A Proposal for A Reverse Logistics Model in The Automotive Sector in Mexico

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Abstract. New fields of study, such as caring for the environment, have influenced the decision-making of organizations and the creation of public policies that seek to reduce the negative impact on the environment. This paper analyses the performance of the logistics of the automotive industry in Mexico and the evolution of the requirements according to international and national regulations, as well as a proposal of a reverse logistics model, with the purpose of showing recycling options for vehicles that are no longer useful and are declared as out of use vehicles. This work seeks to show that there is an economic, social and ecological benefit by adding reverse logistics, at the end of the useful life of vehicles in circulation. Therefore, a series of activities are proposed that make up a management model based on reverse logistics for the recycling of out-of-use vehicles.

Keywords: Reverse Logistics Model, Automotive Recycling, Out of Use Vehicles.

1. Introduction:

In recent years, the search for a balance between economic activities and environmental well-being has been intensified. One way to reduce the impact on the environment is the adoption of practices that reduce unnecessary expenditure of resources or the reuse of materials that are waste receivers generated after consumption.

Attention to the problem of pollution of motor vehicles has focused on the measurement of pollutant emissions into the air, but, however, there is no correct follow-up of the vehicle waste generated at the end of its useful life. That is, the auto-parts, or residues resulting from the vehicle, do not have an adequate disassembly, confinement or destruction treatment that guarantees that there will be no effects on the environment.

This article has been structured in three parts, the first one describes the participation of the use of the automobile and the performance of the automotive industry in Mexico and in the world, followed by the description of the problem in the saturation of old vehicles and in the end the reverse logistics proposal to be applied to increase the value of the vehicle if properly recycled.

2. The Automotive Industry in the World:

According to data from the OICA (International Organization of Motor of Vehicle Manufacturers) in the world, 1,071 million vehicles have been used annually, being Europe and North America the ones that present the greatest use.

It is estimated that 80 million units are purchased annually, including light vehicles, charge vehicles and buses. Of which there is no official count of how many cars are declared out of use worldwide.

3. The Automotive Industry in Mexico

The automotive industry begins its history in Mexico since 1925 with the installation of the first assembler in the country. Until 1962, an import model was maintained, mostly of auto parts that served as a supply for Ford, General Motors and Chrysler assemblers. These assemblers were installed in Mexican territory due to the reduction of production costs that implied for investors, low transport costs, low salaries and high expectations of conquering an easy market to monopolize (Vicencio Miranda, 2007).

This was until 1962 that the first decree establishing the import substitution was issued, by then only 20% of the auto parts installed in Mexico belonged to the national market, and sales were mainly covered with imports.

Currently, it plays a very important role for the Mexican economy, in 2017 it contributed 2.9% to the National Gross Domestic Product (GDP), represents 18.3%

of manufacturing GDP and generates 1.9 million jobs. (AMIA, 2018).

4. The Importance of the Vehicle in Everyday Life:

A car is the main means of transport for both people and merchandise around the world, it is responsible for keeping active the economic sector of the nations. The composition of a car is mainly based on a metal structure, an engine, steering all this assembled on 4 tires that give mobility to the vehicle.

There are different sizes of cars that are required according to the size of the cargo or the type of goods to be transported, as well as transportation of people.

- Light vehicles: Freight transport with a weight not exceeding 8 passengers.
- Light commercial vehicles: Vehicles occupied for the transport of people or cargo not exceeding 3.5 tons.
- Heavy vehicles: They are for transporting cargo weighing up to 7 tons.

5. Overpopulation of Vehicles in Circulation and Abandonment:

In 1992, the North American Free Trade Agreement (NAFTA) was signed, and with it the doors are opened for the definitive import of used vehicles from the United States of America and Canada from 2009, however, in 2005 by Presidential decree, authorizes the importation of vehicles with an age of use between 10 and 15 years, and the beginning of the application of this section of NAFTA is signed. That is why the number of cars in circulation exceeds the number of vehicles sold in the period from 2005 to 2008, as shown in graph 1.

In 2009 it was significantly reduced, due to an economic crisis that it began a year earlier and by the amendment to the decree in which the age of the vehicles to be imported is reduced to 10 years. Imported used vehicles have a shorter circulation time and in some cases are close to being obsolete, or that their mechanical conditions for wear and tear require greater maintenance, with the occupation of more specialized labour that causes repair costs be elevated.

The reasons why a car is declared as a vehicle out of use are diverse, traffic accidents, stop working or by abandonment on public roads, in any of these situations the cars, in most cases are sent to a impound n, where, for legal or economic reasons of the owners, abandonment is a very common practice.

