TOTAL QUALITY MANAGEMENT IN THE PRACTICE OF POLISH METALLURGICAL ENTERPRISES

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Abstract

Variability in the modern world is the only thing that is constant. This is due to the globalization of the economy, introduction of new technologies and materials. The aim of the enterprises becomes to achieve satisfaction not only by the client, but by all parties concerned, shareholders, employees and suppliers. Total Quality Management is used in this purpose. The authors have attempted to analyze the type of used quality management methods and tools for quality assurance in Polish metallurgical enterprises.

Keywords: Metallurgical enterprises, quality management, Poland

1. INTRODUCTION

Organizational management standards are becoming increasingly significant in building competitive advantage of an enterprise. Certification of implemented quality system of ISO 9000 has ceased to be sufficient. In Polish conditions, more and more companies, including metallurgic ones, is implementing a variety of pro-quality tools. Such tools contribute significantly to quality improvement in certain types or organizations or a given industry, while the use of others will not bring any significant or visible outcomes. Due to a strong pressure on a customer market, enterprises are forced to implement standards required in specific sectors, such as automotive industry (IATF-16949) or arms industry (AQAP). Some smelter plants, for instance ArcelorMittal Warsaw, possess not only ISO 9001 certification but also 16949 [1]. Taking into consideration both a market and a customer, every enterprise ought to embrace three categories of requirements; general requirements (regulations connected with law, ecology), customer requirements (technical parameters, quantity, cost, information, deadline), the needs of an enterprise (profit, employee satisfaction, safety). In the last few decades it has been noticed that there is a significant increase in pro-quality requirements from an enterprise. The reasons for the growth can be linked to a few groups of factors. The first group of factors is related to a customer's expectations and is connected to comprehensiveness and productivity, capability, or infallibility. The second group entails laws and regulations, including liability for quality, norms and directives. The third group of factors constitutes the objectives of an enterprise, i.e., innovative products or a high level of approval on a customer market. A good example of an enterprise undertaking a series of actions in this area is SSAB [2-3]. The last group of factors related to competitive advantage is linked to internationalization and shortening of time in which innovations are implemented. The paper aims to present how a variety of available quality tools are used in Polish metallurgic companies striving at optimization of customer needs satisfaction at a reasonable cost and in a proper time span.

2. QUALITY ASSURANCE DURING DESIGNING AND PRODUCTION

New requirements for products, and hence for materials from which they are produced caused the development of methods and quality assurance tools. Depending on the use of the product the process of its manufacturing is burdened with the need to implement quality assurance systems, registration and data analysis and furthermore a process of continuous improvement based on the Deming cycle (PDCA- Plan, Do, Check, Act) [4,5,6]. In order to ensure the adequate quality of materials, products and effectively solve

problems there is needed knowledge about the process or object which problem concerns. Tasks to realize are as follows:

- To determine seriousness of the problem, its nature and the determination of the objective and assessment criteria of its solution. Partial problems separation that can be solved separately, for example unsuitable material, structure, chemical composition,
- collecting measurement data necessary to verify set assumptions and hypotheses,
- formation of assumptions regarding the causes of forming non-compliance and the mechanisms of their formation,
- verification of conjectures based on data collected,
- adoption of the most likely causes of problem occurrence,
- in case of several alternative solutions - the choice of that which will meet the expectations of the customer at the lowest costs,
- preparation of implementation plan of solved the problem,
- identification of potential hazards that can occur with introduction of solution,
- introduction of solution, process improvement,
- verification of the effectiveness of implemented solution, by comparing the obtained results with assumptions.

The presented approach can be noted in the Deming cycle, which is related to the principle of continuous improvement. The basis of implementation of the principle is the development of an action plan. It should determine targets and predict possible obstacles to achieve them. All data and information obtained in the phase of the action should be collected and stored [7,8]. After the introduction in the material (the process) improvements there should be measured obtained quality improvement and the information about it should be used in planning actions in the next cycle. **Figure 1** shows the problem-solving stages in the process of quality assurance in metallurgical enterprises. The frequency of the use of particular tools were introduced based on carried out research of metallurgical industry enterprises in the province of Silesia and Lodz in Poland in the years 2009-2014.

