THE ASSESSMENT OF SELECTED ELEMENTS OF QUALITY MANAGEMENT SYSTEM IN THE METALLURGICAL COMPANY

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Abstract

This paper presents the evaluation of selected elements of quality management system of certain metallurgical company. This company is a supplier of components for companies working in automotive industry. The analysis consists of two elements: the assessment of non-conformances in the department of foundry and the analysis of customer satisfaction. The quantitative analysis of non-conformances occurring in production process in the department of foundry is made. Pareto chart is used in this analysis, the analysis takes into account types and causes of non-conformances of castings. The assessment of satisfaction is carried out using a survey conducted among the largest customers of this company. This analysis was designed to assess the quality management system, which was implemented in the company.

Keywords: Quality management system, castings, non-conformances, customer satisfaction

1. INTRODUCTION

Due to constantly changes on the market, every company should try to increase its competiveness [1]. It provides to the company better position in its environment. It is related to increasing productivity and efficiency of work. Quality problems are concerned to each company, so quality of processes and products should be improved in order to make a company be the market leader [2, 3]. One of the factors effecting the position of the company in the market is Quality Management System, which improves the performance of the company, reduces the risk of claims of customers and improves the organization of work [4, 5].

The analysis of selected elements of quality management system of certain metallurgical company is the main purpose of the paper. The research company has Quality Management System according to ISO 9001 and ISO/TS 16949. The quantitative analysis of non-conformances occurring during production process in department of foundry is made using Pareto chart. The assessment of satisfaction is carried out using a survey conducted among the largest customers of this company.

2. CHARACTERISTIC OF THE RESEARCH METALLURGICAL COPMANY

The company, in which the research was carried out, is the organization operating in the area of Czestochowa for few years. Its offer includes metal parts, which are used in industry, especially automotive. The main products of the company are parts and accessories for vehicles, especially passenger cars and vans [6]. Casting components of brake systems manufactured in the department of foundry are one of types of products of the company that was selected for the analysis.

The research company has a certified Quality Management System which complies with the requirements of ISO 9001 standard. Since the company is a supplier of parts for the automotive industry, it also implemented a Quality Management System in accordance with the standards ISO/TS 16949 [6].

3. METHODOLOGY

The quantitative analysis of non-conformances occurring in the department of foundry was made using Pareto chart. It covers the period of 1 calendar year. Non-conformances of casting components of brake systems were taken into account. They were analyzed in point of view of types and causes.

The analysis of customer satisfaction was conducted based on results of the survey. The opinion-giving group was a group of 55 customers of the company. 55 questionnaires were given among the customers, 50 of them were returned fully fulfilled. The survey consists of 10 questions related to the topic, which take the form of closed questions, and questions about the characteristic features of the group (sex, age, education and income).

4. QUANTITAVIRE ANALYSIS OF NON-CONFORMANCES IN THE DEPARTMENT OF FOUNDRY

The quantitative evaluation of non-conformances in the department of foundry was made. The non-conformance index, as the ratio of the amount of non-conforming castings to the total volume of production, was calculated. Results are presented in **Figure 1** and cover one calendar year.
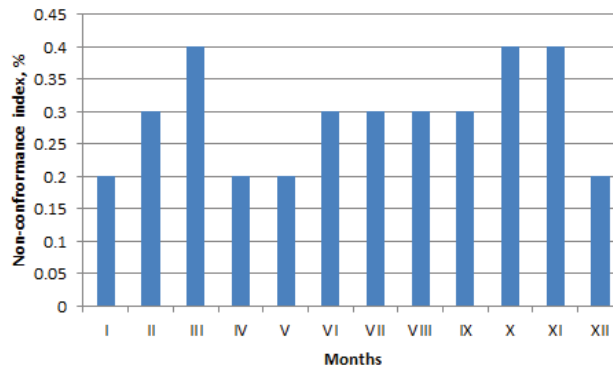

Figure 1 The non-conformance index for the foundry process [Own study based on 6, 7]

Based on the information presented in **Figure 1** it can be said that the non-conformance index was on the level 0.2 - 0.4%. The highest value was noted in 3 months, however the value of this index did no exceed the limit value (1% of production). Causes of non-conformances are related to two main causes:

- Disturbances during operation of machines,
- Short production series.

