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Quality Management System Development for Jenesano Boyaca City Council through the ISO 9001:2015 STANDARD

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ABSTRACT*: A quality management system in the public sector is one of the most important distinctions for public sector entities. as this reflects the image it projects, the benefits the companies have and the credibility of the way they seek continuous improvement; However, some organizations do not take this scope into account in their plan and this is how it was identified an opportunity for the city council of Jenesano, Boyacá, to develop the Quality Management system through the ISO 9001 standard that will allow it to increase user satisfaction. To carry out this objective, a diagnosis was made, and different documents were implemented to collect information, which was processed to carry out the standardization, the risk matrix, and the analysis of the internal and external context of the entity. A critical process is selected to evaluate through statistical control the factors that influence its success. Based on the above, the benefits and costs of the project are evaluated, which has an IRR (Internal Rate of Return) of 78%, which concludes that the study is feasible.*

KEY WORDS – *Management System, Quality, Process, City Council, Benefits.*

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I. INTRODUCTION

Quality is defined as the requirements to which each customer is entitled. Some of these are implicit and others explicit. The formers are those that, as a rule of each organization, must be considered when selling a product or providing a service; the latter are requirements generated by the customer's request. [1]. According to the portal Nuevo siglo, 60% of private companies in the country do not currently have a development or certification system in place [2], this leads to a lack of real trust and customer loyalty. This can also be reflected in public entities since the substantial purpose of both private and public entities is to provide a service.

From this problem arises the Quality Management System, which is a tool that allows planning, executing, verifying, and analyzing its activities to comply with the policies and objectives of the institutions. In addition to this, its main characteristic is to increase satisfaction in the provision of services and products within an organization. [3].

Thus, to verify whether this system has a real impact on the quality management of the organizations, three antecedents were taken that provided relevant information and helped in the understanding and development of the management system.

The first study is developed in the company Papeles Primavera, in which a proposal for the implementation of the Quality Management System was designed to help improve production planning, reduce costs, and increase productivity. The project presents the characterization and documentation of the system and shows the feasibility of its implementation in the company. [4].

The following precedent was carried out in the company Pitanar Arena Football Center. There, the concept of the Quality Management System was implemented, addressing the issue of development in the documentation of the entity's procedures and processes, and providing benefits such as the reduction of reprocesses and greater clarity on the part of the workers when performing the functions in charge in these aspects. [5].

Finally, the implementation of the Quality Management System under the ISO 9001 standard in the municipality of Vitacura, Santiago de Chile. This governmental entity worked constantly for the certifications in various management systems to improve the quality of life of its inhabitants and its collaborators, satisfying their requirements, improving processes, and generating actions that guarantee the sustainability of the community [6].

Considering the benefits brought by the QMS in different organizations, this system is developed in the city council of Jenesano in Boyacá, Colombia. This municipality is nationally recognized for winning the 1999 award for being the most beautiful town in the region for its architectural beauty, its history, and the friendliness of the people who live there. It currently has 7725 inhabitants and an area of 59 km² [7].

It was evidenced that within the municipality's town hall there was a background about the QMS (Quality Management System) under the NTC GP 1000, which was the tool for evaluation and measurement of quality performance for state entities. The last registered update of this system was in 2015, due to the following situations where processes are not properly updated, and some are not registered. There is also a lack of communication to respond to each of the requirements of the population, which causes reprocesses in the entity, delay times above the regulations and loss of resources in the organization.

II. METHODOLOGICAL PROCESS

The methodological development began with the collection of information, where previously studied questionnaires were prepared, based on the ISO 9001: 2015 standard. Following this, quality matrices were established where the necessary aspects of the organization to be evaluated were considered to find the preliminary analysis. It is important to highlight that an interview was carried out with those responsible for the processes to collect the relevant information and once the data was obtained, they were filtered to later identify the current and the missing documentation. A total of 38 processes were worked on, of which 6 are shown in Table 1.

