

Some aspects of quality and risk management in natural gas measurement

P E Ilea¹, D Săvescu² and A Stoica³

¹Product Design, Mechatronics and Environment Department, Transilvania University of Braov, Braşov, Romania

²Product Design, Mechatronics and Environment Department, Transilvania University of Braov, Braşov, Romania

³Engineering Department, Lucian Blaga University of Sibiu, Sibiu, Romania

E-mail: paul.ilea@unitbv.ro

Abstract. The paper refers to some general aspects regarding the natural gas measurement. In this paper, we try to find methods for checking the quality and risks for gas meters. It is trying to find answers to the question of how we could design and operate a gas meter so that the measurement is as accurate as possible. A process has been proposed to identify, analyze and control the emerging risks. The desirable quality of the measuring instrument requires a rigorous analysis of all aspects that could adversely affect. It also shows the interdependence between quality and risk, one can not exist without the other. Based on these principles, the following papers propose the approach of case studies on the innovation of a new type of natural gas meter, focusing on the quality of the new product and its ability to accurately measure and prevent unauthorized consumption.

Keyword: *risk management, natural gas*

1. Introduction

In this paper, we try to find methods for checking the quality and risks for gas meters. It is trying to find answers to the question of how we could design and operate a gas meter so that the measurement is as accurate as possible.

Measurement technique is part of the science of applied metrology and has as its object the theoretical and practical aspects of measuring a certain size or a certain range of sizes or those of a particular field of activity. The essence of measurement technique is to create and develop measurement methods and tools that can take, process and transmit quantitative information as close to the truth as possible.

The science of measurement is based on the fact that the process of knowing the surrounding world is based on the experiment, that is the qualitative or quantitative evaluation.

In the modern economy, measurement is a matter of great responsibility and importance, present in all activities. For example, scientific research is inconceivable without the use of precise measuring tools, and the design and development of new products requires them to be tested in exploitation conditions with measured performance. [1]

Annual gas consumption increased in 2016 compared to 2015, reaching about 11.7 billion cubic meters, with an increase of about 2%, amid a slight increase in end-user consumption that the number recorded in 2016 compared to 2015, also an increase of about 116,000 customers.

In 2016, the total natural gas consumption at the Romanian market was 124.12 TWh. Out of this consumption, the final customers consumption amounted to 111.7 TWh, of which 80 TWh represented the consumption of non-household customers (71.65%), and 31.7 TWh represented the consumption of household customers (28.35%).

The total number of clients registered at the end of 2016 was 3596574, of which 188,253 non-household customers (5,23%) and 340,8321 household customers (94,77%). [2]

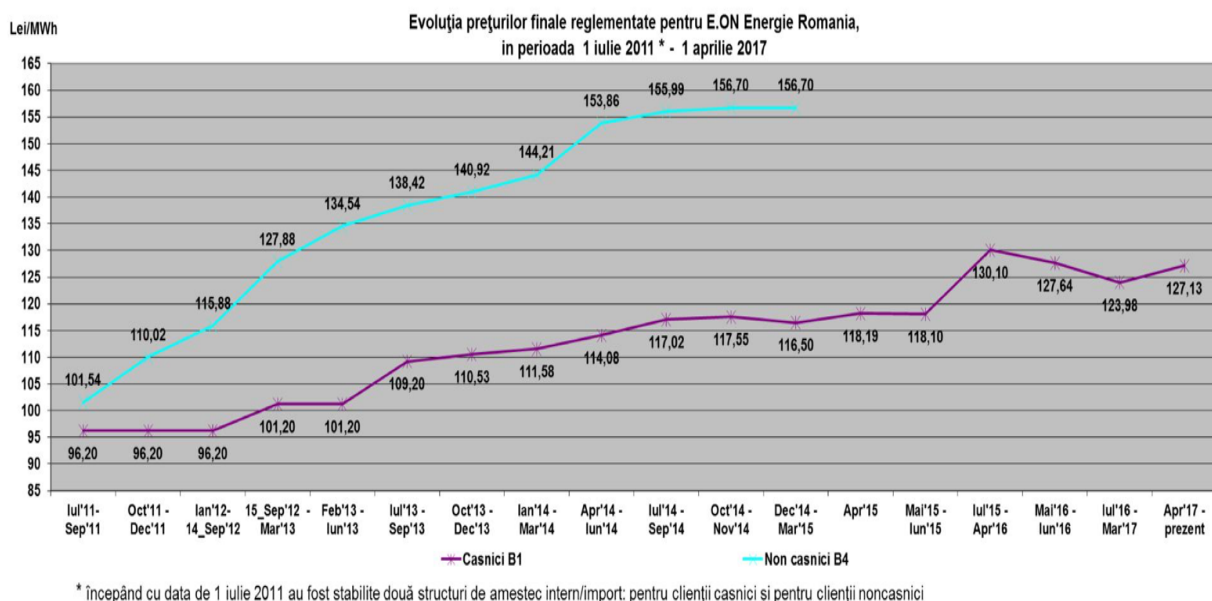


Figure 1. Natural gas price evolution, 2011-2017.

