

# EFFECTIVENESS ASSESSMENT OF FUNCTIONING OF QUALITY ASSURANCE SYSTEM

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## Resume

This paper presents the results of six-year studies that were conducted in an iron foundry. The research consisted in effectiveness assessment of the quality assurance system. Determinants of three groups of estimation criteria were characterized. In technological criterion the required values of dimensional tolerance, the value of required hardness, raggedness, the required values of coefficients of the scattering process and also acceptable fractions of the products were taken into consideration. The economic criteria included the assumed values of internal and external costs of product defects. The exploitation criteria comprised the required level of reliability or durability and the required value of products repairability. The obtained results point to too high costs of lacks in technological criteria. The undertakings were proposed in order to decrease them.

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## 1. Introduction

The quality assurance systems present the necessity and standard in a company, their analysis and effectiveness assessment have even greater meaning. Reparation activities conducted in the company will not bring positive changes and results if the quality system effectiveness assessment does not present correct estimation and diagnosis of the real quality system. The quality system effectiveness assessment is necessary for identification of the differences between the real quality system and the planned one (BORKOWSKI S. et al. 2007)

The assessment system of the quality system effectiveness consists of the following systems: assessment system, diagnostic system, quality service, finance service, analytical centre and operational results use system (ŠUJANOVÁ J. et al. 2005).

The system using assessment results initiates the assessment procedure, it formulates estimation problems for the diagnostic system. Elaboration of the estimation characteristics corresponding to the estimation problem presents the aim of the diagnostic system. The system using assessment results based on the

conducted quality system effectiveness estimation precedes making a decision about implementing changes in the estimation system (LESTYÁNSZKA ŠKŮRKOVÁ K. et al. 2011). The structure of the assessment system of the quality system effectiveness in a casting foundry is shown in Fig.1.

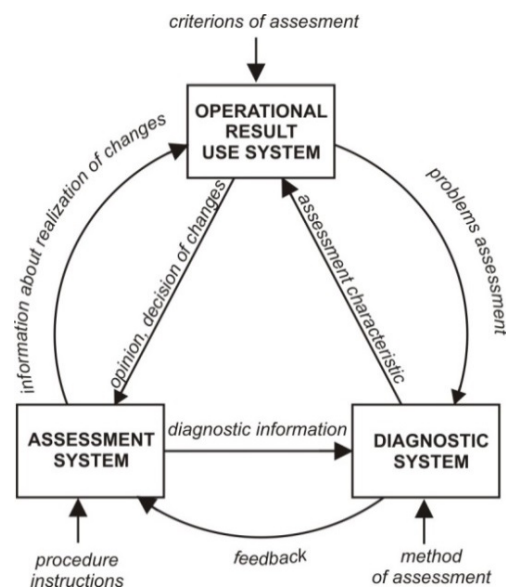


Fig. 1. Structure of the assessment system

In technological criterion the following features can be taken into consideration: the required measurement of tolerance value, the required hardness or roughness value, the required process scatter coefficient or process centring values, admissible parts of the products. In economic criterion: the assumed values of internal or external product fault costs. Operational criterion may include the required reliability or durability level and the required product maintainability value.

The examples of the estimation criteria of the quality assurance system efficiency in chosen stages of the realization of cast were introduced in Fig. 2.

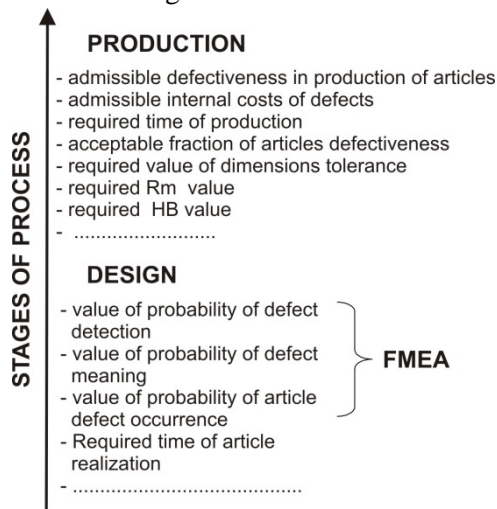


Fig. 2. Chosen estimation criterion for the estimation of the quality system efficiency

## 2. Assessment methods of systems

Among many other methods cost account and statistical methods seem to be particularly effective. Thanks to statistical methods the use of the estimation period is shortened and estimation results reliability is obtained. In the case of mass and numerous populations statistical methods are the only admissible effectiveness estimation methods. Quality system effectiveness estimation methods at the production stage are cost account, seven QC tools, investigated measurable characteristic trial methods (KONSTANCIAK M. et al. 2011). Effectiveness estimation methods can be used at particular stages of casting form production, beginning from marketing through the project, purchase and delivery production stage to the operation stage, where reliability investigation methods can be used. In the investigations two

criteria were used: economic criterion, costs of defects and incompatibilities of produced casting articles (serial and individual) and they were referred to assumed acceptable level. In the technological criterion using  $\bar{x}$ -R and  $\bar{x}$ -s cards (LESTYÁNSZKA ŠKŮRKOVÁ, K. 2012) three most essential features: meeting dimension tolerance, strength properties Rm and hardness HB were considered. In the selection of methods as well as parameters of estimation it is essential that estimation allows achievement of credible results.

