Fernández	Gerente de planta	3 años	I.T.CJ	Ingeniería Industrial

Source: own elaboration, field research interviews, 2015

a) Automotive assembly plants sector

From the interviews made to executives of the assembly plants in the automotive sector it was possible to establish their general characteristics, as well as the level of productive articulation that they present with other business organizations or with their Branch offices all over the world. The following results are:

*b) Lear Corporation / Automotive Seating & E-Systems**

Company of North American origin, ranked number 154 in the world, It designs and manufactures world-class products, was founded in 1917 in Detroit, Michigan as an American manufacturer of metallic products, began repairing radios, commercial and automotive appliances, they founded Motorola and created an aeronautics division (Lear Jet); in the 70´sthis company introduces the seat division, unlike others, over time they have been decreasing some seat parts and eliminated welding; In the 80´s the division is incorporated just in time; Currently Lear Corporation has a team of 150.000 employees in 243 locations in 37 countries worldwide, with general offices in Southfield, Michigan.

Particularly in Mexico There are 10 garment plants, 7 harnesses and electronics plants, 9 just in time plants, 8 metal plants and 3 leather plants, a total of 37 plants in 12 Mexican States, Representing 60% of all employees of the company, in the Cd. Juárez Plant, there are about 30.000, that are engaged in the elaboration of electrical harnesses and garments for cars, with five divisions: Metals (Seat skeleton, rails and mechanisms); leather (Level luxor and prime), Garments, recent acquisition of Eagle Ottawa, 2015; Harnesses and electronics, (Boards, computers, central and audio systems); and Just in time (Area that keeps track of directly supplying the production line of seats to the assembler) It is located in the plants of Nissan, Aguascalientes, GMC San Luis Potosí, VW in Puebla and GMC Guanajuato.

Lear Corporation has plants in Asia, China and India, and in Europe FIAT and Renault, all of them deliver directly to the OEM, figure no. 1. The Cd. Juárez plant works with backward integration strategies to provide cable, fabrics and leather for seating, the only material that is purchased out of the country is the steel that comes from Asia, because the quality is greater than Mexican steel, In addition to its billing characteristics and response level.

95% of the Steel is obtained by import, and 5% from Nuevo León, Coahuila and Tamaulipas, Entities with the highest level of concentration in the metal-mechanic sector; The Saltillo plant Works Steel for example the base for car seats, On the other hand, Cd. Juárez manufactures garments and electric harnesses because of their experience in manufacturing, the latter considered a safety article due to the standards demanded by the automotive plants, the staff has gained experience and speed as they produce high quality products, table no. 3.

The staff of the Cd. Juárez plant is considered as skilled and very productive workforce as it has developed a sense of urgency, due to the speed with which it is necessary to deliver the product to the other side of the border.

Source: http://www.lear.com/Site/Contact/Global-Locations.aspx,2017

Figure 1: Global Location Lear Corporation Plants

* *Table 3:* Basic Information Sheet Lear Corporation	
Presence in Mexico: Aguascalientes, Apodaca, Arteaga, Ascensión, Chihuahua, Cuautitlán, Fresnillo, Hermosillo, Huamantla, Cd. de México, Cd. Juárez, Coahuila, Cuernavaca, El Salto, Estado de México, Guanajuato, León, Monclova, Morelos, Nuevo Casas Grandes, Panzacola, Piedras Negras, Puebla, Ramos Arizpe, Saltillo, San Felipe, San Luis Potosí, Silao, Toluca, Torreón, Villa Ahumada. 37 Lear Corporation plants in México	Presencia a nivel mundial: Alemania Argentina, Australia, Bélgica, Brasil, Canadá, Checoslovaquia, China, Corea del Sur, E.UA., Eslovaquia, España, Filipinas, Francia, Holanda, Honduras, Hungría, India, Indonesia, Italia, Japón, Macedonia, Malasia, Marruecos, México, Moldova, Polonia, Reino Unido, República Dominicana, Rumania, Rusia, Serbia, Singapur, Sudafrica, Suiza, Tailandia, Vietnam.
+ 90, 000 Employees in Mexico + 150,000 world wide	Divisions: Metals, leather, garments, harnesses and electronics and just in time.
2,000 Engineers	Lear Automotive Customers: Don Fang, Rolls Royce, Porsche, Ferrari, Jaguar, Manindra, Mercedes Benz, Ford, Chrysler, BMW, Renault, General Motors, Volkswagen, Toyota, Nissan, Honda, Kia, Hyundai
Source: Self-elaboration from field research 2015	

Lear Corporation's productive articulation begins with the hiring of the collaborators who join the company, There are two trade unions CROC and CTM, who are involved in the staffing process, the job representations elect the applicants who wish to interview and later with the company finally decide who is staying to work in the plant.

