

Feasibility Analysis for Creating a Metrology Laboratory Serving the Agribusiness and Hydrocarbons in the Department of Huila, Colombia

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Abstract

The metrological tools have significantly helped in the production processes of each sector in all industries of the country. In the areas of analysis this feature becomes important because of the diversity of equipment and measuring instruments for evaluating and calibrating aspects that the project can be identified through market studies, technical and financial resources in accordance with the specific needs of a metrology laboratory that serves the hydrocarbon industry and agribusiness in the department of Huila.

The impact of creating a metrology laboratory for these sectors is reflected in the provision of calibration services to potentially 762 companies in which they also significantly reduce the costs of sending their teams to other cities, the corresponding time management and mismatches because of the distances they have to travel.

Keywords: Metrology, calibration, measurement, precision, pattern, certification and laboratory

INTRODUCTION

Metrology is the science of measures: it is the study and application of all proper means to measure quantities such as lengths, angles, mass, time, speed, power, temperatures and currents. Therefore, it is easy to see that metrology enters in all domains of science.

The calibration of the equipment and machinery used in the oil industry must meet minimum quality standards to satisfy customer needs and comply with government regulations as well as to ensure the results of quality service and accuracy. These are key elements for a field where the real action and economic production play important roles.

In the agribusiness sector of Huila technological changes and increased demands on excellent quality in all processes have become more complex which makes it more difficult to compete and be efficient in food production. In consequence, implementing the insurance systems equipment and measuring instruments through accredited laboratories becomes a relevant need for the region.

The project is comprised of a preliminary analysis, which identifies aspects of current industries such as the need of the market, the recognition of the strengths, weaknesses, opportunities and threats, to find the feasibility of the creation of a metrology laboratory for the hydrocarbon sector to be developed in the University Corporation of Huila "Corhuila" located in the city of Neiva.

The overall objective of the research was to establish the viability and feasibility of implementing a metrology laboratory serving agribusiness and hydrocarbons in the new laboratory building of Corhuila, which offers a wide and relevant portfolio of metrology activities for about 510 252 oil and agribusinesses in the department according to data from the Chamber of Commerce of Neiva, and the creation of a culture and awareness of the importance of calibration of measuring instruments as a result of controlled processes that determine products and / or services of excellent quality, with the help of a good human resources and cutting-edge technology.

The research design establishes as final result a study that showed the technical feasibility in terms of specificity and cost of the necessary technology, equipment calibrations to advance both agribusiness companies and oil companies and service stations or fuel sourcing in larger municipalities of Huila.

Currently the department focuses all its efforts on implementing its development plan framed by the productive bets that determine the sectors of agribusiness and hydrocarbons to achieve goals of the regional government that include improving competitiveness of the companies, as well as the living conditions of the population in general.

REFERENCE FRAMEWORK AND STATE OF THE ART.

Background

Colombia is at the forefront on issues of metrology at the international level. The mass laboratory SIC was recognized by German authorities (DKD) as a world authority on these topics.

According to the ONAC (national accreditation), Colombia had a total of 46 accredited laboratories in different areas of metrology, specialized in mass scales, temperature, pressure, length, volume and strength until 2010 (Field, 2010).

In the department of Huila is only a laboratory called "SERVIMETROL" located in the city of Neiva, created in 2011 by Ing. Electronic Leidy Arboleda Constance Caupaz as a fund sponsored undertaking.

So far this metrology laboratory serves the needs of the various sectors of industry in the department of Huila, but, as mentioned above, the service provided by this company is the calibration of pressure and temperature; hinting the unsatisfied demand from other sectors of the regional economy.

REFERENCE FRAMEWORK

Basic metrology

Metrology is the science that studies the measurable properties, measurement scales, different unit systems, measuring methods and techniques at all levels of either mass, length, time, temperature, volume and pressure, among others. Also, it is able to determine the physical quantities.

Its etymology is Greek, consisting of *metrón* (measured) and *logos* (treated). It is defined as the science of measurement, also known as the art of accurately measuring inaccuracy. .

There are 3 kinds of metrology:

- The legal metrology is responsible for the study of the technical requirements in order to ensure correct measurements. These requirements may vary from country to country, in the Colombian case, this area is managed by the Superintendency of Industry and Commerce (SIC) by the technical standards 17000 and 17025.
- Industrial metrology: focuses on actions related to the production and quality control and within their areas of action, calibration procedures, control of measurement processes and management of measuring equipment. Its main objective is to improve standards and production patterns reflected in lower costs and higher profits for those who apply.
- Scientific Metrology: It is the maintenance and preservation of international standards, the pursuit of new measurement standards for new units and improvements in the accuracy of measurement.