[Source: ANRE, 2019].

Given the increase in gas consumption, the increase in the number of consumers, but also the increase in prices, consumers are tempted to intervene on measuring devices.

The desired quality of the metering device requires a risk analysis to identify existing or potential problems.

Risk management aims to manage threats that could have a negative impact on the company, so it is proposed to create a measuring device that highlights real consumption, and to alert the supplier quickly about the existence of interventions on measuring devices. [3]

2. Risk and quality management

2.1. Quality management

The concept of quality can be defined as the degree to which a product, through the totality of technical, economic, aesthetic and exploitation characteristics, satisfies the needs for which it was conceived.

Quality management is a set of activities aimed at achieving objectives, through the optimal use of resources.

A good quality management system must have the following features:

- To be established in writing;
- Ensure that the customers's requirements are met;
- Ensure that the organization's requirements are met;
- To be applicable to all activities of the organization.

Advantages of implementing a quality management system:

- Increase revenue and reduce costs;
- Credibility;
- Improving the company's image;
- Differentiation from competition;
- Control all processes in the company;
- Customer Satisfaction.

The basic principles of Crosby's quality management are:

- Ensuring compliance with requirements, quality means meeting consumer demands, but these requirements must be clearly defined and measurable;
- Quality assurance through prevention, quality must not be controlled, it must be done;
- Promoting the concept of "0 defects", Crosby believes that we can not operate with acceptable levels of quality;
- The quality measure is represented by the costs of the non-satisfaction of the requirements, in his opinion, the quality does not cost, the non-quality is the one that costs.

Crosby's approach is that the basic principle of quality is that of defect prevention described in the following programs:

- **To do everything right the first time and every time** - is based on the work done well for the first time, and there is no room for other levels or quality categories;
- **Zero defects and day zero defects** - the main objective of the quality improvement process is to obtain products / services without defects. 0 defects do not mean that the products are perfect, it means that every person has to perform his / her duties at the first moment and every time, and the failure to fulfill the attributions is unacceptable for their activity, and each activity is done according to the given specifications.

The quality improvement process begins with the four quality truths: quality is compliance with the requirements; the quality system means prevention; the performance standard achieved at organization level is zero defects; quality measure is the price of nonconformity.

Rinne believes that quality management has the following basic functions:

- Planning;
- Checking;
- Keeping under control. [4]

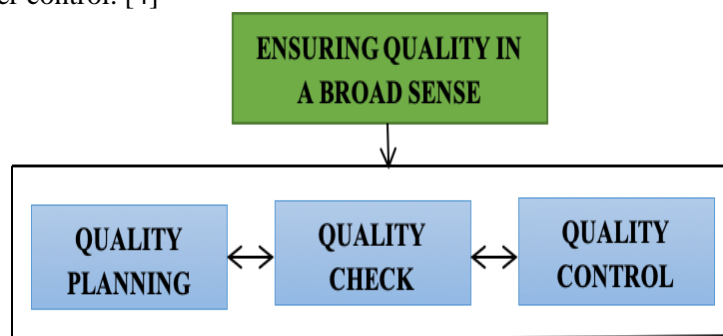


Figure 2. Functions of quality assurance in a broad sense
[Source: Olaru (1999), Quality management]

Total quality is a set of principles and methods organized in a global strategy to mobilize the entire company to achieve better customer satisfaction at a lower cost.

Total quality management can be highlighted as a new philosophy, a new culture model of the company, which orientates the client to all its activities and processes and optimizes them, so as to bring long-term benefits or can also be highlighted through the aspects technical and social, considering that motivation and training of staff is more important than technical aspects.

