

Manufacturing inventory performance enhancement using lean management

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ABSTRACT

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In the globalized business arena, continuous company improvement is a main driver to secure survival and business continuity. The causal relationship between production and inventory management plays a rigorous and vital role in improving company performance. A lean management system (LMS) that relates to production systems and inventory control will enable a company to become a lean enterprise. In this case study, the adoption of LMS through the application of value stream mapping (VSM) helps identify waste. Work-in-progress (WIP) inventory levels are influenced by production systems and improved by implementing LMS (supermarket racking) and the inventory level tracking in terms of cost.

Keywords:

Globalization, production and inventory management, lean management, work-in-progress, value stream mapping

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1. Introduction

1.1 Background to the Case Study

As globalization leads to greater market competition, every enterprise is aiming to secure further business and increase its level of competitiveness. A company's performance can be evaluated in term of inventory level as an indication of efficiency. Inventory turnover has a cause-and-effect relation with the manufacturing system. Therefore, inventory turnover is a key indicator of a manufacturing company's operational performance [1].

Regarding company performance, inventory and production management reveals that productivity directly influences a company's operational performance. Inventory management controls the inventories of raw material, work-in-progress (WIP) and finished goods. The WIP inventory level has a direct causal relationship with production lead time [2]. This case study concentrates on work-in-progress in the production of company A. Company A has 85 employees and a supplies metal stamping assembly parts to the electronic and automotive industries.

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1.2 Work-in-Progress Inventory Issues

High work-in-progress may increase the time to detect production faults thereby increasing defects and/or rework. Long WIP queuing significantly lowers flexibility and the ability to respond to changing market demand [3]. WIP management plays a critical role in manufacturing systems in controlling the material and information flow, monitoring the WIP inventory level for each workstation. In unforeseen circumstances the WIP inventory level in the production line is an ambiguous condition but greatly influenced by the raw material ordering from the supplier. Uncertain part supplies for production can cause semi-finished parts (WIP) to remain in the line awaiting completion.

2. Lean Management System and Methodology

2.1 Lean Operation Enhances Work-in-Progress Inventory

The term “lean” means creating more value for interested parties with less resources. A lean organization understands interested parties needs and focuses its key processes to continuously increase its value. It halves the human effort in the factory, the manufacturing space and the inventory on-site [4]. The lean operation concept involves the control of inventory based on the just-in-time (JIT) approach used in the evolution of Toyota System Production (TPS) from mass production as indicated in Figure 1. Significantly, the control of material input to the production line and the flow of material between the processes in TPS has been developed and the concept of material control evolved e.g. supermarket, Kanban system (production Kanban, withdraw Kanban) to leverage the production schedule and WIP inventory. Traditional manufacturing strategies are driven by a “push system” to match the size of the product inventory with customer forecasts [2]. Inevitably, introducing the JIT approach will require the demand from customer delivery to control the WIP inventory level.

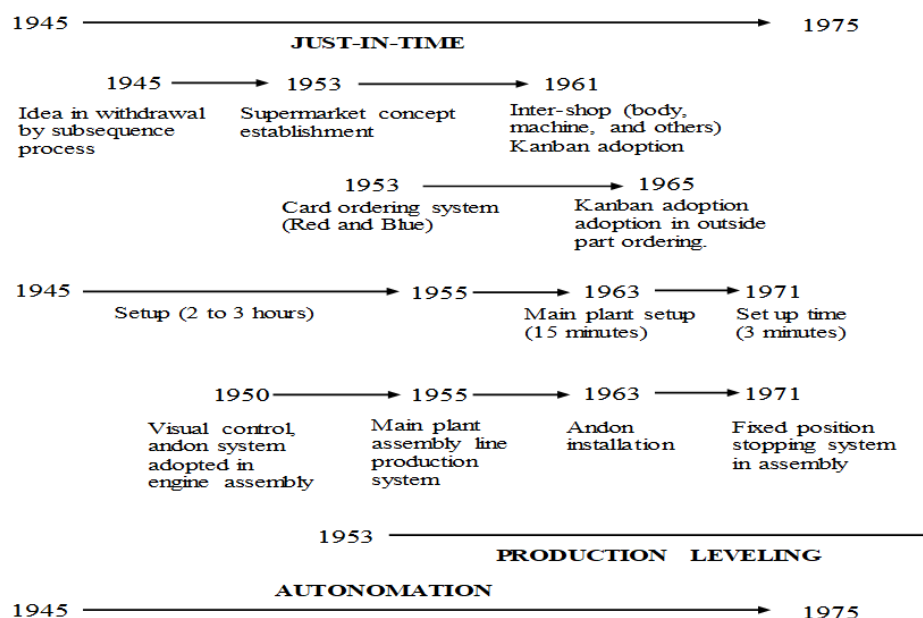


Fig. 1. The evolution of the Toyota Production System

2.2 Methodology: Value Stream Mapping (VSM)

Value stream mapping (VSM) is an LMS technique that illustrates the flow of information and material in a total operation from customer demand to finished product delivery. A similar case study considered the WIP inventory level by implementing VSM as an initial step when introducing lean production to an organization [5]. VSM is a tool for redesigning the production system to accommodate lean production [6]. The researchers conducted their case study of implementing the lean management system by studying the waste in VSM [5] and [7].