Table 1. Sampling of processes and organizational units

ID	PROCESS	LEAD UNIT
1	Agricultural Promotion and Development	Secretariat of Economic and Social Development
2	Tertiary roads management	Secretariat of Infrastructure, Public Works and Services
3	Warehouse and fixed assets	Treasury Secretariat
4	General Services	General and Government Secretariat
5	Internal Control	Internal Control Office
6	Evaluation, monitoring and improvement	Advisory Planning Office

Source: Authors, 2021

Process Characterization

"Processes characterization and the documentation of the support sub-processes allow the organization to know in depth each of the requirements and the procedures to be followed to achieve the processes effectively and efficiently". [8]

This stage began with the development of the characterization format, the identification of the macro-process and its respective procedures of the 38 processes found. At this point it is important to clarify that each format records the following aspects: objective, scope, users, suppliers, inputs, outputs, regulations, management indicators, associated documents, change control. In addition, it must be considered that, to carry out this task, a significant factor is the purpose within the organization that must be aligned with the practice thereof, so the differences presented are analyzed to be able to update 100% of the documentation.

Analyze internal and external context

The SWOT is a tool for studying the situation of an organization, which shows the weaknesses, opportunities, strengths, and threats that are present in the entity's environment. For its realization, the information obtained in the diagnosis was taken as a reference [9].

The internal component of the organization was analyzed and identified with weaknesses and strengths. There, opportunities were established, determining the instruments for the collection of documents to finally detect the current situation of the processes of the city council. It was evidenced that the procedures were not properly designed; For this, a traceability of each of the objectives was carried out, dividing them into activities, methodology and data collection.

Risk estimation

Risk management is defined as the coordinated activities to direct and control an enterprise in relation to risk [10].

The risk estimation was developed by collecting information and validating it to find unclassified risks, or risks that are not considered to be carried out within the secretariats. A risk matrix was drawn up, assigning their respective classification and the effect they may cause. Each of the controls that can be executed according to the criteria registered in NTC ISO 31000, which is the standard that standardizes risk management, were also recorded, as well as the controls currently executed. The risk assessment was completed with the quantification of the different characteristics to be analyzed: level of deficiency, level of exposure, level of probability, interpretation of the level of probability, level of consequence, level of risk and intervention, and interpretation of the level of risk. The tool used in this point was made by the Secretariat for the whole City Council. [11].

Statistical analysis

"Statistics is the science that deals with the collection, arrangement, representation, analysis and interpretation of data generated in an investigation on facts, individuals or groups of these, in order to deduce from it precise conclusions and future estimates" [12].

The importance of statistical analysis is related to the uncertainty processes that are present today and that represent the different variations that may occur in the measurements of the different study events and that are under the same conditions [13].

To perform the statistical analysis, the management of social, vulnerable and Sisbén programs is established as a critical process of the entity, where the criteria for selection are defined; In this case, the greatest amount of participation of the inhabitants of Jenesano, Boyacá are found, in activities and benefits corresponding to the programs of families in action and senior citizens. The data provided was collected through information obtained from previously registered databases, carrying out their respective study. It was evidenced that the lack of communication and dissemination of the programs for the community among other factors is not evaluated.

Indicator system

Indicators are defined as observable and verifiable quantitative or qualitative expressions that make it possible to describe characteristics, behaviors, or phenomena of reality through the measurement of a variable or a relationship between variables. [14].

Management indicators become an improvement tool that provides early warnings when established goals are not being met and allows strategic actions to be taken to facilitate process performance. In the city council it was identified that some of these indicators were not clear and that they were established, but there was no management of them, therefore, it was started with the collection of the most relevant data for each of the procedures and it was decided to propose indicators that helped to improve and to estimate in an easy way each aspect within the development of the same. Afterwards, a resume was prepared, to specify and support each one, based on its function within the entity and the corresponding area. The next step was to record the indicators based on the following questions: ¿What does it measure? ¿How does it measure? ¿When does it measure? ¿Where does it measure? ¿Who measures it? and ¿Why does it measure it?

Cost-benefit methodology

Budgetary technique for the valuation of public investments that considers, in addition to economic and financial valuations, other social, technological, or environmental factors that contribute to the measurement of the effectiveness and efficiency of public spending [15].

The analysis considers the costs of non-conformities determined from the failures in the provision of the service, since they do not comply with the established conditions. To perform the benefit-cost analysis, a discount rate of 10% and an opportunity rate of 3% were used, considering the annual quality costs as the main characteristic. These percentages helped to delineate the values of benefits and costs over time. It was evidenced that some of them do not generate impact within the organization and decrease annually, therefore, it was feasible for the Jenesano city council to start their implementation.

