QUALITATIVE ASPECTS OF RATIONALISATION OF COMPANY MANAGEMENT

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Abstract: The aim of the article is to analyze the production process of cups, which are prizes for outstanding athletes, eliminate the causes of incompatibility of the product contributing to financial losses and generation of production waste and use of natural resources, and propose preventive actions. The methodology of solving a problem of the inappropriate amount of glue in the top of products consisted in the ultimate data connection coming from the Pareto graph - of Lorenzo, the session of the brainstorming, the diagram of resemblance and analysis 5 x Why? The analysis shows that the reason for the inadequate amount of glue at the top cover is the poor technical condition of the machinery park in the company and the lack of proper maintenance procedures for machinery and equipment. The presented methodology of solving the problem of non-compliance in the product is universal. There is a possibility of implications of the presented method of reduction or elimination of product non-compliance in manufacturing companies. The originality of the study was expressed in the methodology of solving the research problem. The use of a single quality management tool or method does not provide assurance that the problem will be solved and that the non-conformity of the product will be significantly reduced and eliminated. The original character of the study also manifests itself in the author's approach to the issue of product quality assurance in the context, not only financial or image, but also in the concept of sustainable development.

Keywords: quality; management; sustainable development; production waste

1 Introduction

The term "quality" is closely linked to continuous improvement and the company's aspiration for excellence.This results in fewer mistakes and mistakes as well as more satisfied customers (Lisiecka, 2009; Hamrol, 2008; Czubała, 2006; Haffer 2003). Quality is a very important and strategic component of competitiveness (Pacana, Bednarova, Pacana, et al. 2014; Priede, 2012). Competitiveness of industrial enterprises is a predisposition to development, achieving profits, benefits and building a competitive advantage (Ślusarczyk, Szajt, 2013; Dobiegała-Korona, Kasiewicz 2000). Companies that want to be competitive on the domestic or foreign market should constantly strive to implement modern solutions and ensure high quality of the offered products. It is important to strive for this at any time and in any area of the company's operation, because there are no ready-made solutions or model models of conduct that would guarantee each organization a permanent, competitive advantage and thus achieve market success (Brzóska, 2014; Korzyński, Dzierwa, et at., 2009; Bielski, 2007).

Improvement of the company seems to be one of the key methods of improving the organisation's operations, creating added value, strengthening its potential and as a result of achieving the planned objectives (Kacała, Wierzbice 2015; Ślusarczyk, Szajt 2013). Improvement of processes consists in elimination of activities that do not create added value for the product, implementation of activities that increase the effects and satisfaction of customers and those that improve communication between persons involved in the implementation of a given process and the introduction of control measures in order to reduce the number of errors arising in individual stages of the process or preventive measures. Improvement also consists in drawing conclusions from analyses and audits carried out, followed by the introduction of corrective or preventive actions. All steps are carried out in order to meet the requirements of customers (Czerwińska, Pacana, et al. 2018; Nogalski, 2010; Bhuiyan, Baghel 2005).

In a situation in which there are inconsistencies in the manufactured product, the product does not meet the customer's requirements and thus generates additional production costs. It is therefore important to identify the cause of this phenomenon (Pacana, Bednarova, Liberko, et al. 2014;Ebenzer, Daradasn, 2011). Inadequate product quality, irregularities at the product design stage and in the production cycle are a source of additional and therefore unforeseen financial losses for the company (Hamrol, Mantura, 2002) and have a negative impact on the environment and social environment, generating production waste that depletes environmental capital and uses natural resources (Martin, Schouten, 2012; Belz, 2010; Peattie 1995).

The aim of the article is to analyze the process of cup production, eliminate the causes of product non-compliance contributing to financial losses and generation of production waste and use of natural resources, and propose preventive actions.

2 Formation process of cups

The company produces: figures (cast and plastic), diplomas (paper and wooden), cups, medals (cases, emblems and ribbons), trophies (wooden, crystal, plastic and glass), as well as subligraves. Within 2 quarters of 2018, the largest number of complaints from customers concerned cups, therefore, it was decided to introduce corrective and corrective actions in their production process.The technological process of the Cup consists of the following stages:

- delivery and storage,
- machining,
- assembly,
- packaging.