The quantitative assessment of types and causes of non-conformances was made. Results of this analysis in the form of Pareto chart are presented in **Figure 2** and **Figure 3**.

Based on results presented on Pareto chart of types of non-conformances (**Figure 2**) it can be said that misruns were the type of non-conformances that occurred the most often in the department of foundry. Percentage of occurring for inclusions was also high. Flashes occurred in the process the least frequently. Exploited machine stock is probably cause of this facts. This can cause problems with settings the proper process parameters. For new machines insufficient training of employees in parameters setting can be a problem. Control of the quality of castings and supervision of non-conforming semi-finished products is the duty of the master of quality control department. Insufficient semi-finished products go to specially designed zone where the responsible manager with the help of foremen control them again.

Many various factors can have the influence on occurring of non-conforming products. They can be divided into 5 main groups (**Figure 3**). After the analysis of causes of non-conformances using Pareto chart following results were obtained: the largest amount of non-conforming products in the department of foundry are caused

mainly due to: errors and imperfection of production machines (38%) and incompatibility of material (31%). The machine stock in the department of foundry is not quite modern. As the consequence of this fact non-conforming products occurred due to the imperfection of exploited machines. Precision and reliability of machines used in the process of production of small and intricate shapes of castings are very important part of production process. Also quality of materials used in the process has great influence on the occurring of non-conformances. This two main groups of causes affect approximately 70% of all non-conforming products in the department of foundry.
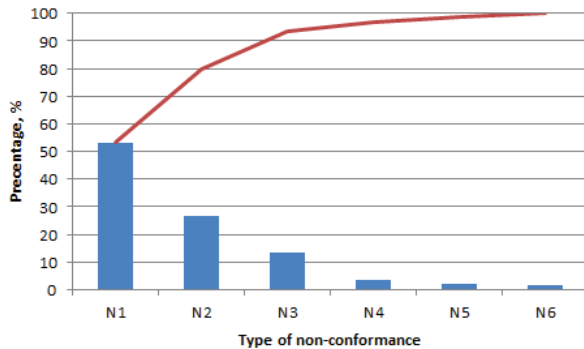

Figure 2 Pareto chart of types of non-conformances occuring on the department of foundry: N1 - misruns, N2 - inclusions, N3 - skin holes, N4 - distorted surface, N5 - dimensional error, N6 - flashes [Own study based on 6, 7]
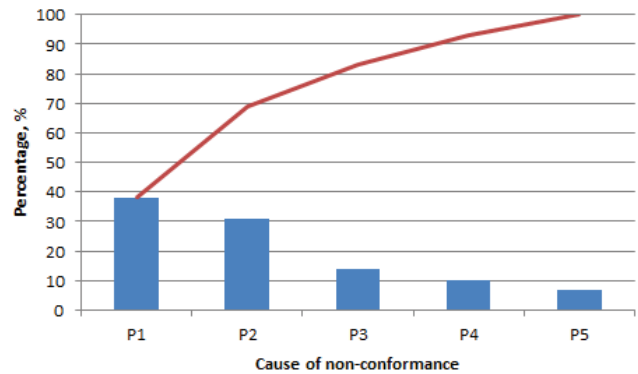

Figure 3 Pareto chart of causes of non-conformances occuring on the department of foundry: P1 - errors and imperfection of production machines, P2 - incompatibility of material, P3 - incompatibility of production method, P4 - operation of man, 5 - errors in process management [Own study based on 6, 7]

5.   THE ANALYSIS OF CUSTOMER SATISFACTION IN THE METALLURGICAL COMPANY

The survey was made in the metallurgical company that produces metal components for automotive industry. The results of 50 questionnaires on customer satisfaction in the research company were analyzed. The survey included 10 questions about customer satisfaction. **Figures 4-13** show the structure of answers to each question of the survey.

