Chapter 3 Implementation of quality control tools in the inspection-receipt area to reduce raw material rejections in electromechanical industries

Capítulo 3 Implementación de herramientas de control de calidad en el área de inspección-recibo para disminuir los rechazos de materia prima en industrias electromecánicas

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Abstract

The metalworking industry turns out to be a starting point for the manufacture of assemblies, subassemblies and circuits that are imported or exported to other work environments; these organizations contribute to the technological growth of the country in which they are established, for the case presented below, the electromechanical industry is evident, which is identified by showing quality problems in the manufactured products, derived from a null control in the inspection-receipt area, which is in charge of receiving supplies and shipments to the warehouse area. According to the project carried out, it is identified that the main cause is the lack of standardization of the activities carried out by the quality department, being of vital importance the implementation of an assertive methodology that ensures that suppliers supply the organization with top quality materials. . The applied quality control methodology is based on three stages: 1) Information gathering, 2) Quantitative and qualitative analysis of variables, 3) Solution implementation, 4) Measurement of solution effectiveness, are developed using the following techniques: Internal audit, Check List, Ishikawa Diagram, input control of raw materials and supplies and labeling of materials. The results obtained were beneficial, reducing raw material rejections by 7% and identifying through the traffic light technique the suppliers that meet the requested requirements, which will be maintained for future purchases, in the same way the economic benefit achieved after the project is $358,506.94 being a considerable amount for members of senior management.

Electromechanical industry, Inspection-receipt, Quality control, Quantitative

Resumen

La industria metalmecánica resulta ser un punto de partida para la fabricación de ensambles, subensambles y circuitos que son importados o exportados a otros ambientes de trabajo; estas organizaciones contribuyen al crecimiento tecnológico del país en el que se encuentran establecidas, para el caso que se presenta a continuación se evidencia a la industria electromecánica la cual se identifica por mostrar problemas de calidad en los productos fabricados, derivadas de un nulo control en el área de inspección-recibo, misma que es encargada de la recepción de insumos y los envíos al área de almacén. De acuerdo al proyecto realizado se identifica que la principal causa es la falta de estandarización de las actividades efectuadas por el departamento de calidad, siendo de vital importancia la implementación de una metodología asertiva que asegure que los proveedores abastezcan con materiales de primera calidad a la organización. La metodología aplicada de control de calidad se basa en tres etapas: 1) Recopilación de información, 2) Análisis cuantitativo y cualitativo de variables, 3) Implementación de solución, 4) Medición de efectividad de solución., son desarrolladas utilizando las siguientes técnicas: Auditoria interna, Check List, Diagrama de Ishikawa, control de entradas de materia prima e insumos y etiquetado de materiales. Los resultados obtenidos fueron beneficiosos reduciendo en un 7% los rechazos de materia prima e identificando mediante la técnica de semaforización a los proveedores que cumplen los requerimientos solicitados, los cuales serán mantenidos para futuras compras de igual forma el beneficio económico alcanzado posterior al proyecto es de $358,506.94 siendo una cantidad considerable para los integrantes de la alta dirección.

Industria electromecánica, Inspección-recibo, Control de calidad, Cuantitativo

1. Introduction

The electromechanical industries in Mexico promote technological growth, contributing to the economic development of the country; These productive organizations are responsible for providing materials and supplies to different sectors, with the automotive industry being the one that mainly benefits from their operational activities. Specifically, in the country, the impact of the electromechanical sector is seen in the export processes of integrated circuits, printed circuits and software programming or translation (manufacturing, testing) concentrating the technological impulse in the formation of subassemblies of components and parts, which promote the effectiveness in the value chain of final tests, quality control and packaging (Ordóñez, 2005).

It is important to mention that electromechanical organizations have two main objectives with respect to the products they manufacture or assemble: The first objective is based on obtaining profits from imports and exports, the second objective is to comply 100% with the requirements proposed by national and international clients, seeking to unite these approaches in two variables:

Time and form, to achieve user satisfaction. Sánchez (2007) indicates that if consumers are satisfied, it is very likely that they will recommend the products to a sequence of 5 more customers, so the value of a customer's perception is five times higher than initially expected, that is, the best recommendation to capture new markets is born with customer satisfaction; for this reason, it is essential that the product or service punctually meets the physical characteristics to maintain a high satisfaction rate. The physical characteristics of the goods are defined from the entry of the raw material, the reception area being a starting point for the control of the quantitative and qualitative variables that contribute to the manufacture of optimal products, for this reason the reception department It is characterized by being monitored with the highest levels of demand due to the fact that the raw material must comply 100% with the requirements of internal clients, considering that not complying with them generates quantifiable economic losses, the main objective of this reception department. is to ensure compliance with quality control standards and regulations for the inputs to be processed.

According to what has been described, there is a need to create effective methodologies that guarantee internal production processes, resorting to the conjunction of quality standards to eliminate the sources that originate raw material rejections, considering that the rejected inputs are those that do not comply with the required standards, causing production levels to decrease and products to be delivered outside the times established by customers, there are various sources that cause rejections, the main causes are: 1) Lack of standardization in quality control processes, 2) Null existence of audit plans, 3) Lack of training for personnel assigned to inspection processes in the area. If these factors are recurrent, the input input process will be incorrect, providing a high level of non-compliance for subsequent processes.

In accordance with the need raised in the previous lines, a system of standardization of quality controls is implemented in the receipt inspection area for the electromechanical industry, aligning the business goals with the objectives of the clients under an effective model of entry assurance. of raw material (polypropylene, polycarbonate, silicones, glass melamine, glass silicone, polyester film, etc.), making use of tools corresponding to quality control, which are: Audits (internal and external), check list, Ishikawa (Guzmán, 2019), these techniques are aimed at reducing raw material rejections by 5% and contributing to attracting customers by 5%, standardizing the reception process at a minimum level of 85% with regarding all the operational processes included in the area, programming that the benefit of the application be visible in the course of 2022 and be permanent as of annual period 2023.