2.3 VSM Case

This case study considers a selected part in the production line: the Electrical Board Assembly (219). It is fabricated using four sub-parts, 219A, 219B, 219C and 219D in a final spot welding process. The implementation of lean management begins by introducing VSM and obtaining the waste from the current VSM. The research flow is illustrated in Figure 2.

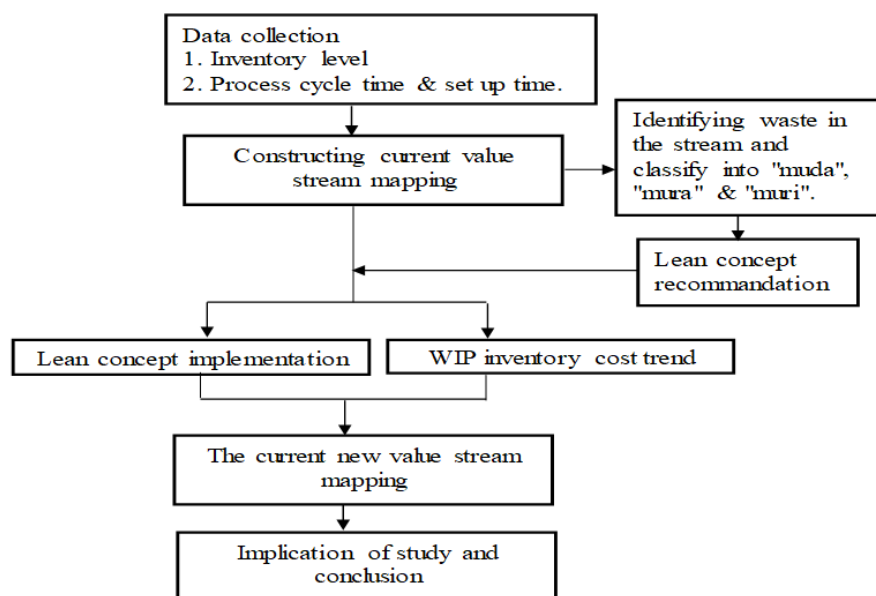


Fig. 2. Case Study Research Flow

3. Results and Discussion

3.1 Supermarket Concept

Referring to the research flow, after collecting the production process flow, process cycle time, process set-up time and WIP stock data (in terms of cost), the construction of the current VSM is illustrated in Figure 3. From the current VSM, there is waste in terms of “MUDA” to handle the sub-parts and storage. This will release when parts are needed by final welding. Thus, a Kaizen activity had been introduced to eliminate the waste.

The study was conducted on the WIP inventory level for each sub-part: 219A, 219B and 219C. These small parts require the least processing, as illustrated in the current VSM. From the production level view, to leverage the production process by following the pace of handling 219D is complicated.

Therefore, the supermarket concept had been established for these three parts and an anytime time frame. Parts 219A, B and C will go to the final welding process according to the 219D production schedule. There are planned minimum and maximum stock levels for refilling 219A, 219B and 219C, keeping 219D in view. Considering the longest process lead time among the sub-parts and upon receiving the demand from the customer, the planning will focus on achieving a constant production lot of 102 units for 219D (see Table 1). Figure 4 illustrates the new current value stream mapping.

