1. Introduction

One of the most dynamic industries, established as one of the most important for the development of Mexico, is the automotive industry. In this country, the automotive parts suppliers has been driven by the presence of original equipment manufacturers (OEMs), such as Audi, BMW, Fiat-Chrysler, Ford, General Motors, Honda, Kia, Mercedes-Benz, Nissan, Toyota, Volkswagen y Volvo. In total there are 23 OEMs with industrial clusters in 14 states of the country, which produce light vehicles and heavy trucks (ProMéxico, 2016). In 2016, the automotive industry contributed 3.3% of the national GDP and 19.6% of the country's manufacturing GDP, and positioned as the leading producer in Latin America and the fourth largest global exporter (ProMéxico, 2016).

Mexico is arising in the world as an emerging economy, derived from its competitiveness in manufacturing sector. The automotive industry is the most successful case and it will drive the country. According to the International Organization of Automobile Production (OICA), in 2017 Mexico took the sixth place as a producer of automobiles that represents a growth of 13% compared to 2016, as well as the fourteenth place in sales globally of 144 countries with a decrease in sales by 4.7% compared to 2016 (OICA, 2017). Nevertheless, despite of the growth that has had recently, there is a risk of failure to comply and meet the demand of international markets, related to the promotion of innovation, technology products and processes, and the quality of the products.

The factors that define the business competitiveness are linked to two macro trends, globalization of the economy and the technological revolution (Fernández-Sánchez, 1997). There are other indicators that also have a positive effect on competitiveness, such as environmental factors, technology, customer demand, and business relationships (Joshi, Nepal, Singh-Rathore, & Sharma, 2013). All this aims at increasing productivity, improving customer satisfaction, and lowering costs (Lefcovich, 2009).

In the automotive organizations are a set of internal elements, whose existence or absence have an impact on the competitiveness of the sector. In this sense, authors as (Ulengin, Onsel, Aktas, Kabak, & Ozaydin, 2014), (Joshi, Nepal, Rathore, & Sharma, 2013), (Díaz-Fernández, López-Cabrales, & Valle-Cabrera, 2014) and (Hirsh, Almaraz-Rodríguez, & Ríos-Manríquez, 2015), concurred on their respective studies with internal factors affecting the competitiveness of the automotive industry organizations, which are quality, technology, innovation, human capital qualified and information technologies.

Since 2000, in Mexico automotive exports have been above the oil in terms of value, except for the period from 2005 to 2008, making this industry the biggest source of foreign exchange for the country. The 71.7% of exports are to the United States, and the rest of the exports are to countries such as Canada, Germany, Brazil and China mainly (CEFP, 2015). For this reason it is essential to strengthen the competitiveness of the automotive part suppliers, because it will bring significant benefits to the country, such as direct jobs, foreign investment, contribution to the manufacturing GDP, national GDP and increase exports.

This research aims to provide an instrument to measure the manufacturing competitiveness of automotive industry (MCAI), specifically for automotive parts suppliers of the State of Nuevo Leon, through the measure of the impact of internal factors of product and process quality, product innovation and processes technology on MCAI. This article presents this measurement instrument supported in an exhaustive literature review, its validity of content test and its results.

2. Literature review. Factors for manufacturing competitiveness in automotive industry

According to Ulengin et al. (2014), there are three levels of competitiveness that affect the success of companies in a global environment, which are in company, industry and country competitiveness. At the same time, the competitiveness of a nation is measured in terms of the macroeconomic environment, the level of higher education, labor market efficiency, financial market development, technological infrastructure, the sophistication of the business and the level of innovation, and each of them are very important to strengthen the manufacturing sector (Kabak, Ulengin, Onsel, Ozaydin, & Aktaş, 2014). In a globally world competed, the level of survival and business competitiveness of manufacturing companies depend on their ability to adapt to external factors such as government policies and the changing preferences of the customers.