Another form of articulation is carried out with public Government agencies, practically in all the regions where Lear is present in Mexico, it makes agreements with the Governments of the States to acquire the benefits of the region, to obtain Preferential taxes or low costs in the land that the company buys to install their plants, starting from a win-win situation, since they are generating jobs and economic spill for the region.

Lear Corporation's plants are incorporated into the Asociación Mexicana de la Industria Maquiladora Index Throughout the country, in the case of Ciudad Juárez there is a very close relationship. This is a non-profit grouping; it Represents effectively and with professionalism the assembly industry, Through quality actions and services. Currently has about 200 companies representing a wide variety of areas related to the assembly industry, its main function is to be aware of demands and requests of the authorities, according to the needs of the Industry.

One of the activities that adds value to the company's functions is innovation and technology Which Is Developed in the leather Division, automating some of the processes of plants and metals in the robotized activities where employees do not intervene. All the innovation and technology activities are part of the corporate in Michigan, U.S.A. and from there it is derived to each division and plant. Its corporate offices are located on Mexico City. The organizational structure of the company at the international level is based on divisions and Vice-Presidents for the divisions and doubles its organization in the case of the Mexican Republic.

The Articulation that is done to meet the supply chain incorporates U.S. and Asian fabric suppliers; Metals from Asia; leather from South America (Argentina); cable from Asia and the USA; los Mexican suppliers provide basic raw materials such as bags and canisters. The mechanical metal industry of Cd. Juárez, provides electrical harnesses for the boards.

Mexico has very good quality products and services, but regarding price it is not competitive. 70% of

the products produced by the plant are left in the country for the original automotive equipment plants for OEM´s and 30% is exported. In El Paso, Tx. U.S.A., Lear has a temporary distribution center to send to other countries.

In Ciudad Juarez There are agreements with all the public universities As an example Universidad Autónoma de Ciudad Juárez (U.A.C.J.), Universidad Autónoma de Chihuahua (U.A.CH.), Universidad Tecnológica de Ciudad Juárez (U.T.C.J.), Instituto Tecnológico de Ciudad Juárez, and Private universities such as TecMilenio y ITESM, depending on the region, agreements are made with local universities, both public and private, to make technological linkages for specific projects and professional practices, not incorporate research professors for the development of innovation and technology projects.

*c) Nidec Motors & Actuators**

It's a global leading Japanese company, dedicated to manufacture small engines for computers, recorders and compact disc equipment for the automotive industry and other sectors, created in 1923, and supplier of the automotive sector since 1927 with control systems for steering wheels, in 1950 it also started Business with the German automotive industry.

Currently Nidec attends six product lines: 1. Small motors for ABS brake Systems; 2. Sunroof and electric windows, Door Compressors, steering wheels and truck stirrups, 3. Car Heating and A/C cooling systems, 4. Motorized and automated seating systems; 5. Transmissions, clutch, torque management; 6 motors for Coffee machines , office, garage doors and window-opening systems, Automated roll-up shutters and health care systems. Some of their important customers are Apple, Nintendo e IBM.

The Company has a strategic alliance with Lear Corporation for the manufacture of seat engines according to the specifications requested by Lear's customers, It also has an alliance with Continental for the manufacture of engines that are shipped to their plants in Mexico and Frankfurt Germany; In the case of sunroofs, they are delivered to plants in Michigan, Georgia, Mexico, China, Korea, Slovakia and the Netherlands.

In Ciudad Juarez, Mexico Has two Plants With a single manager, that serves to the U.S. and Canadian market; Worldwide Nidec has plants in Germany, Poland, China and Spain, specifically related to the automotive sector. Although in Mexico Nidec only has plants in Monterrey, Reynosa and Chihuahua where they manufacture engines for other sectors not related to the automotive products, table no. 4.

