

Development of the quality management system at Gear Electric SAS under ISO 9001:2015.

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ABSTRACT: The implementation of a Quality Management System (QMS) significantly contributes to organizations in terms of planning, standardization, control, and continuous improvement of their activities, products or services, and customer satisfaction. Based on this, the project was developed, and the QMS was validated in a critical process at Gear Electric SAS. Initially, positive aspects and improvement opportunities were identified to define learning conformities. This was achieved through a diagnostic process using tools such as document review, direct observation, surveys, interviews, and statistical analysis to collect data. One of the improvement activities involved establishing audit processes to ensure recurrent and documented verification of procedures, allowing for corrections and progress. By following the Plan-Do-Check-Act cycle, the importance of monitoring each phase was recognized, enabling informed decision-making to promote progress and optimal structuring. This approach also facilitated financial resource optimization and a 22% reduction in costs associated with customer complaints or claims. As a result, the critical process related to customer delivery improved, achieving compliance with process indicators and generating 100% documentation, reflected in increased customer satisfaction.

KEYWORDS: Processes, standardization, quality, improvement, customers

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I. INTRODUCTION

“Quality management systems constitute an important contribution to organizational management, facilitating the optimization of strategic planning and decision-making focused on achieving objectives and favorable outcomes related to customer satisfaction, efficient resource allocation, brand positioning, and profit improvement. [2].

Therefore, this project focused on optimizing a critical process at Gear Electric SAS by developing a Quality Management System (QMS) based on ISO 9001:2015. In this way, the company can manage documentation and operations, promptly identify necessary corrections and improvements, and ensure resource availability aligned with its needs and activity requirements [3].

Currently, the company is at a disadvantage compared to other sector competitors that are quality certified. This has prevented them from participating in bids, resulting in a loss of potential clients. Additionally, buyer dissatisfaction hinders customer retention. Since its establishment in 2011, Gear Electric SAS has been committed to providing high-quality services that meet requirements and satisfy stakeholders’ needs and desires. With this focus, they have identified improvement opportunities in managing their activities due to growth-related challenges.

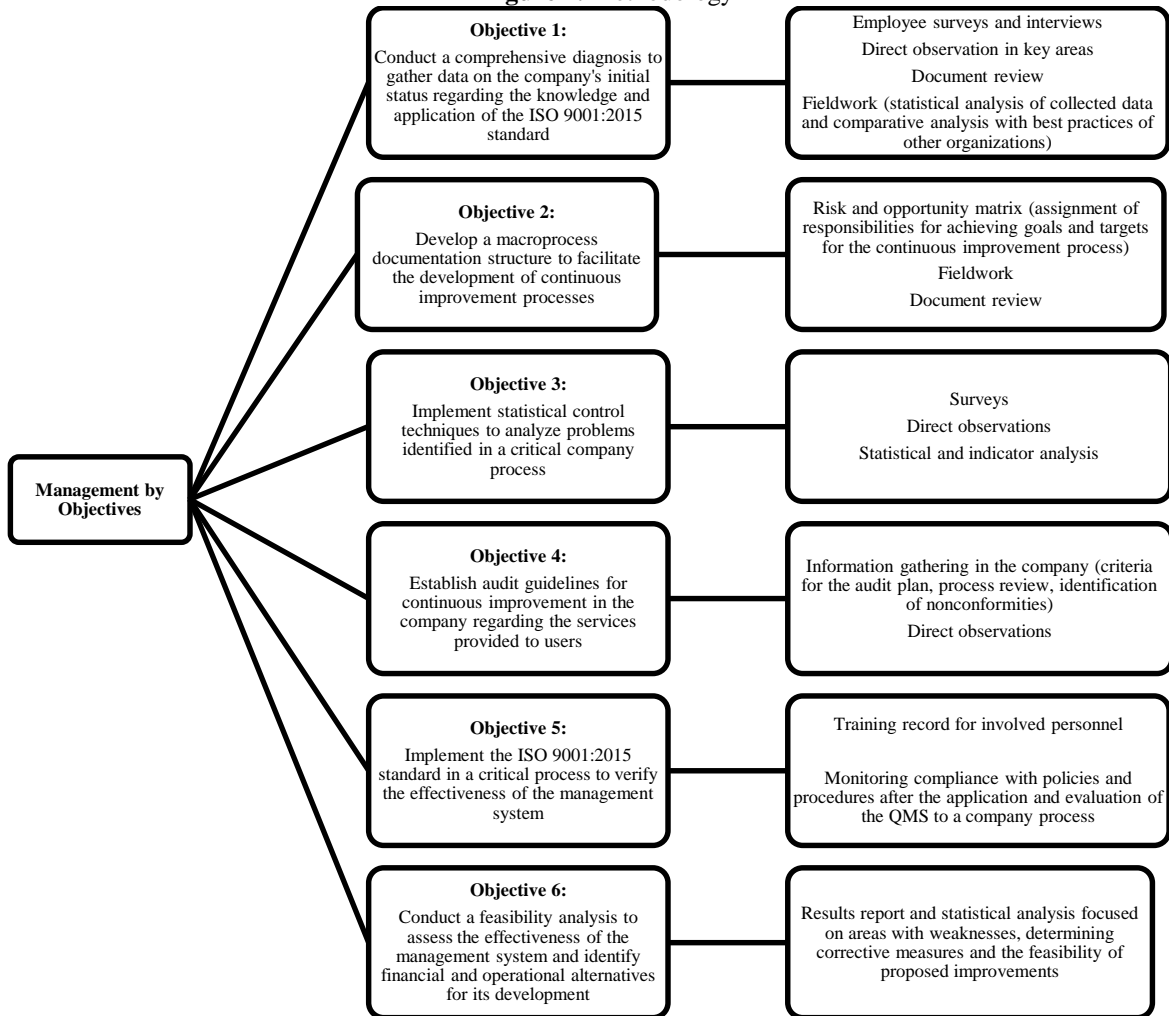
However, the lack of a comprehensive Quality Management System has prevented adherence to established quality standards in response to the market. Obtaining a quality certificate that guarantees service characteristics has also negatively impacted their competitiveness.