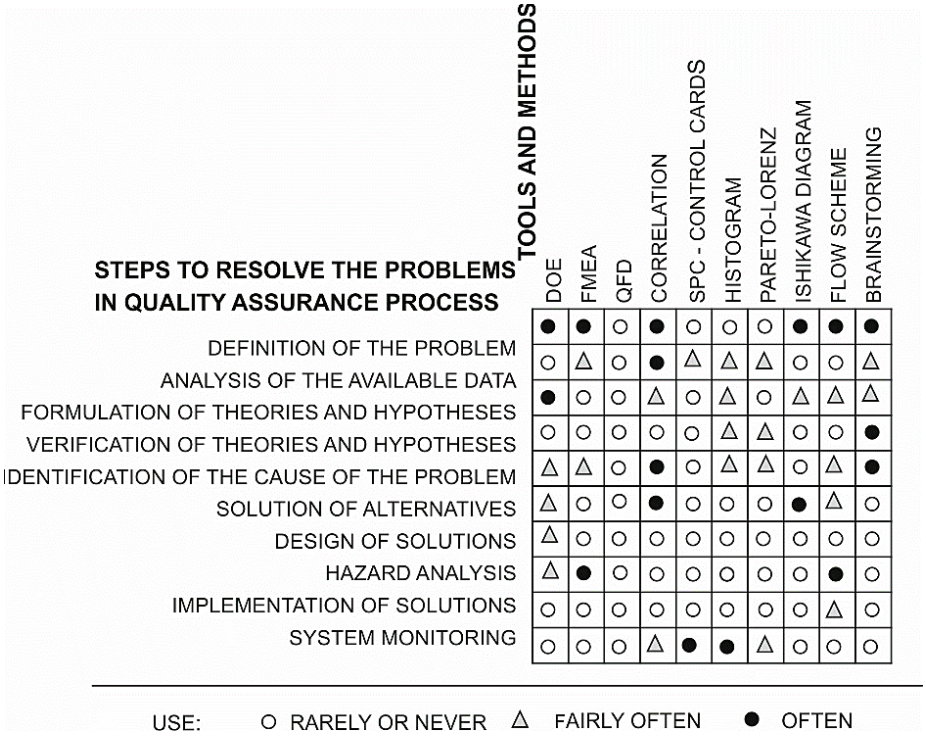

Figure 1 Frequency of use of selected tools and methods at different stages of solving quality problems

3. TOOLS AND METHODS OF QUALITY ASSURANCE USED IN POLISH METALLURGICAL ENTERPRISES

Subject literature [9, 10, 11, 12] identifies five methods of quality management, as well as seven traditional and seven new quality assurance tools. The vast majority of the surveyed metallurgical companies use in lesser or greater extent, quality assurance methods and tools. Near the 75 % of the surveyed companies confirms a significant or strong positive impact of their use on the level of quality of manufactured products, 85 % confirms a strong impact on improving the functioning of the company. Only about 3 % of the surveyed companies do not see the relationship between the implementation of quality management and the improvement of the quality of manufactured products. **Figure 2** shows the research results of the frequency of use of quality management methods as well as old and new quality tools.