The principles of quality management are fundamental rules for the management and operation of an organization, which aims to improve continuously, focusing on customer satisfaction, but also on the needs of shareholders and employees:

- **Customer Orientation** - the success of any organization depends on the customer, therefore, all needs of customers, whether current or future, must be understood, satisfied. The organization must come with products beyond the customers expectations;
- **Ledearship** - an organization is successful when the organization manages to mobilize staff to achieve the set goals. Employees will understand what the company's goals are and will be motivated to achieve these goals, the activities will be evaluated, coordinated and implemented in a unitary manner. Lack of communication between different hierarchical levels will be less.
- **Staff commitment** - success is mainly due to the staff of the organization. It is very important the total involvement of the staff regardless of the hierarchical position or the kind of work performed, in order to achieve the best performance and the continuous development of the organization. By applying this principle, employees are motivated and involved in the work of the organization, are rewarded according to their participation in the organization's success, and their creativity is freely expressed and can be used for the benefit of the company;
- **Process-based approach** - any activity that uses resources to convert inputs into outputs can be considered a process. For a good functioning, the organization has to conduct its activities and resources as processes, identify and manage processes and relationships between them. Managing and developing activities establishes a process leader. By this method the results are improved and predictable, the costs are reduced but also the efficiency of resource use increases;
- **Improving** - it must be a permanent goal of every organization. Improvement is done through employee training on how performance performance can be improved by regularly evaluating established criteria to see where they can be improved by transforming continuous improvement of products / services into a target for each employee;
- **Decision-making based on evidence** - all decisions taken by an organization must always be based on data analysis that can be demonstrated as true. By applying this principle, it is possible to re-analyze and change decisions and opinions, to make realistic substantiated decisions;
- **Management relationship** - this principle is based on the importance of the resources acquired from the suppliers, they must rise to the quality level expected by the organization. A mutually beneficial relationship develops both for suppliers that ensure a high level of quality and for the organization. This type of win-win relationship between the organization and vendors enhances the ability of both entities to create value.

In the concept of total quality, the client is sovereign, and the object of total quality is to exceed the expectations of the clients.

The overall quality management concepts are excellence, exceeding customer expectations and zero defects.

Reaching objectives is done by motivating and training employees, setting measurable indicators and using old and new methods and tools. Another very important aspect is the involvement of top managers, employees, and suppliers.

Total Quality Management translates into practice a new method of organizing quality activities, which integrates inspiration, statistical control, quality assurance and quality management. [5]

2.2. Risk management

Risk management refers to translating a business aspect into all possible scenarios, so risk management becomes a process of identifying, analyzing and responding to the potential risks of a firm.

Risk management involves 5 stages of work:

- Risk planning;
- Risk identification;
- Risk analysis (qualitative / quantitative);
- Establishment of strategies for risk approach;
- Risk monitoring and control.

First of all, risk management involves risk planning. Individuals who respond to each risk are established, regardless of hierarchical levels and risk categories. Errors are not accepted in risk planning because these errors can lead to disastrous consequences.

The next step in risk management involves identifying all risk sources that could affect your business in any way.

Identifying sources of risk can be done through a Brainstorming session, through which multi-category specialists need to discover all the vulnerabilities of the project. The end of the meeting is reflected in a list of possible issues that may arise along the way. The main purpose of this risk identification process is to avoid situations where the manager can get when he is surprised by an unwanted event. In practice it is quite difficult, almost impossible to determine absolutely all sources of risk. Urmatorul pas il reprezinta analiza riscului, care este un proces de examinare a riscului atat calitativ cat si cantitativ. There are aspects such as: if an unwanted event occurs, which repercussions it has on the firm. Depending on the probability and magnitude of the risk, the manager may or may not take into account this risk.

The next step in the risk management process is to develop strategies for addressing risks identified and analyzed previously.

The risk of accident can be transferred to an insurance company.

The main purpose of this risk analysis is to shelter the company from unpleasant events.

The last step is monitoring and control. This stage include the last phase of the management process, here operations are carried out which can again reach the first stage, the risk planning.

In practice, it is quite difficult to identify all the risks, so the main goal of the risk monitoring and control phase is to announce the emergence of new risk situations, preventing the surprise managers with unpleasant events.

The identification process aims at discovering all possible sources of risk in order to reduce or eliminate the effects they can produce.

Risk identification is achieved through:

- Questionnaires;
- Brainstorming;
- Journals;
- Behavioral Patterns;
- Charts;
- Flow charts;
- Periodic meetings with the staff involved.

The main advantage of a risk management program is economic efficiency: managers are aware of the risks to which the organization is exposed and administer properly so that they do not materialize.

The role of risk management in an organization is to help understand the risks to which an organization is exposed so it can be managed. [6]

2.3. Risk-quality correlation

The quality-risk correlation represents the mutual relationship that is manifested between quality and risk, two fundamental notions in the production processes that can not exist without one another.

The quality-risk correlation is the measure of the relationship between the two quality and risk concepts.



Figure 3. Risk-quality correlation

[Source: Unitbv.ro]

The role of the two quality and risk management systems is to create the necessary conditions for the activity to unfold the first time, becoming at the same time:

- A way of continuing training of staff;
- A way of highlighting quality costs;
- A way of analyzing the activities;
- A way of correcting and adjusting activities;
- A way of measuring global risk;
- A modern and performing leading style.