In this regard, after conducting a thorough analysis across all areas of the company, a central issue has emerged: an increase in rework due to lack of organization. The organization lacks a structure that enables proper tracking of each activity or process, resulting in a lack of transparency in meeting the requirements and satisfying the needs of different clients. Additionally, the lack of trained personnel hinders the development of management system activities, leading to poor performance in terms of productivity and limited control over company processes

II. METHODOLOGY

Considering that the project aims to address an issue present at Gear Electric SAS, the type of research falls under applied investigation. Therefore, the work focuses on providing a real and concrete solution within the studied organization. The purpose is to develop a quality management system based on ISO 9001:2015. Regarding the research methodology, it is quantitative. Data collection and analysis were conducted based on statistical and numerical variables to measure and quantify the achieved results and impact. This approach allows for a practical and measurable solution aligned with the identified problem and the organization's needs for efficient quality management that contributes to customer satisfaction and competitiveness. For each of the defined objectives, a methodology (Figure 1) and data collection tools were established to achieve the expected outcomes.

Figure 1. Methodology

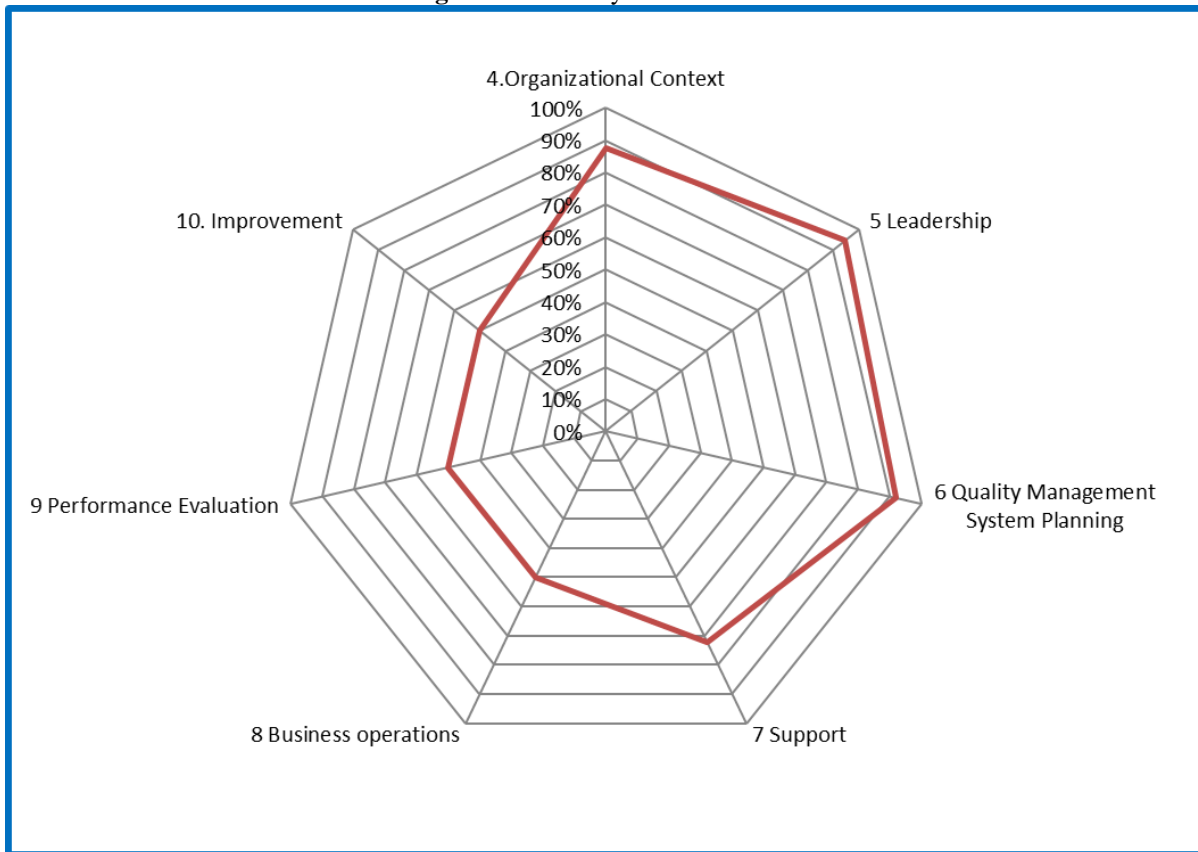


Source: Authors, 2024

III. RESULTS

Regarding the objective of conducting a comprehensive diagnosis to collect data on the initial state of the company regarding knowledge and application of ISO 9001:2015, significant results were obtained through the implementation of a checklist. These results highlight substantial progress in understanding and compliance with the requirements stipulated by ISO 9001:2015 (Figure 2). Additionally, relevant non-conformities were identified and documented for timely corrective actions and continuous improvement.

Figure 2. Summary ISO 9001:2015



Source: Authors, 2024

Therefore, when analyzing in the organization each of the elements that make up the ISO 9001:2015 standard, the following was identified: regarding the company's context, a 98% development has been achieved, with a greater understanding of its operating environment and the internal and external aspects that may affect the achievement of the expected results. In leadership, the level of progress is 95%, demonstrating the presence of leaders who are committed and proactive in the face of the company's need to move forward. On the other hand, the planning element has an execution of 82%, which, although significant, requires changes for a better alignment of the strategic program in relation to the quality objectives and customer satisfaction. As for the support observation, it is 60%, which reflects the need to improve the effectiveness and efficiency of these activities, in order to ensure an excellent provision of resources and staff training. Finally, in correlation with the operation, performance evaluation and improvement, the compliance is 40%, evidencing the obligation of an important progress in the operative processes that guarantee excellence and customer satisfaction.

