



## Importance of The Layered Process Audits "LPA's" For the Sector of Auto parts In the State of Tlaxcala, Mexico

Evelin Amairani Nava Lozano<sup>1</sup> • Rosa Cortes Aguirre<sup>1</sup> • Jorge Luis Castañeda Gutiérrez<sup>2</sup> • Miguel Angel Lozada Aguirre<sup>2</sup>

<sup>1</sup> Administrative Engineering Department, Technological Institute of Apizaco, Apizaco, Tlaxcala, Mexico

<sup>2</sup> Postgraduate Studies and Research Division, Technological Institute of Apizaco, Technologic National of Mexico, Tlaxcala, Mexico  
[amairaninavalozano@gmail.com](mailto:amairaninavalozano@gmail.com)

**Abstract.** In this work, we will discuss the Importance of LPA's layered process audits for the auto parts sector in the State of Tlaxcala. In Mexico, the auto parts industry is one of the most important economic activities, generating year-on-year value, creating sources of employment and satisfaction at the international level. The new ways of working and the number of demands in this sector, companies seek to be leaders worldwide, implementing new forms of quality work to reduce costs and increase their productivity. For the following study, data from official sources, statistical information from both national and international governmental organizations such as: ISO 9001:2015, IATF 1949:2016 and CQI-8, CITLAX, AMIA, Agenda Tlaxcala, among others, were collected.

### To cite this article

[Lozano, E. A. N., Aguirre, R. C., Gutiérrez, J. L. C. & Aguirre, M. A. L. (2020). Importance of The Layered Process Audits "LPA's" For the Sector of Auto parts In the State of Tlaxcala, Mexico. *The Journal of Middle East and North Africa Sciences*, 6(07), 12-16]. (P-ISSN 2412- 9763) - (e-ISSN 2412-8937). [www.jomenas.org](http://www.jomenas.org). 3

**Keywords:** Process Audits, Sector of Auto parts, Quality.

### 1. Introduction:

Mexico's automotive sector continues its positive trend, despite stagnant car sales in the United States, especially the decline in sales of imported cars, and a significant drop in U.S. auto exports, of which a high percentage are Mexican intermediates. In this way, the progress of the sector is explained by a gain in the market share of Mexican automotive exports in the US. Indeed, in 2010 Mexico was the third largest automotive exporter to the US with 21.4% and by 2014 it became the first with a 26.1% stake (Bancomext, 2016).

The main markets in 2014 were China, the United States and Japan, representing 52% of global sales. The main producers were also China, the United States, and Japan and accounted for 50% of world production (Bancomext, 2016).

In 2014, Mexico ranked as the world's seventh largest producer with 3.4 million units produced, surpassing Brazil. By 2015 or 2016, it's expected to go over to India and become the world's sixth largest producer. With respect to exports, in 2014 Mexico ranked fourth above Korea and China, which exported more than Mexico in 2009 (Bancomext, 2016).

The state of Tlaxcala is betting on strategies for the automotive sector, of course, is CITLAX (Tlaxcala State Technology and Innovation Research Consortium), created by the scientific and technological research consortiums of

the National Science and Technology Council (Conacyt), this program is focused on serving the chemical, automotive, textile and sustainable sectors of that entity (CITLAX, 2018).

The destination of Tlaxcala's automotive producers is mostly shipowners such as VW, AUDI, BMW and Mercedes Benz, for higher-end models, so they must meet the strictest dimensional, appearance and quality, logistics and service specifications. All this means that the development and innovation efforts of the state companies are mainly aimed at improving manufacturing, logistics and services processes, as well as maximizing operational efficiency and adopting the most modern manufacturing technologies demanded by the industry (Innovation Agenda in Tlaxcala, 2015).

Automotive companies that are audited in accordance with ISO 9001:2015 and IATF 16949:2016 and CQI-8 LPA's profit great benefits such as securing their processes, identifying areas of opportunity to increase the quality of their products, know the failures, regulations, and critical points that put their quality system at risk. In particular, manufacturing process audits allow you to identify key points of your processes that ensure quality in your products, which are of paramount importance to meet the requirements of the final product according to the requirements of your customers (LENDIZABAL, 2015).