2 Objectives

2.1 General Objectives

Implement a quality control process to reduce raw material rejections in the receiving inspection area by 10%, contemplating the standardization of the specifications of thickness, color, porosity and scratches of parts processed in the electromechanical industry, through the development of statistical control tools, making use of historical information and projecting a quantitative benefit, visible from 2021 and permanent from 2023.

2.2 Specific Objectives

1. Analysis of the inspection process that is carried out for the entry of raw material into the operating processes.
2. Implement statistical control tools.
3. Document the appropriate procedure, and the formats to keep a correct record of the quantity and conditions of entry of the raw material.
4. Establish the quantitative benefits obtained with the implementation of quality control for suppliers.

3. Rationale

The current demands to deliver the products in a timely manner to the client within the transformation organizations, originates the need to implement measurement methodologies that quantify and ensure that the actions carried out in the operating stations are effective; One of the actions considered to be of vital importance is inspection.

According to the conceptualization of ISO 9000, (2005) the inspection is defined as a quantitative evaluation of the conformity of a good, through observation and the issuance of an opinion, which is accompanied by a measurement methodology (tests, tests) with previously established patterns, this quantification in most cases absorbs large economic amounts and does not provide the expected results, for this reason business organizations require that it be validated in the areas that really require it. Considering that the companies are made up of different areas, which are subject to rigorous control, a quality control system is implemented for the section that releases the raw material to the operating processes. This area is known as the inspection area. receipt; Specifically, the main activities carried out in this area are: 1) Unloading of raw material, 2) Inspection of raw material, 3) Application of assurance sampling, 4) Registration of entries, 5) Output and shipment of raw material to the warehouse, these operations are vital for the assurance at the entrance and must be carried out following the strictest protocols, contemplating that when they are not complied with, the entry of raw material with defects is allowed, which originate non-conformities of one or several characteristics of the physical object. causing customer dissatisfaction (Polesky, 2006).

The dissatisfaction in a client is reflected by the decrease in future purchases and in the worst case scenario it ceases to be part of the potential clients of the organizations, this situation has been seen more frequently in electromechanical companies which are characterized by produce sub-assemblies or components that mainly supply the automotive industries. The case presented below shows a lack of control in the inspection-receipt area, resulting from the following actions: 1) Non-standardized operations, 2) Raw material receipt methodology is incorrect. 3) Raw material input validation system is incorrect, these factors cause the raw material that enters the process to present nonconformities that are reflected in a high rate of production stoppages, idle times, waste of raw material and supplies, late order delivery, order rejections, churn; How can we notice not having an effective quality process that quantitatively and qualitatively measures the entry of raw material triggers various factors that lead to economic losses for electromechanical organizations. The standardization of a quality control process in this industrial branch will bring with it the reduction of the sources that cause the entry of defective raw material, making the production lines more efficient and delivering the products to the final consumers in a timely manner.

4 Theoretical Framework

For a better understanding of the aspects that make up this research, the theoretical foundations that support the formulation of the standardized quality control process for electromechanical companies are described below.

4.1 Inspection-receipt area

The definition assigned by the acronym in English indicates the following nomenclature IGI (Incoming goods Inspection) this area quantifies all inspection-receipt services for the entry of goods, raw materials and supplies, establishes activities aimed at quality control to ensure shipments of goods to customers, as well as receipts from different suppliers (Juran, 2001)., the assurance that it includes is measured until the moment in which the products are delivered to the client. The main goal of this area is to detect failures or defects in components or assemblies, through the application of visual and dimensional inspections, gauge tests, unit accounting, packing and packaging review, these actions are carried out through the standardization of the batches of parts requested by the quality, logistics and engineering department (Acevedo, 2016).

4.2 IGI services and operation

The base of the inspection-receipt services is based on the international standards ISO2859 or ISO3951, in which the statistical methods and the operative rules for the quality control of the entrance of the industrial processes are established, in the same way in this methodology. control indicates that the inspection of parts received must be applied to a representative sample based on the military standard MIL-STD or MIL-SPE, emphasizing the importance of sampling plans and the elimination of 100% inspection, it is It is of vital importance to mention that the inspection service prevents the risks of rejecting materials, protecting the production lines under a JIT model, making use of a comprehensive policy that indicates the following:

If the receiving operator detects a defective lot, it must be considered as unsuitable material and must be sent to the corresponding area for its subsequent return or elimination, specifying that if the lot e is released this will cause a negative effect that will bring instability and subsequent problems in the assembly or manufacturing lines. The methodology developed in the incoming inspection-receipt area consists of taking random samples from the lot or shipment, without considering the period of time in which it was manufactured, each piece having the same possibility of being selected for the inspection process, a Once the inspection has been applied and the characteristics of the product have been validated, the acceptance of the lot or shipment is carried out.

It is important to mention that the IGI are applied around two variables, the first variable is represented by the functionality, the second variable is the one related to the type of sampling. The functionality is selected according to the historical analysis of the failures of the suppliers, within this variable is the light functionality (suppliers that expose less existence of defects in parts / assemblies), and the increased functionality (suppliers that expose greater existence of defects in parts/assemblies). The second variable referring to the sampling methodology consists in selecting the measurement system to carry out the acceptance or rejection of the lot, establishing as the optimal option the sequential sampling to ensure that the lot will be accepted by the final client. It is relevant to mention that the Correct implementation of IGI contributes to reducing process times that include the interaction of quality control with production processes by up to 50% and reduces risks due to failures in manufacturing procedures by 35%.