In addition, the SWOT matrix (Table 1) was prepared to identify internal factors (strengths and weaknesses) as well as external factors (opportunities and threats) that may be favorable or detrimental to the organization's operation and performance.

Table 1. Swot Analysis

		Helpful	Harmful
Internal origin	Strengths	<ol style="list-style-type: none"> 1. Technological prowess-driven competitiveness 2. Efficient and high-quality customer service 3. Highly valued services compared to competitors 4. Low employee turnover and absenteeism rates 5. High customer loyalty 	<ol style="list-style-type: none"> 1. Limited customer diversification 2. Lagging behind industry standards in R&D&I 3. Poor tracking of projects and sales objectives 4. Undetermined market positioning of the company's products 5. Aversion to change
	Weaknesses		

External origin	Opportunities	Threats
	<ol style="list-style-type: none"> 1. High profitability of the industry 2. High demand for the offered services 3. Opportunity for continuous innovation 4. Favorable price-quality ratio compared to competitors 5. Brand positioning 	<ol style="list-style-type: none"> 1. Rising inflation and CPI 2. Political and economic instability in the country 3. Uncertain political and economic climate 4. Emergence of new competitors offering lower-priced services 5. Dollar fluctuations and rising costs of equipment and machinery

Source: Authors, 2024

With regard to the objective of generating the documentary structure of the macroprocess that allows the development of continuous improvement activities, the identification of the positions within the organization that are directly linked to the delivery of products or services to customers in areas such as design, production, sales and customer service was carried out. In this sense, the associated processes were analyzed to generate the current status report of the documentation necessary for the implementation of the quality management system [4], such as evidence of procedures and the development of formats for operation and monitoring (Table 2).

Table 2. Approved and Disclosed Documents by Process

PROCESS	COMPLIANCE	DOCS	ON DOC. / ACT.	ON APROB.	DIV.
1. Strategic Direction	71%	55	23	5	26
2. Integrated Management System	59%	31	2	4	25
3. Commercial Management	93%	9	0	8	1
4. Development	70%	23	9	10	4
5. Support and Infrastructure	90%	53	2	2	49
6. Marketing	86%	53	1	1	11
7.1 Purchasing	88%	53	1	1	51
7.2 Financial	70%	7	0	7	0
7.3 Human Resources	67%	7	1	6	0

Source: Authors, 2024

Once this was completed, 100% of the documentation was generated, updated and approved by the company's management.

In order to apply statistical control techniques that allow the analysis of the problems obtained in a critical phase of the company, the process of dispatch and delivery of supplies was taken as a reference, in order to identify improvements in delivery times. For this purpose, a sample of 325 orders from the last quarter of the year 2023 was chosen, analyzing the time it takes for the package to arrive in different departments of Colombia (Table 3). The efficiency and compliance with the established delivery times were identified in order to establish the need for improvement.