The first question was: which factors influenced the purchase decision? The structure of answers is presented in **Figure 4**. It shows that for approx. 25% respondents a fact of having ISO 9001 certification by the supplier is the most important factor. Approx. 16% of respondents indicated the quality of products and 15% - availability of information about the products.

The second question was concerned to the assessment of quality of products in the research company. Based on results presented in **Figure 5**, it can be said that 60% of respondents think that quality is very high and 16% - high. Other people chose other answers: medium, low or very low. It should be said that quality of metal products used in automotive industry has great influence of comfort and safety of using this elements in cars (e.g. components in brake system).

The next question was related to the assessment of quality of products in comparison to the quality of competitors operating in the same branch of industry. Results (**Figure 6**) showed that 64% of respondents answered that quality of products of the research company and competitors are similar, 14 - quality of products of the research company is higher or much higher, 12% - lower or much lower.
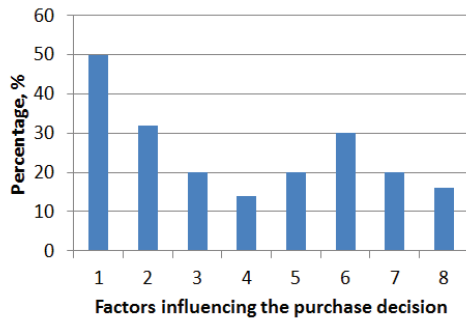
Figure 4 Factors influencing the purchase decision for the customers of the metallurgical company: (1 - possession of ISO 9001 certification by the supplier, 2 - quality of products, 3 - quality of service, 4 - prices of products, 5 - the offered assortment, 6 - the availability of information about the products, 7 - speed of execution of orders, 8 - payment dates) [Own study based on 6, 7]
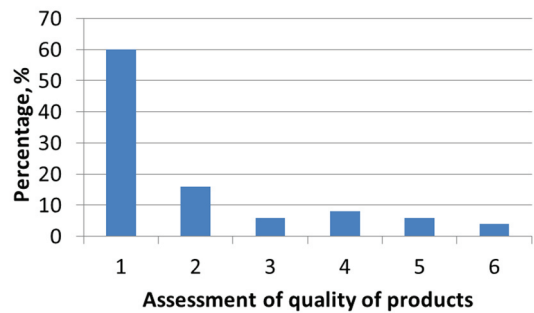

Figure 5 Assessment of quality of products by the customers of the metallurgical company (1 - very high, 2 - high, 3 - medium, 4 - low, 5 - very low, 6 - no opinion) [Own study based on 6, 7]
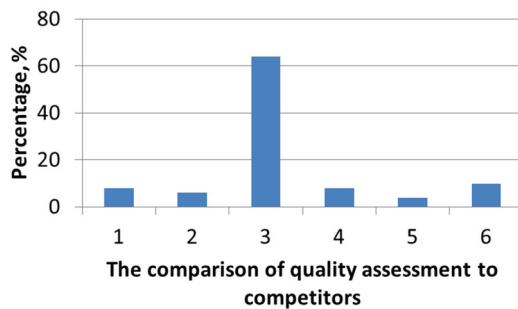

Figure 6 The comparison of quality assessment to competitors of the metallurgical company (1 - much higher, 2 - higher, 3 - similar, 4 - lower, 5 - much lower, 6 - no opinion) [Own study based on 6, 7]
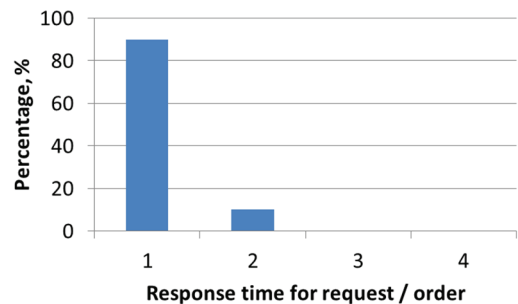

Figure 7 Response time for request/orders of the customers of the metallurgical company (1 - sufficient, 2 - rather sufficient, 3 - insufficient, 4 - no opinion) [Own study based on 6, 7]

The fourth question was related to the response time of the company for the request or orders from customers. The results presented in **Figure 7** indicated that all respondents think that response time is sufficient or rather sufficient. 90% of respondents answered: strongly yes.

