



THEORETICAL ASPECTS RELATED TO THE CREATION OF ALGORITHM FOR QUALITY COSTS MEASUREMENT SYSTEM

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Abstract: *This paper presents the theoretical aspects taken into account when creating an algorithm for a quality costs measurement system, developed using a descriptive-analytical method. The methodological approach relies on the systemic thinking about management of success, including the elements of integration, innovation and agility, taken into account when developing the scope, rules, criteria, possibilities and alternatives. The proposed algorithm provides a structured approach and systematic measurement of the quality costs, which, in turn provides for better understanding, detection and correction of the errors on the spot where they actually occurred and not where they appeared. This ensures the timeliness, accuracy and reliability of the data and information about the costs of quality, opens possibilities not only for diagnostic analytics but also for predictive and prescriptive analytics, which increases the efficiency of the company.*

Key words: *algorithm, system, measurement, quality costs*

Teorijski aspekti vezani za kreiranje algoritma za sistem merenja troškova kvaliteta. *Ovaj rad predstavlja teorijske aspekte uzete u obzir prilikom kreiranja algoritma za sistem merenja troškova kvaliteta, razvijen metodom deskriptivno-analiitičke analize. Metodološki pristup se oslanja na sistemsko razmišljanje o upravljanju uspehom, uključujući elemente integracije, inovacije i agilnosti, uzete u obzir prilikom razvoja prostora, pravila, kriterijuma, mogućnosti i alternativa. Predloženi algoritam daje strukturiran pristup i sistematsko merenje troškova kvaliteta, što zauzvrat omogućava bolje razumijevanje, otkrivanje i korekciju grešaka na mestu gde su se stvarno desile, a ne gde su se pojavile. Time se obezbeđuje pravovremenost, tačnost i pouzdanost podataka i informacija o troškovima kvaliteta, što otvara mogućnosti ne samo za dijagnostičku analizu, već i za prediktivnu i preskriptivnu analizu, što povećava efikasnost kompanije.*

Ključne reči: *algoritam, sistem, merenje, troškovi kvaliteta*

1. INTRODUCTION

The need for sustainability of the modern business and products in an environment entailing complex technical and technological, information and societal and economical systems, contributes to increasing the influence of the quality costs, as an economic category indicating the quality of the operations [1]. In addition to being a measure of the effectiveness and efficiency of the activities, processes and systems, as well as the realization of the quality objectives [1], the quality costs also represent a tool in the rational process making strategic management decisions, used to identify quality related issues and the weaknesses of companies, justify the undertaking of preventive and corrective measures, as well as evaluate the productivity of the company [2, 3].

It has become exceptionally important that quality costs related data and information to feature the properties of so called “enhanced information”, i.e. be “as relevant as possible” and presented in an “as suitable as possible” form for the users [4]. The fulfillment of these requirements entails the design and implementation of a methodologically harmonized process in the quality costs measuring system.

This paper presents a quality costs measurement system algorithm, the methodological approach and explains the phases and the stages of the system, makes

note of specific properties and importance, as well as affirmation for efficient implementation and functioning of the quality costs measurement system.

2. METHODOLOGICAL APPROACH FOR THE QUALITY COSTS MEASUREMENT SYSTEM ALGORITHM

The creation of the quality costs measurement system algorithm employed a descriptive and analytical methodological approach, including systematic management of the interrelated phases, stages and units in the system with the necessary number of iterations. The algorithm incorporates the following affirmations that provide for the functionality of the quality costs measurement system:

1. Acceptance of the “management of success” teaching based on the elaboration of the scope, rules, criteria, alternatives and the opportunities of a certain subject matter, featuring a proactive character [5],

2. Adoption of the ecology of quality assurance, including integration of company resources (human, material and methodological), product and process innovation and the agility related to the fulfillment of the requirements [6],

3. Reviewing the quality costs measurement system using the four functional units: input unit (human resources, material, equipment, knowledge,

procedures), processing unit (activities and functions which transform the inputs into outputs), output unit (notifications, reports, publications, recommendations) and recipient unit (internal and external users) [2],

