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Application of Lean Production Principles and Tools for Quality Improvement of Production Processes in a Carton Company

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Abstract

This work presents an industrial case study focused on improving the quality of production processes, using lean production tools. The analysis of the initial situation was done using cause-effect diagrams, Pareto's analysis, study of setup times and performance indicators, allowing identifying the main problems, such as high setup times, low availability of machines, lack of organization in the working area. Improvement proposals were implemented in the bonding section, like the SMED methodology, the 5S technique and visual management. As result it was achieved an average reduction of 47% in the setup time, corresponding to 10114€ of monthly profit.

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Keywords: 5S Technique; Lean Production; Quality Tools; SMED; Visual Management.

1. Introduction

In general, companies are under pressure to improve productivity and quality while reducing costs. This has led many of these companies to implement a Lean Production philosophy [1]. Lean Production is a multidimensional approach that covers a variety of management practices that aim to reduce waste and improve operational

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effectiveness [2]. However, the application of the practices alone does not ensure the implementation of the Lean philosophy. In addition to technical factors, any Lean implementation should consider non-tangible change factors, such as creating a supportive learning environment and developing leadership in the organization.

Companies may follow a different strategy and bet on continuous improvement of the quality of their products / services, to retain customers and gain market share. Continuous improvement of processes is a key concept of Total Quality Management [3], but it is not the only way of improving a process. In this context, a management strategy that combines TQM principles with Lean Production principles has proved to be adequate for many companies [4].

Other methodologies such as reengineering or automation can also result in improved performance. Thus, these mechanisms to improve company competitiveness may compete for internal resources. Particularly in small to medium sized companies (SMEs) the use of quality tools is low [5, 6]. To improve processes SMEs need to select and prioritize improvement actions [7]. This study aims to assess the effectiveness Lean production and TQM principles to provide evidence on the results companies could obtain.

This work was carried out in a SME of the sector of the production of corrugated cardboard boxes and lithographic boxes for several uses having as main objective improving quality and performance of a production process applying TQM and Lean Production principles and tools.

2. Methodology

The case study methodology is used to respond research questions such as “how complex events happen”. In this case describes a SME that decided to apply Lean Production and TQM principles to its operational processes. The case study will characterize: the company operational processes; the application of Lean and TQM principles and tools; and its quantitative results.

A researcher doing an internship over four months in this company carried out the main activities described. The production process for obtaining the main product (boxes) is divided into six sections, whereby the products go through and undergo changes before reaching the end customer. These sections are described below:

- Design: Creates and develops the image that will be printed on the box;
- Cardboard Cutting: The paperboard rolls are cut in the desired dimensions for the cartons;
- Printing: Makes the impression in the paperboard plane;
- Bonding: After the cardstock plans go through printing, it is necessary to make them stronger. The reinforcement of the plans is made, by gluing a plan of corrugated cardboard, denominated of micro;
- Cut and Fold: Shapes the box according to the type of box that the customer wants. The collapsible planes are pressed against cutting and creasing blades, using a desired mold for the carton;
- Peeling: Removes all surplus material from the box. Thus, the operators manually "peel" the plans, leaving only the box ready to assemble.

Because there were not enough resources to do a detailed analysis and improvement proposal in all of the above mentioned sections, it was decided to carry out a Pareto analysis of the non-conformities found in the various sections and thus select for improvement the section with the largest number of non-conformity records. As can be seen in Fig. 1, the section where most defects have occurred is the Bonding section, which accounted for about 60% of the non-conformities detected during previous year.

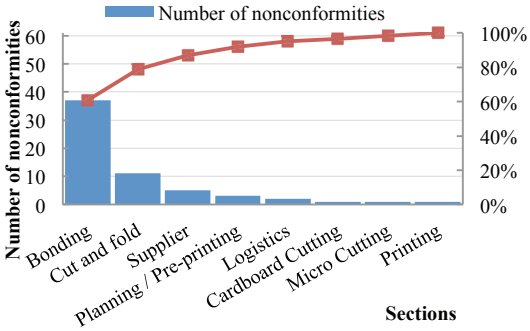

Fig. 1. *Pareto chart on the number of non-conformities per section*