

EVALUATION OF THE EFFECTIVENESS OF THE QUALITY MANAGEMENT SYSTEM OF THE SERVICE ENTERPRISE

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Abstract

The possibilities of development of a model of evaluation of effectiveness of QMS adjusted to the needs of Lithuanian service enterprises are analyzed in this article. In order to achieve the goal the following research methods were used: questionnaire survey of enterprises, structured interview, document analysis, evaluation of the efficacy of processes, expenses for quality, quality culture and enterprise activity compliance with quality standards; for this purpose statistical methods of multidimensional, multi-factorial and correlation regression analysis were used. Research showed that implemented quality standards confirm only high level of the system itself but do not guarantee its efficiency and success. Every effort should be made to ensure practical, but not formal function of the management system. Then it will bring tangible benefit and the results of efficiency measurement will give additional material for strategic planning of an organization. The model of the evaluation of the effectiveness of the implemented quality management system based on the analysis of theoretical data and empirical research was developed and adjusted for the specific needs of service enterprises. Model comprises evaluation subsystems of quality expenses, processes, and quality culture and auditing results. Models also reflects ISO 9004:2010 requirements for the sustained success of the organization that will come into force in mid-2010 and that are not defined in the ISO 9001 standard (e.g., management of financial flows, development of the staff expertise, risk management, assessment of the work environment, process matching, etc.). Since the significance of the individual evaluation criteria used for the assessment of QMS effectiveness differs, weighted coefficient should be used. The proposed model could simplify identification of priority areas for the quality improvement, could help develop the most effective instruments and methods to increase the added value.

Keywords: quality management system, ISO 9001, ISO 9004: 2010, effectiveness, model.

Introduction

Since only activities that could be measured and evaluated are manageable, evaluation of the activities of enterprise is an integral part of management function. As financial results alone are not sufficient to reflect the real situation of the enterprise, it is necessary to evaluate factors influencing long-term success of the business, such as meeting needs and expectations of the customer, constant improvement, etc. Many researches performed up to the present moment proved that enterprises that implemented ISO 9001 Quality Management System gain certain competitive advantage. However, there are only a few researches that precisely evaluate effectiveness of the quality management system and can ensure continuous improvement of the practice of the enterprise.

At the time many enterprises service use quality management systems. According to the Lithuanian Standards Board, at December 1, 2009 ten such enterprises in Lithuania possessed ISO 9001:2000 quality management system certificates. Analysis of activity of these enterprises showed that these are leaders in the business branch. However, benefits of the preparative and certification process of the ISO 9001 are different in various enterprises. Theoretically, up to 20 percent of the enterprise expenditures are used for the development and maintenance of quality management system (Ruževičius *et al.*, 2004). However, no one has estimated the precise benefit gained due to the use of QMS and effectiveness of this management system (Gitlow *et al.*, 2005; Kaziliūnas, 2006).

The goal of this research is to develop the model of the evaluation of effectiveness of quality management system (QMS) adjusted to the needs of the Lithuanian services (including cleaning services) based on scientific literature data and results of empirical research of enterprises performed by authors. The following *research methods* were used: questionnaire survey of enterprises, structured interview, document analysis, evaluation of the efficacy of processes, expenses for quality, quality culture and enterprise activity compliance with quality standards; for this purpose statistical methods of multidimensional, multi-factorial and correlation regression analysis were used.

Development of a quality management system (QMS)

The analysis of different opinions about the evaluation of QMS of enterprise indicates that every theory can assess the effectiveness of the evaluation of QMS only in part. Thus, the conclusion can be made

that it is essential to develop an integrated system of evaluation of QMS of enterprise. The evaluation of performance of enterprise can also be understood as a constituent part of management which helps to make managerial decisions. Enterprises that carry out integrated evaluation of performance work more effectively than those that do not evaluate their performance. Performance evaluation helps to implement the strategy, to follow the development of an enterprise, to integrate short-term and long-term goals and opportunities of an enterprise and evaluate an organization as a single entity (Ruževičius *et al.*, 2004; Gitlow *et al.*, 2005; Kaziliūnas, 2006).