III. RESULTS

Diagnosis of the city council

The diagnosis was divided into two stages, the first stage is where the formats for the collection of information about the processes that are managed within the entity were developed.

And the second stage where the important factors were established based on the NTC ISO 9001:2015 to analyze the situation within the institution. For this purpose, a matrix was created to quantify the secretariat's knowledge of the standard and to evaluate each of the aspects related to quality.

Based on the information obtained in the second stage, some possible causes or problems were found and evaluated through the Vester matrix, which made it possible to establish the central problem (see Table 2).

Table 2. Vester matrix

Number	Problems in the city council of Jenesano Boyacá	1	2	3	4	5	6	7	8	9	10	Total Assets
1	Out-of-date regulations	-	2	2	3	1	0	0	3	0	0	11
2	Non-documented processes	3	-	0	2	3	1	0	3	2	1	15
3	Documentation not updated	3	3	-	2	2	2	1	3	2	2	20
4	Slow information flow	0	2	2	-	0	0	0	1	0	0	5
5	Few proposals for improvement	0	2	2	2	-	2	3	3	1	0	15
6	Few strategies to collect requirements from the population	0	0	0	2	3	-	0	3	3	0	11

7	Budget availability	0	0	2	3	0	0	-	2	0	0	7
8	QA system not renewed	3	3	3	1	2	3	1	-	2	2	20
9	Control of unwanted effects	0	0	0	2	3	3	0	2	-	0	10
10	Poor distribution of functions	0	0	0	2	0	0	0	0	0	-	2
	Total Liabilities	9	12	11	19	14	11	5	20	10	5	-

Source: Authors, 2021.

Process characterization

A format was created and approved by the city council, which contains the following factors: objective, scope, typology, description, procedures, suppliers, users, inputs, outputs, controls, management indicators, person in charge, documents. All this described above helps to deeply understand and explain the processes. At present, the Jenesano city council has 38 processes, all of which have been duly characterized.

Analysis of the internal and external context

The Cross SWOT was used, since it allows establishing improvement strategies based on the weaknesses, opportunities, strengths, and threats that the entity has. This instrument was used in the municipality of Jenesano, Boyacá with the objective of making a qualitative and quantitative analysis. [16].

The following is the development of the entity's SWOT:

Weaknesses

- Resources for the development of Strategic Planning are limited.
- The Municipal Administration of Jenesano does not have an Operation and Management Model by processes duly documented in its entirety.
- The control exercised is prioritized to issues that affect the fundamental rights of citizens, leaving in the background the fulfillment of the work plans of the Management Systems.
- Information flow is slow due to lack of interaction between secretariats.
- Improvement proposals are focused on the external context.
- Low information on its internal failures
- The necessary human resources are not available for the Integrated Planning and Management Model.

Opportunities

- Improvement in the time required to provide services to the population.
- Developing the Management System provides better management of resources and information.
- New Projects in the implementation of Management Systems
- The Municipality of Jenesano has been gaining reputation in terms of economic activities such as tourism, construction and housing, and agricultural activities such as the cultivation of pears, susceptible to improvement through the implementation of standards.
- The development of management systems provides greater territorial recognition.
- Investment by private entities in the Municipality.
- The development of management systems provides a better perception to the population and an improvement in the processes.

Strengths

- Adequate infrastructure for the development of the functions of the company.
- Duly updated regulations for the management of its processes.
- Commitment of top management to the development of the Management System (MS)
- Continuity of the organization over time
- Diversity in the Systems for Collection of Petitions, Complaints, Appeals and Suggestions (PQR) of the Population
- Favorable work environment for the development of its function.
- Good investment of Information and Communication Technology (ICT) resources.

Threats

- No continuity with the projects at the end of the government's term of office
- Economic losses due to non-compliance with planning.
- Change in regulations for local and regional entities
- Cyber-attacks on the Municipality's information
- Difficulty for inter-institutional articulation in the elaboration and implementation of projects.
- Lack of resources for the fulfillment of external planning.
- Loss of image in the eyes of the public as a divided institution

Under these qualitative parameters, two matrices were created, the EIF matrix (Evaluation of Internal Factors) and the EEF matrix (Evaluation of External Factors).

