ISSN (e): 2250 – 3005 || Volume, 09 || Issue, 2 || February– 2019 ||
International Journal of Computational Engineering Research (IJCER)

Standardization of after sales service operations for trucks and tractor trucks in an automotive company - Case study

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ABSTRACT
Companies are constantly presenting challenges regarding process improvement and operations management, among many potential areas, is the after-sales service, which has a direct relationship with customers, which in turn involves time, operations and resources, all these factors, require a correct way of execution that allows the company to be more competitive and meet objectives. The present article proposes the standardization of operations as a group of strategies and tools to generate competitiveness, added value and benefits, with a methodology of diagnosis and evaluation of technical and physical conditions, use of a method of structured estimation of operations and analysis for the identification of improvement strategies. Likewise, results are evidenced that allow to identify strengths and weaknesses, new times of operation and processes; the study is developed and established as a way of implementing all these strategies, generating benefits for the company, providing competitiveness, strengthening and responding to the requirements of after-sales service and the current automotive industry.
KEYWORDS: *After-salesservice, automotive industry, competitiveness, engineering processes, operations management, method engineering,standardization.*

Date of Submission: 21-02-2019 Date of acceptance: 10-03-2019

I. INTRODUCTION

At present, market demands are changing and competitive, a situation that generates in companies the search for new ways to optimize their processes in order to increase productivity. Among the many methods that exist, the companies are using the standardization of operations; that allows to offer to the client, a guarantee of what is offered thanks to the fulfillment of the times and operative requirements, it is a considerable tool to increase the competitiveness, as it is the improvement of the yield, the efficiency of the operations, increases in economic benefits, creation of value and better relation with customers [1].

Therefore, the research is developed in a Colombian company of the automotive sector, whose objective is the standardization of operations, which allows to generate benefits in aspects of improvement of the post-sale service, creating good relationship with the customers; besides this, the company can improve its positioning in the market and have a better control in front of the operators, minimizing the costs of service.

For the implementation of the research, it is important to carry out a verification and evaluation of the processes of the area in order to generate conclusions of the activities and operations to be standardized after their execution, operational benefits will be provided; to exemplify the idea, in the repair service processes, in terms of the technical relationship and equipment there should be a maintenance management program, which will provide the technical capacity and training for internal repair, as well as the efficient and effective scheduling of vehicles for the required maintenance [2].

Traditional strategic service design options consider that standardization is adequate to focus on many customers with little or no contact and users are faced with unique services [3]. The company where the research is carried out consolidates the standardisation of operations, which as a result will present improvements in the organisation's own operational activities.

This document presents an analysis of the important factors that intervene in after-sales service, such as evaluations of the physical conditions of the infrastructure, as well as techniques of the human factor that intervenes in the work of the workshop, whose result presents a diagnosis of the current situation that the

company presents in the operation area where the operations standardization process is going to be developed, whose improvements are implemented to improve the service that applies in each one of the service points of the company; after this a benchmarking or competitive evaluation is generated with respect to other companies, allowing to detect weaknesses that become strategies of improvement for the company.
Finally, it presents the theoretical benefit obtained with the implementation of a structured analysis of times and operations; for this purpose, the percentages of time taken between the options of one and two technicians are analyzed; these calculations take into account the theoretical times obtained in the study performed with respect to the demand and the cycle times obtained in the standardized worksheets [4].According to the demand all the operations and the time of these are studied, generating a classification in order to obtain a standard time in each one of the activities;all these strategies established in the study, allow the standardization of operations to be a viable tool towards competitiveness.

II. METHODS

The analysis of each one of the approaches carried out by the standardization process fulfills the objectives and the time needed to obtain results. The techniques for the development of the project generate effectiveness so that people who are going to schedule work orders with truck and tractor repair operations or who are going to use the tempario[1] obtain reliability in their application, all these tools are an effective means to have the necessary data of all the operations that are carried out in the workshop to perform depending on the time invested and nature, all activities such as repair orders, maintenance of equipment or facilities, cleaning of vehicles and training [5], which allows to meet the results demanded by the market for users who use the after-sales service of the company.
In the process of methodological development in the research a rigorous analysis of the process is carried out, among the proposed objectives is the current diagnosis of the company that allows the evaluation of the technical and physical conditions of the service facilities provided by the workshop, the generation of benchmarking to identify strategies for improvement, analyzing the characteristics of the brands with the highest demand in trucks and tractors, in addition to the generation of structured study of operations and times that allows to classify and order the operations with the best demand in each of the workshops.