## 3. Estimation of Quality System Effectiveness

On the basis of iron foundry data, the effectiveness of the quality system in relation to the costs of casts incompatibilities in the period of 6 years was evaluated. The cumulated costs of casts incompatibilities  $R(t)$  were adopted as an assessment characteristic and the anticipated permissible incompatibilities costs  $P(t)$  were adopted as an evaluation criterion. This analysis showed that up to the third year, the quality system of the iron foundry had been ineffective  $R(t) - P(t) > 0$ . Since then, the foundry has been implementing new procedures and new solutions in quality management. It has contributed to reaching the state where the anticipated incompatibilities costs turned out to be higher than the actual ones  $R(t) - P(t) \leq 0$ . Since the third year, the value of the adopted price characteristics of the effectiveness of the quality system has been contained in the effectiveness area. The effectiveness evaluation of the quality system is necessary and indispensable in order to improve companies and adjust them to a competitive struggle on the market. In the fifth year, big investments were made in the company. They were connected with extending the assortment from the produced casts to precision castings for the motor industry. New machines and technologies were purchased, which, in turn, had a big influence on the process of destabilization at the initial stage. The cumulated incompatibility costs, mainly internal, and external in a smaller degree (warranty repairs), definitely exceeded the anticipated incompatibility costs. The data used for the analysis has been shown in Table 1. The analysis has been presented graphically in Fig. 3.

Table 1. Iron foundry data

Coast% \ Year	Delivery faults	Internal faults	Guaranteed repairs	Faults cumulated costs	Faults planned costs
1	0.70	0.20	0.60	1.50	0.90
2	0.65	0.17	0.65	1.47	0.80
3	0.26	0.14	0.28	0.68	0.70
4	0.20	0.08	0.20	0.48	0.60
5	0.50	0.40	0.30	1.20	0.50
6	0.20	0.02	0.20	0.42	0.40

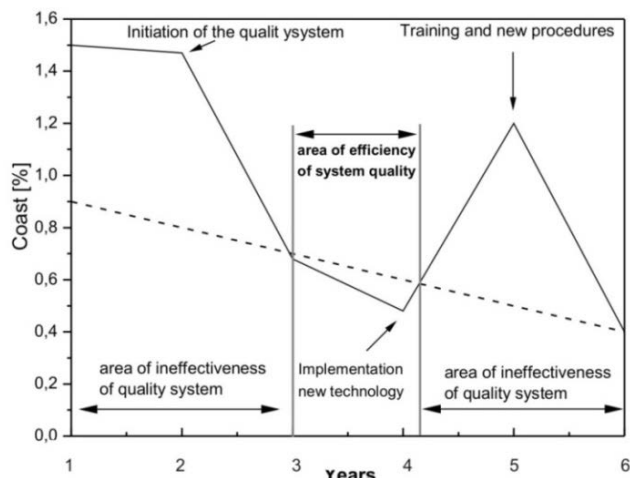


Fig. 3. Chosen estimation criterion for the estimation of the quality system efficiency

#### 4. Conclusions

The aim of this article was to identify effects of implemented quality management system and assessment of its functioning in the foundry. The research problem is not new, visionary, but it is not fully tested, either. In 2000 there came into being standardized quality management systems that were developed by the International Organization for Standardization (ISO - International Standard Organization) which is a worldwide federation of national standards organizations. To this day, there have been introduced updates and new standards specifying a new standard constituting model to ensure the ability to meet quality requirements and increase customer satisfaction in business-to-client. Effective quality management system is one that provides tangible results of introduced changes while increasing the value of the organization. In the considered company, the most important obtained effects indicated by entrepreneurs are: improving the quality of offered castings, better work organization and

effective management of the enterprise, as illustrated in Figure 4.

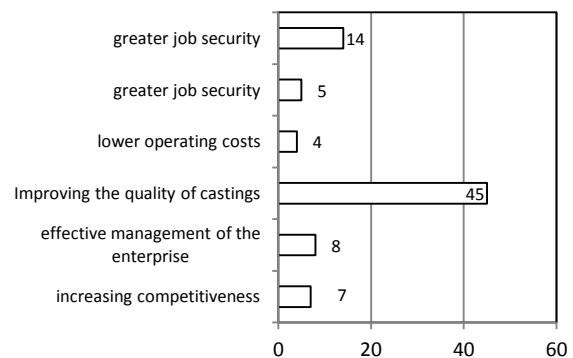


Fig. 4. The effects of the implementation of the quality management system

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