

Procerh: A Certification Program For Metrology Consultants And Technicians

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Abstract

One of the most important factors that determine the quality of a measure, the result of a calibration or the reliability of a consultancy, is the competence of the individuals that perform these activities. Recognizing this fact, the Centro Nacional de Metrología of México (CENAM) launched in 1999, a training and certification program for metrology consultants (PROCERH), as an integral component of the MESURA Interinstitutional Network [1]. The aim of this program is to provide, through competence development, evaluation, proficiency testing and certification processes, evidence of the knowledge and skills of individuals that perform metrological activities, referred to specific codified standards.

This paper presents the principles, objectives, scope and stages of PROCERH, followed by an evaluation of the current experience and possible scenarios for the future, including discussion and assessment of certification criteria.

1. The global environment: Quality management systems, personnel competence and metrology

1.1 The human factor and the competence based strategy

The human factor has been recognized as that with the prior relevance and importance in activities related with quality. Many worldwide organizations have assigned resources in order to improve their quality by improving their hiring and engagement practices, personnel evaluation methods and training needs estimation procedures. However these efforts haven't been always efficient because often they have been separated efforts; this is, the hiring, evaluation and training methods are developed by different departments, are based on different criteria and are made in different times without a unique focus. This problem is solved with a strategy based on personnel competence because all the events related with human resources are based on specific standards suitable for specific functions [2].

A human resource program based on personnel competence comprises: evaluation, certification and training or competence development. In this way, the efforts for improving the human resource performance, and therefore the service or product quality, are carried out with the same criteria because they are led by a standard.

1.2 What does ISO 9000:2000 say about personnel competencies

The “Quality management systems-Requirements” ISO international standard establishes that personnel performing work affecting product quality shall be **competent** on the basis of appropriate education, training, skills and experience.

Table 1 shows the particular requirements established by the standard and the way to fulfill them by means of a program based on personnel competence.

Table 1. Resource management requirements for the human factor in ISO9001:2000, [3] Section 7.6.

Standard Requirement	How to fulfill it with competence based strategy
To determine the necessary competence for personnel performing work affecting product quality	Selecting the applying qualification standards
To provide training or take other actions to satisfy these needs	Designing training programs on the basis of competence development
To evaluate the effectiveness of the actions taken	Applying competence evaluation procedures and certification after training activities
To ensure that personnel are aware of the relevance of their activities and how they contribute to the achievement of the quality objectives	Promoting certification processes among the personnel
To maintain appropriate records of education, training, skills and experience.	Maintaining qualification certificates, performance evaluation results and competence based training evidence

Note: the contents of each point referred of the ISO Standard have been compacted, with the aim of being synthetic but preserving the content; it is suggested that the interested reader refers to the Standard itself for complete reference.

1.3 What does ISO/IEC 17025:1999 say about personnel competencies

The “General requirements for the competence of testing and calibration laboratories” ISO/IEC international standard establishes the human factor as one that determines the correctness and reliability of the test and/or calibrations.

Table 2 shows the particular requirements established by the standard and the way to fulfill them by means of a program based on personnel competence.

**Table 2. Technical requirements for the human factor in ISO/IEC 17025:1999, [4]
Section 5.2.**

Standard Requirement	How to fulfill it with competence based strategy
To ensure the competence of those who operate equipment, perform calibrations, evaluate results, and sign calibration certificates	Obtaining qualification certificates after an evaluation process based on competence standards
To provide supervision to staff who are undergoing training	Supervising based on performance criteria and specific product evidence established in a competence standard
To qualify personnel performing specific tasks on the basis of appropriate education, training, experience and skills	Obtaining qualification certificates after an evaluation process based on competence standards
To formulate goals with respect to the education, training and skills of the laboratory personnel,	Using competence based evaluation results in order to formulate the goals
To establish a policy and procedures for the estimation of training needs and for providing the necessary training	Selecting or developing the appropriate competence standards and applying the corresponding competence development programs
Using personnel who are employed by the laboratory	Do not apply In the future, this requirement may be replaced by one asking that personnel must be certified instead of only employed
To maintain current job descriptions	Replacing or complementing the job descriptions with the appropriate competence standards
To authorize specific personnel to perform particular types of sampling, test and/or calibration	Using the qualification certificates that support specific functions for authorizing personnel that performs them
To maintain records	Maintaining qualification certificates, performance evaluation results and competence based training evidence
Note 1. In some technical areas it may be required that the personnel performing certain tasks hold personnel certification. The requirements for personnel certification might be regulatory, included in the standards for the specific technical field	Applying a competence based certification process, this and all the personnel competence requirements are fulfilled <i>de facto</i>