4.3 Process audit (inspection validation)

The audit has been contextualized over time from the end of the thirteenth century to the fourteenth century, mention is made that during this period audits were carried out, auditing the operations that were carried out within private companies and areas operated by public officials, that is, the audit has existed since time immemorial. According to Sánchez, (2005) the audit is a systematic process through which the set of evidence that is related to reports of economic activities and others, which are directly related to the operations carried out in a public body, is objectively evaluated. or private, for a correct designation these validation tools are classified as follows:

4.4 Internal audit

This audit model ensures the activities of an internal control system by establishing a set of measures, policies and procedures aimed at protecting assets, minimizing risks and improving efficiency, to optimize and make profitable business units, this methodology carries out a punctual follow-up in the management and administration of the businesses; encouraging the growth of the percentage of probability for organizations to increase the achievement of objectives and achieve the desired success (Prado, 2013).

To achieve success, the internal audit is carried out according to a work plan, based on the organizational goals and aimed at fulfilling the following aspects: 1) Comply fully with the plans and procedures indicated by management, 2) Review and evaluate the correct application of the operational, accounting and financial indicators, 3) Carry out an inventory control of the set of goods available to the organization, 4) Verify, evaluate and ensure the accounting information, which must be in accordance with the economic reality of the business unit, 5) Monitoring compliance with the findings and areas for improvement determined in the audit reports. , in the experience of Aroca, (2016) this management technique contributes to the fulfillment of the results in an interval of 86% to 100%.

4.5 External audit

This audit methodology is considered as a detailed examination, which is carried out by an external agent (company outside the institution, specialized auditor, public accountant); The role of the external agent is to provide a real opinion of the behavior of the communication systems of the audited organizations, as well as propose improvements observed during the audit process. In general, the external audit details the reliability and validity of the documents, programs, files and financial statements that make up the company.

The objectives pursued by the external audit are explained below:

1. Determine the optimal method so that the exchange of information of the organizational areas is exposed in a valid, truthful and correct way.
2. Expose the operational, administrative and financial problems that the company faces.
3. Objectively evidence the strengths and weaknesses for making assertive decisions.
4. Provide constructive suggestions.

However, the main characteristics of the external audit are: a) The resulting information is used by management to support future decisions, b) The audit is applied using work programs that include the phases of: Planning, evaluation, and application of reliable tests, c) It is applicable to all activities and areas of companies.

4.6 Types of external audit

According to their nature they are classified as:

- Second party external audit: This audit program results from a direct request by customers, who want to ensure compliance with the requirements contained in the products they purchase.
- External third-party audit: It is characterized by being carried out by certified organizations, which must be recognized nationally and internationally, to guarantee a quality service.

4.7 Check List

Cardona and Restrepo, (2010) affirm that this technique is made up of control lists, checks and verification sheets; are formats generated to monitor repetitive activities, assigned to ensure compliance with the requirements by collecting data in an orderly and systematic manner, the Check Lists are used to comply with the following actions: 1) Check that the activities are carried out in accordance with a previously established work method, 2) Monitoring of activities in which the tasks must be carried out in an established order, 3) Verifying and examining products/services, 4) Examining the existence and location of defects, 5) Verifying the source of origin of non-conforming products, 6) Verify and analyze the organizational operation. The lists that are part of the Check List verify routine actions and ensure that operators, supervisors and area managers obtain reliable information for the generation of statistics. It is important that the Check List include the variables that provide data of interest to the organization, it is recommended that a section be attached to attach the observations and in the case that it is required to obtain data, the construction of graphs or diagrams must be included to control the variables. individual characteristics of the process.

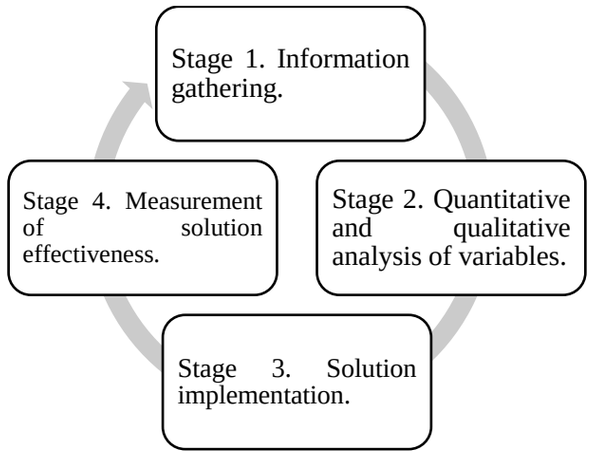
4.8 Ishikawa diagram

The Ishikawa diagram is a statistical tool through which the internal and external variables that affect a given problem are analyzed, considering the potential causes that lead to economic losses, this technique turns out to be effective in business environments because it combines emerging actions to the solution or reduction of the problem; The application methodology is based on a specific study of the factors exposed by the environment, machinery, labour, materials, method and measurement system. This diagram is a way of organizing and presenting the different theories that are proposed to solve a problem, as expressed by Gutiérrez, (2010) who concludes that this technique analyzes the relationship between the cause and the resulting effects.

5 Methodology

Below is the methodological description through which the standardization of the quality control process was carried out in the inspection-receipt area of the electromechanical company (Figure 1. Stages of the methodological process for the development of the application).

