

## Costs of quality or quality costs

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### ABSTRACT

Costs of quality or quality costs do not mean the use of expensive or very highly quality materials to manufacture a product. The term refers to the costs that are incurred to prevent, detect and remove defects from products. There are four categories: internal failure costs (costs associated with defects found before the customer receives the product or service), external failure costs (costs associated with defects found after the customer receives the product or service), appraisal costs (costs incurred to determine the degree of conformance to quality requirements) and prevention costs (costs incurred to keep failure and appraisal costs to a minimum). Cost of quality is a methodology that allows an organization to determine the extent to which its resources are used for activities that prevent poor quality, that appraise the quality of the organization's products or services, and that result from internal and external failures. Having such information allows an organization to determine the potential savings to be gained by implementing process improvements.

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## 1. Introduction

The requirements of a competitive market enforce the necessity to look for the ways of satisfying the customer's needs. The Quality Management System (QMS) is an important tool which secures satisfaction of the customer's expectations. A QMS, built on the basis of dynamic norm ISO 9001 is a popular and effective method for the achievement of production growth and economic efficiency increase as well as greater trust on the part of the customers who expect a stable level of product or service quality from the supplier. This system is a significant instrument for implementation of a quality strategy. The essence of a QMS is constant improvement because the process of changes is a never-ending one. Aspiration for continuous improvement is a requirement of strategic, economic, technological, organisational, legal, informative, social and marketing character.

A QMS means documentation of a company's reliability on the market in the sphere of providing a customer with safe and satisfactory goods; it is meant to improve the economic results of the company; it creates trust of the company towards itself and of the customers to the company.

Introduction of a QMS presents a chance to create a lastingly system of process improvement, it makes it possible to recognise the weak points of organisation it is an important tool for the growth of productivity. The system of quality control is a meaningful subsystem of management besides the management of production, finances, marketing, human resources and environment. A functioning QMS enforces orientation to the customer, costs, creativity, communication and culture.

A QMS enables an increase of the efficiency of management, planning, problem solving, communication with the client, it raises the ability and flexibility in introducing changes, it lowers staff fluctuation, it leads to cost reduction, it increases inner culture in the company, creating a favourable image of the company on the market. A certified QMS most often means more orders, a broader market, development of the company and existence on the competitive market.

## 2. Quality costs in an enterprise

Market orientation requires consistent monitoring of the costs, which follows from a greater role of the economic calculation and stronger competition. From the point of view of a stable quality level is a company; an exceptionally important problem is to introduce the methods of quality analysis in those areas where it is only possible. Quality costs are an instrument which

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creates a plane for understanding between all the levels of management in the company.

Information concerning quality costs should influence the imagination and decisions of the managers and workers.

A high importance of quality costs was emphasised in 1981 by British Standard Institutions, which awarded the quality costs the status of norms BS 6143 - Guide to the Determination and Use of Quality Related Cost, which was the base for the construction of a System of Quality Costs (SQC).

This standard provides guidance on the modelling and determination of costs associated within any business process in a manner consistent with the pursuit of continuous improvement and the concept of total quality management.

The process cost model sets out a method for applying quality costing to any process or service. It recognizes the importance of process measurement and process ownership. The categories of quality costs have been rationalized to the cost of conformance and the cost of non-conformance. This serves to simplify classification. The method depends on the use of process modelling and this standard gives guidelines on useful techniques.

A systematic classification of quality costs was worked out by the Committee of Quality Costs by the American Society for Quality Costs, which distinguished four categories of costs:

### 2.1. Prevention costs

Prevention costs are incurred to prevent or avoid quality problems. These costs are associated with the design, implementation, and maintenance of the quality management system. They are planned and incurred before actual operation, and they could include:

- product or service requirements—establishment of specifications for incoming materials, processes, finished products, and services,
- quality planning—creation of plans for quality, reliability, operations, production, and inspection,
- quality assurance—creation and maintenance of the quality system,
- training—development, preparation, and maintenance of programs.

### 2.2. Appraisal costs

Appraisal costs are associated with measuring and monitoring activities related to quality. These costs are associated with the suppliers' and customers' evaluation of purchased materials, processes, products, and services to ensure that they conform to specifications. They could include:

- verification—checking of incoming material, process setup, and products against agreed specifications,
- quality audits—confirmation that the quality system is functioning correctly,

- supplier rating—assessment and approval of suppliers of products and services.