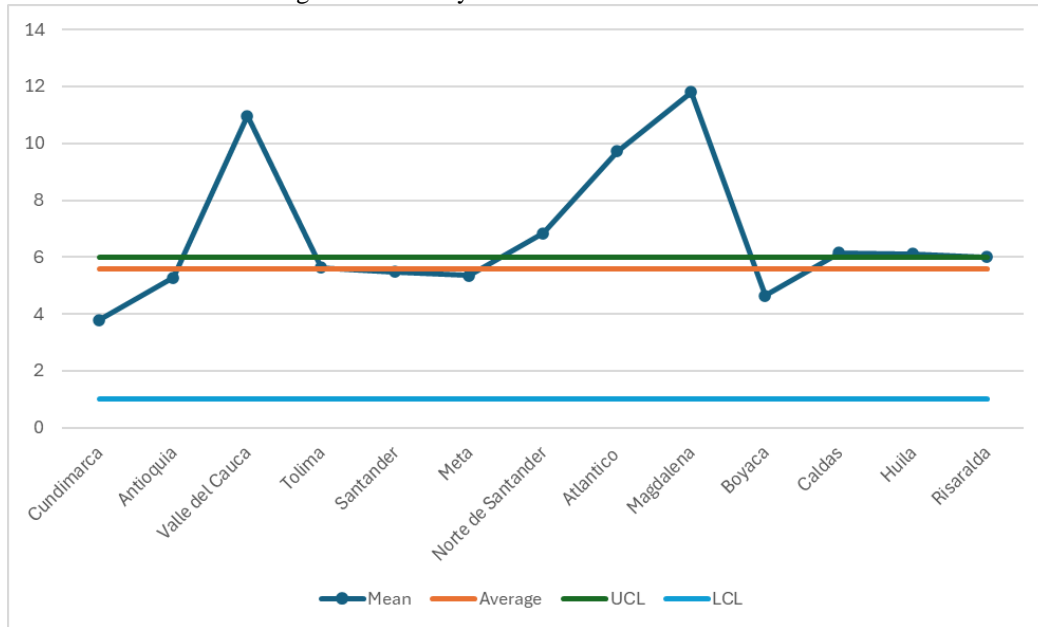
Table 3. Order delivery time by department

Department	Mean	Average	UCL	LCL
Cundinamarca	3,80	5,58	12,39	1,12
Antioquia	5,28	5,58	12,39	1,12
Valle del Cauca	10,96	5,58	12,39	1,12
Tolima	5,64	5,58	12,39	1,12
Santander	5,48	5,58	12,39	1,12
Meta	5,36	5,58	12,39	1,12
Norte de Santander	6,84	5,58	12,39	1,12
Atlántico	9,72	5,58	12,39	1,12
Magdalena	11,80	5,58	12,39	1,12
Boyacá	4,64	5,58	12,39	1,12
Caldas	6,16	5,58	12,39	1,12
Huila	6,12	5,58	12,39	1,12
Risaralda	6,00	5,58	12,39	1,12

Source: Authors, 2024

Based on the results obtained, there was a significant disparity in delivery times, especially in the departments of Valle del Cauca, Magdalena and Atlántico. In addition, when analyzing delivery times in relation to the control limits established by the company, several points were identified that were outside the established limits (Figure 3), which reflects the existence of deficiencies in the quality and efficiency of the process, which may be associated with delays in delivery, lack of stock or logistical problems.

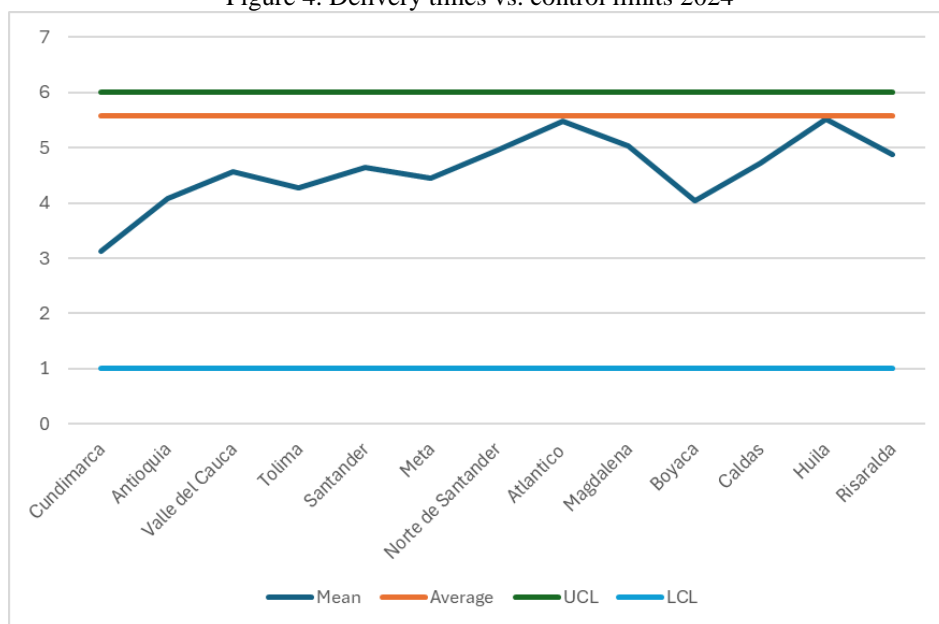
Figure 3. Delivery times vs. control limits 2023