The definition of competitiveness at the aggregate level for the industrial sector, is the average of productivity which has an industry, or the value created by the invested capital; and productivity is related to the quality and characteristics of the product, and the efficiency of its production (Porter & van der Linde, 1995). A manufacturing company performance is measured through its productivity, and also can be measured through their competitive advantages such as the cost of manufacturing, the speed of response, delivery, quality, and its performance, which will determine their competitiveness (Singh, Garg, & Deshmukh, 2007). Authors as (Joshi, Nepal, Singh-Rathore, & Sharma, 2013) y (Nauhria, Pandey, & Kulkarni, 2011) agreed with (Phusavat & Kanchana, 2007), that competitive

priorities of manufacturing are cost, quality, delivery, flexibility, focus on customer service, innovation and technology. Others authors as (Jiménez & Moya, 2011), (D'Costa, 2004), (Lassar, Haar, Montalvo, & Hulser, 2010) and (Ülengin et al., 2014), emphasize that innovation, technology and research and development, are important to compete in global automotive industry. (Bongsebandhu-phubhakdi, Saiki, & Osada, 2009), points out that the total quality management and innovation support the competitiveness of the automotive industry, and it is required that human capital adquire the competencies necessary to achieve organization performance.
(Cinicioglu, Önsel, & Ülengin, 2012) in their study of the automotive industry in Turkey, used indexes that are designated in the Global Competitiveness Index (GCI) of the World Economic Forum (WEF) to measure the competitiveness of the country, because it is recognized by many countries and allows to measure the competitiveness at international level, and in reference of its results in this rank, it considered the automotive sector as the driver of the competitivenes of Turkey. In concordance, Kabak et al. (2014) took as a reference the WEF indicadors to measure the competitiveness of manufacturing in the automotive industry, however they considered that these indicators are multivariate. The GCI consider the productivity as the main determinant of the growth of a nation and points out three main challenge: the ability of finance innovation and technological adoption, emerging economies are becoming with better innovation, and the labor market flexibility and worker protection (WEF, 2018).

2.1 Product and process quality.

In recent competitiveness studies, researchers such as Joshi et al. (2013) and Nurcahyo et al. (2015), refer that the factors that affect it can be classified in three dimensions, being the first with regard to costs, in terms of the price of the product; quality, in terms of functionality and compliance with the requirements of the customer; and time and flexibility, in terms which customer has the product availability and delivery on time. At the beginning of the 21st century, the quality was considered as the most important dimension for business competitiveness (Pešić, Milić, & Stanković, 2012).
Research on competitiveness in the automotive industry, such as by (Curcovik, Vickery, & Droge, 2000), sustain that quality is classified in dimensions attributable to the product or service; and authors such as Ülengin et al., (2014); and Joshi et al., (2013) agree that quality is one key element, among others, that strengthens competitiveness. For its part, (Melgoza-Ramos & Alvarez-medina, 2012); (Garza-Reyes, Ates, & Kumar, 2015); and (Pepper & Spedding, 2010), reach the conclusion that competitiveness is achieved by the improvement of the quality of the processes in the automotive industry using techniques and accurate methods, such as lean manufacturing (LM), and enables operational efficiency. The current theoretical of the concept of quality with greater force in the automotive industry, is the LM. The concept of LM, mainly known as Total Production System (TPS), originated in the automotive industry in Japan after the Second World War, by Taiichi Ohno and his associates, while he was an employee of the company Toyota (Pepper & Spedding, 2010). The ME, as well as the principles and tools of quality, have been used in the automotive industry for the improvement of productivity, customer satisfaction and the impact on the profitability of the organizations (Garza-Reyes, Ates, & Kumar, 2015).

2.2 Product innovation.

The new paradigm to achieve international competitiveness is based on innovation, which is obtained by organizations that have the capacity to improve and innovate continuously their processes, products or services (Porter & van der Linde, 1995). (Joshi, Nepal, Rathore, & Sharma, 2013), considered that the competitive priorities for the operations management include dimensions of cost, delivery, flexibility and quality; in the same way, the implementation of advanced technology through research and development, and innovation of new products, increases the flexibility and quality and reduces delivery time, therefore these elements are also proposed as priorities competitive.
Cars of the future will be characterized by significant developments in the technology of the product as the development of fuel-efficient vehicles, hybrid vehicles, improvements in the systems of engines and exhaust, reduced emissions, sound and vibration and improved telematics; all of these are important areas in which the automotive companies focus their efforts of research and development (Nauhria, Pandey, & Kulkarmi, 2011). Better environmental performance, in terms of the automotive industry product innovation, is a feature that will allow differentiation between competitors, and may address the transformation of technologies, for example design of lighter structures and alternative sources of energy (Triebswetter & Wackerbauer, 2008).