### 2.3. Internal failure costs

Internal failure costs are incurred to remedy defects discovered before the product or service is delivered to the customer. These costs occur when the results of work fail to reach design quality standards and are detected before they are transferred to the customer. They could include:

- waste—performance of unnecessary work or holding of stock as a result of errors, poor organization, or communication,
- scrap—defective product or material that cannot be repaired, used, or sold,
- rework or rectification—correction of defective material or errors,
- failure analysis—activity required to establish the causes of internal product or service failure.

### 2.4. External failure costs

External failure costs are incurred to remedy defects discovered by customers. These costs occur when products or services that fail to reach design quality standards are not detected until after transfer to the customer. They could include:

- repairs and servicing—of both returned products and those in the field,
- warranty claims—failed products that are replaced or services that are re-performed under a guarantee,
- complaints—all work and costs associated with handling and servicing customers' complaints,
- returns—handling and investigation of rejected or recalled products, including transport costs.

Quality costs perform the following functions in an enterprise:

- they have a significant importance for the quality policy and for particular problems associated with quality,
- they constitute an important instrument of management,
- they affect profit formation,
- they reflect the goal of a quality control system,
- they provide information concerning the degree of realisation of a quality control system in an enterprise,
- they constitute a significant instrument for the improvement of quality and management effectiveness,
- introducing them into the frameworks of a company's strategies constitutes the basis for increased effectiveness and efficiency,
- they are an important tool to assess quality activities and to determine the optimum level of quality of a given commodity or service,

- they point at the weak points in processes and goods in accordance with cost priorities.

### 3. A calculation and analysis of quality costs

A calculation and analysis of quality costs is an important instrument for the assessment of the effectiveness of a QMS in an enterprise. Quality competition is of any sense only when it is possible to determine quality costs, if only approximately. It was already Galileo, who said: "You can state that you know something on a definite subject if what you are speaking about can be measured or expressed in numbers; if you are not able to measure it or express it by means of numbers you must state that your knowledge of the problem is of poor quality and unsatisfactory."

The purpose of cost calculation is to determine the tasks which should result in a reduction of production costs with the same or increased level of quality. This calculation should be performed with the involvement of experts on quality and accountancy, where far-reaching understanding and co-operation should be shown.

A lot of companies lack the consciousness of the amount of quality costs in the whole organisation and in the sections of individual products. Quality costs are a difficult element to determine because it is a conventional notion. Full estimation of real quality costs is hard to perform.

Quality costs are supposed to point at the undertakings which aim at improving the quality and it's planning, they provide data for quality reports meant for the managers. The system of cost documentation should be subordinated to the aims of quality management. The purpose of quality costs documentation is to:

- identify the situation in the sphere of costs,
- provide actual, complete and reliable information about the costs,
- keep up and stimulate progress in the sphere of a program for quality improvement,
- bring advantages from the realisation of a program for quality improvement.

To speak about quality one must use the language of management, since quality is one of the important parameters of management. Costs are an economic parameter of quality, and cost analysis can be a means to search for the ways to improve financial indexes; it makes it easier to make decisions about the ways and methods of lowering their level.

Calculating the quality costs is pointless if they are not treated as an instrument of measuring the effectiveness of activity and development. Crosby emphasises that understanding that quality costs are not much to do with the functioning of a quality department, is basic in changing the way of thinking about quality costs (Crosby, 1979).

The principles of calculation and analysis of costs in a company will become a reality when the

attention of the managing staff is focused on identification and measurement of costs, which enables to control the course of the process of quality improvement in a company.

A calculation of quality costs constitutes a part of the system of managing the company, i.e. the management in the field of quality based on the establishment of quality costs; the latter's analysis, determination of their source and planning their liquidation. This calculation is an attempt to view in proper sections all the costs associated with production quality, to conduct an analysis of those costs and to undertake activities for the improvement of quality and minimisation of production costs. Introduction of a cost calculation can be successful only when it is actively supported by the managing staff. Quality costs must provide information which is of principal importance for the quality policy and for particular problems related to quality. Managers of a company should make use of this information for the assessment of their own decisions because it is only then that work outlays on registration of quality costs can be justified. Introduction of a calculation of quality costs contributes to greater costs of preventing defectiveness and of assessment. It also causes reduction of losses on rejections and it lowers the number of the latter. A decrease of quality costs and production costs following the introduction of a calculation of quality costs results in increased levels of quality, greater production and its worth, and higher profits.