4. Introduction of the principle of integration and cooperativeness of the quality and accountancy experts [1, 2].

3. DESCRIPTION OF THE QUALITY COSTS MEASUREMENT SYSTEM

The quality costs measurement system should be able to identify *all* quality costs elements, show the *true value* of the quality costs (by categories and by quality costs elements), track the quality costs to their *primary sources* and measure the occurrence of the quality costs in *real time* [3]. Indeed, there exist obvious difficulties to designing a quality costs measurement system, which will systemically identify, record, measure, register, calculate, compare and analyze all quality costs elements in real time [3]. With a view to overcoming the evident difficulties in designing such a system, the proposed algorithm employs the approach of the author Sorqvist L. [3], who suggests five levels of quality costs measurements: first level–traditional quality costs according to the categorization of the PAF (Prevention-Appraisal-Failure) model, second level–hidden quality costs, third level –lost revenues, fourth level–user costs and fifth level–social and economic costs. In the most general context, the quality costs measurement system entails three interrelated phases [4] (figure 1.):

Phase 1 refers to a complex understanding of the quality costs measurement system framework, which contains and describes the competitive position of the company, the stakeholders – users, owners and

employees, the organizational goals, policies and strategies, the available resources, methodologies and procedures, followed-up and defined from the point of view and acceptable directives, risks, behaviors and policies of all of the elements of the quality costs measurements system. This framework should also contain an understanding of the quality costs beyond the functional limits of the quality departments [2], i.e. within the overall company management [7]. Furthermore, quality costs should be looked at as a comprehensive system and not just a quality management tool [7]

Phase 2 refers to the quality costs measurement process, which comprises three steps: measurement process design, quality costs data collection and recording and analysis – synthesis – recommendation – results and final recommendations. The measurement process design involves the creation and development of a measurement process protocol comprising a design for: data collection; data recording and archiving; access to the data and the realization of the analysis, synthesis and the results.

Phase 3 refers to decision making and taking action, exceptionally important in the field of quality cost measurement system, because it refers to issues related to strategic, tactical and operational objectives and interests of the organization. Therefore the presentation of the results and recommendations should present the output data exhaustively and comprehensively, in the most appropriate, clear and understandable form, impartially, and completely intended for specific users.

The systematic phases require the setup of the entire quality cost measurement system on a level of standpoint or a culture of quality in the company, taking into account the top 10 principles of the quality costs measurement system, proposed by J. Juran [4].

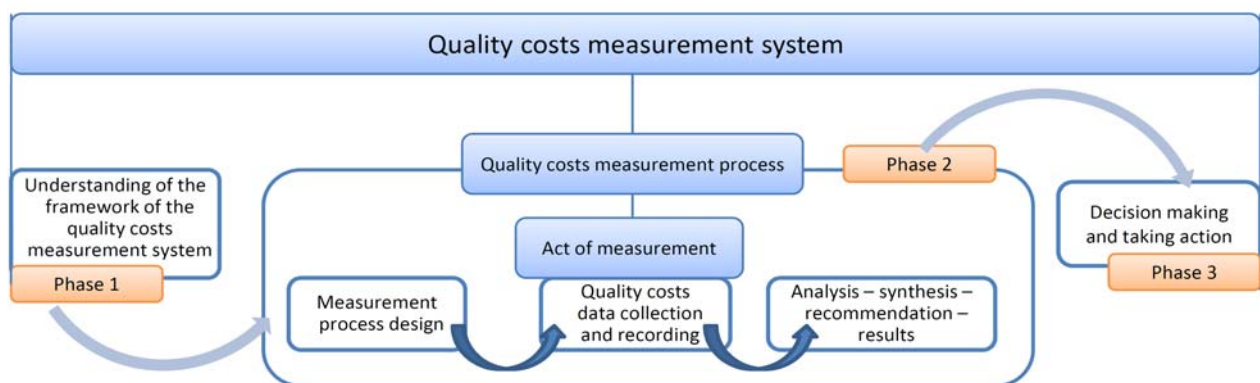


Fig. 1. Quality costs measurement system

The quality costs measurement system should 1.) be managed, 2.) provide for a sufficient packet of measurements, 3.) determine who makes the decisions and how, 4.) the decisions as close as possible to the activities, 5.) have prepared measurement process plans, 6.) facilitate the measurements, analyses and the presentation of results, 7.) ensure the implementation of measurement protocols and data quality programs, 8.) be continuously improved, 9.) help the decision makers manage their processes and responsibilities, 10.) and acknowledge that it functions within limiting

circumstances.

