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Implementing autonomous maintenance in an automotive components manufacturer

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Abstract

The automotive sector constitutes one of the most demanding activities in the global market, since it requires a constant increase in productivity, both in the automobile industry as well as in the companies whose manufacture its components. This sector is currently set within an economic framework where there is a relentless search for costs reduction and an increase in productivity with minimal investment. In order to meet these requirements, companies have sought to optimise their products and processes to ensure higher profits. This study was developed with the purpose of enhancing procedures in the maintenance sector regarding a company which supplies air-conditioning tubes to the automotive sector. The main objective was to increase its machines and equipment availability through the implementation of autonomous maintenance. Due to the undertaken improvements, there was a 10% increase in the monthly indicator of equipment availability on line AA3 at the company where the study was carried out. This, in turn, resulted in an increase of 8% in OEE (Overall Equipment Effectiveness) during the same time period, which was chiefly due to a reduction both in machine breakdown rates, as well as in the MTTR (Mean Time To Repair) on the same line.

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Keywords: Autonomous Maintenance; Automative Industry; TPM; Visual Management

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1. Introduction

Due to the market high demand, industry has been pressed to develop and adopt new production technologies and techniques, as well as management procedures, with no chances for failures or waste. Faced to this scenario, companies must continuously enhance their activities in order to survive in this competitive environment [1]. This demand invariably affects the maintenance sector which, together with production, must carry out their activities in such a way that these do not interfere with the course of the productive process [2]. To this end, maintenance strategies must be drawn up so that possible breakdowns on equipment are reduced to a bare minimum. Thus, the goal is to reach a level of total efficiency to ensure reliable uninterrupted production [3]. Autonomous maintenance is a tool which stems from the eight foundations of the Total Productive Maintenance structure (TPM). Its aim is to eliminate all the forms of time expenditure associated to stoppages in the productive system due to machine breakdowns, which invariably produce a direct impact on process performance [4, 5]. Autonomous Maintenance is, therefore, essential to the implementation of TPM; it enables greater production throughput and includes the support of the company's employees [6]. In order to implement these targets, greater responsibility must be given to the operators: these must be made fully aware of their role in ensuring both the quality of the end product, as well as the efficient running of machines to achieve significant improvement in equipment performance [7].

The work described in this article was developed at a company in the sector of components for the automotive industry, which is located in Porto, Portugal. Autonomous Maintenance was implemented and associated with other Lean philosophy tools (5S, TPM and Visual Management) with the purpose of improving actions in the maintenance sector of a production line, which would then reduce the stoppage rates resulting from machine breakdowns. This article is divided into five sections: section 1 consists of the introduction; section 2 presents a review of literature pertaining to the subject of maintenance optimization tools; section 3 deals with the methodology developed to carry out the work; section 4 describes the course of all the practical work involved and undertaken at the company being studied. This section also presents improvement proposals for identified problems, as well as the results obtained from their implementation. Finally, section 5 deals with the conclusions reached through this research work.

2. Literature review

The industrial sector has indeed become more robust over the years. As a result, there has been an increasingly important need to hone processes so as to meet the challenges of product diversification and the context of growing competition amongst rival companies [8]. In order to excel in this scenario, many have resorted to the use of improvement techniques ensuing from Lean philosophy to reduce waste and eliminate activities which add no value to the process [9]. The LCM process (Lean Centered Maintenance) thus emerged from the attempt to connect these concepts with other areas. It consists of Lean tools applied to the maintenance sector which, through the implementation of their principles and ensuing results, aim to support decision-making in companies, reduce waste and achieve constant improvement in the efficiency of equipment and machines [10]. In order to clarify the meaning of "maintenance", this can be understood as a set of techniques and tools that ensure the quality and reliability of the machines, equipment and facilities found in an industry, so that there are no unexpected interruptions in the system [11, 12]. Deriving from Lean philosophy, one of the tools used in maintenance processes is TPM, which consists of a set of techniques to address the optimisation of maintenance processes. When implemented, it results in the reduction of waste and a significant increase in productivity for the company involved [10]. The concept behind the TPM process is well defined: in order to ensure its successful application, the optimisation of the productive process must include the reduction of machine breakdowns, thus minimising waste and the consumption of products during the process [13]. The implementation of TPM requires setting up eight support pillars, one of which is autonomous maintenance. This is defined as a set of preventive and predictive maintenance activities carried out by the operator, who is involved in machine manufacturing functions and is thus responsible for its maintenance and working order [14]. By taking on this responsibility, the operator is fully autonomous: the worker can request the support of a maintenance team when intervention on the machine is necessary, or when assistance is needed, without interfering in the productive process [15, 16]. The use of this tool is not restricted to the automotive sector, and its application can also be found in other sectors such as: Telecommunications [14], Agriculture [17] and in the area of Metallurgy [18]. One can thus conclude that the application of autonomous maintenance is of crucial importance to a corporation: its use provides great support