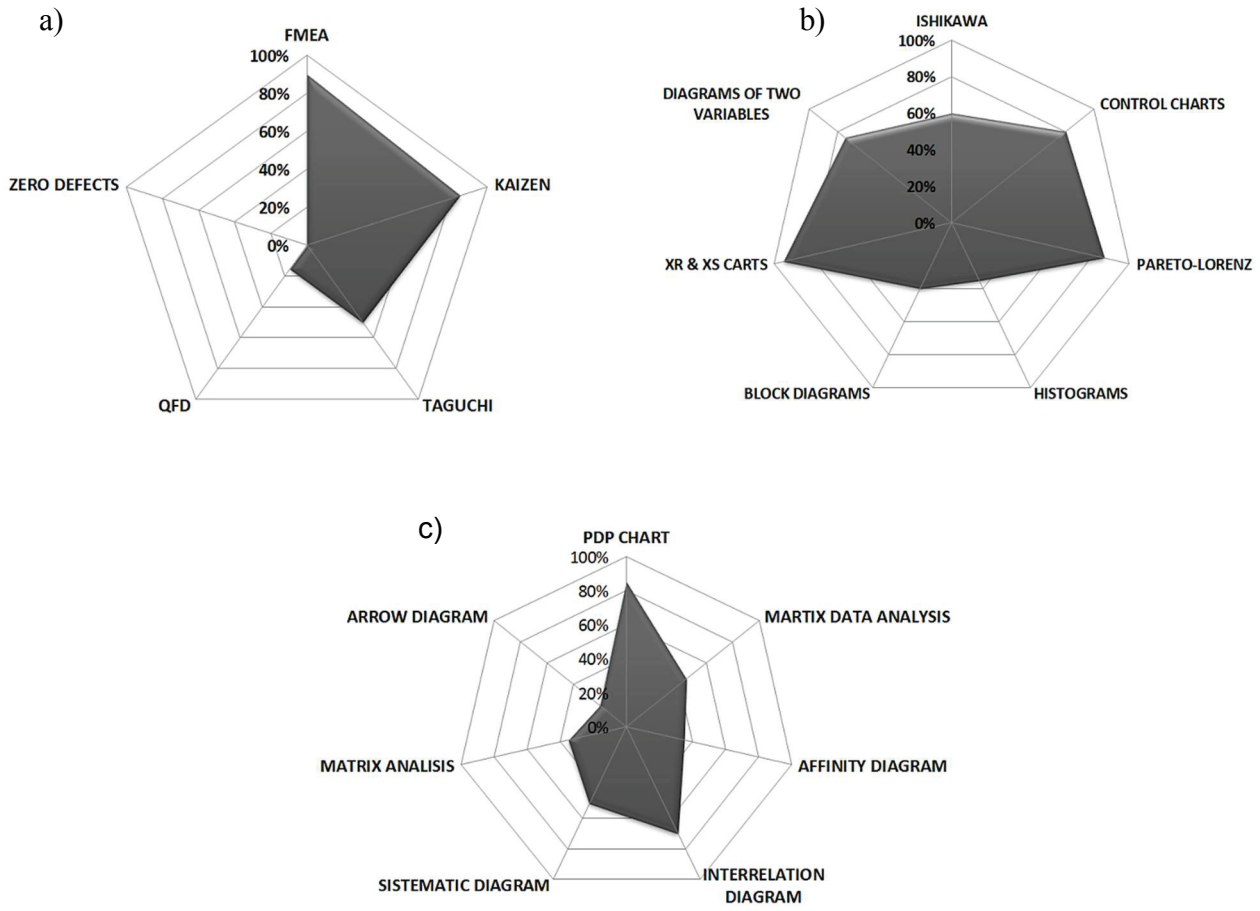

Figure 2 The research result of use frequency of: a) methods, b) tools, c) new tools of quality assurance in metallurgical enterprises

By cancelling obtained results, we can conclude that the metallurgical enterprises eagerly reach for tools which enable the quantitative description of the problem [13,14] (statistical methods, control charts, histograms, Pareto-Lorenz diagram, the degree of risk - method FMEA (Failure mode and effects analysis, qualitative capability factor), but less frequently use descriptive tools (new tool). This stems from the belief that the most important element in the process of assuring quality are research and laboratory analysis. In these processes surveyed companies emphasize the importance of place, method, cardinality and frequency of sampling.