For the production of cups are used ready-made metal elements ordered from the supplier and stone (marble) used as the base of the cup. The metal parts are delivered to the company in parcels containing: foot, rod with caps, cup and top extension. Depending on the dimensions of the elements and the size of the order, there are 10 or 25 pieces of each element in the set.

The stone is delivered to the enterprise in the form of blocks. After checking the conformity of the goods with the order, it is transported to the warehouse.

A stone plate is subjected to mechanical processing, which is pre-cut into smaller parts using a saw. Then two holes of different diameters are drilled in each cube to fix the marble cube with metal elements. The last step in the processing of marble cubes is grinding and chamfering.

The assembly of the cup begins with the connection of the rod to the marble base by means of a cap. The next step is to tighten the foot, extension and cup. Finally, the cap is screwed on. Table 1 shows the components of the cup and the material from which they are made.

Table 1: Cup components

Item number	Element name	Material
1.	Goblet	Metal
2.	End caps	Metal
3.	Upper slip	Metal
4.	Bar	Metal
5.	Stopa	Metal
6.	Base	Marble

Ready cups are packed in cardboard boxes. Previously, they are protected with a bomb film, which is wrapped around the product. Boxes with products are transported to the warehouse.

3 Methodology – analysis of problems arising in the process of cup production

The cup manufacturing process includes: delivery, storage of components, mechanical processing of marble, assembly, packaging and storage of finished products. It is important that the bowl is properly made and passes through all stages of the production process without interruptions. On the basis of data from November 2018 included in Table 2, it can be seen that cups manufactured by the company are the most frequently advertised product.

Table 2: List of advertised products in November 2018 in the analyzed company

Product	Number of manufactured products [pcs]	Number of non-compliant products [%]	Number of complaints [pcs]
Cast figures	39 000	9,1 %	4
Plastic figures	20 000	8,0 %	77
Paper diplomas	8 000	0,51 %	1
Wooden diplomas	15 000	5,2 %	43
Cups	88 000	3,6 %	598
Models	92 000	5,6 %	114
Trophies	70 000	3,2 %	8

The number of complaints in November 2018 amounted to 598 cups, which is more than 70% of all complaints received in the analyzed month. Table 3 presents a list of the advertised defects of cups.

Table 3: List of incompatibilities of advertised cups

Number	Reasons for complaints	Description	Number of complaints
1.	Wrong order of the assembly	Slip being on the spot bases of the cup	107
2.	Disengagement of components	Disconnection sie of building blocks of the cup	99
3.	stains on the cup	Stains of glue on the product	37
4.	Damage	Visible upholsteries of the goblet	87
5.	An end cap is missing	Twisting off sie of goblet	5
6.	No coaxiality	No perpendicularity of the rod in relation to the base, which causes the cup to tilt	18
7.	Wrong elements in the cup	Mistaken cup components	53
8.	Inappropriate amount of glue by the upper end cap	Spilled glue inside the cups of the wok blanking plugs	156
9.	Rusting oneself elements	Visible rust in the goblet and in the base	36

It can be noticed that the most common cause of the complaint is the inadequate amount of glue at the top cover. With the help of the quality management tool, which is the Pareto-Lorenz analysis, it is possible to indicate which of the reasons for complaints are the most important. This analysis, together with other tools, will allow us to find out the cause of the nonconformity of products. For this purpose, the data in Table 3 should be arranged in a descending order and the share of non-compliance in the total number of defective products and their cumulative value should be determined (Table 4).

Table 4: Orderly number of non-compliant products and calculated cumulative values

Number	Disagreement of the product	Number of not harmonious products	Participation of the disagreement in the total of not harmonious products	Cumulative number of non-compliant products	Cumulative share of non-compliant products
1.	Inappropriate amount of glue by the upper end cap	156	26 %	156	26 %
2.	Wrong order of the assembly	107	18 %	263	44 %
3.	Warming up of elements	99	17 %	362	61 %
4.	Damage - upholstery	87	15 %	449	75 %
5.	Wrong elements in the cup	53	9 %	502	84 %
6.	stains on the cup	37	6 %	539	90 %
7.	Rusting elements	36	6 %	575	96 %
8.	No coaxiality	18	3 %	593	99 %
9.	An end cap is missing	5	1 %	598	100 %

Figure 1 shows the Pareto-Lorenzo graph for the number of non-compliant products based on the data from Table 4.

