Chapter 12
A Strategy for the Control of Uncertainty and WIP:
A Case Study Based on Lean Practices

Pablo Viveros Gunckel
Universidad Técnica Federico Santa María, Chile

Rodrigo Mena Bustos
Universidad Técnica Federico Santa María, Chile

Diego Figueroa Ramírez
Universidad Técnica Federico Santa María, Chile

Fredy Kristjanpoller
https://orcid.org/0000-0001-8970-9371
Universidad Técnica Federico Santa María, Chile

Vicente Gonzalez-Prida
https://orcid.org/0000-0001-5257-8224
University of Seville, Spain & UNED, Spain

ABSTRACT

High works-in-process (WIP) levels usually involve significant losses for companies as they trigger dispatching delays, product shortages, increases in immobilized capital, and greater storage costs, among others. This study provides a strategy for gradually decreasing the WIP levels associated with the production line of a pharmaceutical company located in Latin America. The methodology used is based on Lean practices and, more specifically, organized into phases: the diagnosis of the current situation, information processing, mapping out the current situation through value stream mapping, analysis and determination of key factors for uncertainty control, and improvement proposals. The main tools used are value stream mapping, 5-whys, single-minute exchange of dies, and total productive manufacturing.

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I. INTRODUCTION

There are many different types of production systems used by manufacturing companies. These systems can be classified by the type of production process: Continuous, Batch, or Combined (Schenk, Wirth, & Müller, 2010). Generally, the processes that produce by batch have inventories for each stage of the production process and those unfinished products are called Works-In-Process (WIP). This alludes to the fact that batch production has begun but remains incomplete.

The uncertainty and variability that occurs during the different stages of the production process have been studied as have their direct impact on the expected performance of the entire process (Nannapaneni, Mahadevan, & Rachuri, 2016). In batch production systems, uncertainty translates into higher quantities of WIP, which generates costs through increasing immobilized capital and the loss of space, among others (Zandieh, Joreir-Ahmadi, & Fadaei-Rafsanjani, 2017).

Given the above, it is necessary to have a means of controlling and measuring this uncertainty. One way to address this problem is by utilizing Lean Manufacturing (LM) methods, which originated from the strategy that, in order to improve quality, waste and delivery time must be reduced, among other factors (Ghizoni Pereira & Luz Tortorella, 2018). Several authors have studied different tools that make use of LM and their effects on operational and economic performance (Negrão, Godinho Filho, & Almeida Marodin, 2016). Over the course of the last 30 years, LM has led to the development of some of the most popular and effective tools that improve operational efficiency (Möldner, Garza-Reyes, & Kumarc, 2018).

In this way, this study offers a strategy aimed at gradually reducing WIP through the use of LM tools.

The proposed method used in this study is based on the integration of five different phases: the diagnosis of the current situation, information processing, mapping out the current situation through Value Stream Mapping (VSM), analysis and the determination of key factors for uncertainty control and improvement proposals. In addition, an applied case study was performed at a glass factory owned by a Latin American pharmaceutical company.

Finally, the structure of this article is as follows: In Section 2, the theoretical framework of the different tools used is described; In Section 3, the proposed method is detailed; In Section 4, the case study that was performed is described; and in Section 5, the results of the case study and the study's conclusions are given.

II. REVIEW OF THE MAIN TECHNIQUES TO BE USED AS PART OF THE PROPOSED METHOD:

In LM methodology, there are various tools that serve five different purposes (De Oliveira, Oliveira Sousa, & de Campos, 2019):

- Maximum Resource Availability: Total Productive Maintenance (TPM) and Overall Equipment Efficiently (OEE).
- Maximum Quality: Total Quality Maintenance (TQM).
- Maximum Production Flow: Single-Minute Exchange of Dies (SMED), Poka-Yoke and Cellular Manufacturing.
- Minimum Inventory: Just in Time (JIT) and Kanban.
- Decision-Making: VSM, Kaizen, 5S, Visual Management, 5-Whys.