4. QUALITY COSTS MEASUREMENT SYSTEM

Figure 2 shows the quality costs measurement system algorithm [1, 2, 3, 4, 8, 9, 10, 11, 12], i.e. a structured, integrated and systematic approach to understanding planning, implementation, maintenance and management of the quality costs measurement system.

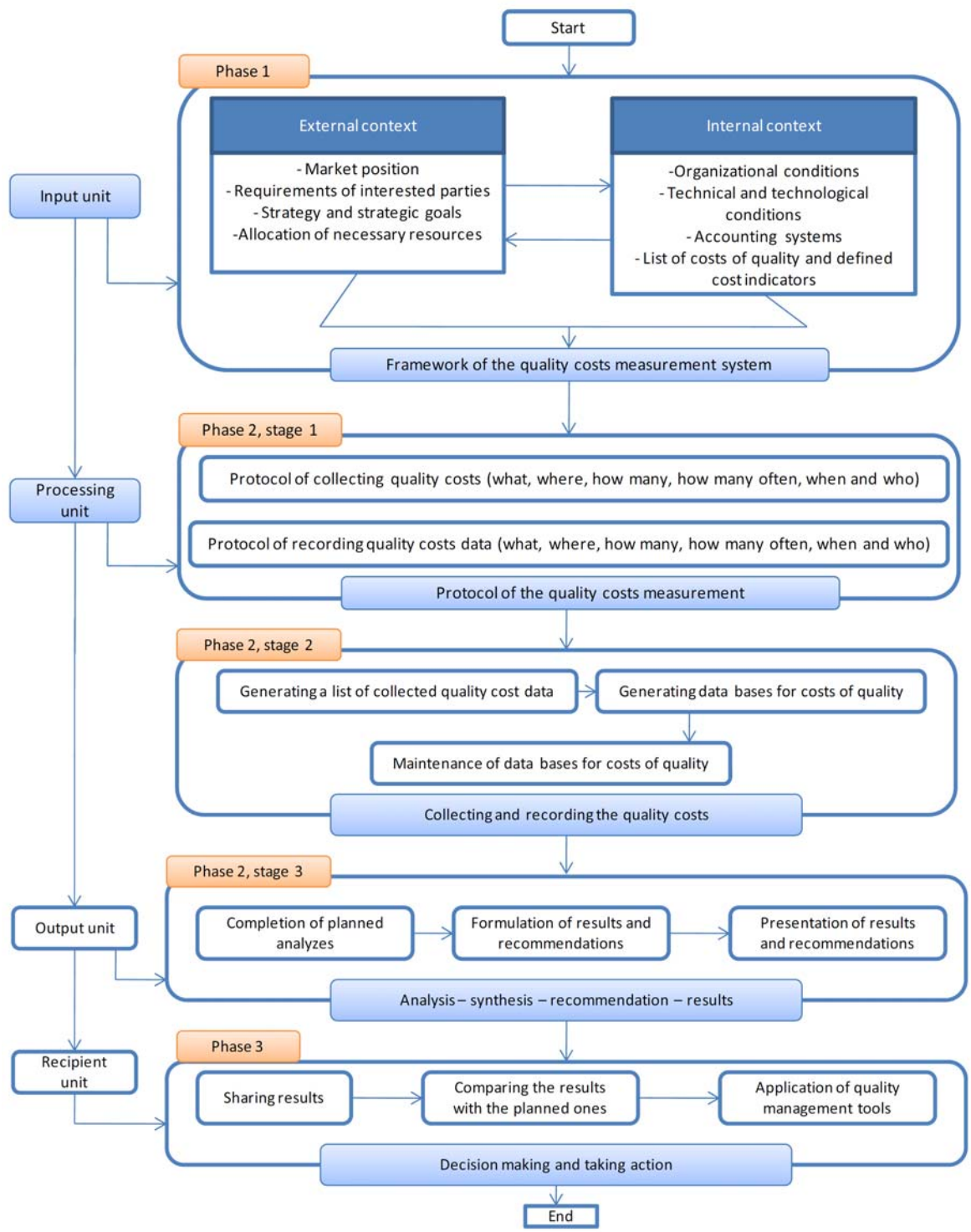


Fig. 2. Quality costs measurement system algorithm

The algorithm, by nature, functions interactively, starting from the first iteration which refers to known elements, followed by subsequent iterations which incorporate less known elements in order to “softly” include the employees and avoid the occurrence of the learning anxiety phenomenon [13].

The algorithm design relies on the principle stipulating the planning, designing and incorporation of quality, rather than controlling the quality [3, 10]. This means that it is always more cost effective to do things well from first time [3]. Hence, each and every stage of product creation and utilization should plan, identify, track, measure, calculate, rank, sort, analyze and

synthesize the costs of quality. Most of the quality costs can be only estimated due to the difficulties or the impossibility to measure them [3]. For example, the quality costs in the group of non-measurable external error costs can be estimated using the Taguchi loss function [3]. From a broader perspective, quality cost measurement represents a joint effort of the entire company and therefore the proposed algorithm involves the organizational practice, the technical and technological aspect, the knowledge related to the modern calculation systems [7] and the knowledge in the field of quality. Ultimately, this aims at changing the mentality in the organizational culture and the

acceptable level of error [2], and replaces it with a zero defects philosophy [3].

The quality costs measurement protocol (phase 2, stage 1) is of especial importance for the measurement of the costs of quality. It should ensure the relevance, simplicity accuracy and cost-effectiveness of the quality cost data [10]. The collection and recording of the quality costs entails the creation of an environment (“absolutely mandatory”) for the company experts responsible for quality and the experts responsible for accounting will work in synergy [2, 1].