## 2. Methodology:

For the purposes of this publication, information is collected from official sources such as International ISO 9001:2015, IATF 1949:2016 and CQI-8, SEDECO, AMIA, Agenda Tlaxcala, among others.

In relation to available literature, reports, official documents and global and national statistical data, in order to know the importance of "LPA's" layered process audits for the auto parts sector.

### 2.1. Impact of the Automotive Sector in Mexico and Tlaxcala

Of the top 10 manufacturers of original light vehicle equipment (OEMs), 7 has a plant in Mexico, whose main export market (mainly the United States). The production plants of OEM of the automotive industry in Mexico are located in 3 main regions: Centro (States of Mexico, Morelos and Puebla) Centro bajo (San Luis Potosí, Guanajuato, Aguascalientes and Jalisco) and Norte (Baja California, Sonora, Chihuahua and Coahuila) (Innovation Agenda in Tlaxcala, 2015).

For its part, the auto parts industry follows the growth trends of the automotive industry (OEMs) and its location in general is in geographical regions surrounding the OEMs it provides; in addition to that market, it serves the production of spare parts (aftermarket). The production of auto parts is divided into 4 main regions, which have a certain degree of specialization; although in all regions, the most common commodities in the industry are produced. In the northwest region comprising the states of Baja California, Sinaloa and Durango there are 70 production plants producing air conditioning systems, heating, interiors, accessories and electrical systems. In the northeast region that includes the states of Chihuahua, Coahuila, Nuevo León and Tamaulipas there are 198 production plants that manufacture air conditioning, automotive system, plastic parts, parts for the electric system and motor. In the low-town downtown region where the states of San Luis Potosí, Queretaro, Guanajuato, Aguascalientes and Jalisco are the states of San Luis Potosí, Queretaro, Aguascalientes and Jalisco there are 142 plants that produce automoviel. Finally in the region of the Center where Hidalgo, State of Mexico, Puebla, Mexico City and Tlaxcala are located there are 101 production plants whose producers are seats, air conditioning, hydraulic jacks, engine parts, interioens, stamps and suspension (Innovation Agenda in Tlaxcala, 2015).

Tlaxcala's automotive contribution is just over 8% of national production, obtaining more than 3.5 million brutal production. Despite a good level of production, it has a low profit margin considering that the automotive sector represents 2.4% of the state's occupied staff and contributing 2% of state GDP. Value added is below average, and intermediate consumption greater than 3

million denotes the associated high costs (Innovation Agenda in Tlaxcala, 2015).



**Illustration 1.** Map of the Mexican Republic of plants manufacturers of light vehicles and motors.

**Information:** AMIA compilation, with publications from the companies themselves and INEGI, (2018).

Tlaxcala has a strategic geographical location that allows them to connect with important communication routes, which facilitates the logistical of inputs and products finished by land and access to ports. (Innovation Agenda in Tlaxcala, 2015).

The state workforce is regarded in the region as dedicated and unconstrained, but untrained. (Innovation Agenda in Tlaxcala, 2015).

The state has an industrial parted area with adequate infrastructure and the cost of industrial real estate is significantly lower than that of the other states of the center of the republic, as well as a policy of incentives to establish new companies in the state, especially those belonging to automotive sector. These have been key factors in the establishment of new companies over the past few years. (Innovation Agenda in Tlaxcala, 2015).

Historically Tlaxcala has depended on Puebla for the formation of human resources, especially of medium and high industry tables were established in the state 15 years ago and have had remarkable growth based on the linkage with the industry. (Innovation Agenda in Tlaxcala, 2015).

### 2.2. Importance of Quality Management System

A quality system is an extensive program of plans, activities, resources of a company, aiming to ensure, through the reduction of variability, that the company's products meet the customer's quality requirements. An effective quality system is the philosophical and practical element that binds all elements of the company (employees, plant, equipment, procedures, etc.) with suppliers and customers. (Guzman, 1998).