2.3 Process Technologies

Technology is important for competitiveness when it impacts significantly on the competitive advantage of the company or the structure of the industry, and the way to do that is through the supply chain, because a set of activities are requires a set of technologies (Porter, 1985). Ortiz (2006) refers that innovation process produces remarkable improvements in the productivity and the quality of the products in the manufacturing process, and represents a superior way of learning that contributes to the development of technological capacities, which lead to a deeper domain of the system product-process that a company uses.

Another crucial element for the competitiveness of a company is the management of technology, since technologies, whether products or processes, provide the main way to differentiate products, reduce costs and offer new opportunities for business (Baines, 2004). The resources for technology management are the electronic exchange of data, automated software for planning materials, computerized statistical process control and inspection system, barcode system, manufacturing center flexible, among others (Bongsebandhu-phubhakdi, Saiki, & Osada, 2009). Bongsebandhu-phubhakdi et al. (2009), mentions in his study that it is required for the automotive parts suppliers to adopt high level of quality management techniques and various technologies such as CNC, CAD, and CAM, as well as technology management, in order to reduce the internal rate of defects and improve their level of technology, according to the demands of the OEMs to become competitive in the market.

This research establishes the hypothesis that product and process quality, product innovation and process technologies are factors that have a positive impact on the competitiveness of the automotive parts suppliers in the manufacturing sector of the state of Nuevo Leon, Mexico. Figure 1 reflects this relationship among the relevant factors with its respective dimension of the automotive parts suppliers manufacturing that affect the competitiveness of the automotive industry.

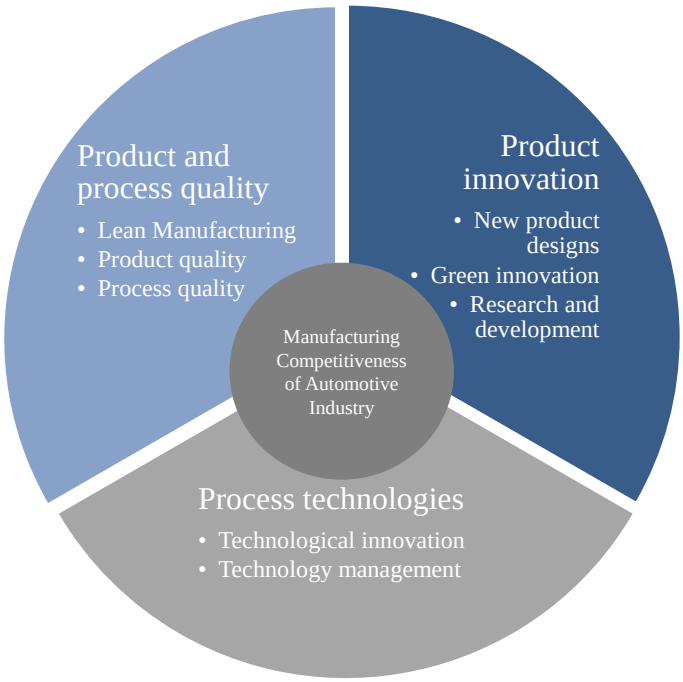

Figure 1. Factors and its dimensions to drive the competitiveness of the automotive industry manufacturing