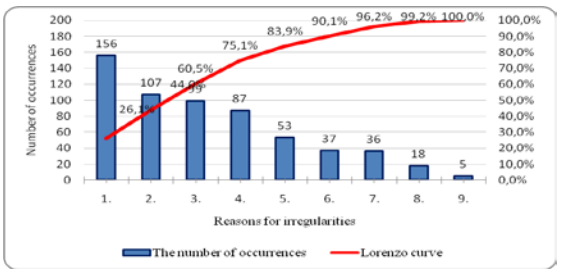

Figure 1: Pareto - Lorenzo graph of the disagreement of the product (Documents provided by the company, unpublished materials)

During the complaint, the following defects were indicated: lack of a cap, upholstery, incorrect order of cup elements and excessive amount of glue at the upper cap. Not all causes of the complaint can be repaired without replacing the elements. These include excessive glue at the top cover and upholstery, which can only be improved by replacing damaged parts. Using quality management tools and methods, it is possible to effectively eliminate the causes of non-conformity of products. Based on the Pareto-Lorenz analysis, 44% of the types of defects (four out of nine defects) generate 75% of all non-conformities. In order to improve, it is necessary to analyse the following defects: inadequate amount of glue at the top cover, incorrect assembly sequence, loosening of the elements and damage - upholstery. Due to volume limitations, the article analyzes the unsuitable amount of glue at the top cap of the cup.

The matrix presents tools and methods of quality management, which can be used to eliminate the causes of product non-compliance (Table 5).

Table 5: Matrix of tool proposals and quality management methods for significant defects occurring during the production process

	Tools and methods of the quality management										
Problems		Diagram Ishikawy	Pareto graph - of Lorenzo	Test sheets	Time sheets	Brainstorming	Diagram of the relation	Diagram of the tree	Diagram of decision-making processes	Diagram of resemblance	5xWhy
	Inappropriate amount of glue by the upper end cap	X			X	X	X	X	X	X	X
	Wrong order of the assembly	X		X	X	X	X			X	X
	Warming up of elements	X	X			X	X	X		X	X
	Damage - upholstery	X	X			X	X			X	X

Table 5 presents the proposed methods that can be used to improve the production process for the most significant non-conformity of the advertised products. The use of appropriate tools or methods will help to find the root causes of non-compliance and then propose remedial measures.

In order to improve the production process and eliminate key incompatibilities, brainstorming sessions, similarity diagram and 5xwhy were used. The brainstorming began with the gathering of all team members in the hall. Then the subject that sounded was clarified: "Non-compliance of the product - inadequate amount of glue at the top cap of the cup. The quality manager presented the problem, assumed the role of the chairman and reminded the basic principles of the brainstorming session, such as: presenting ideas and their transcript, listening to each other, lack of criticism, the possibility of modification and improvement of ideas by team members. The whole group analyzed the problem, presented their ideas, which were written on the board. The focus was on generating a large number of potential causes of non-compliance. The last stage of the brainstorming session consisted in juxtaposing and selecting the best ideas that cause the greatest losses. As a result of the assessment, solutions were obtained, which were placed in the similarity diagram. The ideas listed in the diagram should then be analysed accordingly. A similarity diagram is shown in Figure 2.

