IMPLEMENTATION OF THE CONTINUOUS IMPROVEMENT PROCESS INSIDE AUTOMOTIVE INDUSTRY ORGANIZATION IN THE FIELD OF PLASTIC INJECTION

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Rezumat. *Lucrarea abordează structura procesului de îmbunătățire continuă și implementarea unui sistem de control, analiză și măsuri de corecție pentru toate incidentele înregistrate în organizație ca neconformități.*

Abstract. *The paper addresses the structure of the continuous improvement process and the implementation of a control, analysis, and correction system for all incidents recorded in the organization as nonconformities.*

Keywords: Plastics, Identification analysis, Root causes nonconformity, Organization performance improving

1. Introduction

Plastics injection is a manufacturing process of parts, obtained by injecting molten granules into a mold. The melt cools and by solidification takes the form of the cavity in which it was injected.

In recent years, products made of plastic have grown due to the high productivity of the process, the versatility and potential to replace metal in many applications.

Plastic appeared as raw material at the end of the IX century (ebonite and celluloid). The technology developed slowly until the middle of the XX century when it began to grow. In 1944 the worldwide production of polymer resins, being used mainly in electrical applications, for insulation. The main groups of materials used today, Polystyrene, Polyvinyl chloride, Polyolefins and polymethacrylates, were developed at the industrial level before 1950.

Since the middle of the XX century, the development of plastics has taken a large scale, penetrating the majority of industries.

Plastics injection is used to produce goods such as packaging, auto parts and components, toys, storage containers, mechanical parts, components of medical

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installations and appliances, in electronics, consumer goods, and even military applications.

The use of plastics in the automotive industry, the development of which has driven the development of the entire world economy, has led to lower vehicle mass, increased active and passive safety, lower fuel consumption and emissions, and major aesthetic improvements allowing due to flexible technology shortening the development time of new models.

2. Current stage

In recent years, products made from plastics have seen an important evolution in several industrial areas.

[1] DEX defines plastic as a "synthetic product of organic, inorganic or mixed nature that can be easily processed into various objects, hot or cold, with or without pressure". [1]

Plastics are materials that have the basic components of polymers. Apart from polymers, plastics also contain:

Filling materials: fiberglass, wood flour, asbestos, talc;

Plasticizers: high-boiling esters, increasing elasticity and reducing fragility.

Stabilizers: antioxidants, photo stabilizers for preserving properties during processing.

Plastics processing technologies:

- Compression formation
- Extrusion
- Thermoforming
- Blowing
- Injection into the mold

3. Complexity of activity

In a company that has as main activity the production of plastic parts by injection, there are many activities in many fields, grouped by processes.
Customers require products that meet the technical requirements and have the required quality, low prices and short delivery times.
The company wants to meet customer requirements in terms of profitability, being interested in increasing sales and lowering costs.

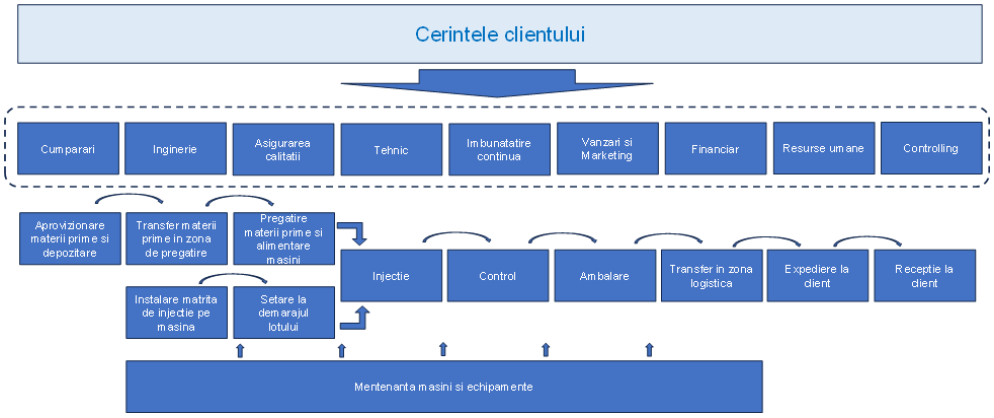

Fig.1. General structure of activities

In this view of complexity (see Figure 1) there are always opportunities for both positive, performance improvement and negative results, defective products, malfunctions in activities.

Defects can have different causes that need to be identified and eliminated by specific actions.

Dysfunctionalities can lead to unjustified stationary of machinery and equipment or activities, or they can be directly fault-generating.

Before the occurrence of defects and malfunctions, preventive actions can be taken to reduce damage due to defects and stationary.

Also, any factual situation, expressed by indicators such as: the number of defects, the percentage of defective parts, the degree of loading of machines, the degree of availability of machinery, the rate of achievement of preventive maintenance, the ratio between preventive maintenance and corrective maintenance, the time of change of manufacture, etc.– can be improved. More than domestic expectations, cost reduction requirements also arise and so the need for continuous improvements becomes mandatory because competition in the field is constantly increasing and customer requirements are also increasing.

In this context, the continuous improvement activity is positioned as a central mechanism for improving performance in a company, through specific actions aimed at preventing the occurrence of defects and malfunctions, quickly and definitively correcting defects and malfunctions, finding solutions to improve the situation and collecting and applying employee improvement ideas.

4. Description of how to approach the improvement system through analysis

An important role in the processes of the quality management system is played by the continuous improvement process, which has as objectives:

- achieving customer satisfaction;
- continuous improvement of the quality of products and services;
- improve the effectiveness and efficiency of processes throughout the organization;
- reducing losses due to poor quality.