Note: the contents of each point referred of the ISO/IEC Standard have been compacted, with the aim of being synthetic but preserving the content; it is suggested that the interested reader refers to the Standard itself for complete reference.

1.4 Personnel certification and measurement interoperability

In the global scene, the challenge of measurement interoperability will be faced, together with the challenge of meeting requirements established for standards, measurement and test equipment, technical procedures and registers, quality systems, etc., with the challenge of meeting requirements of personnel competence. These are more objectively stated in competency standards, and better evaluated through comprehensive certification processes.

As in other fields of activity it is paradoxical, but understandable, how the most important factor that determines quality in any process has been, somehow, the latest being addressed to look for means to standardize and demonstrate its abilities. A competency based certification scheme for human resources involves the evaluation of performance with evidence of knowledge, skills, how to do abilities and attitudes, without regard to the way in which these competencies have been acquired. Thus the scheme focuses in the objective rather than in the process.

Another aspect that gives particular relevance to formal certification schemes in metrology based in technical competencies, is the fact that in most countries there are very few possibilities, *i.e.* schools and programs, for formal training in metrology, e.g. [5]. Most metrologists in laboratories and industry around the world have been trained in some engineering or science discipline, and have become metrologists later with in-house training, some specific courses and experience. This process, though can be valid and the single possibility in many cases, lacks formal mechanisms for ensuring and demonstrating technical competence for performing the specified activities. A certification scheme based on technical competence and referred to formalized standards, overcomes these two limitations. First, it gives the managers of the laboratory an objective reference to evaluate the performance and technical competence of their metrologists. Second, if the competence standards have national or international recognition, the certification provides objective evidence of the competence of the metrologists, thus supporting the reliability of the measurements, calibrations or metrological activities comprised by the standard.

2. The national environment: National Calibration System, the MESURA Interinstitutional Network and the human factor.

2.1 CENAM and the National Metrology System.

2.2

The National Metrology System (NMS) in Mexico has a long history, but its restructuring based in a modern scheme is rather young. This system is headed by CENAM, the National Measurement Institute, which was established in 1994, the same year NAFTA was started.

In the 6 years of operation of CENAM, it has faced several wide scope tasks; some of them are :

- a. Establish the National Measurement Standards and validate them with international comparisons
- b. Contribute to structure, harmonise and consolidate the MSTQ system in the country, with special emphasis in the calibration and testing laboratories
- c. Satisfy the immediate metrological needs of the users, e.g. calibrations, training, consultancy and other services.

The next layer in the NMS is conformed by the calibration and testing laboratories, which are the necessary linkage and multiplying entities for the traceability to the national standards. To strengthen this layer and provide a most reliable and ready access to measurement technology in all its components, CENAM established the MESURA Strategy.

2.2 The human factor in the MESURA Program and MESURA Interinstitutional Network

The MESURA Strategy is based on a systemic approach to metrology, and intends to provide integral solutions to metrological systems in any defined environment. In general, it considers at least three main components:

- i) Hardware: standards, equipment, IT resources, etc.
- ii) Software: methods, procedures, quality systems and know how items.
- iii) Humanware: HR factor with all its implications for any intended function

These three common factors are complemented, in specific environments or applications, with whatever other factor that may be applicable for an specific objective.

The MESURA Strategy, with its holistic approach, has had two main stages, maintaining the same principles: The MESURA Program (1994) designed for the environment of a specific organization, and the MESURA Interinstitutional Network (1998) designed for the National Metrological System.