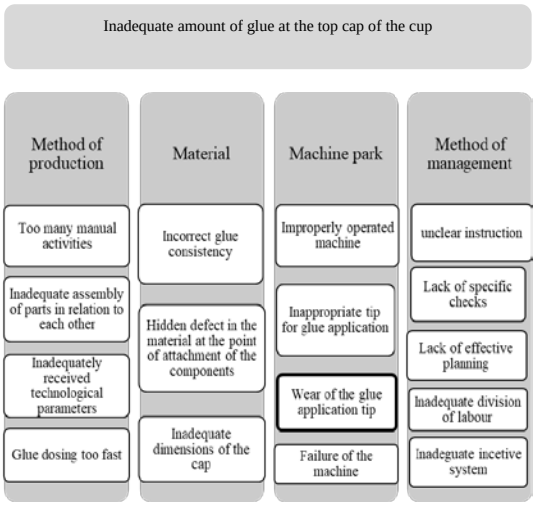

Figure 2: Similarity diagram for the problem of inadequate amount of glue at the top cap of the cup

The potential cause of the analysed inconsistency was considered to be the cause on the side of the machine park - wear and tear of the tip applying the glue and its too rare inspections and replacements. Based on the developed diagram, in the next step of the problem analysis you can use the "5xWhy?" (Figure 3).

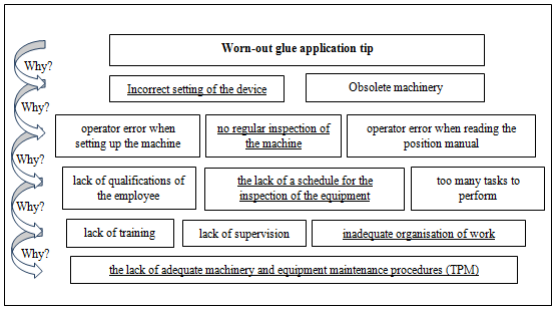

Figure 3: Analysis 5 xWHY? for the problem concerning using the end for putting glue

On the basis of the kinship diagram (Figure 3) the analysis "5xWhy?" was made. When analysing the potential causes of inadequate condition of the components of the machine for bonding the components of the product, the lack of proper machine and equipment maintenance procedures (TPM) has been identified as the key reason.

4 Suggestion for improvement

Most of the reasons, causing the tested product non-conformity, are related to the lack of appropriate procedures for maintenance of machinery and equipment and poor technical condition of machinery in the company. For this reason, it is recommended to implement one of the lean management methods - TPM (Total Productive Maintenance) - first on the workstation and then throughout the entire company. Preventive actions should be carried out in two areas: human and machine. The task of TPM, in the first area, will be to increase the level of effectiveness of employees by broadening their knowledge and skills - which will be tantamount to increasing the degree of their responsibility. According to the method adopted, employees will become more involved, will acquire the ability to correctly interpret situations arising within their workplace, so that they will be able to make appropriate decisions on their own. In the field of machinery, the activity of employees, in addition to their existing duties, should focus on maintaining equipment in a state of high availability. In addition, the maintenance department should be able to obtain information from operators on the current state of the machine park in order to plan the department on an ongoing basis. By getting to know the machines properly, production workers, maintenance workers and technologists will be able to draw up improvement projects (e. g. Kaizen ideas) in order to facilitate maintenance or improve the functioning of the machines. Thanks to training, maintenance staff should change their attitude from reactive to predictive machine operation, which will translate into increased machine availability and reliability, which directly reduces production costs and contributes to reducing unnecessary use of natural resources.

5 Conclusion

Progressing technological development of the modern world and growing consumerism of societies are the cause of degradation of the Earth's natural resources. Due to the fact that all products consume energy and natural resources during the production processes, thus leaving a footprint in the environment, production companies should provide technological and production solutions that minimize the adverse impact of production on the ecosystem.

In the analyzed production process, not all non-conformities of the product can be removed or repaired. An example of this type of non-compliance is the inadequate amount of glue at the top cap, which, if too much glue is used, makes it impossible to

repair the product and thus contributes to the increase in production waste. In order to eliminate the problem studied, an analysis of potential causes of incompatibility was carried out, brainstorming sessions were carried out, a similarity diagram and the 5xWhy method were made. The key reason for the inadequate amount of glue in the upper part of the cup was the poor technical condition of the glue dispenser and the lack of proper maintenance procedures.

In order to prevent the occurrence of product inconsistencies caused by the poor condition of the machine park, it was recommended to implement the TPM method in the company. The aim is to maximise the efficiency of machines and equipment by maximising the time available for the production of compliant products.

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