Figure 1 Stages of the methodological process for the development of the application

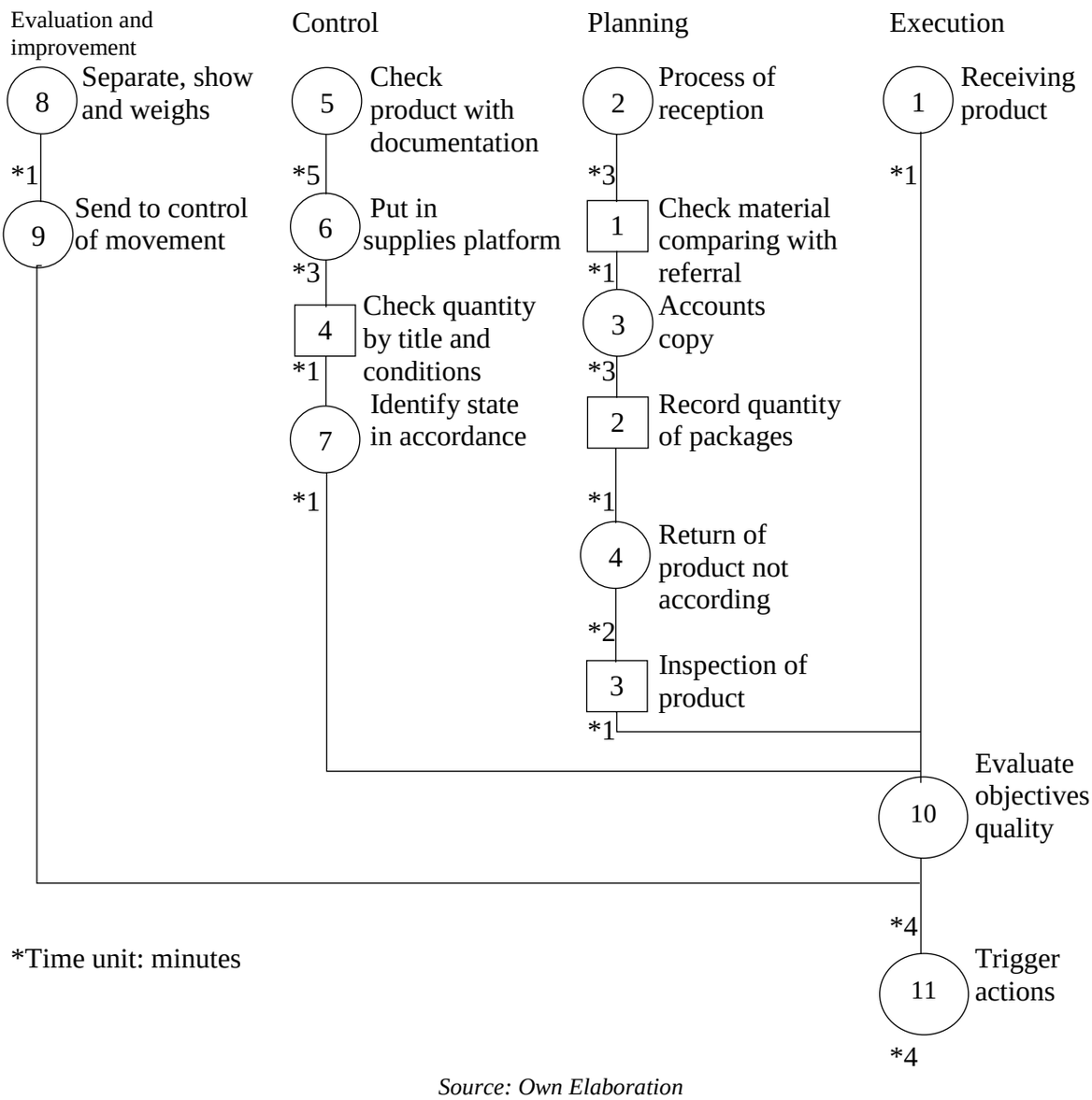


Source: Own Elaboration

5.1 Stage 1: Gathering information

An information survey is carried out to know the general procedure for the entry of raw material (Figure 2. Monitoring of the raw material entry process; Figure 3. Internal area of inspection-receipt of electromechanical company).

Figure 2. Monitoring of the raw material entry process



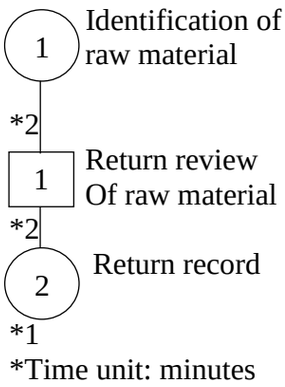
Source: Own Elaboration

Figure 3 Internal area of inspection-receipt of electromechanical company

Source: Own Elaboration

Being of vital importance the current process for the acceptance or rejection of the raw material, the process of rejection or return of supplies is documented (Figure 4. Raw material return/rejection process)

Figure 4 Raw material return/rejection process



Source: Own Elaboration

5.2 Stage 2: Quantitative and qualitative analysis of variables

We proceed to analyze the variables that cause the main problem, which in the first instance are visible through the number of raw material rejections in the inspection-receipt area (Table 1. Index of rejections by supplier 2021).

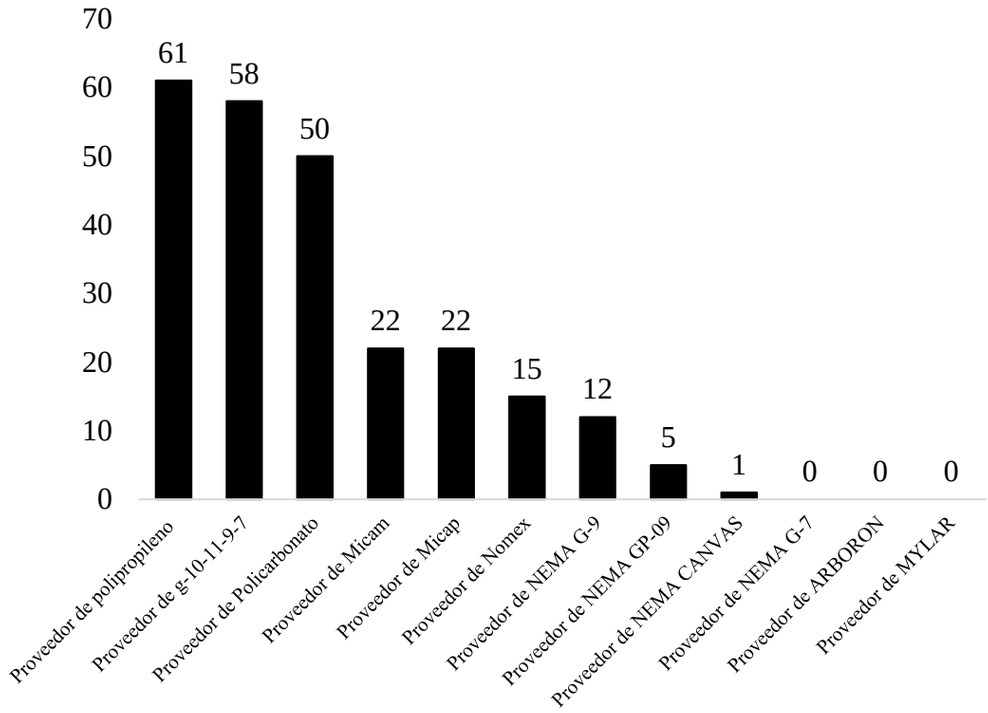
Table 1 Index of rejections by supplier 2021