Improvement opportunities are marked by customer feedback, internal and external audit results, and non-quality analyses, and the conclusions of the measurement and monitoring of processes.
To identify opportunities for improvement, the following steps are followed:

- proving the need for improvement by identifying non-conformities;
- analysis and diagnosis of the causes of nonconformities;
- implementation of improvement actions;
- review of internal standards after implementation of improvements.
- application of improved working standards so that results are always applicable and measurable;
- transversal of the measures identified to all processes and products with transversal potential;
- measuring the effectiveness of the actions taken;
- use of lessons learned at the organization level.

The working methods established to identify improvement opportunities and action measures are:

- QRQC (Quick Response Quality Control) - is a tool that allows effective problem solving, based on a cross-cutting working group, which works according to all criteria of quality technical analysis and is led through the continuous improvement department. [7].

5. Problem identification

Following the health crisis and the economic crisis, overlapped by the process of profound transformation of the automotive industry generated by the transition from thermal engines to green – electric motors, hydrogen or using other clean sources, competition in the field has increased.

The firm has been affected by the fact that customers demand lower prices and there are competitors who manage to offer them.
During 2023, the impact was a loss of 5 million euros in potential turnover.

6. Determining the elements to be improved (operational objectives)

The way the company can overcome this difficulty is to reduce costs and this can be achieved by improving operational performance.

7. Objective

Strategic objective:

To win new contracts to compensate for the lost 5 million euros and to bring another 5 million euros so a total of 10 million euros.

Strategic objectives follow the vision of the future of the company, which essentially refers to reaching the elite of automotive suppliers at European level

One of the ways to achieve this vision and the strategic goal is to reduce costs while increasing quality. For enrolment on this path, operational objectives have been set, some of them closely related to the continuous improvement process.

Operational objectives:

- reducing the overall cost level by 2%.
- reduction of the discard coefficient from 5% to 0.5%.
- reducing the number of quality incidents at the customer from an average of 350 per year to a maximum of 1 incident per year.
- improvement of OEE (overall equipment efficiency) from 50% to 60% by reducing parking times due to machine and mold defects [11].
- reducing the share of standstill times due to machine and mold defects from 30% to 20% each.

Fig.2. Objective

8. Implementation of the improvement system

Key success factors for implementing a continuous improvement system that is a solid basis for improving results are:

- commitment of the organization management at all levels
- changing the organizational culture to determine an appropriate organizational behavior that can perpetuate indefinitely the efforts of continuous improvement
- the involvement of all employees in the continuous improvement efforts
- implementation of a simple but rigorous analysis system and integration of all departments in efforts to identify solutions
- implementing a rigorous system to track how actions are implemented and the results obtained from this implementation

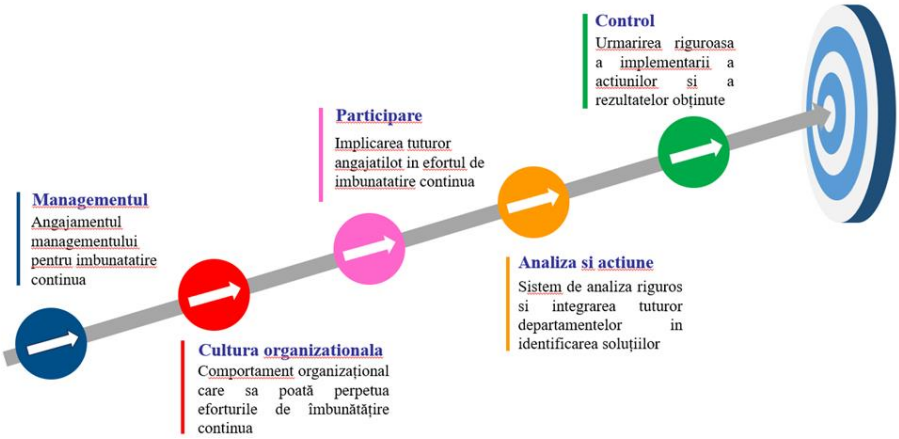

Fig.3. Key success factors

In order to achieve the level of performance outlined by the organization, it was decided to implement the system of analysis of nonconformities through the QRQC system and the following important decisions were taken:

- abandoning the approach of methods of analysis on the problem of the day model, the synthesis of the day and the method of addressing all problems
- addressing all issues in the QRQC process by addressing all issues focused on complex analysis of causes
- daily conduct of QRQC analyzes, with the participation of all persons involved in the process and through the direct involvement of department heads
- involvement of top management in the analysis action to contribute to the process support effort

9. Conclusions

The main goal of the research was to identify a working system to analyze the causes of nonconformities in the plastic injection process. Due to the diversity of products and services carried out within plastic injection companies, the non-conformities that occur vary depending on each area of activity, such as production, quality, logistics, maintenance or even human resources.

Two of the main challenges of applying the working system were:

1) -create an effective communication flow between processes so that non-conformities are properly reported and analysed in a coordinated way to ensure correct identification of root causes and not just treatment of symptoms.

2) -implementing a well-structured change plan that will face resistance to new from employees or teams.

The choice of nonconformity analysis system in the plastic injection industry contributes significantly to improving the performance of the organization. By both theoretical and practical nature of the tools used in the process of continuous improvement, applied through the analysis of nonconformities, an efficient production, a high-quality level and a high degree of customer stasis are obtained.

The results obtained by testing each method analyzed, demonstrate:

- Reducing the costs of non-quality by analyzing and eliminating the causes of non-compliance
- Increasing productivity through continuous optimization of processes, activities and allocated resources
- Improving customer satisfaction and increased competitiveness
- Mature organizational culture, customer-oriented and competitive results
- Continuous training of employees
- Alignment to the quality standards in force

By applying the proposed solutions, a 90% reduction in the defect rate and an improvement in production time by 20% has been demonstrated. Also, the developed solutions have helped to increase customer satisfaction by delivering more consistent quality products.

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