Quality and risk theory applies to both products and services, with the idea being that it is easier to sell products than services, and an unsuccessful service from the start leads to 90% of the cases to the final loss of the customer.

For any organization, quality and risk integration should become key priorities.

Industrial excellence is the achievement of superior quality products/services offered in a shorter time and at a lower price.

The policy that governs industrial excellence is overtaking the expectations of its own employees, competitors and customers.

Industrial excellence is trying to achieve at the same time three aspects:

- maximum quality;
- minimum time;
- maximum results.

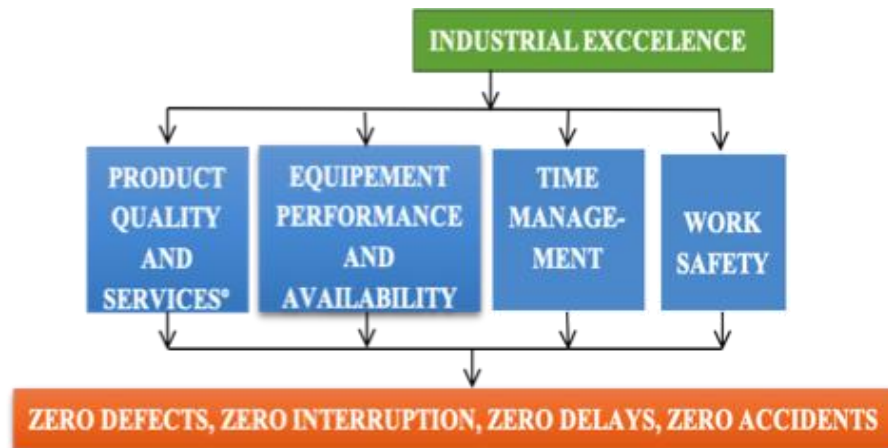


Figure 4. Industrial excellence
[Source: Unitbv.ro]

3. Methods of quality verification

A very important activity in quality assurance is quality analysis. Quality analysis activity is done by analyzing current non-conforming states in order to identify ways of intervening on the problem.

There are many ways to check quality, but are generally used: brainstorming, the cause-effect diagram, quality circle method, matrix methods, multivoting methods, the structured problem-solving cycle, the Pareto diagram method. [7]

The product is the one that ensures functionality, solves the problem and generates revenue. Product quality is the most important element because it depends on the quality of the whole project.

Part of product quality assurance refers to the compliance of standard procedures for doing it, but they do not have to be in the form of rigid rules followed with holiness on the grounds that they would be more important than the quality of the product.

Man is subjected to mistakes, and it is therefore necessary to introduce protection procedures to verify the product as it is being mastered, and the management process as it is enforced.

This measure is necessary to ensure that the product is executed correctly each time and with 0 defects. There is a big difference between production and project activity in terms of quality assurance and control. Millions of products are manufactured in production, and quality assurance can be done on samples using statistical control techniques that determine if production deviates from the original specification.

In the case of a project, we can not do a destructive test because we only produce one product. If I mistaken him once, I mistaken him irretrievably, and wrong once means wrong every time. That's why it's important to make the right product from the beginning.

There are three simple steps to verify the quality:

- Let's check what we're doing;
- Compare what we accomplished with what was planned;
- Take action to recover any delays.

3.1. Pareto analysis

Pareto's analysis is based on the assumption that 80% of all quality events are the result of only 20% of all cases and that 20% of events are the result of 80% of the causes.

This analysis teaches us to discover those few and vital issues instead of identifying and solving the vast majority of the causes that do not result in only a small part of our problems.

As we eliminate vital causes one at a time, we can focus on the next vital cause, but that has a much diminished effect. By this method you can quickly obtain high efficiency cost efficiencies.

3.2. Six Sigma

Six Sigma is a management methodology that aims to increase quality by determining and removing the causes of defects so as to ensure customer satisfaction.

Six Sigma is a management methodology based on 5 simple steps: define, measure, analyse, improve and control.



Figure 5. Six Sigma
[Source: ttonline.ro]

This management methodology uses two statistical tools to improve quality: FMEA - Failure Mode and Effects and QFD - Quality Function Defiction, together with modern management methods. [8]

4. Conclusions

Based on the above, we can see that risk and quality management is a very important process in the manufacture of a product and that it is absolutely necessary to implement it within the company if we want to be successful.

We can see the interdependence between quality and risk, one can not exist without the other.

In the following papers, some case studies will be dealt with on the innovation of a new type of natural gas meter, focusing on the quality of the new product and on its ability to accurately measure and prevent unauthorized consumption.

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