

International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012)

## Production Flow Analysis through Value Stream Mapping: A Lean Manufacturing Process Case Study

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### Abstract

Click ‘Lean’ approach has been applied more than frequent in many manufacturing management floors over these few decades. Started in the automotive industry, sequential improvement initiatives were implemented to enhance the manufacturing practice changes. The team described a case where Lean Production (LP) principles were adapted for the process sector of an automotive part manufacturing plant. Value Stream Mapping (VSM) is one of the key lean tools used to identify the opportunities for various lean techniques. The contrast of the before and after the LP initiatives in determine managers potential benefits such as reduced production lead-time and lower work-in-process inventory. As VSM involves in all of the process steps, both value added and non-value added, are analyzed and using VSM as a visual tool to help see the hidden waste and sources of waste. A Current State Map is drawn to document how things actually operated on the production floor. Then, a Future State Map is developed to design a lean process flow through the elimination of the root causes of waste and through process improvements. An Implementation Plan then outline details of the steps needed to support the LP objectives. This paper demonstrates the VSM techniques and discusses the application in an LP initiative on a product (Front disc, D45T) case study.

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*Keywords:* Lean manufacturing; Lean Production; Value stream mapping; Kaizen, Gemba

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### 1. Introduction

Lean manufacturing is one of the initiatives that many major manufacturing plants in Asia, especially in Malaysia have been trying to adopt in order to remain competitive in an increasingly competitive global market. The focus of the approach is on cost reduction through eliminating non value added activities via applying a management philosophy which focused on identifying and eliminating waste from each step in the production chain respective of energy, time, motion and resources alike throughout a product’s value stream, known as lean. Since the birth of Toyota Production System, many of the tools and techniques of lean manufacturing (e.g., just-in-time (JIT), cellular manufacturing, total productive maintenance, single-minute exchange of dies, production smoothing) have been extensively used. This activity is more towards to Toyota Production System (TPS), a systematic approach to identify and eliminate waste activities through continuous improvement. All these effort is objectively to keep cost down and stay ahead in the race.

The paper begins by providing a brief synopsis on the principles applied in this study followed by the background information on the work conducted in the project. In general view, Lean Manufacturing (LM) is an arrangement of techniques and activities for running a production industries or service operation. Depending on the application, the

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techniques and activities would respectively differ accordingly. Nevertheless, they have the same core principle: the elimination of all non-value-adding activities and waste from the business. Types of waste that outlined in the project include the following 7 *Muda* [1]. Lean was chosen as the key ingredients in the improvement program objectively to suit the purpose of waste removal. Lean application is guided by 5 simple steps starting from identifying the value of process, identifying the process value stream, focusing on the process flow, configurations of the pull factor and work towards process perfection [2]. The most regular quality gurus such as *Toyoda*, *Shigeo Shingo*, and *Taiichi Ohno* are those responsible in formulating a new, disciplined, process-oriented system, which is known today as the “Toyota Production System,” or “Lean Manufacturing” [1]. By applying tools that could identify major sources of waste, and then using tools such as production smoothing approach, setup time reduction and others to eliminate waste, the project team applied the following related lean tools such as *Kanban*, Total Preventive Maintenance (TPM), Setup time reduction, *Yamazumi* chart, Total quality management (TQM), 5S and VSM: A collection of all actions (value added as well as non-value-added) that are required to bring a product through the main flows.

The objective of this project is to use a case-based approach to determine how lean manufacturing tools are utilized to help the process industry eliminate waste, maintain better inventory control, improve product quality, and capable of better operational control. A Small Medium Industries (SMI) is a local company referred to demonstrate the approach followed is referred to as SMC throughout this paper. In SMC, the team adopted VSM to map the current operating state for SMC. In case of before LP is implemented, VSM mapping is used to identify sources of waste and to discover the appropriate lean tools for reducing the waste. A later map is then established to highlight the improvement in the area and the applied lean tools.

## 2. Methods

### 2.1. Process Review and Data Collection

Prior to LP implementation, a process review on D45T was conducted to investigate the existing method of its actual assembly processes through direct observation. Hardcopy information on actual manufacturing activities are based on their Operations Manuals and the Standard Operating Procedure (SOP). The Cycle Time or Processing Time measured is as per SMC manufacturing data collected from Production In-process Quality Control (QC) for the past 3 months were compiled in order to establish the baseline for data analysis. Further to that, line observation was conducted to monitor and to grasp full understanding on the current practice at the assembly line as well as to identify types of wastes in the process. Changeover time, transportation time, queuing, handling and machine time data were tabulated during the first month of the monitoring period. Method to establish VSM is presented through the following;

- Data of Cycle time or processing time
- Data of Changeover time.
- Initial data collection on overall cycles times, waste time, in-process queue time.
- Data gathering for % rejects and work-in-process
- *Gemba*
- Establishing VSM
- *Kaizen* initiatives
- Monitoring and improvised.

### 2.2. VSM – The mapping Process

Value stream mapping (VSM) is an effective tool for the practice of lean manufacturing. VSM approached the entire process flow in a three-step methods [4] in which first producing a diagram showing the actual material and information flows or Current State on how the actual process operates. This is created while walking down the production line. Secondly, a Future State map is produced to identify the root causes of waste and through process improvements that could give great financial impact to the process, a lean process flow. These improvements are then carried out, the Implementation Plan as part and partial details and action needed to gain the project objectives in process *kaizen* (continuous improvement) and *poka-yoke* [3]. Figure1[5] shows a map of a simple value stream. This example is a material-flow-only value stream map. A weekly truck shipment of material is kept as inventory for 5 days before being assembly and inspected. Assembly process and inspection activities are being captured in the data box. Complete products are kept for another 30 days in the inventory before is scheduled for delivery.

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