The proportion of quality costs in a number of enterprises constitutes from 5 to 25% of the yearly turnover. Crosby (1979) distinguished adjustment costs which are borne for adjusting the product to the requirements and which constitute 3 - 5% of the value of production. On the other hand, costs of the products lack of adjustment to the requirements are related to rejections and they constitute about 20% of the sales in production companies and 35% of operational costs in services. Dispersion of costs in a company is followed by:

- lack of information about their real amount,
- no possibility of a comparison,
- no basis and possibilities of making decisions.

Separation from total costs those items which are related to the assurance of a quality level required by the customers constitutes the base for the formation of principles of keeping a calculation of quality costs. A calculation of quality costs makes it possible to:

- work out the policy of lowering the production costs with the same or increased quality level of products,
- to increase self-control of the system of quality assurance,
- to modernise realisation of a quality improvement program,

- to control realisation of aims and tasks in the sphere of quality costs.

A calculation of quality costs constitutes a sub-system of an analysis of quality costs, activities for the improvement of quality and optimisation of the costs of improper quality. Information about the quality costs, in accordance with the norms ISO 9000 series should be regularly passes on to the managers, and the costs of quality should be submitted to constant supervision of the managers with the aim of (Dale and Plunkett, 1999):

- assessing the adequacy and effectiveness of the quality control system,
- determining additional areas which require attention,
- establishing the aims related to quality and costs.

A very important problem in the calculation of quality costs is to determine the places where those costs appear in such a way that they should not be recorded according to the places where they are found but according to the places where they come into being. The number of places of documentation of quality costs is related to the size of an enterprise, its organisational structure, the degree of relation with the suppliers and customers, the latter 's requirements as well as demands which result from the introduced system of managing and assuring the quality.

The effectiveness of a QMS in an enterprise depends first of all on whether quality costs are introduced into the frameworks of the company's strategies and whether they will be supported by proper resources (Rehacek, 2017).

The possibility and necessity of introducing a calculation of quality costs is confirmed by practice and the effects achieved this way include:

- a multi-fold increase of reliability and a decrease of defectiveness,
- a significant decrease of post-production sphere costs,
- frequent reduction of employment,
- a possibility to reduce the costs in a non-investment way through technological and organisational undertakings,
- possibilities to make decisions on the basis of cost documentation but this requires systematic perfection of all the areas of the company, including the services of quality, quality control or quality assurance,
- achievement of visible effects in the company is possible only with a far-reaching integration of the activities of technical and economic sectors.

A calculation of quality costs brings about improvements in the sphere of management, organisation of work or technologies but also in affecting the workers' mentality in the area of quality understood in a complex way.

The analysis of quality costs and the reflection of its results in organisational undertakings which aim at quality improvement must be constantly advanced.

Besides, an important aim of documentation and analysis of quality costs in a company is:

- cost controlling, i.e. planning, regulating and controlling the level of quality costs in order to optimise the activities which assure quality in the process of the formation of products - finding the basis to carry out comparisons in order to see how one company's quality costs are comparable with another company's from the same branch,
- creation of an information base for the calculation and planning of quality costs.

More important tasks of the system of costs include the following:

- help in establishing the quality policy,
- possibility of better monitoring of the quality of products from the point of view of the formation of quality costs beginning with research work and ending with the use of a product by the customer,
- pointing at the weak quality points in the product and in the process according to cost priorities,
- determining undertakings which are aimed at lowering the costs and at improving the quality,
- possibility of planning quality taking into consideration the costs,
- possibility of better recognition of the economic importance of quality requirements,
- providing the data to quality reports meant for the managers,
- optimum planning of quality control in respect of the costs,
- finding the quality costs which were overestimated and which occur as a result of improper quality criteria which are not demanded by the market.

A system of quality costs will fulfil its tasks if:

- cost registration is organised and realised in accordance with economic principles,
- quality costs calculated by the company's accountancy are up-to-date and clear,
- causes of the appearance of quality costs are given for their analysis,
- reports about quality costs present the growth of costs in time, which makes it possible to follow the effectiveness of undertakings supposed to assure quality.