4. IMPACT ASSESSMENT OF METHODS AND TOOLS ON OPERATION OF METALLURGICAL ENTERPRISES

An important element of carried out research is to know the opinion of metallurgical enterprises on the impact of the application of methods and tools of quality assurance to improve their functioning as well as to improve the quality of manufactured products. Tools and methods are divided into two groups and entrepreneurs were asked to indicate the importance of each of five methods of quality management and of each tool by positioning it on the corresponding position in a hierarchy of importance. Subsequently, there was calculated the Severity Rating *W* (1) [15].

$$W = \frac{\sum_{i=1}^{k} n_i w_i}{k \sum_{i=1}^{k} n_i} \quad (1)$$

Where:

W - Severity Rating,
i - indication of method place (tools),
k - the maximum weight (indication of the order of the method meant assigning weights in reverse order),
n_i - number of indications of given method (techniques) on *i* -number place,
w_i - weight corresponding to the place of *i* technology.

Assessment of the impact of quality management methods on the functioning of metallurgical enterprises is shown in **Figure 3** and on tools **Figure 4**.

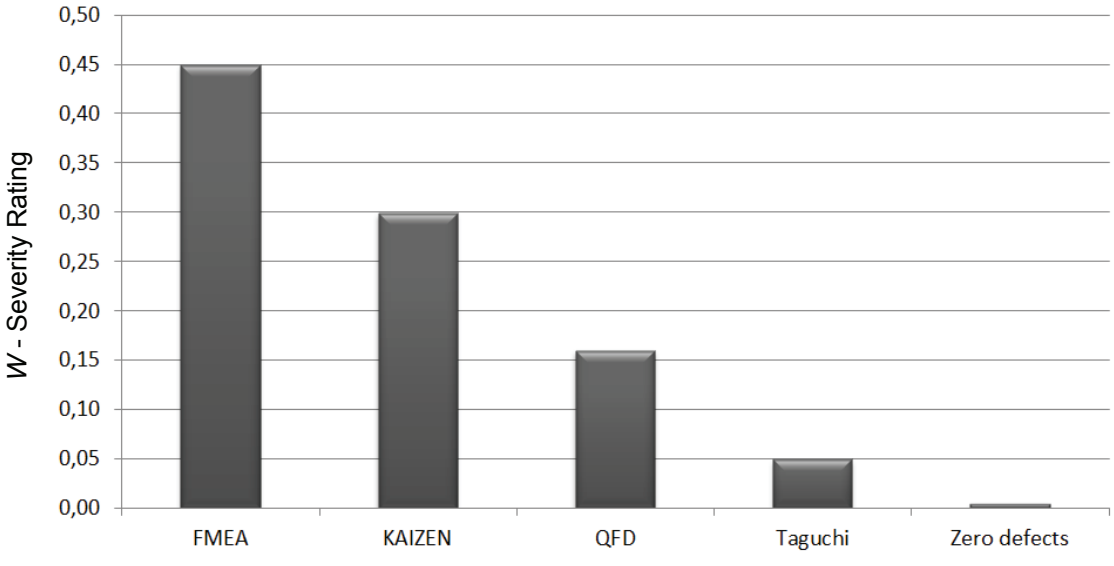

Figure 3 Assessment of the impact of quality management methods on the functioning of metallurgical enterprises

In the first place in terms of impact on the functioning of enterprise among methods of quality management has found the FMEA method, followed by Kaizen, QFD (Quality Function Deployment), Taquchi method, and zero defects. By analysing individual cases of Polish enterprises, we can conclude that the most commonly are used quantitative methods, what is indicated by the dominant position of FMEA method and the assessment analysis of tools impact on enterprise operation (**Figure 4**).

Analysis of the results presented in **Figure 4** shows that Polish metallurgical enterprises in small degree use methods supporting design of products. In the first place of influencing on the functioning of enterprise was

found a statistical process control in the form of control charts, control sheets and diagram of two variables. Also, there was carried out assessment of internal effects of use of selected methods and tools for quality assurance. Surveyed enterprises as the most important effects of implementation classified in the first place management improvement, focus on eliminating quality and procedural problems and improvement the process of their elimination. At the following places enterprises indicated to facilitate the introduction of new staff into their responsibilities, improve organizational culture and productivity. The results of conducted analysis allow to conclude that for the metallurgical enterprises in Poland the most important result of the introduction of total quality management is to improve management.