2.1 Evaluation of technical and physical conditions

The business diagnosis is the analytical technique applied on the design of the strategy, plan or program; on the implementation, functional strategies, systems, or specific operations; with the purpose of determining its present condition, identifying the main factors that determine its current level of performance, as well as its consequences, and the possible courses of action to adopt to improve or optimize. The execution of a diagnosis with such characteristics requires on the part of the consultant:

- To know the technique of diagnosis, to know how it is carried out.
- Possess knowledge about the field to which the diagnosis refers.
- To have the abilities and skills related to the exercise of the technique.
- Have the ability to discern and perceive the different situations encountered and their primary causes [6].

To the above, the diagnosis of the current situation of the company for the evaluation of technical and physical conditions of the facilities is structured and classified to evaluate the conditions of an automotive service workshop, taking into account the factors that affect the final product, during its development or that affect the safety of workers, in order to determine what are the strengths, weaknesses and possible points for improvement. The factors considered correspond to order and cleanliness, handling of tools and equipment, execution of activities with work order, compliance with the 9 S, and evaluation of personal protection elements.

2.2 Benchmarking

The benchmarking was developed based on the theory of Broxwell Jr Robert, J (1995), this technique consists of learning from others, how to identify them and study them in order to be able to generate new competencies. Therefore, this tool is vital in terms of complementing the knowledge of each facet of the organization's management, from the development of something new and the purchase of what is necessary to create the product or service to its production, through the development and management of the integrated management system, and the delivery to managers of the information necessary to make good decisions, up to the sale[8].
The benchmarking development was carried out to identify improvement strategies by the competition, the inspection counts on the development of evaluation of several items that are going to be rated from 1 to 5 and obtaining the strong, competitive and weak points against the competition. The evaluation format was developed by the authors to obtain exact and effective results for the implementation of the standardization of operations,

[1]Technique for counting the time shop workers spend on repairs to obtain information about service efficiency.

where the factors to be evaluated are established such as points of sale, points of service, location, website, brand distinction, time in Colombia, social network strategy, sales price of vehicles, reliability, growth over the previous year, annual sales, product portfolio. The format used to carry out the evaluation consists of the item evaluation columns, evidence to justify the search for information on each brand and the observations of the points evaluated with a rating awarded.
Finally, it shows theconsolidated companies, in which the final results of the comparison between companies are obtained in order to obtain the final rating of each item and to obtain the final conclusions of the evaluation of each one of the points. The results are expressed by the word strength if the score of each item is higher than those compared, competitive if the score is equal to two or more brands and weakness if the score is lower than those of other brands.

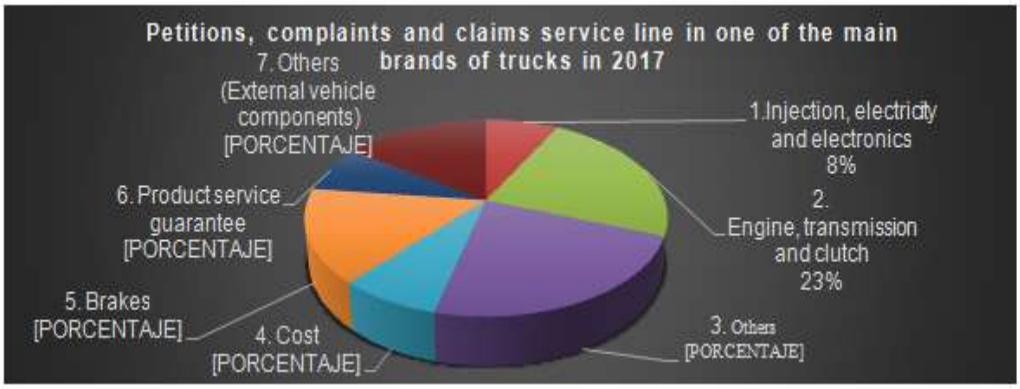
2.3 Approach to the study of methods
The study of methods consists of the systematic recording of the ways of carrying out activities, to effect improvements in any area of the company. It consists of following several steps:

- Select the work to be studied and define its limits.
- Record by direct observation the relevant facts related to that work and collect from appropriate sources any additional data that may be necessary.
- Critically examine how the work is done, its purpose, where it is done, the sequence in which it is carried out, and the methods used.
- To establish the most practical, economic and effective method, through the contributions of the people concerned.
- Evaluate the different options for establishing a new method by comparing the cost-effectiveness between the new method and the current method.
- Define the new method clearly and present it to all persons who may be concerned
- Introduce the new method as a normal practice and train all people to use it.
- Control the application of the new method and implement adequate procedures to avoid a return to the use of the previous method.

It should be noted that there are other external factors that can modify the recording of times between these fatigue, lack of tools among others [9], the authors related to the topic [10] affirm that standardization versus customization in service design is a subject of considerable discussion and debate. However, it is recognized that any service company needs to standardize.

2.4 Work selection for study
Any activity carried out in a work environment can be the subject of research to improve the way it is carried out; however, by concentrating attention on some essential operations, a specialist in the study of work can achieve far-reaching results in a relatively short period of time. There are three factors that should be kept in mind when choosing a task: Technical considerations, human considerations and economic considerations [9]. Other obvious options in the study include those related to essential profit-generating or costly operations, errors that are hampering time-consuming production activities or long operations, repetitive labour-intensive activities, and long-distance movements of materials [9].
In particular, the performance of the different actors at the process level of the framework coincides in determining the overall performance of the service to the end customer. In addition, links to other levels (mainly business and activity) may be necessary or useful[11].
Therefore, the development of the application of the estimation method performs the evaluation of operations that file complaints and claims in each of the workshops by the brands of trucks and tractor trucks. The following aspects were analysed according to the database of petitions, complaints and claims presented:

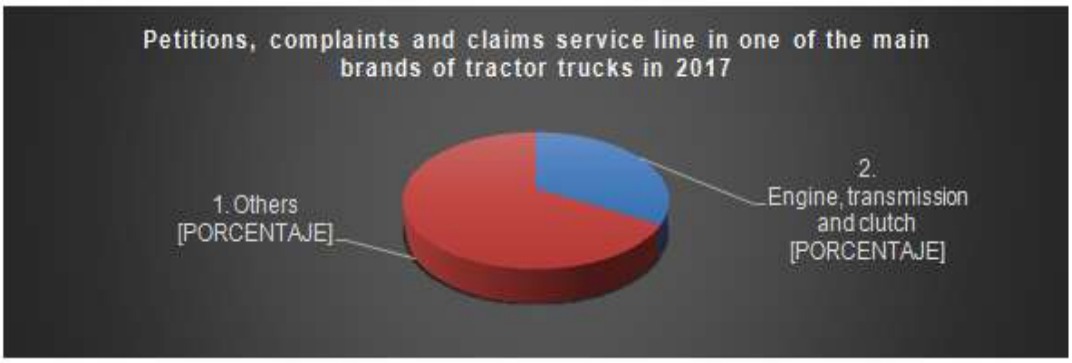
Figure1. Petitions, complaints and claimsservice line in one of the main brands of trucks in 2017



Source: Automotive company, 2017

Figure 1 presents complaints of delays in the time of operations corresponding to item 3, which has a percentage of 23%. Another factor is the delay in dispatching spare parts for the inventory presented in the warehouse, a situation that consequently generates orders to other branches. The percentages corresponding to the remaining parts of the vehicle correspond to item 2 of the figure with 23%, item 4 with 8%, item 5 with 15%, item 6 with 8% and item 7 which is the specification of component of vehicles or machines with 19%.

Figure2. Petitions, complaints and claimsservice line in one of the main brands of tractor trucks in 2017



Source: Automotive company, 2017

Figure 2 presents claims with a percentage of 67% situation given by the delay of dispatch of spare parts that increases the time in the operations part, some factors of this situation are due to the lack of tools and inventory of spare parts. Item 2, with 33%, presents the demand for maintenance, an arrangement for which it affects the delay times in operations.