The overpopulation of cars close to being obsolete causes that the characteristics that must be met to be declared as out-of-use vehicles are not clearly identified, and as a consequence, they are in circulation generating pollution from emissions, or otherwise, when they cease to be useful, they become waste that is abandoned in streets or the impound n, without receiving a special treatment of destruction.

The main problem for which until now the government (mainly in the central zone of Mexico) has taken preventive measures has been the emission of polluting gases to the environment, due to vehicular traffic, it is an environmental problem that affects Direct way to the quality of life of people and the environment, although it is not the only affectation that can occur, abandonment on public roads or in the impound n, causes in the first instance that the oils or liquids contained within the vehicle are spilled into the environment and emit polluting gases or in a longer exposure, the metal components begin with the oxidation process and the particles fall to the ground and contaminate the aquifers.
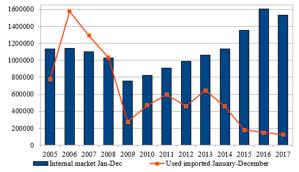

Figure 1. Sales in the domestic market vs. import of used vehicles.
Source: Modified from the Mexican Association of Automotive Distributors, 2018.

6. Current Regulations for Vehicle Recycling at the End of its Useful Life in Mexico and International References:

The international reference, currently in force in Europe, is Royal Decree 1383/2002, on vehicle management at the end of its useful life. Its purpose is to reduce the impact of vehicles on the environment and set standards for the proper environmental management of vehicles at the end of their useful life, considered from the design and manufacturing phase.

This European regulation is considered as the beginning part for the proposal of the management model in Mexico, and as a precedent in 2012 the Vehicle Management Plan was issued at the End of its Useful Life, published by the SEMARNAT (Secretary of Environment and Natural Resources) in cooperation with the International Agency of Japan (JICA), the objective of this plan is to reduce the impact on the environment generated by improper handling of vehicles, either during their use or recovery.

This plan seeks to ensure that all obliged subjects, producers, importers, exporters, distributors, traders, consumers and large waste generators are incorporated into compliance with NOM-161-SEMARNAT-2011.

The NOM-161-2011, is the one that establishes the criteria to classify Special Management Waste and

determines which are subject to management plan, within the Mexican territory.

Federal Public Registry is the database in which: high, low, infringements, locations, thefts, recovery and destruction of vehicles that are manufactured, assembled, imported or circulated in the national territory are registered. And the direct participation with the proposed model is that from the registration of the withdrawal, the logistic activities of collection and use of the vehicle begin.

AMIA, is the Mexican Association of the Automotive Industry AC, is constituted by vehicle manufacturers, with the purpose of having an exclusive representation of the sector, defends the interests of the companies before the governments, municipal, local, state and federal

Mexican Association of Automotive Distributors A.C. (AMDA), is the grouping of more than two thousand distributors of new vehicles in Mexico. The activities of all these governmental and civil institutions are those that directly impact the performance of the automotive industry in Mexico, as well as the management of the waste generated, and with the information they publish, you can have a clearer vision of the impact of mishandling on the environment.

7. The Logistics of the Automotive Industry:

Logistics or supply chain is generally made up of suppliers, processing companies and customers, Mentzer et al., Defines the supply chain as the systematic and strategic coordination in traditional business functions and tactics between participating companies. In the flow of supplies in order to improve the long-term performance of individual companies (Estrada Jerez et al., 2015).

The logistics chain in the automotive industry starts with the acquisition of raw materials for the development of auto parts, which is called acquisition logistics or supply logistics. Next in the process, the transformation logistics or manufacturing logistics is carried out, which is the transformation of the raw material into auto parts, moving to distribution logistics, which is where it is responsible for delivering the products or services in the hands of the customers or consumers, which in this case are the assembly companies. A representation of the sequence of activities is observed in the manufacturing cycle diagram.

Once the auto parts have been delivered to the assembler, it is responsible for assembling a new vehicle, in this process the distribution logistics is repeated to the dealers and / or car dealers.

Figure 2. Manufacturing cycle Source: Modified from (Cruz Rivera & Ertel, 2008).

The second stage of the logistics of the automotive industry is the cycle of use, in which it begins with the use of the automobile and an indefinite cycle of repairs.

Figure 3. Use cycle. Source: Own elaboration.

The life cycle of a vehicle concludes with the decision of the owner to dispose of it, to declare it as an out-of-use vehicle, the causes can be diverse, such as obsolescence, road incidents, etc. and the most common is that the vehicle is taken to junkyard or workshops fix so that from the vehicle can be removed parts that can be occupied as spare parts and those that represent more economic value.

8. Reverse Logistics in the Automotive Industry:

The Council of Logistics Management defines logistics as the "part of the supply chain management process responsible for planning, implementing and controlling in an efficient and effective way the storage and direct and inverse flow of goods, services and all the Information related to these, between the point of origin and the point of consumption, in order to meet consumer expectations" (Urzelai Inza, 2006).

