"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

GERMANY

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2011
Brasov, 26-28 May 2011

IMPLEMENTED TPM TO INCREASE THE COMPETITIVENESS DIE PRODUCTION SYSTEMS

Mariana C. RĂŞINĂ, Vladimir M. KLEIN

Transilvania University, Braşov, România

Abstract. *In a global market a competitive production system provides a good place in keeping customers and winning new markets and customers. The production system must find the necessary tools to increase competitiveness by decreasing costs, increasing the quality of products and processes, higher flexibility to the market requirements. One of the tools that ensure the increased competitiveness of the production system is the implementation of Total Productive Maintenance (TPM Total Productive Maintenance).*

Key words: *production system, Total Productive Maintenance, competitiveness, change over.*

1. INTRODUCTION

Currently there is a clear trend towards market globalization and to save what determines an increasing interpenetration of national economies.

Globalization is a process that takes place with amazing speed, includes almost all countries of the world and has been determined and encouraged by the fast technology progress.

The main feature to operate on a global marketplace is competitiveness.

Competitiveness is a system of production capacity to act in a competitive market. The notion of competitiveness is much broader than quality, productivity, profitability, etc. which encompasses it. Always, at any level in any field, quality, productivity, profitability, etc. are just faces of competitiveness [1, 2, 3, 4].

According to OECD (Organization for Economic Co-operation and Development), "Competitiveness is the ability of businesses, industries, regions, nations or supranational complexes to provide input to the profitable production units and a relatively high level of use on a sustainable basis, given that they are exposed to free competition "[5].

2. THE COMPETITIVENESS OF THE DIE PRODUCTION SYSTEM

The competitiveness of a mould making production systems and competitive as any production system, are measured the same as any production systems competitiveness, analyzing the competitiveness of each of the activities of its departments. Some activities are more important than others, depending on the activity of the production system and thus belonging departments have a greater role. If production systems that made moulds for casting and forging ,organizing the supply, production, delivery, business activities and how it intertwines in the concept of

sustainable development in business activities, are some activities that can make the production system, a system competitive, or the contrary.

3. TPM DEFINITION

TPM means Total Productive Maintenance and is a system of maintenance to covering the entire life of the equipment and the total human resource.

TPM is a tried and tested way of eliminating waste, saving money and making factories better places to work. It gives operators the knowledge and confidence to manage their own machines.

TPM is a long term process to increase skills, raise efficiency and achieve zero losses.

4. STEPS FOR IMPLEMENTED TPM

TPM is not just a concept it's a TPM requires effective leadership from the start. That is part of the meaning of "total" in Total Productive Maintenance. Without effective leadership that links TPM efforts to the business and holds people accountable for performing highly specified work, equipment performance and reliability will continue to decline and TPM initiatives will be short-lived [5].

A die production system to be competitiveness must understand the maintenance was not only responsible for "fixing things" – not for preventing problems.

Viewing maintenance as a non-value-adding support function, often subject the maintenance department to severe cost-cutting; this usually results in higher costs due to decreased equipment effectiveness and a lower competitiveness.

To implement TPM in a die production system must following 12 steps:

Step 1: Announcement of TPM. Top management needs to create an environment that will support the introduction of TPM. Without the support of management, skepticism and resistance will kill the initiative [6].

Step 2: Launch a formal education program. This program will inform and educate everyone in the organization about TPM activities, benefits and the importance of contribution from everyone. Can use flyers, posters, billboards s.o.

Step 3: Create an organizational support structure. Can start through o project. The team project will promote and sustain TPM activities once they begin. Team-based activities are essential to a TPM effort [7]. The team project needs to include members from every level of the organization – from management to the shop floor. This structure will promote communication and will guarantee everyone is working toward the same goals [8].

Step 4: Establish basic TPM policies and quantifiable goals. Analyze the existing conditions and set goals that are SMART:

- Specific: clear about what, where, when and how the situation will be changed;
- Measurable: the ability to quantify the targets and benefits;
- Attainable: capacity to achieve the objectives (knowing the resources and capabilities available to the production system) ;
- Realistic: the ability to get the change reflected in the objective;
- Time-based (in Time): determining the time period during which each objective will be achieved. Practical way to implement TPM is workshops.

Step 5: Outline a detailed master deployment plan. This plan will identify what resources will be needed and when for training, equipment restoration and improvements, maintenance management systems and new technologies.

Step 6: TPM kick-off. Implementation will begin at this stage and it will be follow like a project with stage, gates and millstones.

Step 7: Improve the effectiveness of each piece of equipment. Project teams will analyze each piece of equipment and make the necessary improvements. First stage must be the observations.