Providers	Number of rejections initial status (lots)	Reported defect	% Accumulated
Polypropylene supplier	61	color fault	0.2479
g-10-11-9-7 supplier	58	color fault	0.4837
Polycarbonate Supplier	fifty	Porosity	0.6869
Micam provider	22	color fault	0.7764
Micap supplier	22	Porosity	0.8658
Nomex Supplier	fifteen	Porosity	0.9268
NEMA G-9 Supplier	12	color fault	0.9756
Supplier of NEMA GP-09	5	color fault	0.9959
Supplier of NEMA CANVAS	1	Porosity	1
Supplier of NEMA G-7	0	n/a	1
Supplier of ARBORON	0	n/a	1
MYLAR supplier	0	n/a	1

Source: Own Elaboration

The statistical analysis indicates that the supplier in 2021 that presented the greatest rejections is the supplier of polypropylene, which shows a level of affectation of 24.79%, followed by the supplier of raw material g-10-11-9-7, which exposes a monthly affectation level of 23.57% (Figure 5. Index of raw material rejections in the inspection-receipt area).

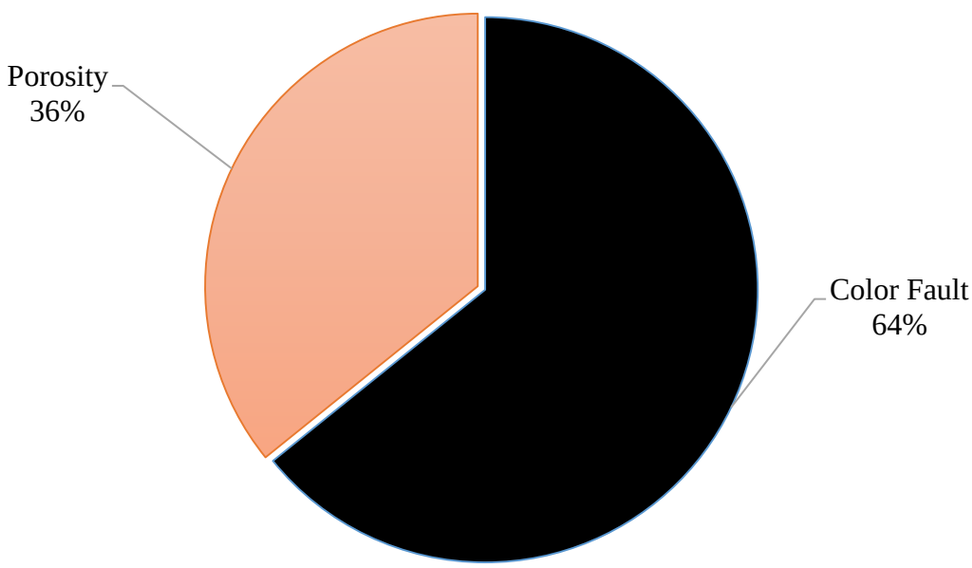
Figure 5 Index of raw material rejections in the inspection-receipt area



Source: Own Elaboration

According to the analysis carried out, which provides the investigation of the quantitative data, we proceed to determine the causes that cause the rejection of the raw material, as we can observe the two defects that are exposed are: Porosity and color failure, for which a statistical analysis is carried out to determine the affectation index of each non-conformity (Figure 6. Default affectation index).