*Table 4: Basic information Sheet Nidec Motors & Actuators

Presence in Mexico: Ciudad Juarez Chihuahua (2 Plants)	Worldwide: Germany, China, E.UA., Slovakia, Spain, France, Japan, Mexico, Poland.
+ 650 Employees in Mexico	6 Product lines: 1) Brakes, 2) sunroof and electric windows, 3) Heating and air conditioning, 4) clutch and transmissions, 6)Engines for other office, workshop and home applications
	Important Customers: -World-Famous automotive Brands - Apple, Nintendo, IBM

Source: Self-elaboration from field research 2015

The Supply Chain is integrated depending on the application or the engine to be manufactured, most of its suppliers are international,30% from Germany, Italy, Poland, Slovenia and Spain; For brake and seating applications, 55% from Asian, China, Japan, Hong Kong, and South Korea, And the remaining 15% are suppliers of U.S.A. (4), Canada (4), Mexico (4) and Honduras.

They suply about 4000 numbers of parts, 50% are active, the remaining ones are services employed when the life of a car ends. Automotive companies must continue to sell the product for 10, 15 or 20 years.

The majority of the customers collect the materials in the warehouse of "El Paso, Tx, U.S.A., Where the Nidec distribution center is located, only in case of Benright, Holland and Continental in Germany, which require sunroof engines, they pay for transportation.

There Are some national suppliers, Copper-Monterrey, N.L., Coils- Irapuato, Guanajuato., Bearings-Toluca, Edo. de México.

The distribution of the personnel is about 650 workers in production and within all the shifts in both plants of Cd. Juarez, they don't have a union.

Only 7% of the production is for national consumption, 93% is delivered to other plants worldwide. A long-term plan of the company is to develop national suppliers since that means a lower delivery time, Lower inventory and streamline the rotation of raw materials and inputs for production by eliminating or minimizing the stored materials, However, quality standards impede this plan by the requirement of

certification, despite the fact that companies are not willing to pay for it.

There are some agreements with the Universidad Autónoma de Ciudad Juárez (UACJ) y el Instituto Tecnológico de Estudios Superiores de Monterrey campus Cd. Juárez (ITESM) In the engineering areas to perform specific work and professional practices.

There is currently No Research and Development in the plants of Nidec Cd. Juárez, since it's been done in Japan for some years, In Germany there is another Research and Development center, The latest developments that have emerged from these centers are for sunroof safety.

*d) Federal Mogul**

American company founded in 1899, Sells and distributes a broad portfolio of products through the most recognized brands of the global aftermarket, Caters to OEM´s vehicle manufacturers, with products that include brake system components, Chassis, windshields and other vehicle components.

Federal Mogul has plants in Germany, China, Portugal, Brazil and U.S. with corporate offices in Michigan, also 10 plants in Mexico, (3) in Cd. Juárez, Aguascalientes (1), Puebla (2), Naucalpan (1), Tlalnepantla (1), Tlaquepaque (1), Tepotzotlán (1)

Integrated by two divisions: a) Tren Motriz (power train), pistons, sealant, protection systems, Bearings, Ignition, Rings and Coatings, Valve Seats and Guides; b) Autoparts (Motorparts), breaks, Chassis, windshields, Accessory Market Components. The most recognized brands are Abex, Anco Atlas, Beru, Carter, Champion, Fel-Pro, Ferodo, FD Diesel, Moog, National, Sealed Power, $TS_{TM,}$ Wagner, See table No. 5.

In Cd. Juárez is integrated in three business segments, windshields, Harnesses and brakes all three of the corporate power train. These are considered in three Plants, Federal Mogul Lighting, belongs to Power train, And the other two plants to Mogul Packs, y Lighting focuses on harnesses for car lights.

There Is A permanent interaction between the human resources directors of U.S. and Mexico, which they are considered Tier 2 suppliers, to end the completion of harnesses since they deliver to Automotive Lighting and Lear Corporation. Locally they distribute their products to Mexico City and Puebla. They Have about 1800 employees in their three Cd. Juárez manufacturing plants, table no. 5.

They have agreements with the Universidad Autónoma de Ciudad Juárez (UACJ), For professional practices with formal agreements, some of the students can be contracted in a definitive or temporary manner.