Source: Authors, 2024

Therefore, in response to the situation identified, it was proposed to adjust the purchasing and inventory replenishment procedures, optimize and expand training for personnel involved in the process, implement additional controls for order cross-checking and stock verification, improve collaboration and communication between the departments involved, and finally, provide feedback to the client regarding the dispatch and delivery of orders. After implementing the recommendations, the statistical control was again carried out, showing that the deliveries analyzed were within the established limits (Figure 4), which reflects a reduction in errors related to order distribution.

Figure 4. Delivery times vs. control limits 2024




Source: Authors, 2024

As a conclusion, in the development of this objective it was possible to identify the importance of management indicators as a control and follow-up tool that allows monitoring processes by measuring their results, thus detecting shortcomings that can lead to corrections or improvements [5]. Therefore, by determining that a quality indicator is an essential tool to evaluate the QMS objectively and efficiently ensuring the maintenance of standards [6], it is further evidence that within the improvement activities indicators are key to verification. Similarly, the use of indicators allows the identification of risks and opportunities especially in critical processes [7], which was visible in the development of this objective by showing that delivery times can significantly affect customer satisfaction, decreasing the risk of losing revenue and increasing market share.

With regard to the objective of establishing audit guidelines for continuous improvement in the company with respect to the services provided to users, it was proposed to conduct an audit following the requirements established in the ISO 19011 standard (Figure 5), such as the preparation of the audit plan (establishment of objectives, scopes and methodology), the appointment of the audit team, the holding of the opening meeting with the participation of managers and personnel involved in the process, the analysis and evaluation of the findings and, finally, the report in the audit report (Figure 6), The audit team was appointed, the opening meeting was held with the participation of managers and personnel involved in the process, the findings were analyzed and evaluated, and finally, the report was issued, which sets out the corrections and improvements that could be implemented, thus improving the follow-up of activities.

Figure 5. Audit process at Gear Electric SAS

Audit		Integrated Management System Process	
Code	Version	Elaboration Date	Update Date
SIG-PD-006	1.1	2020-12-01	2024-06-25



6. Development

The number [#] at the end of each activity indicates the sequence in which the activities are carried out.

BEFORE THE AUDIT		
RESPONSIBLE	No	ACTIVITY
Coordinator IMS	1	Schedule internal audits of the Integrated System at planned intervals, in accordance with clause 4.11, covering all organizational processes using the SIG-FT-009 Audit Program format. [2]
	2	Assign auditors to the various scheduled audits during the period. [3]
Auditor	3	Review relevant documents in preparation for the audit. [4]
	4	Prepare the internal audit by completing the SIG-FT-010 Audit Plan format. [5]
	5	Send the SIG-FT-010 Audit Plan to the person responsible for the audited process (with a copy to the SIG Coordinator) well in advance of the audit date. [6]
	6	Prepare the audit using the SIG-FT-013 Audit Checklist format, considering the following criteria, among others: Organization requirements (Policies, manuals, Instructions, etc.), Applicable legal and contractual requirements, and customer requirements. [7]
	7	Conduct the audit opening meeting, during which you should present the audit team, the audit scope, the work plan, and the methodology. [8]
	8	Conduct the audit, ensuring that: <ul style="list-style-type: none"> Information is gathered through interviews with the responsible personnel. A sample of the documents applicable to the process or area is reviewed. The activities to be audited are observed in detail. [9]

Source: Authors, 2024

In addition, when consulting the audit process defined in Gear Electric SAS, it was identified that it establishes the people in charge with their specific activities, following the PHVA cycle to make it efficient and in accordance with the purposes of the organization. Within this, there is a planning, in which the administrative and financial director has the obligation to schedule internal audits and appoint auditors for each of them.

The auditors are responsible for reviewing the corresponding documentation, preparing the audit, conducting the opening and closing meeting, executing the audit and presenting the report. In conjunction with the administrative and financial director, opportunities for improvement are defined based on the findings identified.














Finally, it is determined in this objective that the standards defined in ISO 9000 allow to manage in an efficient way the resources and instruments for quality management [8], this includes the implementation of audit processes that lead to continuous improvement of processes, especially those that are critical and can lead to risks in companies such as Gear Electric SAS.