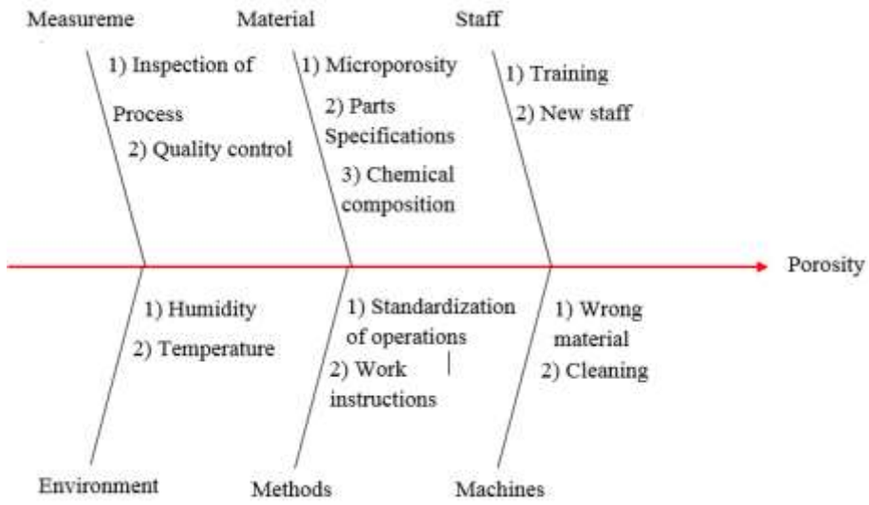
Figure 6 Default affectation index



Source: Own Elaboration

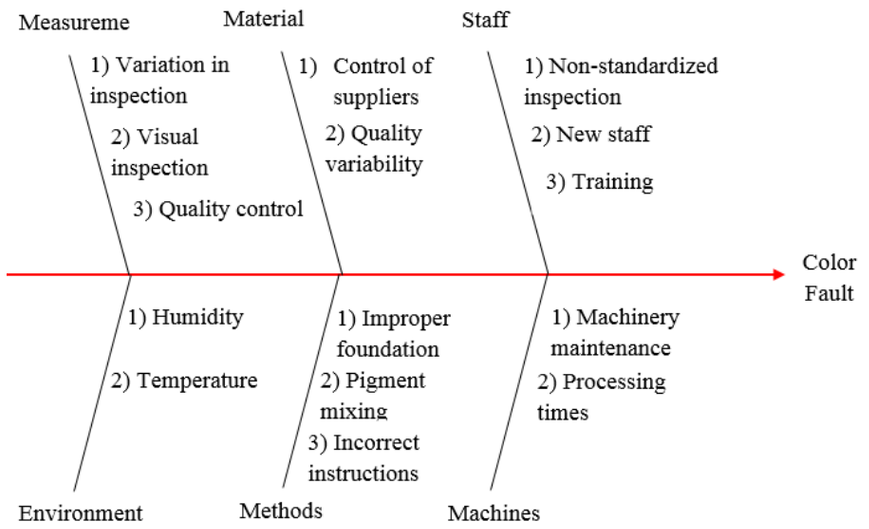
Once the main defects have been detected, a qualitative analysis of the sources that originate them is carried out, through the application of the statistical control tool called the Ishikawa Diagram (Figure 7. Ishikawa Diagram. Analysis of potential causes for the generation of defects due to porosity., Figure 8. Ishikawa diagram Analysis of potential causes for the generation of defects due to color failure).

Figure 7 Ishikawa Diagram. Analysis of potential causes for the generation of defects due to porosity



Source: Own Elaboration

Figure 8 Ishikawa diagram Analysis of potential causes for the generation of defects due to color failure



Source: Own Elaboration

5.3 Stage 3. Implementation of solutions

5.3.1 Solution 1) Design and implementation of Check List

Martín, (1989) defines the Check List as a set of guidelines in the form of a questionnaire, aimed at measuring the behavior of a system. Following this same line, a sequence of 16 questions is designed, which will be applied when the raw material and supplies arrive at the company's unloading ramp, this checklist's main objective is to ensure the entry of materials into the organization's internal warehouse (Figure 9. Check List of receipt of raw materials and supplies).

Figure 9. Check List of receipt of raw materials and supplies

business logo	**Company name** **Home address:** **Warehouse location:** **Warehouse number:**	**Document No:** **Version:** **Date of admission:** **Elaborated:** **Revised:**	
Check List: Receipt of raw material and supplies		Yes	No
1	Remove the padlock from the mid-trailer box.		
2	Check raw material according to the invoice.		
3	Use stop on the key once the trailer is positioned on the ramp.		
4	Unloading of raw material.		
5	Issue purchase order according to the invoice in Purchasing .		
6	Position raw material in receiving area.		
7	Attach purchase order to invoice.		
7.1	Check if the order matches the purchase order with the supplier invoice.		
7.2	Ensure that the raw material matches the invoice.		
7.3	Check that the prices of the invoice coincide with the purchase order (if not, ask if it is a partial shipment).		
7.4	Check that the amount of raw material on the invoice is the same as that indicated on the purchase order.		
7.5	Check that it contains the conformity sheet.		
8	Inspect the raw material using measuring tools (vernier, flexometer).		
9	Review of resins, threads and weight.		
10	In the event that the weights are lower for both containers, threads and totems, notify the area manager.		
10.1	For Angles and Channels: Check thickness, length, width, porosity, and edge chipping.		
10.2	Polycarbonates: Check thickness, length, width and that they do not show scratches or contamination.		
10.3	Sheets with hardness check: Inspect thickness, length, width, porosity and chipping on edges.		
10.4	Flexible in roll: Measure with vernier the diameters (interior, exterior) and height of the roll to determine its length.		
10.4.1	In (A) inside diameter.		
10.4.2	In (B) outside diameter.		
11	Make the receipt: Pass invoices to enter the system.		
12	Send invoice, purchase order and receipt label.		
13	Receipt label printing.		
13.1	Open Print station located on the task bar.		
13.2	Select the Recerving tag tag All Lines (in case the order has only one line):		
13.3	Print two labels, for warehouse and for invoice.		
13.4	Select Reserving tag Single Line (if the order has several lines)		
13.5	Indicate the number of pieces that were inspected (Lot simple Size).		
13.6	Indicate date of inspection (Date of inspection).		
13.7	Indicate the name of the person who made the review (Inspected by).		
14	Paste a label on the back of the invoice and pass it through to the system.		
15	Stick labels on pallets.		
16	Send to the warehouse area for racking.		
Date:	Observations:		

Source: Own Elaboration

5.3.2 Solution 2) Internal process audit

A process audit was implemented to monitor the reception and storage of the raw material, applied on a weekly basis, with the main objective that the area managers carry out the work processes in accordance with the procedures and work instructions (Figure 10. Internal audit checklist).