The next question was concerned to the problem of quality of answers to questions asked to the company. The results (**Figure 8**) indicated that 70% of respondents think that they are sufficient, 20% - rather sufficient. Only 10% of respondents think that answers are definitely insufficient.

Customers were asked about the time of date of realization of orders by the research company in comparison to the competitors operating in the same branch of industry. The following results were received (**Figure 9**): around 70% of respondents think that time realization in the research company is shorter or much shorter, while 24% of respondents - similar to the competitors.

The seventh question was related to the problem of contact with the research company. Respondents gave the following answers (**Figure 10**): 88% of respondents answered that they had no problem in contact. Only 4% of customers experienced any problem.
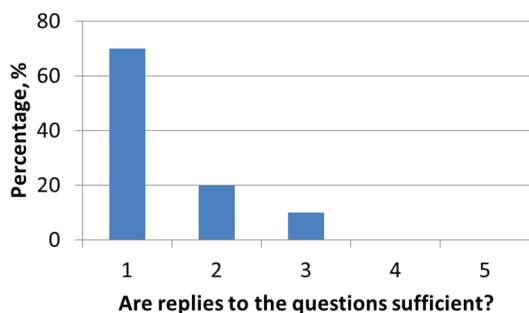
Figure 8 Are replies to questions sufficient? (For the customers of the metallurgical company) (1 - yes, 2 - rather yes, 3 - no, 4 - definitely insufficient, 5 - no opinion) [Own study based on 6, 7]
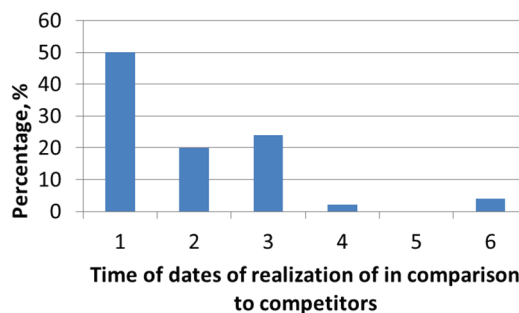
Figure 9 Time of dates of realization in comparison to competitors of the metallurgical company (1 - much shorter, 2 - shorter, 3 - similar, 4 - longer, 5 - much longer, 6 - no opinion) [Own study based on 6, 7]
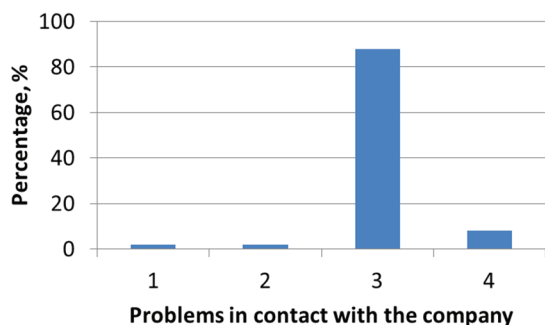
Figure 10 Problems in contact with the metallurgical company (1 - yes, 2 - rather yes, 3 - no, 4 - no opinion) [Own study based on 6, 7]
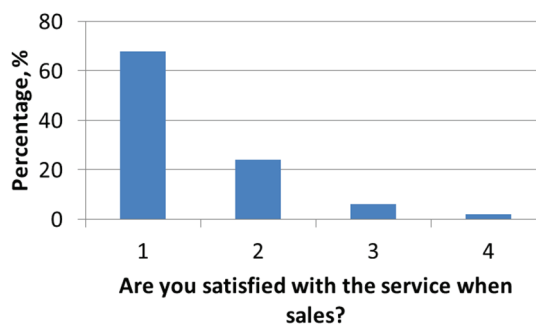
Figure 11 Are you satisfied with the service when sales? (The customers of the metallurgical company) (1 - yes, 2 - no, 3 - no opinion, 4 - difficult to assess) [Own study based on 6, 7]
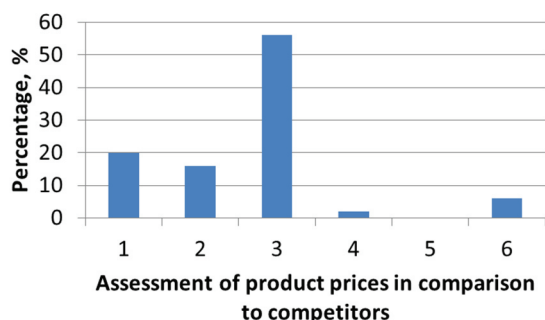
Figure 12 Assessment of product prices in comparison to competitors of the metallurgical company (1 - much lower, 2 - lower, 3 - similar, 4 - higher, 5 - much higher, 6 - difficult to assess) [Own study based on 6, 7]
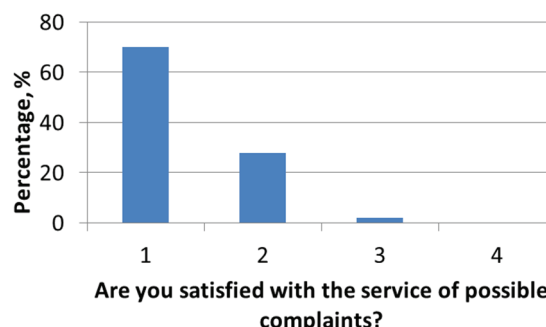
Figure 13 Are you satisfied with the service of possible complaints? (The customers of the metallurgical company) (1 - yes, 2 - rather yes, 3 - no, 4 - no opinion) [Own study based on 6, 7]