The EIF matrix groups two parameters of the SWOT which are the strengths and weaknesses, these are given a quantitative assessment by their level of importance: 3-4 for strengths and 1-2 for weaknesses and are assigned a percentage weight (%), the value is established with the product between the importance of the weighting and the classification of the evaluation.

The EEF matrix groups two parameters of the SWOT which are the opportunities and threats, these are given a quantitative assessment by their level of importance from 1 to 4 and are assigned a percentage weight (%), the value is established with the product between the importance of the weighting and the classification of the evaluation.

Finally, the cross SWOT was performed under the combination of the four quadrants giving an enumeration or code to each of the characteristics, the first quadrant shows how to use strengths to take advantage of opportunities, the second quadrant is how to use strengths to avoid threats, the third quadrant seeks to reduce weaknesses and avoid threats, and the last quadrant allows weaknesses to be overcome by taking advantage of opportunities. Figure 1 shows the strategies generated for each quadrant that contribute to the continuous improvement of the entity.

Figure 1. Description of the cross SWOT

(F1, F2, F3, F5 - O1, O2, O3) The development of the QMS aims to maximize the efficiency and quality of its processes	(D1, D2, D3, D6, D7 - O1, O2 O3, O5)Implementing the Management System improves the distribution of resources, improves the flow of information, prioritizes improvement activities in the internal and external context, distribution of functions
(F4, F7 - O4, O5, O6, O7) Promoting publicity with the development of Management Systems helps the recognition and possible investment in the Municipality of private companies.	
(F3, F4, F5, F7 - A1, A2, A4, A5, A7) Developing the Management Systems, improving all the processes that are carried out, helping to continue in the continuity of these, also improves the established compliance times, prevents threats through investment and continuous improvement of its systems, articulates the different secretariats of the Municipality.	(D1, D2, D4 - A1, A2, A5, A7) Documenting all processes helps to prevent non-continuity, and avoid the loss of allocated resources, and to continue executing the activities already planned, as well as to immediately inform the secretaries and increase the good perception of the population towards the mayor's office.

Source: Authors, 2021.

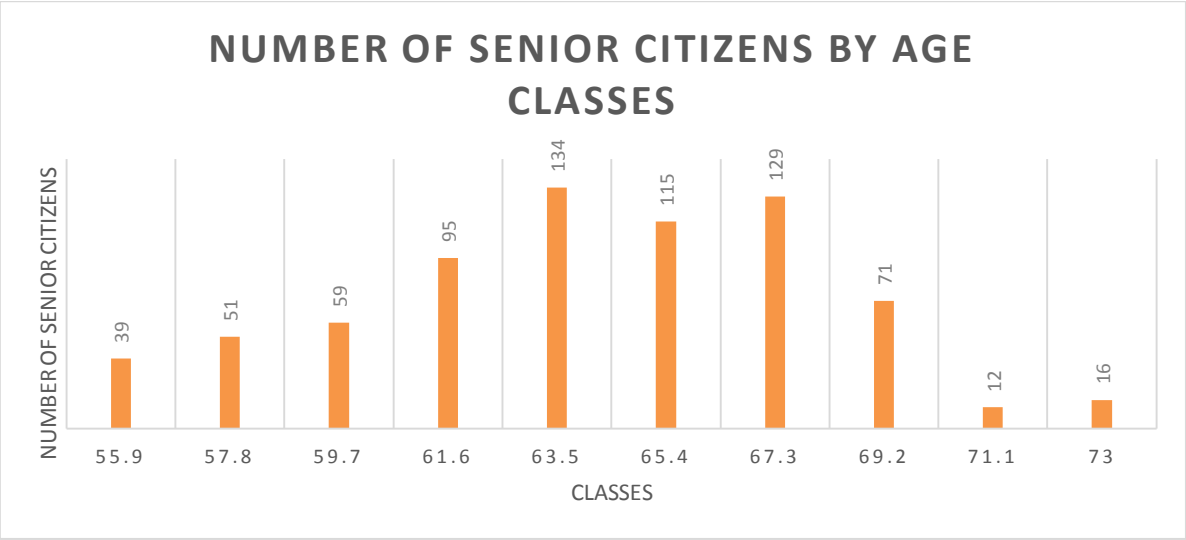
Statistical analysis

The critical process of the entity was selected, which was the Secretariat of Economic and Social Development, under the parameter of coverage of social programs.