Figure 10 Internal audit checklist

Business logo	**Internal process audit**	Document No.: MEX-F-	
		Revision No.:01	
		Issue date: 02-15-2021	
		Review date:	
Data			
W.O: _____	Part No.: _____	Machine: _____	Date: _____
Operator: _____	Area: Warehouse	Supervisor: _____	Turn: _____

Check list					
Nope:	**Questionnaire**	**Yes**	**No**	**N/A**	**Comments**
1	Does the material have a technical specification sheet? (color, thickness, material, size, etc.).				
2	Is the raw material arrival inspection carried out? (Check List according to the technical sheet of the material).				
3	Are the appropriate standards for the handling of raw materials complied with?				
4	Do the stocks have the correct identification tag?				
5	Is there an inventory control check-in/check-out system?				
6	Is the material identified with an expiration date?				
7	Is there a physical or digital record of warehouse entries and exits?				
8	Are the materials ordered and located in a specific and easy to identify place?				
9	Is there verification of quantities received against production reports?				
10	Are stocks stored in an orderly and systematic manner?				
11	What is the periodicity with which physical inventories of materials are carried out?				

Source: Own Elaboration

6 Stage 4. Solution effectiveness measurement

To measure the effectiveness of the implemented solutions, a control format is generated, whose main function is to account for and monitor the quantities of rejected material, in order to know the current standards of the inspection-receipt area (Figure 11. Material control internal).

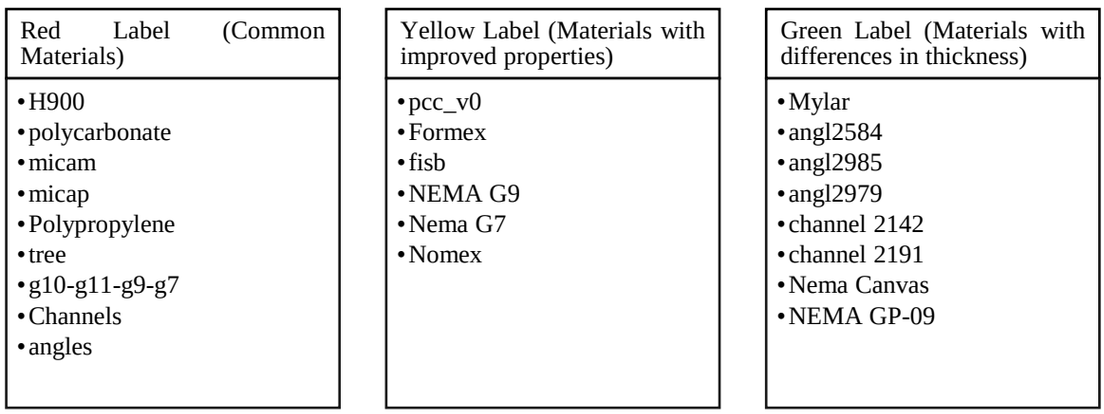
Figure 11 Material control internal

Company name: Address: RFC:					Business logo
Control of raw materials and supplies					
DATE	T1	T2	OPERATOR		
Work Order			Work Order		Work Order
Material			Material		Material
Quantity of rejected material			Quantity of rejected material		Quantity of rejected material
Quantity of material returned			Quantity of material returned		Quantity of material returned

Source: Own Elaboration

Once the control format has been implemented, the documentation and classification of the types of materials that are rejected or sent to scrap continues, according to the business history a color code is assigned to identify non-compliant products (Figure 12. Labeling of non-conforming materials).

Figure 12 Labeling of non-conforming materials



Source: Own elaboration

7. Results

According to the activities developed for the quality control process of the inspection-receipt area, the following results were obtained:

7.1 Result 1)

With the internal audits, the process of arrival of the raw material was controlled, standardizing the deliveries of material, the measurement is shown through the traffic lights of suppliers, which in the experience of Rosas, (2016) is an effective methodology that indicates an evaluation Quantitative of the deliveries in a timely manner, for the case analyzed, this signaling indicates the suppliers that managed to meet the requirements requested by the electromechanical company (Table 2. Current status of suppliers).

Table 2. Current status of suppliers

Providers	Traffic lights	Score obtained
Polypropylene supplier		90%
g-10-11-9-7 supplier		88.5%
Polycarbonate Supplier		92%
Micam provider		60%
Micap supplier		90%
Nomex Supplier		55%
NEMA G-9 Supplier		94%
Supplier of NEMA GP-09		74%
Supplier of NEMA CANVAS		89.4%
Supplier of NEMA G-7		95%
Supplier of ARBORON		95%
MYLAR supplier		95%

Source: Own Elaboration

As we can see, 75% of the suppliers represented by: Polypropylene supplier, g-10-11-9-7 supplier, polycarbonate supplier, Micap supplier, NEMA G-9 supplier, NEMA CANVAS supplier, NEMA G-7, supplier of ARBORON, supplier of MYLAR with an average rating of 92.1%; It is important to mention that with this assessment an improvement area was detected, represented by the Supplier of NEMA GP-09, which obtained a rating of 74% and a yellow traffic light. Although the aforementioned suppliers are adapted to the organizational needs, in the same way those that, according to their limitations, will be convenient to replace them to avoid problems of future rejections, contemplating Micam suppliers, Nomex suppliers as suppliers not suitable for later purchases.

7.2 Result 2)

After the application of the Check List, raw material rejections were significantly reduced, reaching an average reduction benefit of 7.7%, with respect to the rate reported at the beginning of the project (Table 3. Level of rejections in the inspection-receipt area).