3. Measurement instrument for manufacturing competitiveness of automotive parts suppliers.

This research will be conducted quantitatively, and seek to test the hypothesis of a positive impact of the factors product and process quality, product innovation and process technology with respect to the variable of manufacturing competitiveness of automotive industry, specificly for parts suppliers in Nuevo Leon, Mexico. As a results it is expected to came up with specific strategies for the automotive industry in this region. For this aim it was define a measurment instrument to gathering data, wich consist in a survey questionnare applied to high-level employees of companies that are suppliers of automotive parts in Nuevo Leon, for the levels Tier1 and Tier2. Each item of the questionnare has been prepared through an analysis of empirical studies, comparatives with others research instruments, and several theoretical contributions from different authors who have published their studies in major journals indexed and / or refereed.
The measurement instrument is composed by two main sections with a total of 44 questions. The first section corresponds to the measurement of control variables, intended to establish the profile of the automotive parts suppliers. It include 10 closed questions, based on the authors Garza-Reyes & Kumar (2015), whose research was applied to Turkish automotive industry parts suppliers of first and second level (Tier 1 and Tier2). The data to collect is years of the company operations in the state; products produced by the company; size of the company (number of employees); location of the company's clients, location of the suppliers. Additionally, it include questions related to the object of study which are CEOs and managers of operations, quality and innovation of the automotive parts suppliers; the data is gender, age, organizational position and seniority in the company. The second section measures the perception of these object of study and consists in 34 questions divided in four constructs: manufacturing competitiveness of automotive industry, product and process quality, product innovation and process technologies. Each question use a Likert scale from 1 to 7. The selection of this scale is supported on the authors (Kafetzopoulos, Gotzamani, Gkana, & Vasiliki, 2015), (Adam et al., 1997) and (Curcovik, Vickery & Droge, 2000), whose studies agrees that the use of a perception survey with a Likert scale of 1 to 7, allows a greater variability of the answers. The type of scale is ordinal, ranging from totally disagree=1 to totally agree=7.

3.1 Manufacturing competitiveness of the automotive industry.

Manufacturing Competitiveness of the Automotive Industry (MCAI) is the dependent variable of this research, and some of the elements for its measuremente are based on the Global Competitiveness Index (2016) , published by the World Economic Forum, and the Global Manufacturing Competitiveness Index (Deloitte, 2016). Both organisms sustain that the manufacturing sector is a global economy driver due its influence on the development of infrastructure, the generation of direct employment and its contribution to GDP. Other measurement elements of the MCAI are supported by the main authors (D'Costa, 2004), (Lassar, Haar, Montalvo, & Hulser, 2010), (Ülengin, Önsel, Aktas, Kabak, & Özayd , 2014) and (Porter, 1985), who refer the technology and innovation as a relevant element of competitiveness; as well as (Lefcovich, 2009), (Heras, Marimon, & Casadesús, 2009) and (Grossman, 1993) who refer the productivity as an indicator of competitiveness measurement. The dimensions included in the construct of the MCAI are productivity, innovation and technology, financial impact and human capital.

3.2 Product and process quality construct.

The product and process quality construct, is based on the main authors Curcovik (2000), (Kafetzopoulos et al., 2015), Heras (2009), Lucato (2012) and Pešić (2012), (Adam et al. ., 1997), whose contributions allow to identify concepts in which quality has a positive impact on the MCAI, as Total Quality Management, product and service quality and Lean Manufacturing principles. From this information it can be inferred that there are three big dimensions of quality, which are process quality, lean manufacturing principles and product quality. The items of the questionnare were constructed based on the findings and results of the studies prepared by Curcovik (2000), Heras (2009) and Pešić (2012); as well as part of the instrument research of Lucato (2012), (Kafetzopoulos et al., 2015) and de (Adam et al., 1997). The items are taken from their respective instruments and are translated and adapted to the context of the present study.

3.3. Product innovation construct.

The development of the instrument in relation of the product innovation construct is supported by the main authors Agostini (2015), Kwintiana (2005), Kamp (2008), Nauhria (2011), Joshi (2013), Triebswetter (2014) and Lin (2014), whose contributions refer important elements such as the state of the art in product design, the consideration of the environment, the involvement of government incentives, and the research and development that companies do in order to compete in the market. This research identified three dimensions in the innovation product factor: design of new products, green innovation and research and development. The items designed for these construct were created accordely to the studies of these authors and on the proposed instrument of Kafetzopoulos et al. (2015).