Based on the previous definition, reverse logistics is "the process of projecting, implementing and controlling a flow of raw material, inventory in process, finished products and related information from the point of consumption to the point of origin in an efficient and as economical way as possible, with the purpose of re-recovering its value or that of the return itself" (Ballesteros Riveros & Ballesteros Silva, 2007).

To all this process it is proposed to add the Reverse Logistics stage, which in definition is to carry out the same logistics process described above, but in reverse, it begins with the reverse of distribution logistics, which is to collect a product from The point of delivery, towards an earlier point, the causes of return are diverse, may be due to poor manufacturing, customer return, or that the product has fulfilled its function and seeks to recover the value of the vehicle after completing its use cycle.

Once the product subject to reverse logistics, is delivered to a point before the final customer, which can be a collection and / or treatment center, it is evaluated and returned at the beginning of the production process or reinserted in the process of manufacturing.

8. Proposed Reverse Logistics Model:

After the end of the vehicle's life cycle is declared, the stage of collection, dismantling, destruction and use of the parts for which an ecological and economic benefit can be obtained begins (see figure. 4).

This model focuses on broadly showing the benefits of implementing the reverse logistics model. As a trigger

for the entire reverse process is the removal of the Federal Public Registry vehicle, that is, to notify the authorities that the vehicle will no longer circulate and will be destroyed.

Immediately the vehicle is directed to a dismantling center, where the fluids and liquid elements of the vehicle such as gasoline, antifreeze, oil, water and radiator fluids will be removed. Follow, the classification of parts to be dismantled and that will be reused as spare parts.

Homogeneous elements that can be removed from vehicles, such as glass, textiles, plastics, etc., are removed leaving at the end the main metal structure of the vehicle, which will be compressed and sent to metal recycling suppliers. As well as each of the homogeneous elements removed. And the collected fluids will be handled by a supplier that treats hazardous waste and delivered to confinement.
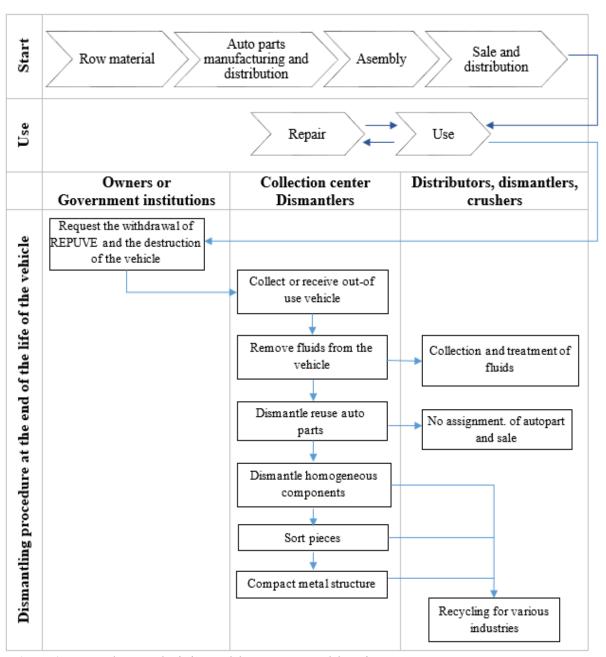

Figure 4. Proposed reverse logistics model. Source: Own elaboration

9. Problems Facing the Implementation of the Model:

Lack of public information regarding the manufacture of vehicles, which facilitates the recycling of the components and the commercialization of the parts that can be reuse. Standard tests, to ensure the proper functioning of parts removed from out-of-use vehicles, in order to be reused. Recycling campaigns supported by recyclers and insurers, in the case of vehicles that are declared out of use due to road accidents. Lack of a comprehensive computer system where you can register the parts that will be reused in vehicles in circulation and thus ensure traceability in case of legal conflicts or insurance compliance with the new vehicle.

10. Conclusions

The proposal and implementation of public policies for the management of vehicles at the end of their useful life would be largely a contribution to the reduction of damage to the environment. The problems that stand out are the emissions of old vehicles and the saturation of the vehicle fleet, which is notorious in large cities, to which is added the abandonment of vehicles on public roads or in the impound and the poor management of waste.

Vehicles that are adequately recycled nowadays are immediately re-incorporated into the first stage of the supply chain of the automotive industry, so that the ecological impact is significantly reduced, and organizations engaged in this task obtain a double benefit, ecological and economic. If current recycling practices in the automotive industry were supported by compliance with government policies or decrees, they would have a greater impact on the national industry. And it would lead to the creation of new strategies to facilitate recycling and reuse.

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