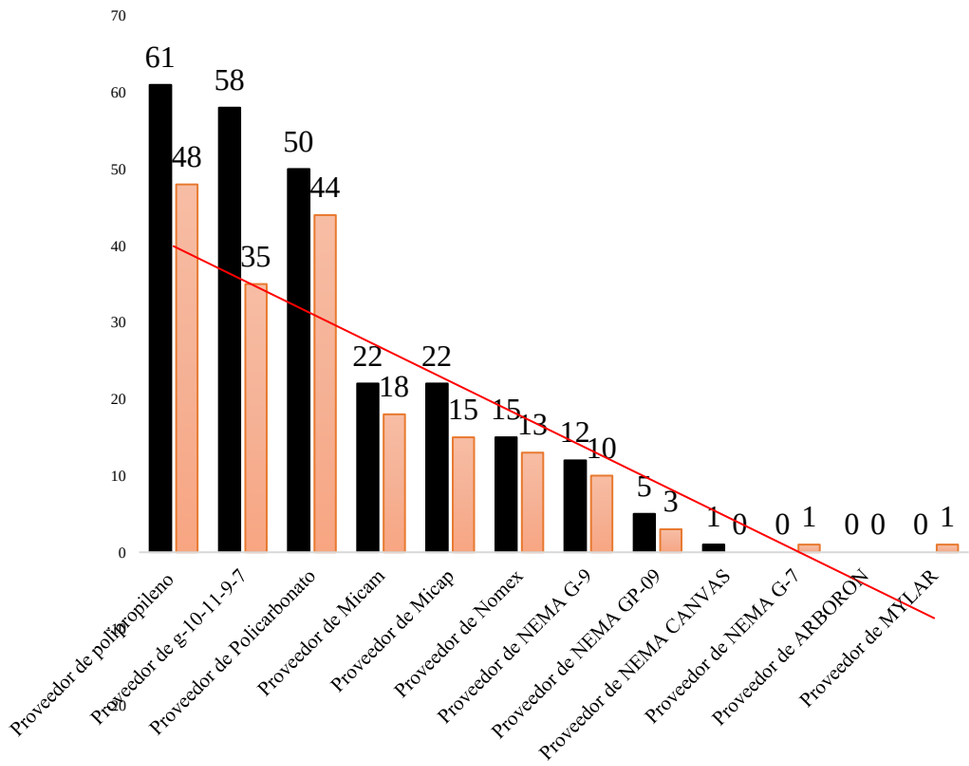
Table 3. Level of rejections in the inspection-receipt area

Providers	Number of rejects (lots) initial status	Reported defect	Number of rejections (lots) final status (after application)	Reported defect	% Decrease
Polypropylene supplier	61	color fault	48	Color Fault (32)/Porosity (16)	21.3%
g-10-11-9-7 supplier	58	color fault	35	Color Fail (35)	39.6%
Polycarbonate Supplier	15	Porosity	44	Porosity	12%
Micam provider	22	color fault	18	Color fault/ Porosity	18.18%
Micap supplier	22	Porosity	15	Porosity	31.8%
Nomex Supplier	15	Porosity	13	Porosity	13.3%
NEMA G-9 Supplier	12	color fault	10	color fault	16.6%
Supplier of NEMA GP-09	5	color fault	3	color fault	40%
Supplier of NEMA CANVAS	1	Porosity	0	n/a	100%
Supplier of NEMA G-7	0	n/a	1	Porosity	+100%
Supplier of ARBORON	0	n/a	0	n/a	0%
MYLAR supplier	0	n/a	1	n/a	+100%

Source: Own Elaboration

The statistical analysis allows us to observe a decreasing trend with respect to the initial period and the final period (Figure 13. Comparison of the initial and final index of raw material rejections in the inspection-receipt area).

Figure 13. Comparison of the initial and final index of raw material rejections in the inspection-receipt area



Source: Own Elaboration

7.3 Result 3)

Economic benefit: The economic impact that originates is notorious, for this reason a costing table is developed below, in which the costs per material and the savings achieved on a monthly basis are shown (Table 4. Cost analysis).

Table 4. Cost analysis

	Providers											
	Polypropylene supplier	g-10-11-9-7 supplier	Polycarbonate Supplier	Micam provider	Micap supplier	Nomex Supplier	NEMA G-9 Supplier	Supplier of NEMA GP-09	Supplier of NEMA CANVAS	Supplier of NEMA G-7	Supplier of ARBORON	MYLAR supplier
Initial cost per rejected lot	$345,621.15	$270,214.20	$195,600	$226,513.14	$254,300.18	$78,615.2	$93,745.19	$76,800.17	$10,400.22	$0.00	$0.00	$0.00
Cost achieved per rejected lot	$271,964.18	$163,060.29	$172,128	$185,328.93	$173,386.48	$68,133.17	$78,120.99	$46,080,102	$0.00	$23,600.12	$0.00	$11,500.24
Benefit achieved	$73,656.97	$107,153.91	$23,472	$41,184.21	$80,913.7	$10,482.03	$15,624.2	$30,720.06	$10,400.22	**-$23,600.12**	$0.00	**-$11,500.24**

Source: Own elaboration

According to the exposed costing, a net benefit of $358,506.94 is obtained, mentioning that an improvement area is detected for the NEMA G-7 supplier, and the MYLAR supplier, who show a rebound with 1 batch of raw material rejected by each provider.

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9. Conclusion

This application demonstrates the importance of developing projects that control quality processes in transformation industries, according to the case evidenced, it is the inspection-receipt area that exposes the greatest problems, causing quantifiable economic losses, this as a result of a lack of standardization in operational activities caused the different suppliers to return to the area of origin with rejected shipments; With the implementation of quality controls (internal audit, check list, input control of raw materials and supplies, and labeling systems), 85% of operating activities were standardized. It is important to mention that in order to achieve the proposed benefits, a training process was carried out for the staff that was part of the auditing group, which would make up the internal commission to carry out the audits on a monthly basis, as well as for the application of the Check List. to the training of personnel (inspection-reception operators) who are in charge of receiving the raw material and supplies; Finally, a follow-up methodology was designed to avoid the generation of future rejections.

However, according to the results obtained, it is verified that the tools that structure quality control are effective techniques, which, when applied correctly, allow obtaining quantitative (economic) and qualitative (standardization-monitoring) benefits for organizations. transformation.

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