3.4. Process technologies construct.

The process technologies construct is based on the main authors Ortiz (2006), Gabriel (2016), Nurcahyo & Wibowo (2015), Kafetzopoulos et al. (2015) and Bongsebandhu-phubhakdi (2009), whose contributions refer relevant elements in the industrial technologies of the automotive sector, new technological advances, and their relevance to support the competitiveness of companies. In this study, the dimensions defined for the process technologies construct are: technological innovation and technology management. The items of the instrument were constructed, based on the studies that were made by these authors, and some items were taken from the instrument proposed by the research of Kafetzopoulos et al. (2015), which were adapted to the context of the present research.

The detailed measurement instrument for the competitiveness of the parts suppliers of the automotive industry, are shown in table 1. It is also presented the dimensions by construct and their respective items.

Table 1. Measurement Instrument for MCAI

Construct	Dimensions	Items
Manufacturing Competitiveness of Automotive Industry	Productivity	1. The competitiveness of the organization is supported by its productivity
	Innovation and Technology	2. The competitiveness of the organization is strengthened by its capacity for innovation
		3. The competitiveness of the organization is strengthened by its technological capabilities (industrial technology and information infrastructure)
		4. Investment in advanced manufacturing technologies generates competitiveness in the organization
	Financial impact	5. The increase in sales of the organization is an aspect that arises from being competitive in the market.
		6. The organization profitability increase because of its competitiveness.
		7. The growth in the export capacity of the organization is generated by its competitiveness.
		8. The reduction of the manufacturing products cost has an impact on the competitiveness of the organization.
	Human Capital	9. The incorporation of qualified personnel in the organization reinforces its competitiveness.
		10. The competitiveness of the organization allows the generation of direct employment.
Product and process quality	Process quality	11. Quality management systems IATF 16949: 2016 and ISO 9001: 2015 are required to reinforce the organization competitiveness.
		12. The application of quality tools for solving problems are used to increase the productivity of the organization.
		13. Statistical quality control for the process improvement is required to decrease the manufacturing cost of the organization.
	Lean Manufacturing Practices	14. Lean manufacturing practices are required to improve the organization competitiveness.
		15. Lean manufacturing practices allow the manufacturing and operative cost reduction.
	Product quality	16. Meeting the product specifications required by customers allows increase the company sales.
		17. The level of reliability of products provided to customers allows the improvement of the competitiveness of the organization.
		18. Delivery on time the volume and type of product required by customers, allows to increase the company sales

Construct	Dimensions	Items
Product innovation	Design of new products	19. The number of new products introduced to market allows the increase of the organization competitiveness.
		20. The speed of the new product development allows the improvement of the organization competitiveness.
		21. The use of the latest technological innovations in the design of new products enables to increase the technological capabilities of the organization
		22. The number of patents for new products that are developed enables to increase the innovation capacity of the organization.
	Green Innovation	23. Environmental public policies encourage the design of new green products, which strengthens the ability of innovation of the organization.
		24. The number of new green products that are introduced to the market allows the improvement of the organization competitiveness.
	Research and Development	25. Current public policies encouraging research and development to design new products, to strengthen the innovation capacity of the organization.
		26. Investment in research and development for new product design allows the growth of the innovation capacity of the organization.
Process Technologies	Technological innovation	27. Technological innovation of production processes is required to strengthen the competitiveness of the organization.
		28. The speed to adopt the latest technological innovations in the production process allows the increase technological capabilities of the organization.
		29. The flexibility of production processes to manufacture products allows the improvement of the organization competitiveness.
		30. Automation of production processes enables the improvement of the productivity of the organization.
		31. The introduction of advanced high-tech industrial manufacturing systems, allows increasing the technological capabilities of the organization.
		32. The installation of new industrial technologies for environmental sustainability improves the organization competitiveness.
	Technology management	33. The technological infrastructure (industrial machinery) for the development of production processes allows the improvement of the organization productivity.
		34. Industrial technology management allows the improvement of the profitability of the organization.