** Table 5:* Basic information Sheet Federal Mogul

Presence in Mexico: Ciudad Juarez Chihuahua (3 plants), Aguascalientes Puebla, Naucalpan, Tlalnepantla, Tlaquepaque, Tepotzotlán	Worldwide: Germany, China, Portugal, Brazil and the U.S.A.
+ 6, 000 Employees in Mexico	a) Tren Motriz (power train), Pistons, sealant, protection systems, bearings, ignition, rings and liners, seats and valve guides; b) Autoparts (Motorparts), breaks, chassis, windshield, aftermarket components.
The most recognized brands belonging to Motorparts are: Abex, Anco Atlas, Beru, Carter, Champion, Fel-Pro, Ferodo, FD Diesel, Moog, National, Sealed Power, $TS_{TM,}$ Wagner.	

Source: Self-elaboration from field research 2015

*e) Johnson Control´s**

Leading American Company in the automotive industry and other sectors, building efficiency, automotive batteries and energy storage, seats and garments for the automotive industry, It has more than 120.000 employees in 150 countries within the six continents, The general offices are located in Milwaukee, Wisconsin; In Mexico they have (7) plants, Puebla, Saltillo, Monclova and (4) in Cd. Dedicated to self-propelled garments and one of them to provide service to their products, 100% of the production is delivered to the U.S. and Canada. Puebla delivers garments to VW and Audi, for its different car versions, as well as a design center for cutting and sewing.

The Annual production is estimated to be around 4500 vehicles per day for 240 working days, it means that about 1 ´ 080,000 garments done per year for these cars; 95% of the production is for Export and the other 5% is National. In each of the plants They have 67 employees-salary or administrative personnel, 169 indirect employees and approximately 2700 direct employees, It is considered one of the best companies in the sector for wages and benefits for workers; There are permanent policies to increase the salary based on each worker's career plan and on permanent training.

Its supply Chain is composed mainly of leather suppliers in Guanajuato and Saltillo, it's a very low percentage, 90% from the U.S. and 10% from Japan.

They have a warehouse in El Paso, Texas, U.S.A., The Company has patents on registered hardware and software, 35% in Mexico and the rest in other parts of the world, table No. 6.

There Is An occasional link with the Government of the State of Chihuahua in Innovation and Technology projects For the development of ideas or products, and also Universities like the Autónoma de Ciudad Juárez (U.A.C.J) and the Instituto Tecnológico de Ciudad Juárez (I.T.C.J.)For the realization of professional practices, they elect young people who dominate English because 65% of them are hired.

*Table 6: Johnson Control´s Basic information Sheet

Presence in Mexico (7) plants, Puebla, Saltillo, Monclova and (4) in Cd. Juárez dedicated to self-propelled garments and self- serve their own products,	Worldwide: 120.000 employees in 150 countries on the six continents, the general offices are in Milwaukee, Wisconsin. 100% of the production is delivered to the U.S. and Canada.
+18, 000 Employees in Mexico approximately.	Building Efficiency, automotive batteries and energy storage, seats and garments for the automotive industry
Leading customer Brands: Ford, GMC, Toyota, Lexus, Nissan, VW, Audi, Mazda	

Source: Self-elaboration from field research 2015

*f) Key Safety Systems**

Asian Company, with general offices in the U.S.A., located in the design area, with five technical centers in China, Germany, Japan, South Korea and U.S..; 20-year presence in Mexico, Originally a safety belt provider and currently produces air bags, for all automotive brands, with 32 plants around the world: (6) in China, (1) India, (2) Japan, (2) South Korea, (1) Thailand, (1) France, (2) Germany, (3) Italy, (1) Macedonia, (2) Romania, (1) United Kingdom, (3) Mexico, (6) U.S.A., (1) Brazil, table No. 7.

Serves the market of automotive brands worldwide, and in Mexico it's not delivered to the assembly plants, everything goes to the shipping lines. In the plant of Cd. Juárez, they have 1900 employees distributed, 1700 in the operative area, 140 indirect and 50 are administrative; they produce 8´000,000 airbags in a year, Workers are given constant training through scholarships to obtain different school degrees, their main concern about the Human Resource of the company is the retention of the employee, so they maintain a high wage level plus extra bonuses.

In terms of supply chain, 90% of suppliers are foreigners, 60% of them Americans, 20% European and 20% Asian, which corresponds to metal parts, plastic and textiles, and 10% are national, screws, hardware, clips, small inputs.