After analyzing the process of operations segmented by the ABC method, the mathematical analysis is performed to obtain the standard time, which is distributed in different times whose sum returns the standard value that must be taken into account in order to apply. The relation of times that are had to have the standard time are the current time that they have in the tempario of workshop, the estimated time on the part of the head of workshop or expert of maintenance, the time of factory that have the company that manufactures the automobiles and the time in chronometer that were taken in the workshops with respect to the demand. These times and combinations show with type A and a percentage of 60% of operations, type B with 25% and type C with 15%.

At the end of calculating the standard time with respect to the final combination, the last analysis is applied with the table of supplements that presents the additional time required by each operation according to its duration, which includes various types of supplement recognized by the International Labor Organization (ILO), presented in table 1.

Table1. Standard time combinations

T. Actual	T.Estimated	T.Factory	T.Stopwatch
0,2	0,3	0,2	0,3
0,2	0,4	0,4	
0,2	0,4		0,4
	0,3	0,3	0,4
0,2	0,8		
	0,7	0,3	
0,4		0,6	
		0,2	0,8
0,2			0,8
	0,3		0,7

Source: Research authors

Table 2.shows the supplements with respective information to obtain the standard and final time of each operation of the tempario. This total time is calculated as a percentage; if it does not exceed the hour, 7% of the time is added; if it is between one hour and two, 9% of the time is added; and if it exceeds two hours, 13% of the time is added.

Table 2. Supplements table

Supplement	**0-1 (hours)**	**1-2 (hours)**	**+ 2 (hours)**
Work Standing	1	1	2
Position	1	2	2
Individual needs	5	5	5
Ilumination	0	1	2
Monotony	0	0	1
Stress	0	0	1
Total	7%	9%	13%

Source: Researchauthors

III. RESULTS

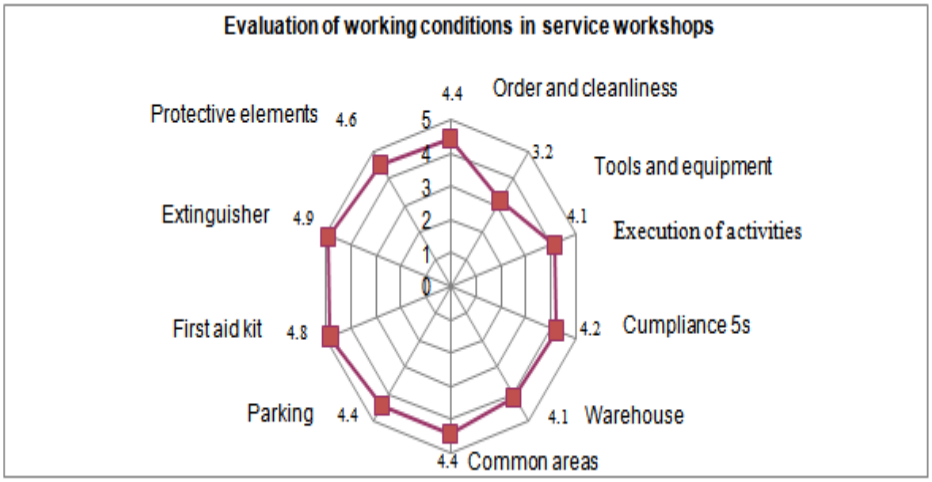
The results presented correspond to the evaluations of the technical and physical conditions of the facilities, which show both the strengths and weaknesses of the area of study in question, and which allow the analysis of all the factors that may be generating operational inconveniences when carrying out activities specific to the area, another result is the benchmarking, this competitive evaluation, allows the company's current situation to be known, with the intention of finding improvement strategies with respect to items in which weaknesses are presented, in the same way, as a result of the structured estimation method, new standardized data of the operations and execution times of the specific area of study are obtained, so that the company can attend to its operational requests in an efficient manner, allowing standardization to be established concretely as a tool for competitiveness

3.1 Assessment of the technical and physical conditions of the service facilities for trucks and tractor-trucks

The evaluation of the technical and physical conditions of the facilities through a radial graph, presents results of a qualification from 0 to 5 of different items, that allow to diagnose the situation of a service or specific area as far as the facilities or places where it is given, since it determines the main factors that affect the operativity, besides that the correct functioning of the technical and physical conditions of an area in question favor the standardization with respect to the improvement of the service, much more efficient processes, better managed resources.