In relation to the objective of applying ISO 9001:2015 in a critical process to check the efficiency of the

QMS, through the application of the PHVA cycle (Plan-Do-Check-Act), the verification of the effectiveness of the management system in the activity of installation of services or products was performed. Regarding the planning phase, it was identified that the Gear Electric SAS organization carefully identifies improvement actions within this work, which are mainly related to delivery delays, accuracy problems in the assembly of biometric equipment and personnel coordination. Based on the critical points identified, the company collects data for the respective analysis and identification of shortcomings, subsequently establishing goals for improvements focused on eliminating the causes of these problems.

In this sense, in the cycle of doing, Gear Electric SAS implements what was planned by assigning the corresponding tasks and people in charge, as well as ensuring the necessary resources and the availability of the documents and formats required for the development of the activity (Figure 6). Likewise, during the development of this phase, information or data is collected to permanently identify improvements that can be implemented within the process, including active feedback from the parties involved.

Figure 6. Process Document List

	SIF-FT-017 Entrega Usuario Plataforma Admincooperar.docx
	SIF-FT-021 Check List Alistamiento Nuevo Ingreso Registro Civil.docx
	SIF-FT-022 Check List Alistamiento Tablet IDSCRENN1.2.pdf
	SIF-FT-022 Check List Alistamiento Tablet IDSCRENN1.3.docx
	SIF-FT-023 Check List Alistamiento Dispositivos Moviles1.3 .pdf
	SIF-FT-023 Check List Alistamiento Dispositivos Moviles1.3.docx
	SIF-FT-024 Check List Alistamiento Nuevo Ingreso.docx
	SIF-FT-024 Check List Alistamiento Nuevo Ingreso.pdf
	SIF-FT-025 Check List Alistamiento Punto Adicional.docx
	SIF-FT-025 Check List Alistamiento Punto Adicional.pdf
	SIF-FT-026 Check List Alistamiento Nuevo Ingreso Declaraciones.docx
	SIF-FT-027 Check List Alistamiento Nuevo Ingreso Autenticaciones.docx
	SIF-PD-001 Instal servicio o producto V1.2.docx

Source: Authors, 2024

As for the verification phase, the company evaluates the effects obtained after the implementation of the action plan, determining whether the expected objectives and improvements have been achieved. In this aspect, the company analyzes whether the goals of reducing installation times, improving the accuracy of biometric configuration and other previously defined objectives have been achieved. Therefore, an exhaustive analysis is carried out to check whether the results meet the initial expectations.

Subsequently, the data collected during development is analyzed to determine whether significant improvements have been achieved in the installation process. Records of installation times, configuration accuracy, customer feedback and other key indicators are reviewed to identify any positive or negative trends in the performance of the activity.

During this analysis, any deviations between expected and actual results are identified. The underlying causes of these deviations are investigated to understand why certain targets were not met or if there were any unexpected factors that influenced the results. This allows us to identify specific processes that may require additional adjustments at the facility.

Additionally, Gear Electric SAS also determines if the initial problem has been adequately addressed and if the stated objectives have been achieved. It evaluates whether the changes implemented during the “Do” phase were effective in resolving the identified problems and whether the previously established improvement results have been achieved. In this sense, this evaluation helps the company to understand if the installation process has undergone significant improvement and if progress has been made towards operational excellence.

Finally, following the reports generated in the verification, the company enters the Act phase,

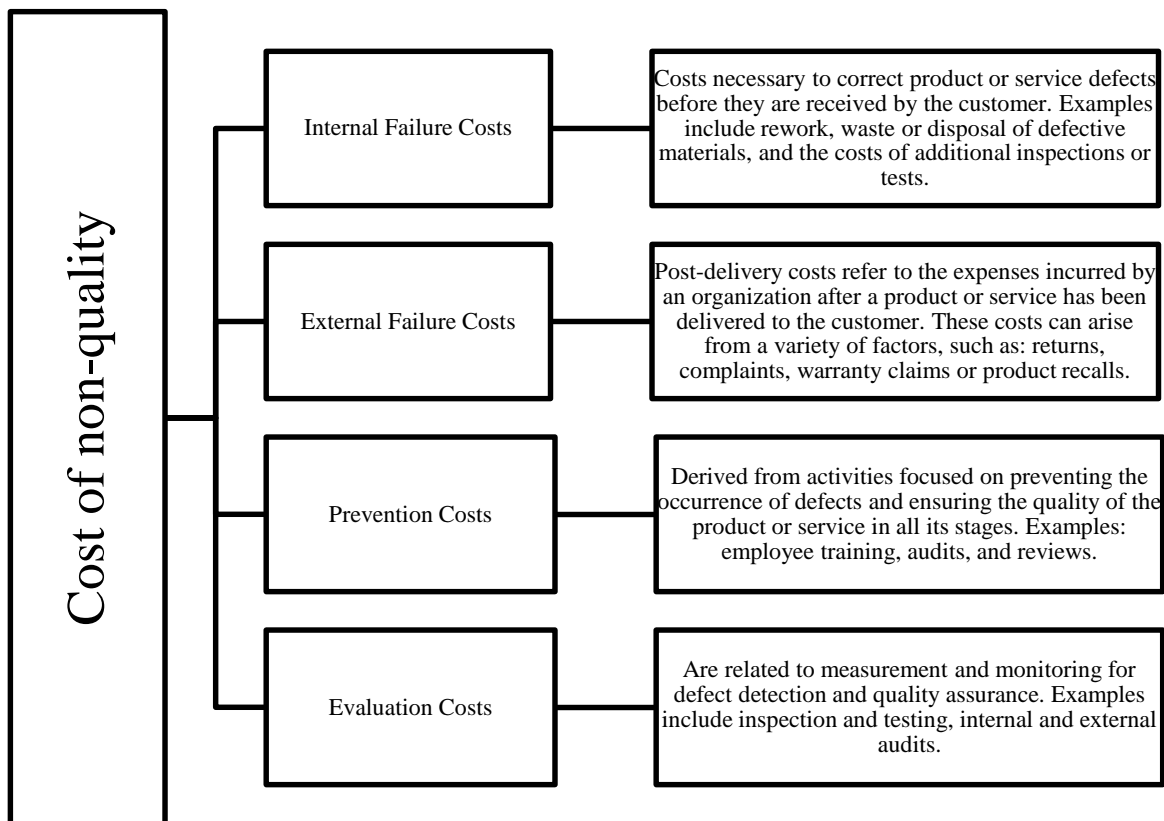
where it makes decisions based on the results obtained to implement the necessary corrections or take advantage of improvement opportunities applicable to the process. In this way, the use of all the stages of the cycle is maximized, working continuously to optimize the objectives.