4. Content validation test.

According to (Mendoza Mendoza & Garza, 2009) the validity of the measurement instrument content is related to the adequate selection of the items for each construct, and to ensure this validity and reliability of it, is necessary to perform tests with experts. This research study use the method proposed by Mendoza & Garza (2009), where academic and automotive industry experts are consulted. The profile of academic experts participants in this study were researchers who earned postgraduate degree in operations research, administration and / or strategy. On the other hand, the experts in the automotive field were general directors or operations managers of Tier 1 automotive parts suppliers companies and OEMs which are members of the Automotive Cluster of Nuevo Leon (CLAUT).
The method used for the validation of the content has two tests. The first one is a concordance test to identify if the items of the questionnaire correspond to their respective construct. This test was applied to five academic experts. The second is a relevancy test, which indicates for each construct which are the relevant items, using a scale of 1 to 4, where 1 is irrelevant and 4 is very relevant. This test was applied to five automotive field experts. For both tests, the same questionnaire of the measurement instrument of MCAI was applied electronically to participants for gather data through the tool questionpro, and consists in a total of 34 items. At the end an analysis of the results was performed.

5. Results.

The obtained results from the concordance test identified if the items are properly located in their respective construct, as well as the results of the relevancy test identified the items that are important for the automotive industry. In the results of the concordance test, those items with results 3, 4 or 5 responses in the same construct were considered as concordant with its respective construct. And in the relevancy test, those items with results with an average greater than 3 were selected as relevant. Table 2 shows in blue the items that confirm relevancy and concordance; in yellow, those items that in concordance were in another variable than the one proposed, and for relevancy they are little or irrelevant; and in gray those items considered with uncertain results. It should be noted that in the concordance test some results were omitted because the expert considered outside of these four constructs, so some results are less than 5 in total.

Table 2. Results of the content validation tests: concordance and relevancy

		Concordance test				Relevancy test						
Item Num.	Variable	MCAI	Product and process quality	Product Innovation	Process Technologies	Irrelevant	little relevant	Relevant	Very Relevant	Mean	Standard Dev.	Variance
1	MCAI	**3**	1	0	1	0	0	3	2	**3.40**	0.55	0.30
2	MCAI	**2**	0	**2**	0	0	0	4	1	**3.20**	0.45	0.20
3	MCAI	1	0	0	**3**	0	0	4	1	**3.20**	0.45	0.20
4	MCAI	1	0	0	**4**	0	0	0	5	**4.00**	0.00	0.00
5	MCAI	**4**	1	0	0	0	1	2	2	**3.20**	0.84	0.70
6	MCAI	**5**	0	0	0	0	0	4	1	**3.20**	0.45	0.20
7	MCAI	**5**	0	0	0	0	3	1	1	**2.60**	0.89	0.80
8	MCAI	**4**	1	0	0	0	0	2	3	**3.60**	0.55	0.30
9	MCAI	**2**	0	0	0	0	0	2	3	**3.60**	0.55	0.30
10	MCAI	**4**	0	0	0	0	2	3	0	**2.60**	0.55	0.30
11	Product and process quality	0	**5**	0	0	0	1	2	2	**3.20**	0.84	0.70
12	Product and process quality	0	**5**	0	0	0	0	1	4	**3.80**	0.45	0.20
13	Product and process quality	0	**5**	0	0	0	2	1	2	**3.00**	1.00	1.00
14	Product and process quality	**2**	**2**	0	0	0	0	0	5	**4.00**	0.00	0.00
15	Product and process quality	**3**	2	0	0	0	0	0	5	**4.00**	0.00	0.00
16	Product and process quality	1	**4**	0	0	0	1	4	0	**2.80**	0.45	0.20
17	Product and process quality	1	**4**	0	0	0	1	2	2	**3.20**	0.84	0.70
18	Product and process quality	**3**	2	0	0	0	0	3	2	**3.40**	0.55	0.30
19	Product Innovation	0	0	**5**	0	0	1	2	2	**3.20**	0.84	0.70
20	Product Innovation	0	0	**5**	0	0	3	0	2	**2.80**	1.10	1.20
21	Product Innovation	0	0	**4**	1	0	0	5	0	**3.00**	0.00	0.00
22	Product Innovation	0	0	**5**	0	0	2	3	0	**2.60**	0.55	0.30
23	Product Innovation	0	0	**3**	0	0	2	2	1	**2.80**	0.84	0.70
24	Product Innovation	2	0	**3**	0	0	3	2	0	**2.40**	0.55	0.30
25	Product Innovation	0	0	**4**	0	0	2	3	0	**2.60**	0.55	0.30
26	Product Innovation	0	0	**5**	0	0	0	2	3	**3.60**	0.55	0.30
27	Process Technologies	0	0	1	**4**	0	0	3	2	**3.40**	0.55	0.30
28	Process Technologies	0	0	1	**4**	0	0	4	1	**3.20**	0.45	0.20
29	Process Technologies	1	0	0	**4**	0	0	2	3	**3.60**	0.55	0.30
30	Process Technologies	0	0	0	**5**	0	0	3	2	**3.40**	0.55	0.30
31	Process Technologies	2	0	0	**3**	0	0	2	3	**3.60**	0.55	0.30
32	Process Technologies	1	0	0	**4**	0	1	4	0	**2.80**	0.45	0.20
33	Process Technologies	1	0	0	**4**	0	0	1	4	**3.80**	0.45	0.20
34	Process Technologies	**3**	0	0	2	0	0	3	2	**3.40**	0.55	0.30