Therefore, the example obtained from the study is presented in the truck brand, which shows the handling of tools and equipment with great difficulties to operate, with a score of 3.2 with respect to the rest of the items that exceed the score of 4, a situation that the company may consider for future studies. With respect to tractor-trailers, there are the elements of protection, warehouses and warehouses, as well as the handling of tools and equipment, as weaknesses to be considered for the company and which must be improved.

Figure2. Locative evaluation in one of the truck brands



Source: Research authors

3.2 Benchmarking for trucks and tractor trucks

The benchmarking evaluation contemplates several items of evaluation of competitiveness between different brands, which allows to obtain results that detail the current state of the brand with respect to the others, focuses strictly on factors that affect the competitiveness of the company, in this way generate and identify strategies to improve the weaknesses that can be found after the evaluation. In table 3, we can see weakness in the item social networks, a factor to consider for the company to improve its presence in digital markets, and so this identification of improvement factors is crucial when undertaking new improvement strategies to obtain a better positioning with respect to competing brands; However, there are strengths in localizations, website, brand distinction, seniority, reliability and product portfolio, factors that must also be taken into account to maintain the level of competitiveness.

Table3. Benchmarking evaluation of truck brands

Ítem to evaluate	Main brand	Chevrolet trucks	Jmc	Foton	Jac	Results
Sale sites	4	5	4	2	3	Competitive
Service sites	3	3	4	3	3	Competitive
Location	5	4	5	3	3	Strength
Web page	5	3	5	4	2	Strength
Distinction of the brand	5	4	4	2	4	Strength
Time in Colombia	5	5	3	1	3	Strength
Strategy in social networks	3	5	3	5	1	Weakness
Sale price vehicles	5	3	5	5	5	Competitive
Reliability	5	4	3	2	2	Strength
Growth versus the previus year	4	5	2	3	3	Competitive
Annual sales	4	5	2	4	4	Competitive
Product portfolio	5	5	3	3	3	Strength
Total	**53**	**51**	**43**	**37**	**36**	

Source: Research authors

Several brands are observed with items that represent weaknesses and strengths, allowing to compare and denote the current status of the main brand, whose strengths are evidenced in localization, website, brand distinction, seniority, and whose weakness was evidenced in social networks, with respect to tractor trucks were evidenced strengths in distinction, seniority and strategy, while weaknesses, such as growth in time, sales and product portfolio.

3.3 Structured method of operations estimation in one of the brands of trucks and tractor trucks.

The structured method of operations estimation is generated according to the application of the ABC method, a tool that allows operations to be established and organized according to a specific criterion. The results obtained from this method focused on standardization are improvements in the efficiency of processes and the execution of operational activities, since thanks to this tool, operations are segmented in order of importance according to

specific criteria of interest to the company; proposing the applied example, the operations are segmented according to the level of demand of the required repair operation in a period of time, paying attention to the optimal fulfillment of the vehicle repair service, which will generate a greater capacity of response to the clients, improving the relationship with them and thus, generating added value for the company.

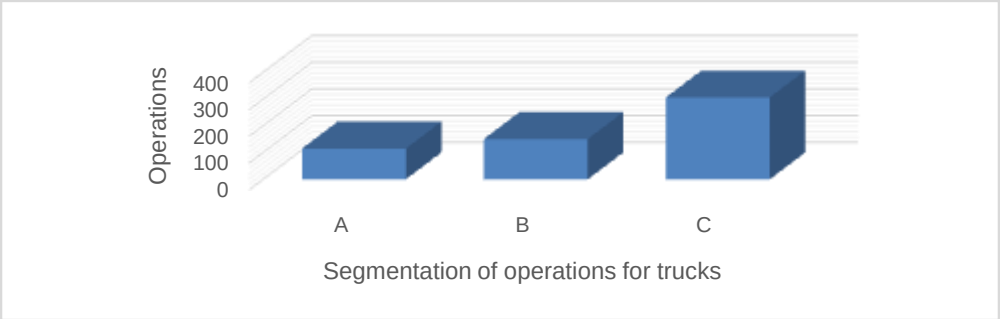
Table4. Segmented operations of the ABC method for trucks