Constant monitoring is carried out, using these results to improve the planning and execution of the process. In this objective, it should be emphasized that the constant training of personnel is essential to have a permanent update in the operation of the processes and the improvements implemented, facilitating the appropriation and participation of employees in each of the phases of the PHVA cycle [9].

Finally, in order to prepare the feasibility analysis that allows the assessment of the effectiveness of the management system and the financial and operational alternatives for its development, the starting point was the concept of non-quality cost (Figure 7), which refers to the expenses that arise when a product or service does not meet the established quality standards, which can have a significant financial impact on the company [10]. These costs can be direct or indirect and are the consequence of errors, defects, failures and other quality-related problems.

When analyzing the costs in the company, the financial and purchasing subprocesses were taken as a basis, specifically the procedures of purchases, suppliers, collection and portfolio management, petty cash, filing and approval of invoices, and finally, the request and legalization of advances, which harbor a variety of risks to which it may be exposed in the normal operation of the company, which is why an exhaustive analysis of how much it would cost to apply or not the Quality Management System in Gear Electric SAS should be performed.

Figure 7. Cost of non-quality



Source: Authors, 2024

Purchasing costs (Figure 8) were identified as representing 66% of total costs, which is a fairly high proportion. This could mean that most of the expenditures are being incurred in the acquisition of inputs, components, or services from external suppliers, reflecting a high dependency. It is crucial to ensure that such suppliers meet the required standards to avoid problems in the provision of services or delivery of final products. This also indicates that there is a potential to reduce costs through better supply chain management, negotiation of better prices, or improvement in the quality of purchased materials.

Figure 8. Costs-purchases Gear Electric SAS

Risk code	Sum of prevention costs	Sum of evaluation costs	Sum of internal failure cost	Sum of external failure cost
AB1	\$ 613.541,67	\$ 518.750,00	\$ 678.125,00	\$ 146.875,00
AB2	\$ 888.541,67	\$ -	\$ 1.006.250,00	\$ -
AB3	\$ 328.125,00	\$ 259.375,00	\$ 587.500,00	\$ -
AB4	\$ 421.875,00	\$ 771.875,00	\$ 1.006.250,00	\$ -
PA1	\$ 1.668.750,00	\$ 1.834.375,00	\$ 1.459.375,00	\$ -
PA2	\$ 1.246.875,00	\$ 771.875,00	\$ 1.459.375,00	\$ 453.125,00
PA3	\$ 1.025.000,00	\$ 1.290.625,00	\$ 1.006.250,00	\$ 453.125,00
A1	\$ 1.446.875,00	\$ 1.575.000,00	\$ 678.125,00	\$ 453.125,00
A2	\$ 1.246.875,00	\$ 2.093.750,00	\$ 1.131.250,00	\$ 600.000,00
A3	\$ 1.668.750,00	\$ 1.290.625,00	\$ 678.125,00	\$ 146.875,00
A4	\$ 1.118.750,00	\$ 1.541.666,67	\$ 1.265.625,00	\$ 453.125,00
AC1	\$ 1.446.875,00	\$ 1.541.666,67	\$ 1.390.625,00	\$ -
AC2	\$ 1.446.875,00	\$ 771.875,00	\$ 1.390.625,00	\$ 453.125,00
AC3	\$ 1.025.000,00	\$ 771.875,00	\$ 678.125,00	\$ 453.125,00
ES1	\$ 1.638.541,67	\$ 2.832.291,67	\$ 1.265.625,00	\$ 682.291,67
ES2	\$ 1.246.875,00	\$ 1.290.625,00	\$ 712.500,00	\$ 453.125,00
ES3	\$ 941.666,67	\$ 518.750,00	\$ 1.265.625,00	\$ -
ES4	\$ 1.246.875,00	\$ 1.321.875,00	\$ 678.125,00	\$ -
ES5	\$ 941.666,67	\$ 259.375,00	\$ 1.265.625,00	\$ -
ES6	\$ 1.216.666,67	\$ 518.750,00	\$ 1.006.250,00	\$ -
RP1	\$ 888.541,67	\$ 518.750,00	\$ 1.265.625,00	\$ -
RP2	\$ 1.446.875,00	\$ 1.290.625,00	\$ 937.500,00	\$ -
RP3	\$ 613.541,67	\$ 2.572.916,67	\$ 678.125,00	\$ -
RP4	\$ 1.310.416,67	\$ 1.031.250,00	\$ 781.250,00	\$ -
Total	\$ 27.084.375,03	\$ 27.188.541,68	\$ 24.271.875,00	\$ 4.747.916,67