*Table 7: Basic information sheet Key Safety Systems

Presence in Mexico (3) Plants, Ciudad Juarez, Chihuahua, Valle Hermoso and Matamoros Tamaulipas	Worldwide: China, India, Japan, South Korea, Thailand, France, Germany, Italy, Macedonia, Romania, United Kingdom, Mexico U.S.A., Brazil
+ 6, 000 Employees in Mexico approximately.	Air Bags
Leading Brands customers: Ford, GMC, Toyota, Lexus, Nissan, VW, Audi, Mazda and others	

Source: Self-elaboration from field research 2015

*g) Nexteer Automotive**

American Company with more than 100 years in the market, with three plants in Mexico (1) on Cd. Juárez and (2) in Querétaro; World Wide they have plants in Australia (1), Brazil (1), India (3) and China (5); Its main activity is the manufacture of steering columns for cars of all brands.

They have a warehouse in El Paso, Texas that delivers directly to customers in the U.S., The main ones are Ford, GMC and Toyota, in Cd. Juárez there are 380 employees including Direct, indirect and administrative. The headquarters are in Queretaro, Mexico, table No. 8.

In the supply chain most providers are foreigners, and just a few nationals, the production of the assembly plants in Mexico are 80% for the international market and 20% stay in the country. They carry out a program of supplier development and seminars in different areas.

There is a continuous improvement program in which employees participate with different points of view and proposing updates for the company, they provide training to staff members regarding their needs in all areas. Nexteer offers scholarships up to 70% for all workers to improve their academic skills.

There is a direct link with educational institutions like U.A.C.J., U.T.C.J., for professional practices.

*Table 8: Basic information sheet Nexteer Automotive	
Presence in Mexico (3) plants, Cd. Juárez, and Queretaro	Worldwide: Australia, Brazil China, India, Mexico, U.S.A.
+ 1,200 Employees in Mexico approximately.	Steering Columns for cars
Leading Brands customers: Ford, GMC, Chrysler, Toyota, Nissan, VW, Audi, Mazda and others	
Source: Self-elaboration from field research 2015	