Type	%	Operations
A	60%	115
B	25%	151
C	15%	307
Total	100%	573

Source: Reserch authors

Contextualizig, the example presents how it is established the correct segmentation of workshop operations by item, and the number of operations by each, this process will update the repair times in an orderly manner and as expressed above, depending on demand, which will benefit the relationships with customers of the company with greater reliability.The figure 4. Presents the segmentation of the operations for the example proposed:

Figure4. Segmentation of operations for trucks



Source: Research authors

The ABC method, is very useful applied in standardization, because it allows obtaining concrete results and comparing them between several types of analysis, as well as applying it in any context, with respect to tractor trucks, presents wide variation, due to the behavior of the demand in the workshops where the service is provided, reason why the segmentation of the operations presented changes with respect to the priority operations, which allows evidencing the adaptability of the method in different areas, although this generates the same evaluation of the times taken, and also with the support of workshop experts, are updated times that can not be taken by conditions of the sector and workshop, being so that is presented below, the number of operations that were segmented with this tool, the values obtained in tractors after the segmentation of operations for trucks are: 120 for item A, 224 for item B, and 350 for item C.

3.4 Increase in times for trucks and tractor trucks

According to the new structuring of operations derived from the segmentation applied by the ABC method, and new time information obtained, there may be an increase or decrease in execution times of operations, a situation that can be analyzed with respect to historical data, so depending on the situation; This variation will allow conclusions to be drawn with respect to the way in which work was being done before the structuring process was carried out. For the case studied, there is a registered increase in the total time of all the operations carried out in the truck after-sales service, the percentage of which is 39.8% thanks to the large number of new operations obtained, which now add up to a total of 2213.8 hours.

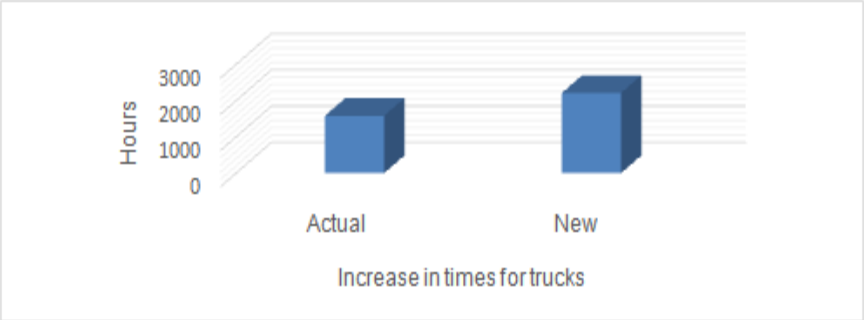
Table5. Increase in times for trucks

Increase in times for trucks	
Actual	1583,39 (h)
New	2213,8 (h)
Increase	39,8%

Source: Research authors

With respect to the tractor trucks, contrary to the line of trucks, there was less increase, due to good structuring, however the recorded increase in times of all operations of the after-sales service of tractor trucks was 1.089%, mostly by operations requested by the brand, in total, after the new structuring of repair times, the total sum is 2326.9 hours for all operations.

Figure5. Increase in times for trucks



Source: Research authors

The correct structuring allows to unify all the operations, eliminating those that end up affecting the processes and generating delays in times and in general operative problems, for this case 573 operations were obtained.

T**able6**. Number of operations per family trucks

Operation description	Quantity
Number of final operations after structuring	573
Number of operations they implemented with the services provided by the workshops	245
Number of new operations added to the new storm after structuring	328

Source: Research authors

To obtain a correct structuring and order of the operations, it allows to generate order and clarity with respect to the processes, the studied case presents the number of operations that were established, where a great number was registered in families like motor, electrical system, transmission and several.