For the agribusiness sector there are several management programs such as safety good agricultural practices, good manufacturing practices, HACCP (Hazard Analysis and Critical Control Point) system ISO 22000, among others that necessarily need to have infrastructure whether at laboratory level in the same companies or at market level. Also the technical competence is required in a form that enables the maintenance or adjustment of such systems and ensures market acceptance results. Additionally, they must implement the models of quality assurance proposed in the ISO 17025 standard.

Another model of quality assurance is established by the ISO / IEC 170 257 standard, which is proposed by the International Organization for Standardization ISO. It is a standard that describes the requirements for technical competence of laboratories to perform any test on any product .

Consequently, there is to be highlighted a certain complementarity in all regulations in order to improve conditions, ensuring quality and process excellence. (Metrology in quality processes).

Metrology in quality systems

There was always a need that mankind has had to trade (counting and measuring) among different populations and

assimilation between phenomena or make things up creating systems of measurement or comparison, which today are a major part in the development of processes, so that these companies have found an important basis for improvement (Liliana Faciolince, 2003).

The metric systems used in the world vary depending on the country, like The English system, MKS, CGS and the International System, which makes it difficult to understand the measures.

On the long term, changes are expected, where the consolidation of a single system of units allows the unification of measures to avoid conversions that can lead to generate more uncertainty in the measurements

Actually, the change may not be immediate, and the clearest example is the United States, which has long used the English system and its technology is based on that system, so they requested a period of 30 years to fully adopt SI (international system) due to industrial transformation, technological change and the huge necessary investments.

Metrology in Colombia and the structure of the Sic

Legal metrology in Colombia is controlled and developed by the Superintendency of Industry and Commerce (SIC) and more properly in the Control Center Quality and Metrology (CCCM) (Liliana Faciolince, 2003).

Resolution No. 140 of February 4th, 1994 (now revoked by resolution 8728 of March 21st, 2001), refers to the accreditation procedure for establishing activities carried out by the National Standardization and regulates certification and metrology. It mandates the SIC to "Establish, coordinate, direct and monitor national programs for industrial quality control, weights, measures and metrology considered essential for the proper performance of their duties" and "accredit and monitor

- Certification Bodies
- Laboratory tests and trials
- Calibration laboratories
- Agencies inspection and testing

In order to have an extensive infrastructure REMEC is created, which is the network.

Metrology laboratories, in which all laboratory performing calibrations are committed, are compulsory for those who serve the request without discrimination.

Later ASOREMEC, the Association of Metrology Laboratory Network, appears, which is intended to defend the rights of accredited metrology laboratories and actively participates in addressing metrology in Colombia.

Legal framework

Colombian law has enacted decrees and rules throughout the years, in order to address and control metrology laboratories of both, established companies as well as those who work

externally providing the service.

Present and applicable regulations for proper legal operation of laboratories in Colombia are:

- Decree 1993. 2269 "national system of standardization, certification and metrology".
- NTC-ISO 9000: 2000 "Systems of quality management. Fundamentals and vocabulary. "
- NTC-ISO 9001: 2000 "Systems of quality management. requirements "
- NTC-1000 "International Unit System."
- NTC 10012: 2003 "Management System requirements for measuring processes and equipment."
- NTC-17025 "General requirements for the competence of testing and calibration laboratories."
- NTC-170 257 "presents the requirements for technical competence of laboratories to perform any test on any product."
- NTC-22000 "Good Manufacturing Practices, HACCP (Hazard Analysis and Critical Control Points) system."

INVESTIGATION METHODOLOGY

The project was developed using an applicative methodology with a descriptive cross-sectional design that allows the implementation of a data collection instrument (survey) to a sample of 68 companies in the hydrocarbon sector, which were mainly service stations, and 60 agribusinesses such as ric, soda companies and ranches.

The applications of these surveys determine the following information:

- General Company.
- Aspects that have to do with the characterization of the measurements made by the agribusiness companies.
- Identify which analysis and studies the company has prepared to learn whether it is profitable or productive to calibrate their equipment.
- Identify the efficiency of its production process.

The results of the characterization and understanding of the population surveyed are defined in the database, which will also include potential customers using the service to be provided, the benefits that these industries will receive, and primarily serves to allow to know the viability of the project.