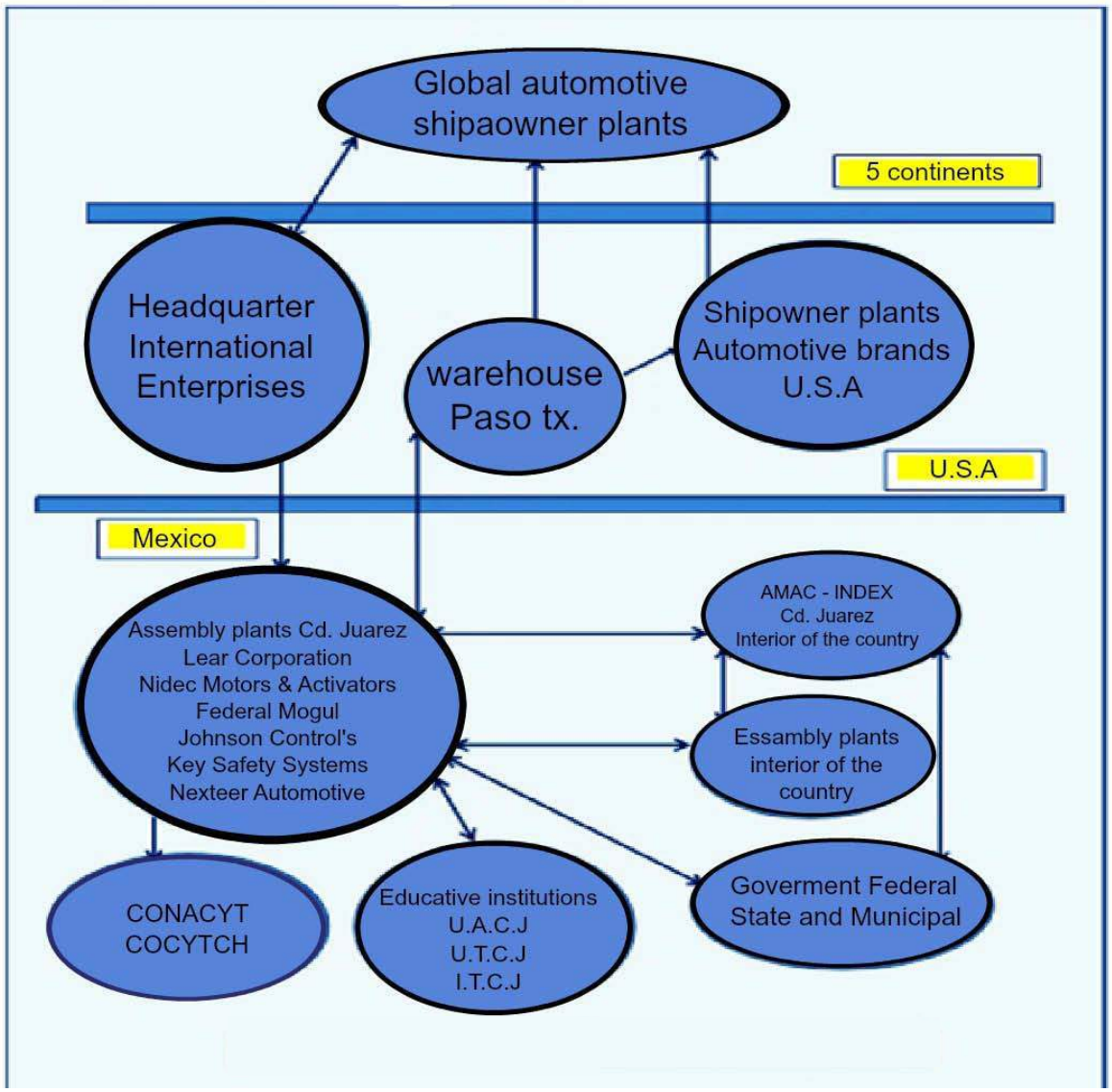
V. Conclusions

Based on the objectives and hypothesis raised at the beginning of the investigation, it can be established that the productive articulation that is carried out between the assembly plants of the automotive sector in Cd. Juárez-Mexico-El Paso, Tx., it has as a fundamental aspect which is the production of inputs for the automotive industry between 80% to 90% for the international market and only a small percentage of 10% for the national market, Most of the products are placed in warehouses of "El Paso, Tx and from there distributed to the assembly plants of all brands for the U.S. and shipped to other parts of the world. The processes of innovation and technology have been derived to the general offices of the companies and there is practically no generation of patents, industrial formulas or trademarks, when someone tries to register it they normally decide to do it in the U.S.., when interviewing the managers, the reason being there is an immediate return of investment for the automotive sector but particularly for the company that performs it, figure no. 2.

The relationships of assembly plants with other Governmental and Educational sectors, is to maximize the preferential rates for payment of taxes and to obtain benefits in public infrastructure, in some cases isolated with federal agencies as the Consejo Nacional de Ciencia y Tecnología (CONACYT) or the Consejo Estatal de Ciencia y Tecnología de Chihuahua (COECTCH), for innovation and technology projects; Although there is a constant demand for workers for the automotive industry, There is a high turnover and workers constantly change their company with the intention of just getting the hiring bonds while remaining a few months in the company; In the educational sector, most assembly plants make agreements for professional practices and detect talents to incorporate them as a work mind and not to develop specific research and consultancy projects. One aspect to highlight is the incorporation of the assembly plants into the Asociación de Maquiladoras AMAC-INDEX, however, It is only at the request of the companies that are integrated to demand the Government certain kinds of services and support, But not to stimulate a more effective productive articulation for projects of innovation and technology as well to perform business together.

The working conditions of the employees in the assembly plants are not the most adequate, The model to follow from the assembly plants that started out these last decades is well below the workers expectations, companies only grant the benefits of law and only some of them offer salaries, compensations and additional benefits for employees and also their families, combining the countries situation, the economy of these families do not allow them to have permanent growth in their lifestyles.

Finally it is necessary to review the operating conditions of the assembly plants particularly in the automotive sector in Mexico, despite being one of the most important economy generators in the country, This is not reflected in the lifestyle of employees and their families, so it is necessary to generate comprehensive programs that contribute to promote the improvement of social conditions of the population nuclei where the assembly plants are located; It will also be important to create effective articulation programs between large companies with their peers but also with small companies continuing to promote development and certification programs for suppliers, they need to link the education sector to carry out applied research and consultancy projects and the incorporation of associations and business unions to foster a culture of associativity.



Source: Own elaboration from 2015 field research

Figure 2: Map Productive joint assembly plants Automotive sector Cd. Juarez

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