Evaluation can be *standardized*: that is evaluation when the results of the evaluation are compared to the results of other enterprises of the same group. Such evaluation, when the results of several enterprises are compared, allows putting the enterprises in order, to group according to the results achieved, to determine whether their achievements comply with the determined standards. Such evaluation is usually performed using the method of testing. Evaluation based on standards is intrinsic part of traditional evaluation.

Since after doing the exploratory research it came to light that it is impossible to research several enterprises of the same branch of business, the *criteria based evaluation* was chosen. Before beginning the evaluation, the criteria of evaluation (i.e. the compliance of the process criteria with the results expected) were formulated; later, when performing the evaluation, the results of process criteria are compared with the criteria defined beforehand. The quality management system of an enterprise can be evaluated well if the results of the criteria correspond to the requirements provided. Criteria based evaluation gives more information on the effectiveness of the QMS, it helps to highlight the flaws and managerial problems. It also allows applying *the principle of idiographic evaluation*, i.e. to comparing the enterprise to itself when performing criteria based evaluation, recording progress made in a certain time, rejecting evaluation by points and providing comprehensive descriptive feedback information on the progress made.

The evaluation of the effectiveness of the quality management system is carried out in four stages:

I. Performance evaluation in operative level (1. To evaluate the processes – to define the efficiency of the process criteria; 2. To evaluate the expenses for quality; 3. To evaluate the effectiveness of processes).

II. Quality based evaluation of an organization (1. Quality culture; 2. Compliance with the requirements of ISO 9001 standard).

III. The principles of managing for sustainable success (1. Management of financial flows; 2. Development of the staff expertise; 3. Risk management; 4. Evaluation of work environment).

IV. Generalized index: the effectiveness of QMS.

Evaluation of the efficiency of processes

The evaluation of processes does not require large costs or reductions of quality. It is important to have sufficient knowledge and experience, as well as technical potential when implementing changes in an organization, to profit from experiences and good practice of successful enterprises. The improvement of performance does not have to be limited to implementation of means of improvement of processes and application of methods; it is important to observe the influence of changes on the effectiveness of processes and take appropriate actions of adjustment if necessary (Gitlow *et al.*, 2005).

The values of efficiency of processes can be expressed by relative indexes that define the ratio of real and previously planned performance indicators. Relative efficiency can be expressed by this simple formula:

$$R_{Sant} = \frac{V_{Fakt}}{V_{Plan}} \quad (1)$$

here: R_{Sant} – Relative Efficiency; V_{Plan} – Planned Value; V_{Fakt} – Real Value, which is measured in the end of a process.

It is a rather simple way of evaluation. It does not require evaluating the resources used. Before beginning to evaluate process criteria it is analyzed which indicators will be evaluated. These indicators are presented in the descriptions of processes. Based on the data provided by the managerial evaluative analysis of the enterprise researched a form of evaluation of the efficiency of process criteria is created (Table 1).

Table 1. Evaluation of the efficiency of the process criteria

Process	Criterion	Evaluation indicator	Real value	Planned value	Relative efficiency	The result expected

After calculating the relative efficiency we grade the results and arrange them in descending order.

When carrying out the quantitative analysis of data received (relative efficiency) the average value of relative efficiency is calculated by adding all values of quantitative variable and dividing the sum from the number of values:

$$\bar{R}_{Sant} = \frac{1}{n} \sum_{i=1}^n R_{Sant(i)} = 0,927 \quad (2)$$

The average mean of indicator R_{Igvv} (the implementation of real values compared to planned values taking into account the goals defined) is calculated in the same way:

$$\bar{R}_{Igvv} = \frac{1}{n} \sum_{i=1}^n R_{Igvv(i)} = 2,1\% \quad (3)$$

After carrying out the analysis of position and dispersion of relative efficiency data using the methods of descriptive statistics we can make the following conclusion. The average mean of relative efficiency is 0,927. Since the average mean is always affected by remote values, the median equal to 0,933 was calculated. The average mean and median of relative efficiency do not coincide, thus, the conclusion is made that the relative efficiency of project evaluation criteria is asymmetric. The coefficient of asymmetry calculated equals 0,430. This means that the data is distributed asymmetrically, i.e. their distances from the average mean are unequal; also, most of them are lower than the average mean. Thus, the relative efficiency of most of the criteria is lower than average. The coefficient of kurtosis, equal to -1,378, showed that the estimated values of relative efficiency of process evaluation criteria are concentrated not around the average mean, but more remotely from it. Characteristics of dispersion, i.e. dispersion and standard deviation showed that the values of evaluation criteria are not very remote from the average mean. Since the estimated average of relative efficiency process evaluation criteria is less than 1, the conclusion can be made that the real values of implementation of most of these criteria are lower than the planned ones. However, the remote values are influential.