**Illustration 1.** Location of corridors, cities, Tlaxcala parks and industrial areas in 2002.

**Information:** Flexible Auto Parts Companies and their Location in the State of Tlaxcala. (2016).

A system is a set of functions or activities within an organization interrelated to achieve organizational goals. Quality systems are initiated with the basic principle of total quality control, since customer satisfaction cannot be achieved by concentrating on a single area of the company or plant because of the importance that each phase has in its own right, in this way the total quality system is the foundation of total quality control. A quality system is the functional structure of work agreed throughout the company, documented with effective technical and administrative integrated procedures, to guide the coordinated actions of the workforce, machines, company information in an efficient, effective, more practical way, to ensure customer satisfaction and quality economic costs (Aguilar, 2010).

A quality management system is a way of working, through which an organization ensures the satisfaction of the needs of its customers. For which you continuously plan, maintain and improve the performance of your processes, under an efficiency scheme that allows you to achieve competitive advantages (Yáñez, 2008).

A management system (SG) is a set of related elements that aim to provide a frame of reference for the continuous improvement of the company, increase customer satisfaction and establish a dialogue with society. Quality management systems are a means to ensure the productivity of a company based on quality, with the main objective of generating trust among customers (Choto, L. & Peña, L., 2013).

### 2.3. ISO 9001:2015 and IATF 16949:2016

The International Organization for Standardization (ISO) is the body responsible for promoting the development of international standards of manufacture, trade, communication for all industrial branches except electrical and electronics. Its main function is to seek

standardization of product and safety standards for companies or organizations internationally (Quiroz, 2010).

According to the needs of the market, the International Organization for ISO Standardization is the ISO 9001 standard. ISO 9001 originates from BS 5750, published in 1979 by the British Standards Institution (BSI). The current version of ISO 9001 (the fifth) dates from September 2015 and is therefore expressed as ISO 9001:2015. ISO 9001 versions to date:

- Fifth version: ISO 9001:2015 (23/09/2015)
- Fourth version: ISO 9001:2008 (15/11/2008)
- Third version: ISO 9001:2000 (15/12/2000)
- Second version: ISO 9001:94 - ISO 9002:94 - ISO 9003:94 (01/07/1994)
- First version: ISO 9001:87 - ISO 9002:87 - ISO 9003:87 (15/03/1987)

ISO 9001:2015 will be presented with a valid structure to design and implement any management system, not only quality, and even to integrate different systems. (Quiroz, 2010).

ISO/TS 16949 is not strictly a standard, but a technical specification based on ISO 9000. Applies only to establishments where parts are manufactured for production or automotive services. (Correa, J. & Ramirez, D., 2008).

The International Automotive Working Group (IATF) and the Association of Japanese Automobile Manufacturers (JAMA), with the support of ISO/TC 176, Quality Management and Assurance, prepared IATF 16949:2016 (ISOTools, 2020).

IATF 16949:2016 is the quality management systems (GSC) standard specific to the automotive industry, based on the international quality management system standard according to ISO 9001. (ISOTools, 2020). The objective pursued by IATF 16949:2016 is the development of a Quality Management System that provides continuous improvement, emphasizes error prevention and the reduction of variation and waste in the automotive supply chain. (ISOTools, 2020).

IATF 16949:2016 is important for all types of organizations dedicated to providing automotive material, from small manufacturers to multinational companies, regardless of their geographical location.

IATF 16949:2016 requires all automotive companies to comply with this standard which tells us: In section 9.2.2.2 audits of quality management systems in the IATF 16949:2016 specification states that the organization must audit its quality management system to verify compliance with the standard and additional quality management system requirements. (ITK, 2020).

In section 9.2.2.3 Manufacturing process audits in IATF specification 16949:2016 provides that the organization must audit each manufacturing process in order to determine its effectiveness. In section 9.2.2.4 Product audits in IATF specification 16949:2016 provides that the organization must audit its products at the



appropriate production and shipping stages, to verify compliance with all specified requirements such as dimensions, functionality, packaging and labelling of products at a defined frequency (ITK, 2020).

