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Reconfigurable Standardized Work in a Lean company – a case study

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Abstract

A Lean company is always in a journey of continuous improvement and innovation. Every process, procedure and/or tool are critically studied in order to highlight problems and satisfy the customers' needs without any waste. In the studied Lean company there are many production support tools that were developed as a temporary solution to solve a specific problem but, frequently, remain definitive and became themselves a problem. Examples of these tools are Standard Work Sheets (SWS) and Control and Fabrication Instructions (CFI) that demand updated, easy access and trustworthy information. Improving these tools (e.g. by automatizing) is an opportunity for a company to become more competitive. The SWS and CFI are indispensable tools for Process Engineering and have implications on product quality and productivity. The development process of SWS and CFI involves many human resources, resulting in a long task that is susceptible to the introduction of errors. By including the process of documentation for all shifts, it facilitates the coworkers training and reduces both variability and irregularity. Currently, the SWS in the studied company is not automatically performed and articulated with the updated real time knowledge of CFI, production quantities and assembly lines coworkers' availability. This generates inefficient resources utilization. The objective of this paper is to present an undergoing project that intends to automate the SWS and CFI development process and to facilitate their integration with other company systems information.

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Keywords: Lean Production; Standard Work; Control and Fabrication Instructions; Optimization; case study.

1. Introduction

Nowadays, due to the high level of markets competitiveness, companies are seeking for improvement in their performance and their processes efficiency in order to remain competitive and meet the customer requirements. Lean approaches are becoming one of the most used methodologies to optimize processes and decrease wastes.

The Lean company under study in this paper is facing low levels of productivity in the development process of work instructions, known by this company as Control and Fabrication Instructions (CFI), and also in procedures, called Standard Work Sheets (SWS). This is due to the high level of resources and man-hours used on these development processes. Non-standardized and manual operations and Microsoft Excel sheets support this development and result in inaccurate information that is difficult to access, consumes too much time and resources and has high variability and irregularity. Additionally, using the excel software (e.g. VBA and macros) results in several problems with the integration of this tool with other company information systems. This creates difficulty in the articulation of standard work implementation with real-time updated information regarding CFI, production quantities and resources availability.

The aim of this paper is to present an ongoing project oriented to the automation of the abovementioned tools through the development of an informatics system that will be integrated with the Enterprise Resource Planning (ERP) and others information and management systems in the company.

As the project is just beginning, the research methodology adopted was the case study. In a first phase, the right questions must be asked to diagnose how CFI and SWS processes in the company have been developed and identify the main problems associated with it.

The paper is structured in five sections. After a brief introduction, section two presents a literature review about the

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concepts related with the study. Section three explains the research methodology and the fourth section describes the case study. Finally, in the last section conclusions and future work are drawn.

2. Literature Review

This brief literature review approaches the Lean Production methodology, the Standard Work, the process documentation, the automation of Control and Fabrication Instructions and Standard Work Sheets generation processes as well as optimization algorithms. These themes support the ongoing project and solutions to be developed.

2.1. Lean Production

Lean Production is an organization management methodology that had its roots in the work of Taiichi Ohno and Shigeo Shingo, which conceived and perfected the Toyota Production System (TPS), after the Second World War period [1,2], a challenging and demanding period for the Japanese economy. It became a successful approach and has been globally spread across many different sectors. The TPS, while enabling for greater production flexibility along with quality assurance and timely deliveries, do more with less resources. For this reason was called Lean Production [3]. The TPS was designed, by Toyota, in a way that fewer and fewer resources would be required, in order to deliver the right products at the right time and at the shortest possible deadline, through the elimination of all types of wastes. Ohno [2] considered wastes the activities that do not add value to the products and classified them in seven categories: 1) overproduction; 2) over processing; 3) transportation; 4) defects; 5) motion; 6) inventory and 7) waiting. Later on, Liker identified an extra waste, i.e. untapped human potential [4].

To systematically eliminate these wastes, Womack and Jones [5] have designed the Lean principles: 1) Value; 2) Value Stream; 3) Flow; 4) Pull production and 5) Pursuit of Perfection. These principles happen cyclically, and the last one opens the door to the continuous improvement, known as kaizen. And, who is capable of doing this? People seriously committed with Lean and not satisfied with the status-quo become creative and become thinkers [6].

However, even the best results achieved by Lean companies all over the world have not convinced the most skeptical [7]. Nevertheless, it seems only a matter of time for a larger adoption of Lean, with so many studies and reports pointing out the benefits of Lean and advocating that Lean implementation is a major enabler for moving manufacturing operations from overseas and remain competitive [8]. Also, Lean is multidisciplinary [9].

2.2. Standard Work

Standardization is the practice of setting, communicating, following, and improving standards [10]. "One must standardize, and thus stabilize the process, before continuous improvements can be made" [11]. That is to say, that standards form the baseline from which all the improvement activities take part in the continuous improvement process. However, if we think standards are confining, then progress would not take place, as Mr. Taiichi Ohno said: "Where there is no standard, there cannot be improvement" [2]. With the standard to measure against, there would be a process to depend on, and a way to know how to improve it or whether or not it had been improved.

Standard work is defined as a set of work procedures establishing the best methods and sequences for each process and each worker [10]. Like all the Lean production methods, standard work aims to minimize waste while maximizing performance in the workload and operation of each worker. It is a tool used in cellular manufacturing and pull production in order to keep the pace of production lined up with the flow of customer orders, and in such a way that the operators can easily change positions within the process. Standard work involves three key elements [1,10]:

- **Takt Time:** is the rate of production in harmony with the pulse of customer orders. "Takt" is the German word for a musical beat or rhythm. And as the metronome keeps the beat for music, working to takt time keeps the beat for customer demand [12]. Thus resulting in a steady, and smooth flow of goods. Takt time is not measured or observed, but calculated as the quotient of the available time by the output required [13]. Managing production to takt time allows to detect any abnormal condition and respond accordingly. To describe and calculate the rate of production there are several definitions to understand: total cycle time, operation cycle time, operator cycle time, machine cycle time, end-of-line rate, takt time and pitch. *Total Cycle time* is the time from when the raw material enters a plant until a finished product is shipped [10].
- **Standard work sequence: It** is the order in which the set of tasks is done in a given process and represent the safest and the best way to do it. Each worker performs these tasks repeatedly and consistently over time, making it more efficient and revealing additional improvement opportunities [13]. To distribute work, line balancing is done to determine the number of workers needed on each line or cell to meet the takt time, and to ensure that every worker is well used, that some workers are not doing too much in comparison to others and that downtimes do not occur [12].
- **Standard work-in-process inventory:** Provide the minimum amount of inventory to maintain the pace of production in a continuous flow and without idle times. The kanban system helps to reduce this amount to the minimum. Excess inventory will slow down the parts and operators will fall behind and the same will happen if the inventory is not enough. In both cases the result will be a decrease in productivity [13].

"Standard work provides a basis for consistently high levels of productivity, quality and safety" [12], because it is the culmination of the Lean production process. Therefore, after the implementation of Lean tools, such as 5S and visual control, quick changeover, mistake-proofing, total productive maintenance, Jidoka, cellular manufacturing, JIT/pull production with kanban, load leveling and line balancing, and multi-process operations and multi-task operators,