Evaluation of expenses for quality

International standard defines expenses for quality as expenses in order to guarantee satisfactory quality and losses because of inadequate quality. Specialists of organizations are not certain about what should be regarded as expenses for quality and how to separate them from other expenses, as well as define them precisely and manage their accounting. It has been estimated that expenses for quality of production firms and companies comprise from 15 to 30 percent and those of service organizations from 20 to 35 percent of total expenses (Kaziliūnas 2007). Expenses in an enterprise are classified into the following groups: *evaluation expenses*, *preventive expenses*, *internal malfunction expenses* and *external malfunction expenses*. The following characteristics of relative efficiency are estimated for relative expenses as well: arithmetic average of relative expenses of process evaluation criteria, dispersion characteristics of estimated relative expenses, dispersion of relative expenses. Estimated dispersion characteristics of values of relative expenses showed that these values are on an average not very remote from their arithmetic average. Using the methods of descriptive statistics and after the estimation of position and dispersion of relative expenses data we can make the following conclusions based on the results:

The average mean of relative expenses of process evaluation criteria is 0,942. Since the average mean is always affected by the remote values, median equal to 0,977 was calculated. The arithmetic average and median of relative expenses do not differ much. However, after verifying the asymmetry of process evaluation criteria of relative expenses, coefficient of which equals -2,821, and after estimating the coefficient of kurtosis, which is high and equals 9,755, we come to a conclusion that the data is distributed asymmetrically, i.e. at the unequal distances from the both sides of the average mean. Also, the influence of remote values is major. The characteristics of dispersion, i.e. dispersion and standard deviation showed that the values are not very remote from the average mean. Since the estimated relative expenses for most of the process evaluation criteria is less than 1, the conclusion can be made that the expenses for the implementation of most of these criteria are lower than planned, however, several criteria have major influence on the general average.

Evaluation of the effectiveness of the process criteria

Knowing the relative efficiency and relative expenses for implementation of each project evaluation criterion, we can evaluate the effectiveness of evaluation criteria of quality management processes of an enterprise E_{Sant} :

$$E_{Sant} = \frac{R_{Sant}}{I_{Sant}} = \frac{V_{Fakt} \times S_{Plan}}{V_{Plan} \times S_{Fakt}} \quad (4)$$

After performing the calculations of process evaluation criteria, the data received is graded and arranged in descending order.

In order to evaluate the effectiveness of processes, the relative efficiency and relative expenses were used, i.e. two independent variables. When calculating the effectiveness of the process evaluation criteria according to formula 1, the relationship between relative efficiency and relative expenses was estimated. Thus, it is necessary to determine whether there is relationship between these two variables. Correlation relationship does not show, which variable is the cause and which one is the effect. They prove that a variation of one variable cause the variation of the other one (Rudzkienė, 2005).

Knowing that there is a statistical relationship (correlation) between the two variables, it can be stated that their variation is interdependent. However, we can not say which variable causes these changes based only on correlation because correlation does not show the cause of change. Thus, we use Formula 5 to estimate the correlation coefficient:

$$r = \frac{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sigma_x \sigma_y} = 0,631 \quad (5)$$

The estimated mean of the correlation coefficient shows correlation of medium strength. The coefficient of determination is frequently used in statistics; it shows what part of the variation of one variable can be explained by the variation of values of the other variable. The coefficient of determination R^2 is equal to the square of the coefficient of correlation between the variables X and Y (Rudzkienė, 2005):

$$R^2 = r_{xy}^2 = 0,631^2 = 0,398 \quad (6)$$

Coefficient of determination shows that 40 % of variation of Y (relative expenses) can be explained by variation of X (relative efficiency). It is also important to determine how these values affect each other. Thus, the nature of interdependency of these values has to be determined using the methods of regression analysis. Multi-factor linear regression methods are used.