Step 8: Develop an autonomous maintenance program for operators.

Operators' routine cleaning and inspection will help stabilize conditions and stop accelerated deterioration. Must realize standard maintenance instructions with specific pictures.

Step 9: Develop a planned or preventive maintenance program. Create a schedule for preventive maintenance on each piece of equipment divided on each shift.

Step 10: Conduct training to improve operation and maintenance skills. The maintenance department will take on the role of teachers and guides to provide training, advice and equipment information to the teams.

Step 11: Develop an early equipment management program. Apply preventive maintenance principles during the design process of equipment [9].

Step 12: Continuous improvement. As in any lean initiative, the organization needs to develop a continuous improvement mind-set.

The modalities to measure the TPM are the following: the indicators like OEE (Gage), maintainability, reliability, availability (down time loss), efficiency, quality rate (defect loss), performance (speed loss).

5. OEE AN INDICATOR OF TPM

The modalities to measure the TPM are the following: the indicators like OEE (Gage), maintainability, reliability, availability (down time loss), efficiency, quality rate (defect loss), and performance (speed loss).

OEE breaks the performance of a manufacturing unit into three separate but measurable components: Availability, Performance, and Quality. Each component points to an aspect of the process that can be targeted for improvement. OEE may be applied to any individual Work Center, or rolled up to Department or Plant levels. This tool also allows for drilling down for very specific analysis, such as a particular Part Number, Shift, or any of several other parameters.

It is unlikely that any manufacturing process can run at 100% OEE. Many manufacturers benchmark their industry to set a challenging target, 85% is not uncommon.

The components of OEE are related in figure 1:

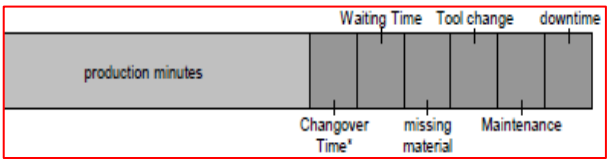

Fig. 1 The components of OEE

6. DECREASING CHANGEOVER TIME TO A GRINDING MACHINE IN A DIE PRODUCTION SYSTEM

A production system that produces molds is characterized by a production of unique and rare pieces of small series. For this reason the handle different commands from a clients, the system should be able to adjust quickly the production to the client's request. The Indicator that measures that is called processing time.

At the grinding machine used for the grind round mold plates the round the transformation time is very high. A TPM workshop is held to analyses the values changeover time throughout the year. High values are resulting, that values are constant month by month although the changes are the same.

A 5Why analyses are made and the conclusions are that the changeover time is too high (Figure 2) because for the product changes are required too many operations (Figure 3).

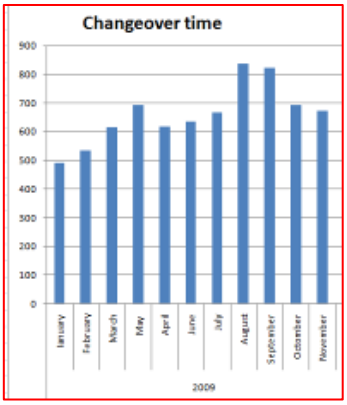

Fig. 2 Changeover time at grinding machine

Fig. 3 The grinding machine segments on plate's machine

A brainstorming is organized and deciding to replace the car with some new segments. The new pistons adapts easy to the new diameter of the engines die. Fix the car plate and the work piece is placed on them without the need for additional fixation (Figure 4).

New segments are designed, are given for execution, are mounted on the machine table and tested.

Fig. 4 The grinding machine new segments on plate's machine

After this test the results are a much better changeover time and the decision to implement these new segments. The Changeover time before and after implementation is found in Figure U. It shows a decrease of processing time (Figure 5), a growing number of transformations (Figure 6) and a considerable decrease of the minutes / no changeover (Figure 7).

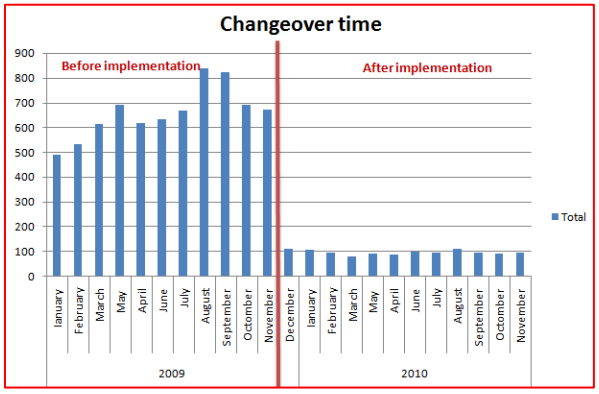

Fig. 5 The changeover time value before and after the implementation of the new segments on plate's machine