PROCESS AND MATERIALS

The project is developed by applying an information collection instrument (survey) technically designed and tested to a significant sample in the city of Neiva and replicas subsamples calculated for populations Pitalito, La Plata, Aipe, Gigante,

Palermo and Rivera among other municipalities of Huila to be the largest in terms of enterprise infrastructure and population.

To make the field study, a personal interview with employees has been requested to the selected sample to get to know the processes of each sector and for prior scheduling appointments with the enterprises. The instrument was applied following the provisions of the script procedure designed for that end.

The design shows the type of stratified sampling, where each municipality corresponded to a layer. The subsample was calculated in proportion to the number of inhabitants.

Statistical analyses of the surveys were developed through the SPSS (Statistical Package for the Social Sciences) software, Excel spreadsheet and the word processor Word for writing the final report.

EXPECTED RESULTS

Define, if the Ingenio" and "Espind" formed in the research group Juran Industrial Engineering program, earlier a major project of Corhuila, which aims to establish the conditions for implementing a metrology laboratory, meets the need for adjustment and calibration instruments of the activities of the sectors of agribusiness and hydrocarbons in the department of Huila.

The *Semillero de Investigación*¹ "if the mill" conducted the research about the departments hydrocarbons sector, while "Espind" analyzed the advancement in the agribusiness sector and consolidated results for the purpose of the implementation of the metrology laboratory in the Corhuila building. Nevertheless, each sector has its own results as requirements of the Corhuila.

ECONOMIC RESULTS FOR STUDY AND FINANCIAL SECTORS

The projected operating revenues represented by sales of metrology laboratory services to companies in the agribusiness sector and hydrocarbons, presented an average increase of 7.68% during the first five years of operation and, likewise, the costs of sales and operating expenses show an increase of 5.65% and 3.30% respectively.

On the other hand, the income statement (profit in all periods) shows an average annual increase of 36.11%. Therefore can be stated, that, based on the results of the projections, the project is viable in its execution.

As for the projection of the balance sheet that determines us stability in financial position for the first five years of the project, total assets increased by average of 23.58% despite of an average decrease of 33.13% in the Property Plant and Equipment, due to the depreciation of equipment.

It is important to note that the distribution of metrology laboratories as a business unit are likely to improve in accordance with the dynamics of the demand for services

¹ Semillero de Investigación: Research project for young researchers and students at Corhuila

sectors and projected capacity. Corhuila wants to adapt to new technologies and change government policies established by the department (Huila productivity agenda).

The services provided by the laboratory meet the projected goal of 893 companies in the agribusiness sector and 696 for oil calibration services in the first year with an average increase of 1%.

Moreover the selling prices set by DUT 2015 are:

Description Unit	Price calibration equipment COP (\$)
Thermometers	337.000
Chemical instruments	400.000
Weights and scales	285.000
Nanometers: hydrocarbons	350.000
Registrars	250.000
Serafin	250.000
Pistols fuel sourcing	50.000

CONCLUSION

These project represented a breakthrough in applied research in the region by allowing to investigate the specific needs of the agro-industrial and hydrocarbon sector. Furthermore, it establishes the technical and economic feasibility of implementing the university corporation of Huila, Corhuila, a metrology laboratory that meets the quality standards both nationally and internationally in this field.

These projects took part in the IX departmental meeting of Semilleros de investigation conducted on 9 and May 10, 2013 at the University Antonio Nariño based in Neiva, where they obtained scores of 98 and 96.6 respectively by the qualifying jury of the event, which in time guaranteed participation in the national meeting that took place in September of the same year in the city of Monteria (Córdoba).

Importantly, the feasibility of creating a metrology laboratory serving the hydrocarbon and agribusiness sectors, consists not only in meeting the current demand in the sector, but also in implementing strategies that contribute to the improvement and economic sustainability of enterprises of these sectors in the department of Huila.

The creation of a metrology laboratory opens the way for more companies in other sectors, who seek market competitiveness through compliance with current regulations (ISO 9001).

The study made it possible to identify the current demand in the market, and the discontent of many companies finding no calibration laboratories for their teams and must attend labs in nearby cities, with corresponding damage in handling and transportation and even the loss of the same.

It is essential to consider the NTC ISO 17025 standard "requirements for the competence of testing and calibration laboratories" as useful for general laboratory organization. Also, the way to accreditation (ONAC should be opened to

improve the recognition of the competences of laboratories on a national level

The creation of a laboratory in the department of Huila contributes to the achievement of the objectives of the University Corporation of Huila "Corhuila" to create leaders who promote the use and suitability for major department development production processes.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this paper.

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