In the sub-process of Management of Social Programs, Vulnerable and Sisbén, two programs were taken which are: The senior citizens program and families in action, where a histogram and analysis was performed for each of these.

In the first case, under data provided by the city council, it was found that 53 people are not covered and that most of the elderly population benefited by the program are between 61 and 67 years of age, the corresponding analysis means that on average women would need 16 years and men 8 years to free up a quota. Taking into account that the average life expectancy of a woman in a rural area is approximately 78 years and that of a man is 72 years (See Figure 2).

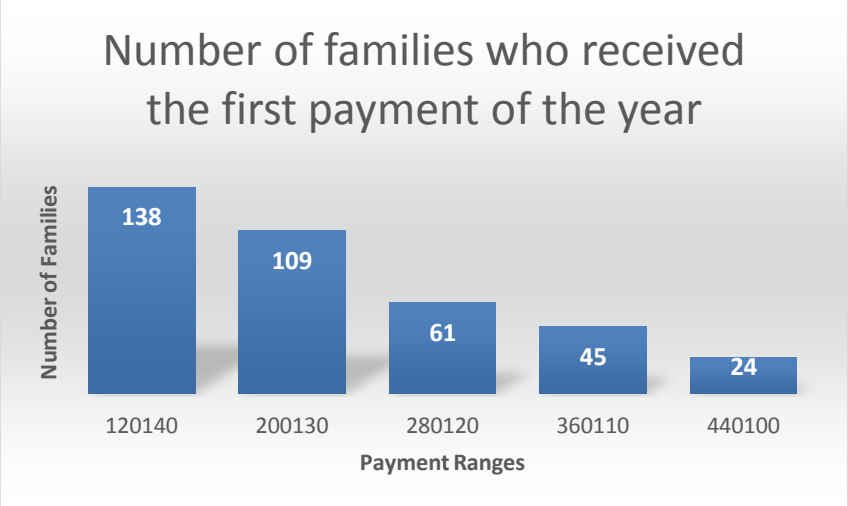
Figure 2. Number of senior citizens by age



Source: Authors, 2021.

The Families in Action subsidy indicates that the largest number of beneficiaries in this first payment is in the range of 120,140 pesos, indicating that the largest number of beneficiaries are overcoming the crisis and increasing their resources, this means that 20% of the inhabitants of the municipality are in extreme poverty and that the families that are likely to overcome poverty in this year (2021) is 1.5% (8 families) (See Figure 3).

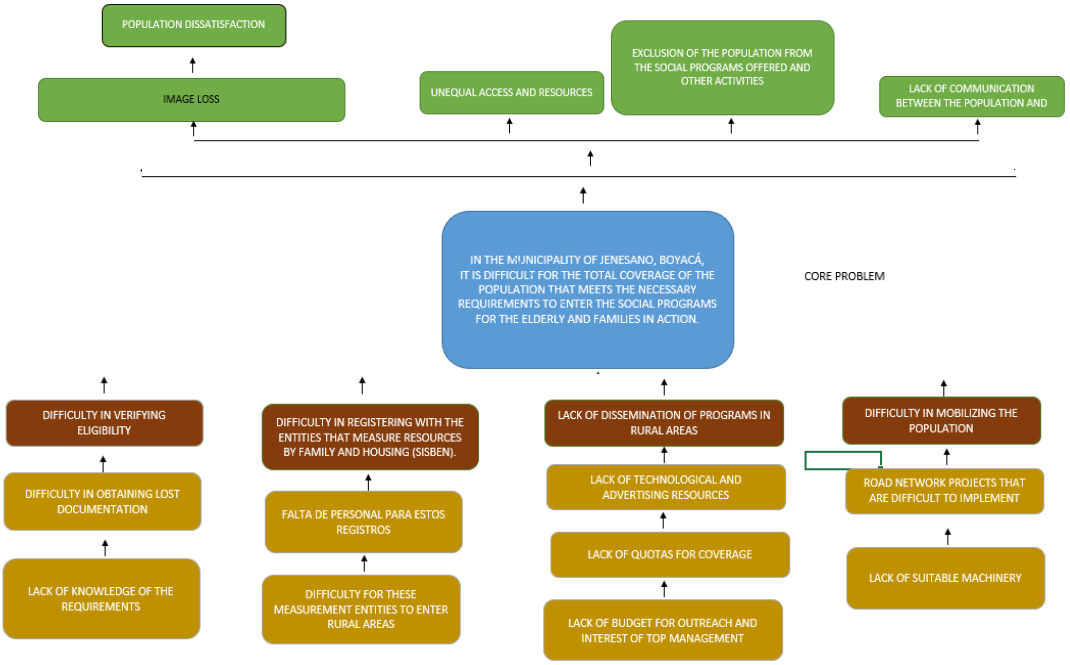
Figure 3. Number of families who received the first payment of the year



Source: Authors, 2021.