Once the results were observed, a comparison was made between the relevancy and the concordance of each item. First, the items of the relevancy test were evaluated, and those items without relevance or with little relevance, were eliminated from the instrument. Then the concordance was analyzed and those items that were not in agreement with their respective construct, the decision was to relocate the items in the corresponding variable or to eliminate it. In order to concentrate the results, a percentage of items with positive results in the concordance and relevancy test were obtained for each dimension of the respective constructs, this is shown in Table 3.

Table 3. Resultant from concordance and relevancy tests per construct and its dimensions.

Construct	Dimensions	Concordance Percentage	Relevancy Percentage
Manufacturing Competitiveness of Automotive Industry	Productivity	100%	100%
	Innovation and Technology	0%	100%
	Financial impact	100%	75%
	Human Capital	50%	50%
Product and process quality	Process quality	100%	100%
	Lean manufacturing practices	100%	100%
	Product quality	66%	66%
Product innovation	Design of new products	100%	50%
	Green innovation	100%	0%
	Research and development	100%	50%
Process technologies	Technological innovation	100%	83%
	Technology management	50%	100%

6. Conclusion.

This article presents an instrument to measure the manufacturing competitiveness of automotive industry parts suppliers supported by a comprehensive literature review through the authors found that the factors of product and process quality, product innovation and process technologies have a positive impact in MCAI. This article aims to corroborate this measurement instrument through a content validation method using two different tests, one of the concordance and the other of relevance; these were applied to ten experts in the field.

A practical implication provided in this article is the results of the content validation test. It is observed that in terms of the relevancy of the constructs of MCAI, product and process quality and process technologies, the results shows that most of the items were relevant for the experts, so we can infer that the content of these constructs were adequate. Respect of the results of the construct of product innovation it was found that an important part of its content is considered with little relevance, particularly the dimension of green innovation. In no case the automotive industry experts consider irrelevant the proposed items.

In the case of the concordance test, it can be concluded that the constructs of product and process quality, product innovation and process technologies had results that show the content of the measurement instrument agrees with the measured variables. Regarding the dependent variable of MCAI, it was found that the items of the innovation and technology dimension must be relocated respectively to product innovation and process technologies constructs.

Another important finding is that the human capital dimension of the MCAI construct didn't obtain positive results in both tests, only one item was relevant, and this was not considered to be consistent to measure competitiveness. In future research it will be considered to measure human capital as another factor with positive impact on the MCAI.

The future for this research will be modify the measurement instrument based on the results of the content validation method, and apply it to the study objects which are CEOs and operations, quality and innovation managers of the companies that supply parts at Tier 1 and Tier 2 of the automotive industry of Nuevo Leon, Mexico, with the aim to prove the hypothesis proposed in this study.

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