#### 2.4. CQI-8 Layered process Audit LPA's

The ISO 9000 vocabulary standard defines auditing as "a systematic, independent and documented process for obtaining evidence from the audit (records, statements of fact or any other information) and evaluates them objectively in order to determine the extent to which the audit criteria (set of policies, procedures or requirements used as a reference) are met". This is a methodical review to determine whether quality-related activities and outcomes satisfy the pre-established provisions that are actually carried out, as well as verifying that they are appropriate to achieve the proposed objectives (AEC. Spanish Association for Quality, 2014)

Auditing management systems "is a systematic review and evaluation of an organization, or part thereof, done for the purpose of determining whether the organization is operating effectively" (Vilar, 2014).

Layered Process Audits (LPA) or also called Tiered Audits seek verification of the correct execution of the operational standards of the Organization's Quality System and that of its customers or suppliers (as the case may be). They are a system of review and standardization of the process that verifies from the level of qualification of the operators, the correct adherence of the methods to the process to the correct situation of tools. But it also places special emphasis on those points that are high risk for customer satisfaction and product quality (ITK, 2020).

Layered process audits are used to verify that different roles or areas within an organization follow critical processes and procedures. They ensure that defined methods, work statements are used, and implemented corrective actions are maintained. Due to the scope and purpose of layered process audits, the management or management of operations in the areas where audits are conducted must own the process. Operations managers must ensure the following:

- Layered process audits are conducted on time by designated team members.
- Results are recorded and reviewed on a regular basis.
- Resources are available and corrective actions of detected nonconformities are focused.

Nevertheless, it should be borne in mind that certain OEMS in the automotive sector require their suppliers (at least in addition to them) to have implemented a layered audit procedure that ensures the stability of the manufacturing processes of their parts, it is the case: Opel, Jaguar, GM or Chrysler who reflect it in their Customer Specific Requirements (ITK, 2020).

In 2005, AIAG published the CQI-8 Layered Process Audits Guideline based on the requirements agreed between DaimlerChrysler and General Motors with

the aim of establishing a common framework. This being the most standard document in this area, let's see what this guide says regarding the procedure and organization of these audits.

CQI-8 establishes 5 factors as the basis for the organization of LPA audits:

- Elements to audit: what are we going to audit?
- Audit Levels/Layers: What levels of your organization will be involved?
- Audit frequency: How often will each layer in your organization perform the audit?
- Reaction to a nonconformance: what is the plan when a nonconformance is found?
- Audit ownership: Who ensures that the audit is carried out and that the results are reviewed and implemented?

Typically, these audits should include checkpoints/questions that can be verified quickly and whose answer is YES/NO. For example, it is typical for an audit to verify the existence of the first part inspection record, but not that it requires someone to actually complete the first part inspection process. To establish this list of process checkpoints, the CQI-8 guide recommends forming an inter-functional team within your organization to develop it.

Typically, a checklist of an LPA audit might contain questions from the following areas:

Meters, Meter calibration, Visual aids, Process/machine parameters, Setup and/or change procedures, Working instructions, Construction/processing technique, Product identification, Monitoring equipment, Documentation /record keeping, Error-proof or error-proof equipment, Lab controls, Inspection of part characteristics, Safe processes, Corrective actions of past quality problems, Preventive maintenance, Internal cleaning, Stacking / Packing Requirements

When defining the checkpoint sheet of an audit, we must consider that an organization can have multiple checklist/ control sheets, being able to develop a list of control points specific to each operation, process or product line. In fact, the more specific the control sheet, the more effective it will be. It is especially important to be clear that an LPA audit should not include an exhaustive list of all process requirements, only of those critical aspects (ITK, 2020).

### 3. Conclusion and Recommendations

Most quality issues in the industry are due to the lack of process control up to the deficiency adherence of the proposed instructions and methods: the implementation of Layered Audits brings benefits to the company while allowing it to be opened up to new customers who demand the implementation of this type of audits to its suppliers.

According to CQI-8 LPA's standard, layered process audits have different tangible and intangible benefits, most are associated with process compliance and



directly impact product quality. It is recommended that it be obtained with the implementation of layered process audits are:

Measurement and promotion of standardization of work processes, Reinforces key or up-to-date process steps, including security requirements, Openly publish what is important and what will be checked, The interaction between plant management and line operators is increased, It allows operators to provide first-hand feedback to plant management and see the implementation of immediate corrective actions when appropriate, They give evidence of the importance of the processes and key steps of the processes themselves, reviewing them by the administration of the plant together with the operators, Institutionalizes entertainment, process knowledge to operators, and all levels of plant management, Reduces errors, scrap or waste, costs and increases good the first time, and Improves product quality and customer satisfaction.