The problem tree helped to establish the central problem within the process based on the graphs developed, which allowed the causes and effects of the problem to be established (see Figure 4).

Figure 4. Problem Tree



Source: Authors, 2021.

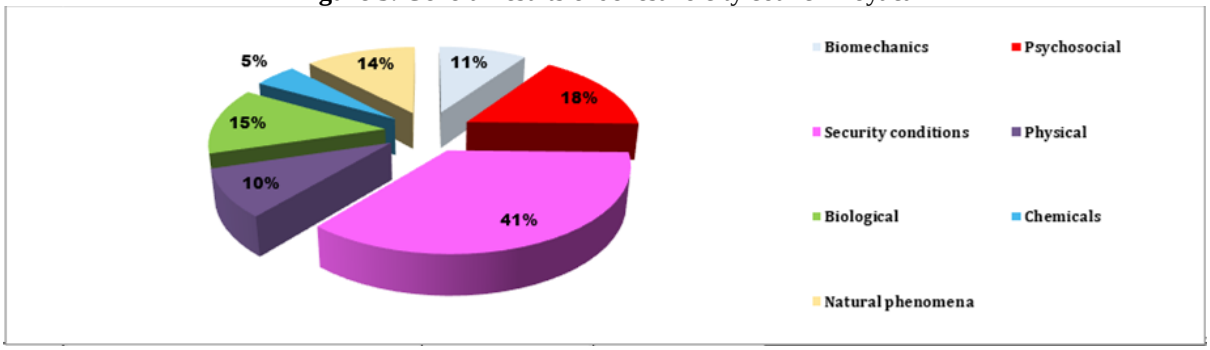
Risk identification matrix

The risk matrix is a management tool that allows to objectively determine which are the relevant risks that the entity has, initially it was worked for the safety and health of workers but nowadays all the risks present in the organization are analyzed. Its completion is simple and requires the analysis of the activities carried out [17]

In this case, it was determined to evaluate the risks to which each official of the mayor's office is exposed, a matrix was created to identify these risks, which results in the classification and percentage of each risk obtained to generate a proposal of controls that allow the reduction of each one of them.

Figure 5 shows a general analysis of the risks of the entire municipality separated by classes, where the most important risk is security conditions with 41%.

Figure 5. General results of Jenesano city council Boyacá



Source: Authors, 2021.

Management Indicators

In this objective an important contribution was developed, which is the format of the life sheet of the indicators where each one of them was described, to be as clear as possible at the time of implementation by the person in charge.

The following aspects were considered for the development of the life sheet of each indicator: Process, objective, description, formula, parameters, frequency, current target, responsible party, unit of measurement and observations.

In addition, each of the indicators was recorded where the What does it measure? How does it measure it? When does it measure it? Where does it measure it? Who measures it? and Why do you measure it? This allows the collaborator of the city council to be clear about the due process that must be carried out for the corresponding indicator.

Benefit of implementation

The goal of the organizations is to generate profit, therefore, all joint actions and projects developed in the entities must be evaluated qualitatively or quantitatively.

The development of the Quality Management System generates great benefits for the organization both internally and externally. Among the internal gains of the entity, we can highlight a growth in the organizational culture, standardization of processes to increase efficiency in the services provided and avoid setbacks, reducing costs. Additionally, it allows to achieve a better level of work, raises the capabilities and competencies of the collaborators through training programs, and allows to generate synergy within the entity.

From the external point of view, the company's image with users is improved and leadership is increased among the processes developed in the region through the excellence of the services provided and the projects generated. Likewise, it allows obtaining investments or potential clients. Taking into account the above, public entities always seek to provide a quality service to customers that adds value. [18].