After performing the correlation – regression analysis we can state that 40 percent of variation of relative expenses can be explained by variation of relative efficiency.

The evaluation of quality culture of an organization

After analyzing the experiences of the implementation of quality management systems (QMS) in various organizations it has been established that the implementation of QMS is the most efficient when the project of implementation is coordinated directly by the executives of the company and a well-proportioned team for the implementation of the QMS is formed from professional managers and the employees of the company; thus, the new quality culture is being formulated purposefully. If the quality policy of the authorities is not clear or not defined well enough or if the executives do not engage in strategic management of improvement processes or if they expect that a group of "authorized" persons will create the system in some miraculous way or if the QMS is being implemented only because of external needs, the implementation of quality system is slow, it does not give the expected results and is not accepted by most of the employees of the enterprise. The implementation or improvement of management system is primarily *strategic management of change*. It will take time for a new culture of quality management system to spread throughout the organization and change the well-established work culture (Serafinas & Ruževičius, 2009).

The employees of an organization have various quality related opinions, beliefs, traditions and experiences. This is called quality culture of an organization. Pursuit to understand this culture should be a part of the evaluation of the quality related activity of an organization.

While evaluating the quality culture of the selected organization, questionnaire surveys of the employees and structured interview with the representative of the executives for quality were carried out. Respondents were given a questionnaire, which consisted of two parts: 5 questions reflect the driving forces, the other 5 questions reflect the restraining forces. The responses were analyzed using the method of *force field* analysis (see Table 2). The purpose of the method is to explore the driving forces and restraining forces in order to perform necessary positive changes in an organization.

Table 2. The implementation of quality culture in an organization

Effect	Driving forces →	Restraining forces ←	Effect
2,60	Good communication	Fear of the future	1,91
2,86	Training	Lack of confidence	2,66
2,57	Involvement of employees	Bad coordination	3,43
2,83	Rivalry	Incompetent management	1,89
3,77	Relationship with client	Lack of perception	3,14
14,36			13,03

After carrying out the research it was determined that the driving forces are about 2 per cent stronger than the restraining forces. The conclusion was made that a positive opinion about the requirements of quality management is developing in the organization. Most of the employees of the administration surveyed feel the fear of the future; however, they understand the values of the organization.

The effectiveness of the performance depends on involvement and concentration of the members of organization which are influenced by the community of the values. Effectiveness is a result of organization culture and can be a category for evaluation of culture. Thus the efficiency depends not only on organization of work, management style, but also on personal beliefs, attitudes and values.

Evaluation of QMS conformity to quality standards

Auditing is widely used for the evaluation and analysis of QMS. Certain advantages of auditing are its formality, consistency and independency. The results of auditing are based on facts whether it complies with the standards of ISO 9000 series completely.

From the first sight everything seems appropriate; however, there are some drawbacks, too. Inspections carried out in the enterprise do not provide constant and systematic control of QMS elements and the system itself. The effectiveness and completeness of auditing mostly depend of the qualification and experience of the auditor. Inspections are performed simply in order to provide statistics, since the auditor only records the flaws and mistakes; however, they do not provide the knowledge about the factors causing them. Furthermore, the implementation of minimal standards can not prove the effectiveness of QMS system fully because it only corresponds to 17 percent of performance of a quality system of a perfect enterprise (Еленева & Просвирина, 2003).

The results of auditing often lack quantitative indicators of the effectiveness of QMS. Clear drawback of auditing is that there is no quality analysis of the economic basis of the system. This affects the effectiveness of QMS. It is important to highlight what is presented in the ISO 9000 standard: internal and external auditing, requirements of estimations, analysis, adjusting and preventive actions, customer feedback, constant improvement also require the evaluation of effectiveness. In order to improve the documentary inspection of compliance with the requirements of the ISO 9001 standard the authors suggest to use the evaluation form (see Table 3).