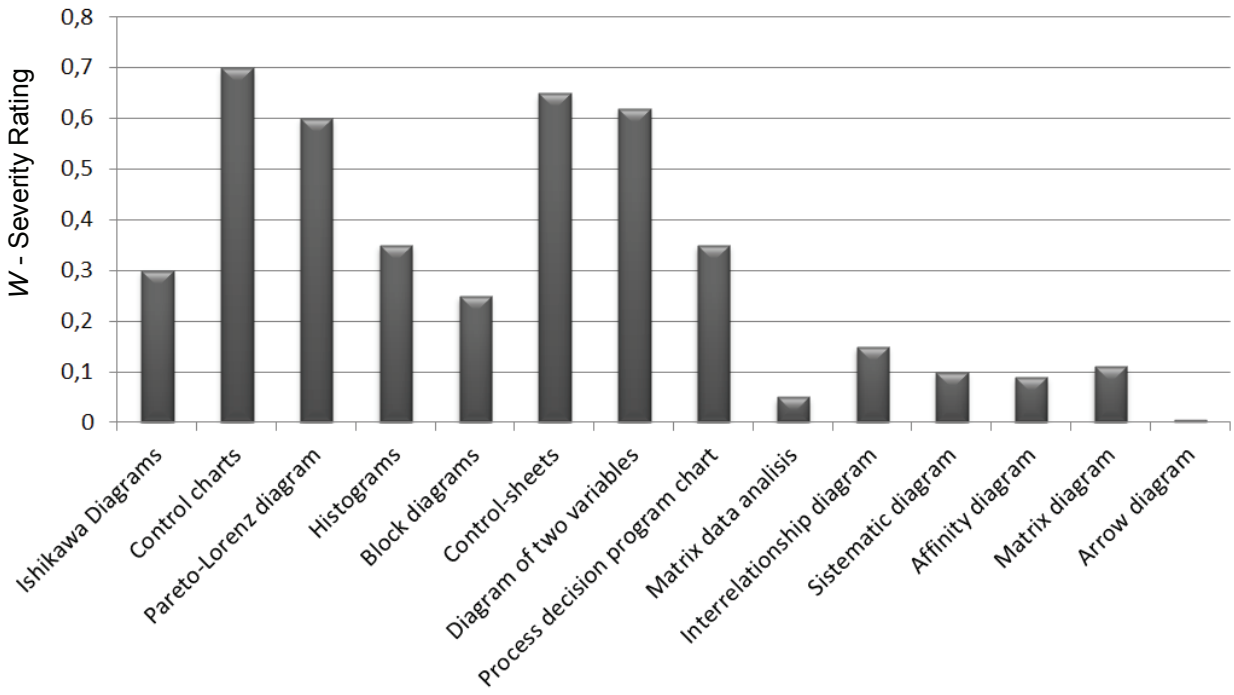

Figure 4 Assessment of quality tools impact on enterprise operation

5. CONCLUSIONS

Giving a high ranking to quality assurance problems in examined metallurgical enterprises may be strongly marked in the system of organization and management in the enterprise, including through the pro-quality orientation of global strategy of the enterprise and its implications at all levels and within all functions of management. The adoption of such pro-quality management concept and orientation does not exclude the possibility and need for using other its concepts, methods and techniques (e.g. marketing), wherein it is necessary to ensure their consistency. Quality management cannot be limited only as occurred in several surveyed enterprises for statistical process control.

Speaking about the modern approach to the issue of quality management there should be paid attention to the fact that many organizations today produce high quality products using traditional methods of quality management. Changes taking place in the business environment trigger an effect that K. Bleicher [16] defines as "time scissors." This means that the complexity of the processes and problems and their dynamics increases at the same time, so we need a new approach to quality management issue. Hence, Total Quality Management is an appropriate solution for metallurgical enterprises to be able to in a relatively short time to adapt to qualitative changes occurring in the environment. In order to meet the demands of the market, it is necessary to implement systemic solutions, which in addition to the measurements - a guarantee of

compliance with the requirements of the material, will ensure optimal conditions for the functioning of manufacturing systems.

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