Customers were asked about the satisfaction with the service during the sale. Based on the results (**Figure 11**) it can be said that 68% of customers were satisfied, 24% - dissatisfied with the service.

Customers were asked about the prices of products of the research company in comparison to the competitors operating in the same branch of industry. 50% of respondents answered (**Figure 12**) that prices of products of the research company and competitors are similar, 36% - lower in the research company.

The last question was related to the customer satisfaction in relation to the service of possible complaints. The results (**Figure 13**) indicated that the majority of customers (98%) are satisfied. Only 2% of respondents indicated dissatisfaction with the service.

6.   CONCLUSION

The analysis of non-conforming metal component using in brake system was made. First, the analysis of the level of non-conformance index in the department of foundry was done. During the study period this index was on the level of 0.2 - 0.4% and did not exceed the limit value. During this period 6 types and 5 causes appeared. The most frequent types of non-conformances were misruns and inclusions, while the most frequent causes were errors and imperfection of production machines and incompatibility of material.

Based on the analysis of survey results presented in the paper it can be said that quality of products offered by the research company is high but similar to the competitors operating in the same branch of industry. Products prices are also similar. Therefore, the way of customer service has a great importance for customer satisfaction. Respondents indicated the most important factors such as: fast response time for orders, short time of date of realization and lack of difficulties in contact with the company. ISO 9001 certificate held by the company is also very important.

It should be remembered that the quality of products in metallurgical companies is determined at every step of production process: starting from ore preparation in suitable way, by production of material to the processes of forming material into finished products. The instability of chemical composition and physico-chemical properies of raw materials, old and emergency machinery and equipment or unstable parameters of various metallurgical processes affect negatively on the quality of products. This can be prevented by:

- The use of raw materials with constant parameters from reliable suppliers,
- The maintenance of machinery and equipment in good condition,
- Staff training in order to improve their skills in operation of production process.
- The implementation of Quality Management System (e.g. ISO 9001), which enables to increase customers' satisfaction.

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