Table 3. Matrix of compliance with the requirements of the standard

Processes Process evaluation criteria	No objective proof					Some objective proofs					Objective proofs				
	0	2	3	5	10	15	20	25	30	35	40	45	50	55	60

table 3 continuation

Clear objective proofs					Comprehensive objective proofs					General evaluation
65	70	75	80	85	90	95	97	99	100	

This evaluation matrix was created by the authors based on the evaluation table of European Fund for Quality Management (EFQM) Excellence Model. In Table 2 each factor is evaluated from 0 to 100 percent. Using this evaluation system it was established that the real compliance of the enterprise researched is just 55 percent of all the requirements for indicators defined in the project.

Evaluation by the principles of managing for sustained-success

Since the new ISO 9004: 2010 standard – Managing for the sustained success of an organization – a quality management approach – came into force; enterprises can use a new system of instruments of quality management which allows performing a complex self-assessment based on activities and processes and to improve the management of activities which are not defined in the ISO 9001 standard. It includes management of financial flows, development of the staff expertise, risk management, evaluation of work environment, process matching, etc.

Currently finance departments of enterprises rather often work without taking into account the principles of quality management. Their activity is based on common management principles of an organization, thus the employees of finance department have the smallest role in the activity of maintenance and improvement of QMS. Usually the personnel department is responsible for employee training. Until now this activity was limited to formal employee training without paying attention to development of expertise. The enterprises who have implemented the OHSAS 18001 management standard, manage risks, pay attention to the evaluation of work environment. However, such modern quality management methods as process matching, self-assessment, LEAN are rarely used and the criteria for the evaluation of their implementation have not been defined.

Integrated indicator: the efficiency of QMS

Effective management of enterprise is becoming the essential precondition in order for an enterprise not to simply survive but also to be competitive in the market as well as grow and develop. One of the means of effective enterprise management to improve the effectiveness of management is the evaluation of efficiency of quality management system implemented in the enterprise.

Taking into account basic and practical quality management theories and the results of complex research and evaluation of performance quality of an enterprise providing specific services, the model of evaluation of efficiency of quality management system was implemented in a certain enterprise is presented. The main insights of the parts of this model are presented in Figure 1.

Wide selection of means for performance evaluation becomes a problem because in order to choose the right means that would ensure effective enterprise management the executives have to know advantages and disadvantages of different means. Furthermore, it is essential to take into account that the selection of performance management system is an individual process for each enterprise. According to A. Sližytė and I. Bakanauskienė (2007), even if a certain performance evaluation system is selected, it has to be applied based on particularity and the needs of the enterprise.