2.2.1 The MESURA Program [5]

This Program is leaded by CENAM and provides technical assistance to organizations, i.e., metrology laboratories, industries and other organizations in three main aspects of measurement technology:

- i) Standards, instruments and its traceability
- ii) Methods, procedures and other technology items
- iii) Personnel and its abilities to perform their tasks, or competences

The personnel abilities constitute the most dynamic and important factor and have to be harmonized with the other two, as well as to the functions and objectives of the organization.

2.2.2 The MESURA Interinstitutional Network [6]

This is an association of CENAM with accredited calibration laboratories, working in a franchise scheme, to offer the MESURA Program and any other metrological service in an integral package to organizations. To warranty the quality of the consultancy and other services provided by the partners in the network, three strategic systems have been established:

- i) SIMET, Metrological Information System, based on Internet.
- ii) SICAME, Metrological Quality System, electronically maintained.
- iii) PROCERH, Training and Certification Program for metrology consultants and technicians.

3. PROCERH: its objectives, strategy and scope

3.1 The PROCERH objectives

Recognizing the importance of personnel competence in calibration and consultancy services, the CENAM launched in 1999, together with the MESURA Interinstitutional Network a training and certification program for metrology consultants. The name of this program is PROCERH (Programa de Capacitación y Evaluación de Recursos Humanos).

From section 2.1 and 2.2, it must be clear that Human Resource has been recognized as the most important for ensuring the quality of the results in the National Metrology System, and for those of the MESURA Interinstitutional Network and the fulfillment of their objectives.

From this two independent, but related systems, the two main objectives of PROCERH arised:

- a. Ensuring the technical competence of calibration technicians of the National Metrology System
- b. Ensuring the technical and communication competence of metrology consultants of the MESURA Interinstitutional Network

Thus, the PROCERH objective can be stated as to provide the necessary means to ensure the technical competence of metrology consultants and technicians, required to achieve quality, reliability and consistency in the National Metrology System, and in the consultancy service provided by the MESURA metrology consultants.

3.2 The PROCERH strategy

After a study and analysis of the possible means to achieve this goal, the PROCERH strategy was selected as a certification scheme based on technical competencies, referred to codified and formalized standards.

To the definition of this strategy, it was very appropriate that in 1995 Mexico created a national system for the certification of personnel competences, and a national institution to coordinate it: CONOCER [7], the national council for standardization and certification of personnel

competences. The CONOCER scheme was adopted very soon, since it provided the necessary legal and institutional framework to anchor the PROCERH strategy.

The necessary means to implement the PROCERH strategy within the CONOCER scheme implied development of:

- competence standards
- evaluation mechanisms based on performance criteria
- competencies development programs (training)

3.3 The PROCERH scope and stages

The PROCERH scope is defined by the needs of the country in terms of personnel competencies in metrology, and the intersection of these needs with the scope of two systems: the National Calibration System and the MESURA Interinstitutional Network.

Due to the fact that the National Metrology System is a wider and more complex system in the country, the stages of PROCERH have been defined in an inverse order as the needs:

Stage I. Metrology Consultants for the MESURA Interinstitutional Network

Stage II: Calibration Technicians for the National Metrology System

After these two stages, a possibility will be analyzed to take a further stage:

Stage III. Testing and measurement technicians of the user sectors: industry, commerce, etc.

Metrology consultants must be competent in analyzing, diagnosing, proposing and implementing solutions about metrological systems. In the MESURA Interinstitutional Network there are two levels of consultants:

AG: General Metrology consultant, focused in the process of the organization

AE: Specific Metrology consultant, focussed in specific metrological quantities.

Calibration technicians working in accredited laboratories must be competent in performing calibration activities in specific quantities, within specific ranges and uncertainties, and with specific techniques.

Metrology technicians could be certified in specific quantities or techniques and in several levels (master, official, junior, operator) according to the most common requirements of competence in industry and other organizations.

3.4 PROCERH mechanisms of operation

With PROCERH, CENAM have established mechanisms to operate the different components for each function to standardize. The components are showed in figure 1.