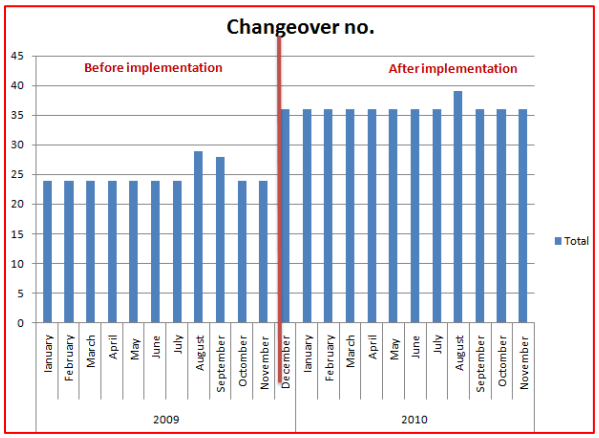

Fig. 6 The changeover no. value before and after the implementation of the new segments on plate's machine

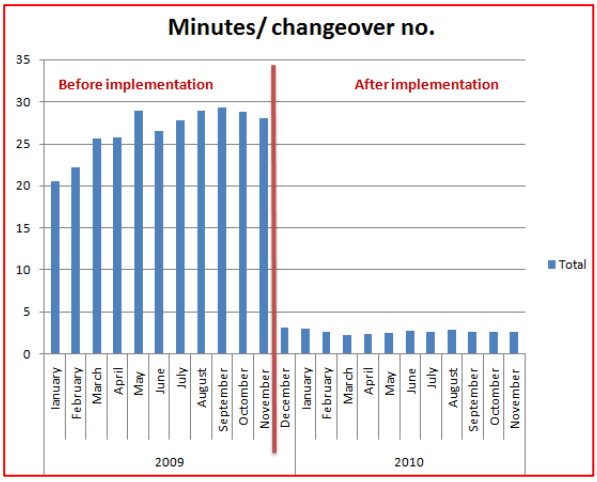

Fig. 7 The changeover minutes reported to changeover no. value before and after the implementation of the new segments on plate's machine

7. CONCLUSIONS

Increasing competitiveness implies the use of methods and principles to help the production system to become more competitive than other production systems which operate on the same market.

TPM is a Lean Instrument; with the implementation of TPM in the production system it becomes competitive by achieving maximum equipment efficiency throughout the lifecycle and significantly reducing costs.

Introducing TPM requires a well-established plan, materialized through a project and a well specialized team. A successful implementation requires the involvement and training of all employees, including the management.

Increased competitiveness through TPM is a good opportunity to raise operator's skills and know-how, to foster improvement suggestions.

TPM increase the competitiveness of production system through:

- a optimum productivity of machines, a reduction of the costs incurred and a reduction in the time for the return on investment;
- minimize the under-utilization of equipment: cause of losses (including financial);

The conservation of equipment through close observation of the factors for keeping (an operational condition of machines).

The TPM are following through OEE indicator.

The example describes a workshop of decreasing changeover time.

Reduction of change-over costs, an easy production of smaller lot sizes/prototype parts combined with an increased number of changeovers, urgent orders can be quickly produced, Set-Up becomes easy, no special skills are needed. Indirectly improved productivity (increased efficiency, less waste, less machine defects), improved flexibility.

REFERENCES

1. Popa, H.L. s.a.: *Managementul □i ingineria sistemelor de produc□ie*, Politehnic Eublisher, 2001; ISBN 973-8247-72-1, Timi□oara (in Romanian)

2. Popa, H.L. (2001): *Evaluarea competitivită□ilor, Marketing & Management*. Anul XI, Vol. 4-5, 2001; p. 376 – 382, ISSN 122-9105 (in Romanian)

3. Popa, H.L., *The competitiveness variety*. Scientific Bulletin of the "Politehnica" University, Transactions on Management. Engineering Economy. Transportation Engineering, Tom 46 (60), Fasc. 1-2, 2001; p.16 - 23, ISSN 1224-6050, Timi□oara, (in Romanian)

4. Garelli, S., *Top class competitors: how nations, firms and individuals succeed in the new world of competitiveness*. J. Wiley and Sons, 2006; ISBN 0-470-02569-7
5. http://www.cse.uaic.ro
6. http://www.reliableplant.com/
7. http://www.plant-maintenance.com
8. http://www.hutchins.co.uk
9. http://www.productivityinc.com
10. http://en.wikipedia.org