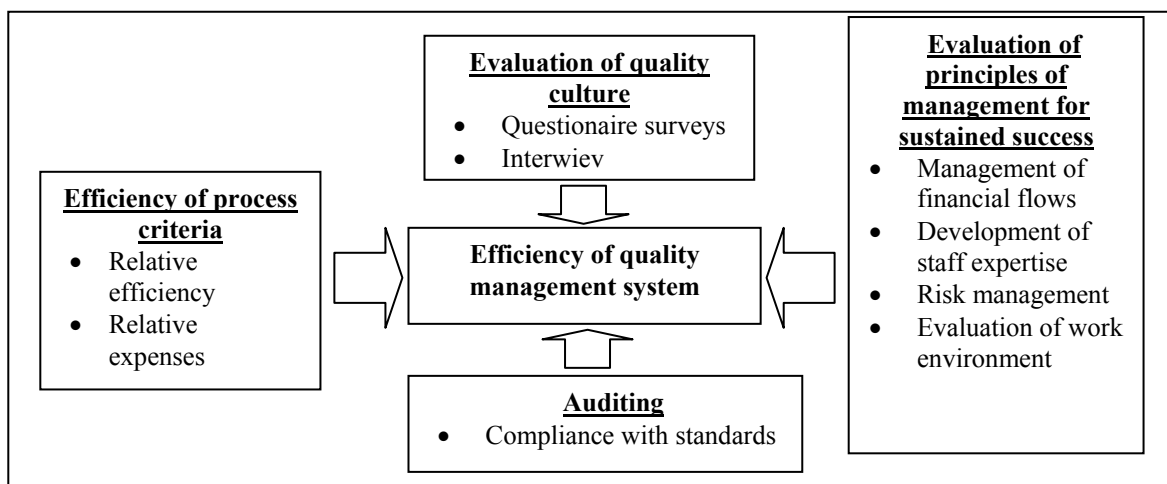


Figure 1. QMS efficiency evaluation model

The development of evaluation model has been aggravated by the lack of data in the enterprise in order to make generalized conclusions and observe the dynamics of efficiency. Data of only one year has been analyzed. After analyzing this data the insights on the QMS efficiency were prepared. Integrated indicators were evaluated. Since the importance of separate criterion is not equal, we use Formula 8 where the

weighing coefficient is introduced. Considering that the evaluation of process criteria and quality expenses are the most important factors when evaluating the QMS higher weighing coefficient is assigned to these indicators.

$$Q_{KA} = \sum_{i=1}^n P_i \times m_i = P_1 \times m_1 + P_2 \times m_2 + \dots + P_n \times m_n \quad (8)$$

Here: P_1 – Evaluation of process criteria efficiency, m_1 – 0.4;
 P_2 – Evaluation of quality expenses efficiency, m_2 – 0.3;
 P_3 – evaluation of quality culture, m_3 – 0.1;
 P_4 – evaluation of compliance with the standard, m_4 – 0.2

Based on this formula we calculate relative quality indicator of the enterprise researched. This indicator show the level of implementation of the quality goals set by the organization.

In order to evaluate the efficiency of QMS, the quality level indicator Q_{KL} is calculated. In literature it is used to assess product quality, however, we can also assess QMS using the same method.

$$Q_{KL} = \frac{Q_{KA}}{Q_{KB}} \quad (9)$$

After implementing QMS in an enterprise it is strived for excellent performance which can be relatively defined as one. With these two indicators (Q_{KA} - enterprise quality indicator, and Q_{KB} – reference quality indicator of the results wanted) we can express the enterprise quality level Q_{KL} . The suggested model could simplify the identification of priority spheres for quality improvements, it would help to reveal the most efficient means and ways to increase added value.

Conclusions

The standards implemented confirm the high level of the system itself but do not guarantee its efficiency and success. It is essential to struggle that the performance of management systems would be real and not just formal. Only then it will bring tangible benefit and the results of efficiency measurement will give additional material for strategic planning of an organization. When evaluating the QMS criteria and quality costs, there is a statistical relationship (correlation) between the relative efficiency of criteria and relative expenses, their variation is interdependent. Estimated value of the coefficient of correlation shows correlation of medium strength. 40% of variation of relative expenses can be explained by variation of relative efficiency. For some of the process evaluation criteria the estimated values of relative efficiency, relative expenses and effectiveness are very remote from the arithmetic mean value. Though their influence on the numeric value of average mean is not significant, it has substantial influence on the evaluation of organization quality management system of an organization.

After carrying out the evaluation of quality culture a conclusion was made that the administrative employees of the organization do not understand the quality management principles in the enterprise entirely, most of the employees think of quality management system as a source of additional work. Some of the less qualified employees do not understand the essence and importance of quality management system at all. Thus, it is recommended to develop the systematic quality management training for the administrative employees of the enterprise, which would include all the employees of the organization and would be differentiated based on groups and positions of employees.

It was established that the real conformity of the performance processes of the enterprise researched is just 55 percent of all the requirements for indicators defined by the ISO 9001 standard. This shows that not enough attention is being paid to maintenance and improvement of quality management system in the enterprise.

According to the analysis of theoretical data and empirical research, the model of the evaluation of the effectiveness of the implemented quality management system was developed and adjusted for the specific needs of service enterprises. Model comprises quality expenses, processes, and quality culture and audit results evaluation subsystems. Models also reflects ISO 9004:2010 requirements for the sustained success of the organization that will come into force in 2010 and that are not defined in the ISO 9001 standard (e.g., management of financial flows, development of the staff expertise, risk management, assessment of the work environment, process matching, etc.). The suggested model could simplify the identification of priority spheres for quality improvements, it would help to reveal the most efficient means and ways to increase added value.

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