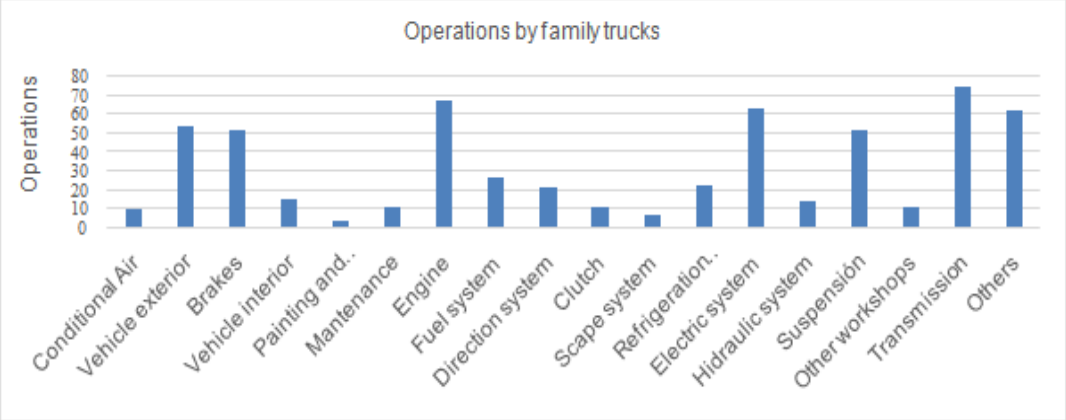
Table7. Families of operations with quantity

Family	Operations
Conditional Air	9
Vehicle exterior	54
Brakes	52
Vehicle interior	15
Painting and lettering	3
Mantenance	10
Engine	67
Fuel system	26
Direction system	21
Clutch	11
Scape system	6
Refrigeration system	22
Electric system	63
Hidraulic system	14
Suspensión	52
Other workshops	11
Transmission	75
Others	62

Source: Research authors

There is variability among families with more than 50 operations, with respect to those with fewer operations.

Figure6. Operations by family trucks



Source: Research authors

In this case, there was a reduction in the number of operations due to the presence of inconsistencies in the times and operations previously handled by the company, which generated the need to purify certain operations. In the same way, a large number was registered in families such as engine, electrical, suspension and transmission.

IV. CONCLUSION

To respond to the different needs and requirements of today's companies, this study was established, which presented strategies and tools that can be applied in the standardization and management of operations to an area in the context of the company to generate a source of value and constant improvement; the proposed methodology allowed to fulfill a robust and complemented process to correctly establish the standardization of operations and represented a way to analyze and evaluate the situation of the company, its strengths, weaknesses, and options for improvement to obtain competitiveness, allowing it to operate with clarity providing a more effective service, which directly benefits both customers and the company itself.

On the other hand, in order to achieve good results, it implied complying with the standardization process from the correct analysis, corresponding to the evaluation of the technical and physical conditions of the place where the service activities are carried out, in which several items were evaluated, where the technicians carried out the repairs to the vehicles, and where the structuring of operations and times begins to be executed with a solid base, so that a correct structuring is generated that executes after-sales service activities with full security that are generated and comply with the standards, This task exemplifies phenomena such as manufacturing servicing, which has been considered a powerful source of competitive advantage [11] , and at the same time seeking to have a better relationship with customers in terms of being able to offer a correctly standardized service with a good quality level of service, since with more satisfied customers, an organization can increase its margins while improving the cost of the service [12].

In the same sense, when considering benchmarking as a tool, each of the factors can represent a source of competitiveness for the company through comparison in each of the topics of interest in which the company may have a remarkable development in the future, too important a factor to take into account, because there are companies in the sector that still experience a lack of knowledge regarding the concept of benchmarking and its role in improving the effectiveness and competitiveness of their business processes [13] allowing to generate a correct execution of the standardization because a major challenge for organizations, and a differentiator of corporate performance, is the ability to execute the strategy [14] so these strategies to standardize are crucial for companies towards competitiveness.

This study serves as a starting point for future research, since the evaluation of standardization and its application over time is a starting point to record the results of the execution of the process, evaluate and carry out a constant and rigorous monitoring, in which decisions can be made or changes can be adapted as required by the company within a general context, since knowledge is a source of competitiveness of the company and is created, disseminated and standardized within the knowledge network [15]. The study in context, presents a level of confidence in the execution of operational activities, being the modeling of processes an important part of business management and improvement of business processes [16], and that will provide good results with implementation.

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Ever Ángel Fuentes Rojas" Standardization of after sales service operations for trucks and tractor trucks in an automotive company - Case study" International Journal of Computational Engineering Research (IJCER), vol. 09, no. 2, 2019, pp 32-41