Figure 1. PROCERH components

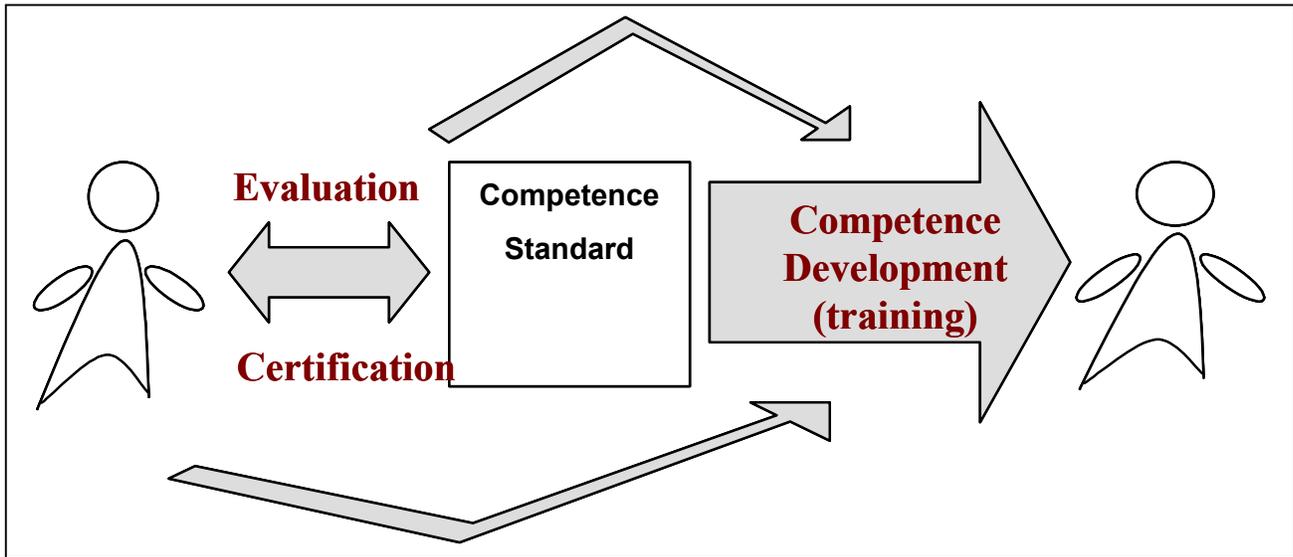


Figure 1 will be explained with an example.

Assume that you are a free consultant interested in joining to the MESURA Network. A requirement for joining is that you must be an certified MESURA consultant. For getting the certificate you have been evaluated. The evaluation result will indicate if you are competent or if you still are not competent. If you are competent you will obtain your certificate.

If you still are not competent the PROCERH will indicate you a development competence program. You will have another opportunity for being evaluated, but you will have the security that the training you receive will contribute for improving your skills and performance related to the metrology consultancy.

4. Current state and future work

4.1 Current state

As for the current developments, PROCERH has been a most suitable Program for organizing around it the different activities performed in order to ensure the technical competence of metrology consultants in the MESURA Interinstitutional Network. This has allowed to expand the Network to 4 more centers besides CENAM, maintaining the highest standards of quality and competence of the personnel that provide consultancy to industry and laboratories.

4.2 Future work

The next stages for development of the Program are:

Stage I: The MESURA Interinstitutional Network

Developing a number of specific standards for metrology consultants in specific quantities

Establishing the certification organism and evaluation centers

Establishing programs for competence development

Stage II: The National Metrology System

Developing the complete scheme for metrologists that perform calibration activities in accredited calibration laboratories

Stage III: The user sectors: industry, commerce, services, academia.

Developing the complete scheme for metrologists and other functions as instructors.

This stage could be implemented better by groups of secondary laboratories and the user sectors, but CENAM could provide some technical leadership when necessary.

4.3 PROCERH and other international programs

For the moment, PROCERH is providing a very solid basis for the human resource strategy in Mexico, and it is believed that this Program constitutes a strength of the National Metrological System that will be more important as the advantages of personnel competence schemes become more widely recognized and widespread. Similar schemes based in personnel competences in metrology are being implemented in other countries, and as example the initiative of the American Society for Quality [8] in the USA can be mentioned. In the near future, these programs properly harmonized could provide the basis for mutual confidence of certified personal in the metrology systems of both countries.

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