The subject of a calculation of quality costs is:

- registration of fragmentary quality costs,
- interpretation of the achieved information and making comparisons in time,
- providing the information to all those interested,

- establishment of the degree of realisation of the goal of a quality assurance system,
- preparation of suggestions for possible verification of the assumed program of quality improvement for the managing board.

The quality costs analyses are one of the most important elements of the system of quality control. This is not only a test but also a verifier of the efficiency of the system as a whole and the correctness of the company's management.

An improper structure of quality costs makes it possible to minimise the total quality costs. One of the features of such a structure is a high proportion of bad quality costs borne because of outer and inner defectiveness and a low proportion of prevention costs.

It is estimated that those enterprises which introduced the analysis and calculation of quality costs in a full scope and achieved a drop by 50% were forced to double their expenditures on prevention.

Introduction of the analysis of quality costs and including it into the system of management has the aim of:

- creating possibilities of raising the effectiveness of a system of quality control and increasing the customers' trust,
- measuring the costs and publishing the results, which are continuous information processes and which are constituted the basis for undertaking proper activities by the managers.

Preparing the analysis of quality costs one should consider not only the producer's costs but the customer's costs as well and take into account the logic of thinking of our customer.

The purpose of the quality costs analysis is to determine the following:

- position of costs which can be reduced or liquidated,
- kind of undertakings which should serve realisation of the tasks,
- interests of the producer and the consumer,
- effect of increased expenditures on prevention on the formation of the losses caused by rejections,
- formation of the level of costs in the structure of particular groups and positions of costs,
- effect of quality costs on the financial result.

The analysis of costs should be conducted together with the analysis of advantages and risk. Then, it enables to determine the anticipated economic effects.

From practical experiences of the companies which introduce the calculation of quality costs and make their analysis it follows that the following effects can be achieved:

- reduction of total costs,

- increased profits,
- greater trust of the clients,
- providing the managers with significant numerical data for decision making,
- undertaking rationalisation and prevention, showing to the managers of all levels and the workers the financial effects of their activities,
- reliable estimation of the effectiveness of the quality control system from the point of view of their economic effects,
- forming the basis for the programs of costs reduction and constant improvement.

#### 4. Conclusion

The effectiveness of a QMS is to a great degree related to whether quality costs are introduced into the frameworks of the company's strategies and supported by proper resources. While assessing the quality one should remember that it should consider economic, social and consumer aspects. The economic aspect is related to the costs borne for quality, effects of a lack of quality and the achieved effects.

This assessment concerns the effectiveness and efficiency of a QMS. In this area one can measure the costs in the sphere of designing and assessment as well as to measure the inner and outer shortages. The measurement and analysis of those costs and determination of their tendencies should provide the managing board with the data about decisions of strategic character.

An estimation of the effectiveness of quality control is performed from the point of view of realisation of goals contained in the quality policy as well as by means of a quality costs analysis. The latter should provide the ways of estimating the effectiveness and create the basis for the inner programs of quality improvement. Presentation of the elements of costs meant for realisation of quality goals makes it possible to guarantee the means necessary for those goals. Increased profitability is an important goal of the calculation of quality costs in a company.

The decisions included in the norms ISO 9000 series state that the main aim of recording the costs related to quality is to enable the assessment of the effectiveness of a QMS and formation of a base for inner programs of quality improvement. The analysis concerning the costs and the advantages has crucial importance both for the enterprise and the customer.

The economic estimation of quality has to be linked with an estimation provided by the customer, because it is him who determines the company's development or only vegetation. A customer who is satisfied will say about it to a few people, a dissatisfied one will inform some more, and about 90% of the dissatisfied customers will never come back to the firm. Therefore, the customer's assessment of quality should constitute the fundamental measurement and indicator of the

firm's correct proceedings. At the same time it should be treated as a chance for the company's success.

Proper quality which satisfies the customer's expectations plays an extremely important role which should be viewed in a social aspect. Higher quality means economising on raw materials, fuels, energy; it means lower social costs viewed in a drawn account, it means a chance for development of the society, greater prestige on the international scene, and it means a hope for partnership within the Union of Europe.

The problem of quality costs becomes especially important in the context of QMS, which enables increase of effectiveness, flexibility, and which raises competitiveness of the organisation. QMS makes it

possible for the employees to undertake attempts to eliminate wastefulness through concentrating on reduction of quality costs. QMS is an attempt to determine the total costs of quality, which is a sum of the costs of consistence, lack of consistence and the costs of lost chances.

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