These great benefits obtained from the development and maintenance of the Quality Management System, implies a definite cost for the company, but at the same time, it also generates a greater benefit for the organization. However, to make the best decision, a cost-benefit analysis is performed, which indicates the time it takes to recover the investment. In this case of the QMS, quality and non-quality costs are determined.

A company that has implemented the quality management methodology will find it much easier and less costly to implement new technologies. [19].

Quality costs or compliance costs are those incurred to ensure that the provision of the service meets the established specifications and requirements.

Non-quality or non-conformity costs are associated with service failures due to non-compliance with specifications and requirements. They are classified internally (activities aimed at eliminating faults detected before reaching the user) and externally (those incurred after the service has been provided and it is detected that they do not comply with the descriptions).

To perform this cost-benefit analysis, a discount rate of 10% and an opportunity rate of 3% were taken, the benefit, prevention and evaluation values are diminished over time because there are activities that are not replicated. On the other hand, they are reduced annually since they do not generate the same impact on the organization when they are first implemented and become part of the normal operation. However, there are always profits that will impact the entity year after year. As a result of this study, it is evident that it is totally viable for the municipality of Jenesano, Boyacá (See Table 3).

Table 3. Results of the Quality management system profitability indicators

ANNUAL QUALITY COSTS			
Prevention costs		$	18.579.200
Evaluation costs		$	11.002.630
Not quality costs	Internal failure	$	7.889.200
	External failure	$	64.394.640
Total cost		$	101.865.670
Benefits		$	134.266.525

VPN	$ 39.085.295
TIR	78,16%
B/C	1,56

vna income	$ 370.491.606,45
vna expenses	$ 205.771.895,61
vna income + expenses	$ 237.033.396
COST-BENEFIT	1,56

FIRST SCENARIO	DISCOUNT RATE	10%	OPPORTUNITY RATE	3%

YEAR OF OPERATION	PREVENTION COST	EVALUATION COST	NOT QUALITY COSTS	BENEFITS	CASH FLOW	Present value
0	$ 31.261.500		$ 72.283.840	$ -	-$ 31.261.500	-$ 31.261.500
1	$ 18.579.200	$ 11.002.630	$ 70.115.325	$ 134.266.525	$ 34.569.370	$ 31.426.700
2	$ 15.325.000	$ 11.332.709	$ 68.011.865	$ 120.839.873	$ 26.170.299	$ 21.628.346
3	$ 14.865.250	$ 11.672.690	$ 65.971.509	$ 108.755.885	$ 16.246.436	$ 12.206.188
4	$ 14.419.293	$ 12.022.871	$ 63.992.364	$ 97.880.297	$ 7.445.770	$ 5.085.561

Source: Authors, 2021.

IV. DISCUSSION OF QMS DEVELOPMENT

Three articles that provide significant information and contributions about quality management systems are taken as a reference.

The first article focuses on looking at organizations as a set of interacting processes and argues that applicability is not only necessary in production companies but is also important in-service companies. [20]. The second article shows the importance of the standard in establishing important guidelines for the development, improvement and maintenance of a Quality Management System, as well as implementing statistical tools to measure the performance of the organization. [21]. Finally, the third article touches on the topic of the PDCA cycle (Plan, do, check and act), which allowed to develop the System with a focus on quality engineering, where it touches on the topics of staff integration and their corresponding training the use of measurement tools under a strategic document that helps to facilitate their procedure [22].

In general, the articles presented here talk about the tools and the use of the NTC ISO 9001:2015, while this article took into account the development process that was used with this entity, also the most relevant point of the project was the estimation of the benefits where more security is provided when making the decision to make the implementation and corresponding certification, since they have knowledge about the costs of non-quality and what it would cost them not to develop the processes that are handled in a timely manner and with quality.

V. CONCLUSIONS

The Quality Management System in a public entity becomes a pillar of development and continuous improvement since it allows to establish the needs of the population as a starting point for the standardization of processes.

Likewise, it allows everyone to speak a common language and information to flow through the different established channels, establishing measurement metrics through indicators that become the control points to generate improvement strategies that allow the fulfillment of the goals set by the municipal administration.

Finally, it is established that the QMS is dynamic, that it allows to evaluate and control the risks that arise in the entity and generates benefits that are analyzed from a qualitative and quantitative point of view, allowing to establish that doing things right from the beginning generates surpluses that can be used in other projects required by the community.

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