Other benefits are associated with the administration of an organization, including increasing floor time for plant management itself. Not all benefits apply to each organization, there may be other, more significant benefits that come from using the tiered process methodology.

The importance of having certifications and tools, make them guarantee their processes and count by offering the market quality products, reducing expenses and defects in the company of the auto parts sector.

#### Corresponding Author:

Evelin Amairani Nava Lozano, Eng.  
Administrative Engineering Department, Technological Institute of Apizaco, Apizaco, Tlaxcala, Mexico  
E-mail: [amairaninavalozano@gmail.com](mailto:amairaninavalozano@gmail.com)

#### References:

1. AEC. Asociación española para localidad. (Agosto de 2014). Auditorias de Calidad. Obtenido de [http://www.aec.es/c/document\\_library/get\\_file?uuid=783d8fbd-12df-43f3-b12c-b1c5ca5ce5d7&groupId=10128](http://www.aec.es/c/document_library/get_file?uuid=783d8fbd-12df-43f3-b12c-b1c5ca5ce5d7&groupId=10128).
2. Agenda de Innovación en Tlaxcala. (30 de 3 de 2015). Obtenido de <http://www.agendasinnovacion.org/wp-content/uploads/2015/03/AgendaTlaxcala.pdf>
3. Aguilar, A. (2010). "Propuesta para implementar un sistema de gestión de la calidad en la empresa" Filtración industrial especializada S.A de C.V." en Xalapa Veracruz. En T. M. Veracruzana.
4. Bancomext. (2016). Sector Automotriz. Obtenido de [https://www.bancomext.com/wp-content/uploads/2015/08/Automotriz\\_1er\\_Informe\\_2015.pdf](https://www.bancomext.com/wp-content/uploads/2015/08/Automotriz_1er_Informe_2015.pdf)
5. Choto, L. & Peña, L. (2013). Diseño de un sistema de gestión de calidad para la empresa carrocería mayorga en base a la norma ISO 9001:2008.
6. CITLAX. (2018). Consorcio de Investigación y de Innovación del Estado de Tlaxcala. Obtenido de <https://citlax.mx/>
7. Correa, J. & Ramírez, D. (2008). Modelo de evaluación por autogestión de sistemas de calidad basado en la norma TS/16949 del sector. Tesis profesional. IPN UPUESA.
8. Guzmán, R. (1998). Mantenimiento al sistema de calidad de una empresa. En U. A. León.
9. ISOTools. (2020). Obtenido de <https://www.isotools.com.mx/iatf-169492016-sistemas-gestion-la-calidad-la-industria-del-automovil/>
10. ITK. (2020). Obtenido de <https://itksuite.com/queson-las-auditorias-por-capas/>
11. LENDIZABAL, A. E. (2015). implementación de la norma CQI-8 LPA's en el proceso de inyección de cera perdida. TIANGUISTENCO; MÉX.
12. Quiroz, J. (2010). Sistema de Gestión de la calidad en el área socio educativa, perteneciente a la casona de la universidad de oriente-Núcleo Bolívar, mediante la aplicación de la norma ISO 9001-2008.
13. Vilar, J. (agosto de 2014). la auditoria de los sistemas de gestión de la calidad. Obtenido de [books.google.com.mx/.../La\\_auditoria\\_de\\_los\\_sistemas\\_de\\_gestion.htm](https://books.google.com.mx/.../La_auditoria_de_los_sistemas_de_gestion.htm)
14. Yáñez, C. (Agosto de 2008). Sistema de gestión de la calidad en base a la norma ISO 9001. Obtenido de [www.internacionaeventos.com/Articulos/ArticulosISO.pdf](http://www.internacionaeventos.com/Articulos/ArticulosISO.pdf)

Received May 28, 2020; reviewed June 01, 2020; accepted June 21, 2020; published online July 01, 2020