The most frequently presented methods for collecting quality costs include: collection from the accounting records, by persons involved in a given activity, by working hours, by error types, using the personal logs of the employees [2], by time [12], by the elements and the categories of the costs of quality, by organizational units and by processes [10]. The analysis of the quality costs data (phase 2, stage 3) can cover a long term and can apply to the process of strategic planning and monitoring of the entire progress; short term and apply to the process of promoting and attainment of the objectives specified for the organizational units; and short term and useful for tracking quality costs data in order to identify and eliminate the reasons for non-compliance and errors [10].

The unit of recipients (phase 3) is the final unit of the quality costs measurement system in the presented algorithm. Phase 3 involves activities such as results sharing, comparisons between actual and planned results and application of quality management tools. The results of the integration of the activities in phase 3 are recognized in the existence of three types of main responsible centers: 1.) Cost center which analyses the company performance by monitoring the costs and the responsibility for the costs, 2.) Profit center which analyses both the costs and the profits of the company and 3.) Investment center which tracks the costs, the revenues and the investments of the company [11].

5. CONCLUSION

The quality costs measurement system represents one of the ways to measure the effect of the programs and initiatives for company quality improvement. The proposed algorithm clearly shows the sequential activities in the quality costs measurement process, adapted to the real needs and capabilities of the companies in an environment of limited knowledge and limited resources. The stage and the systemic structure of the quality costs measurement system algorithm facilitate identification and tracking of the quality costs at the places where they actually occur and not at the places where they appear. This ensures the timeliness, accuracy and reliability of the data and information about the costs of quality, opens possibilities not only for diagnostic analytics but also for predictive and prescriptive Analytics of the costs of quality. Using this approach, companies that have introduced adequate, proper and acceptable quality costs measurement systems, where all components function as planned with the assistance of a program for provision of quality data and measurements also have the highest efficiency.

6. REFERENCES

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