Purchasing costs		Different costs to the purchasing area	
\$ 27.084.375,03	\$ 27.188.541,68	\$ 24.271.875,00	\$ 4.747.916,67
33%	33%	29%	6%

Source: Authors, 2024

IV. DISCUSSION

In reference to previous studies on the importance of developing a QMS, it is evident, for example, in the work “An experience in the development of the management system of a service company” [11] that starting from a single process of the organization, it is possible to identify the interconnection of activities related to other organizational actions that may impact on the management of a specific process, This implies that quality management requires a general application, based on the PHVA cycle and on the integration of all the company's procedures, identifying the communication and the effect that may occur between them and the scope of the final results.

In relation to the study “Incidence of ISO 9001 certification on productivity and profitability indicators in free trade zone companies in Barranquilla through discriminant analysis” [12], it is highlighted how the implementation of a quality management system can be highly beneficial for organizations. This approach makes it possible to optimize processes through the use of indicators and continuous monitoring, which improves results and facilitates the timely identification of improvement actions.

In this sense, it was identified that in Gear Electric SAS, the development of a QMS is particularly effective. This is due to the fact that a significant optimization of delivery indicators has been observed, thanks to a more rigorous and detailed follow-up. This has resulted in improved delivery times, which in turn has increased customer satisfaction. They also stress the importance of ISO 9001 certification as a key tool for improving the productivity and profitability of companies.

With regard to the study “Quality management and customer service as a factor of competitiveness in service companies” [13], there is an important connection focused on the importance of developing a QMS for customer loyalty on the part of the organization. Therefore, when a company carries out an efficient management and control for continuous improvement, it can establish an excellent relationship with its users, who will feel a support from the company to receive a quality product or service that meets their needs. In this sense, the progress in customer service monitoring on behalf of Gear Electric SAS, is relevant to maintain and improve the loyalty of its consumers, thus strengthening the positioning of its brand. Thanks to this, achieving greater strength in the face of the threat of new competitors in the market.

Referring to the study “Design and Implementation of an ISO 9001:2015 Quality Management System in a Colombian University” [14], a concordance is given regarding the identification of criteria and structures required for the implementation of a QMS, which should respond to standards, facilitate the continuous monitoring of processes and promote continuous improvement.

Finally, in relation to the article “Incidence of ISO 9001 certification on productivity and profitability indicators in free trade zone companies in Barranquilla through discriminant analysis” [10], the positive impact

of the implementation of a QMS in favor of reducing non-quality costs and expenses that may occur due to reprocesses or failure to meet user needs in a timely and efficient manner is highlighted. Therefore, improving customer follow-up at Gear Electric SAS can result in minimizing costs and expenses associated with complaints or customer dissatisfaction.

All studies highlight the benefits obtained when quality management systems are developed in different organizations, regardless of their size or sector, so it would be important to measure the results of the implementation of these processes in organizations to facilitate future work of this type.

V. CONCLUSIONS

Thanks to the realization of the project, it is possible to conclude that the development of a quality management system for a company is very important, since in this way it is possible to optimize the planning, monitoring and improvement of processes based on the guidelines defined in the ISO 9001: 2015 standard. Additionally, it broadens the knowledge of organizations regarding the tools available for the constant monitoring of their activities, statistical analysis and the positive increase of results, allowing them to be increasingly recursive and innovative in their management.

Similarly, the QMS allows organizations to identify existing failures and timely actions for improvement, being a determining factor in order to ensure competitiveness and permanence in the market with quality products and services that meet customer needs, ensure customer satisfaction and benefit the company in obtaining better profits.

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