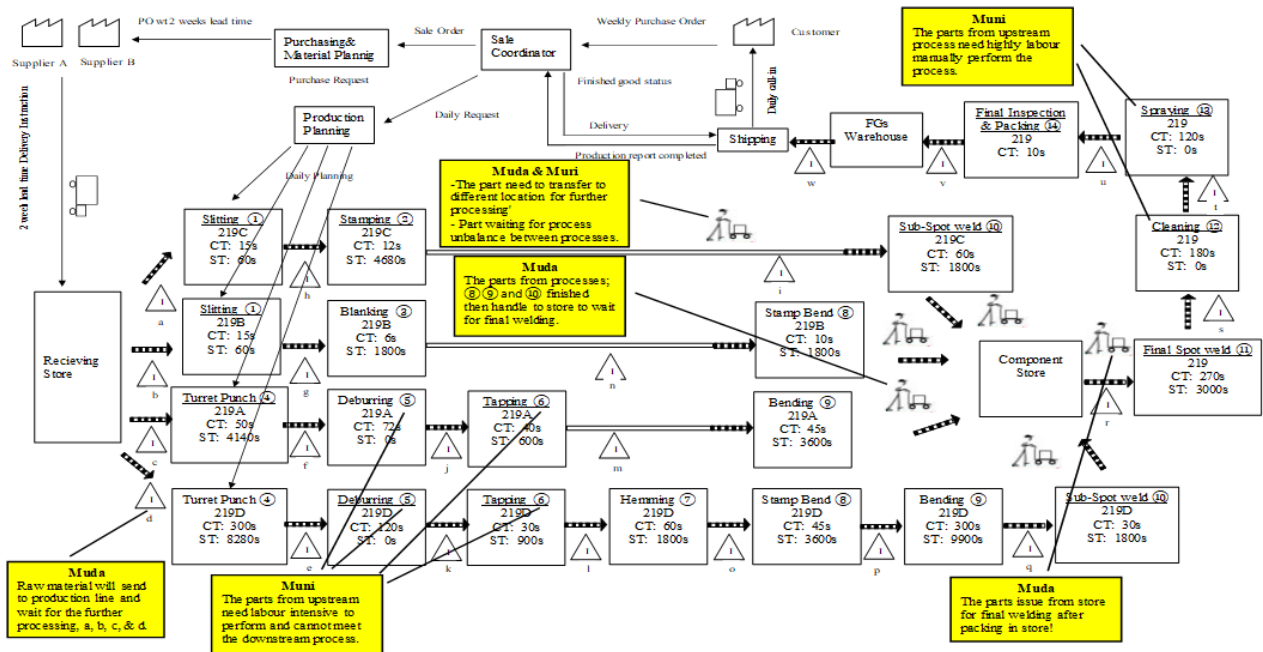


Fig. 3. Current Value Stream Mapping

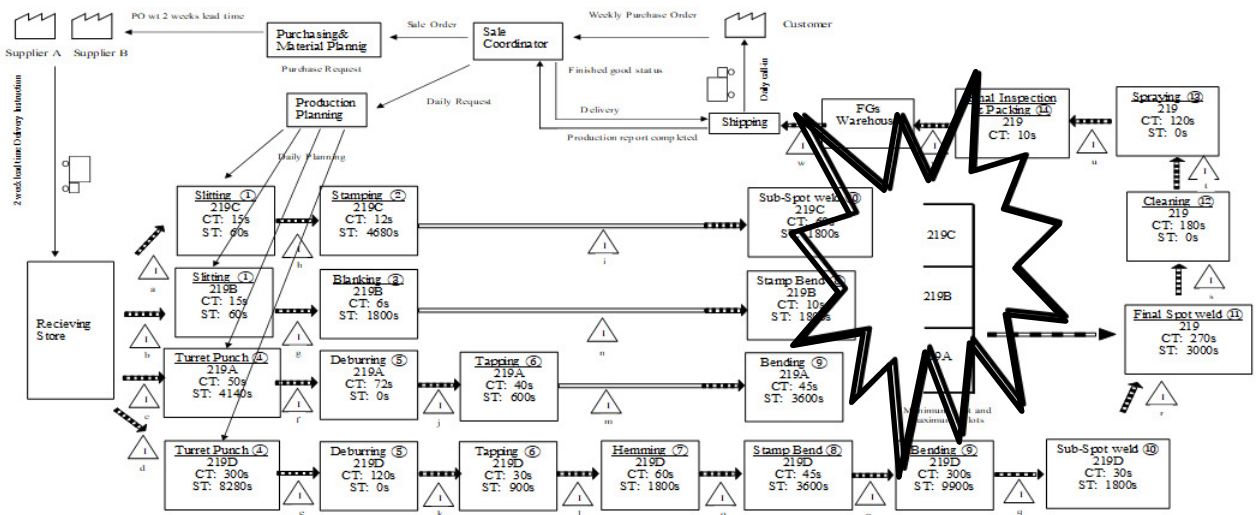


Fig. 4. The new Current Value Stream Mapping

Table 1
 Stock level and production lot

Part Code	Maximum(unit)	Minimum (unit)	Production Lot (unit)
219A	102	306	-
219B	102	306	-
219C	204	621	-
219D	-	-	102

3.2 Work in progress inventory level

The WIP for the sub-parts (219A/B/C/D) was monitored from the beginning of the case study. Figure 5 indicates the trend. From the trend, the WIP inventory before the implementation of the supermarket concept fluctuates because no constant production lot is imposed. However, in the implementation of the lean concept (supermarket racking) indicated in Figure 6, the maximum and minimum WIP inventory level had been fixed, thus creating a reference or base line for further improvement in line inventory. The maximum and minimum inventory levels will be influenced by the customer forecast and demand.

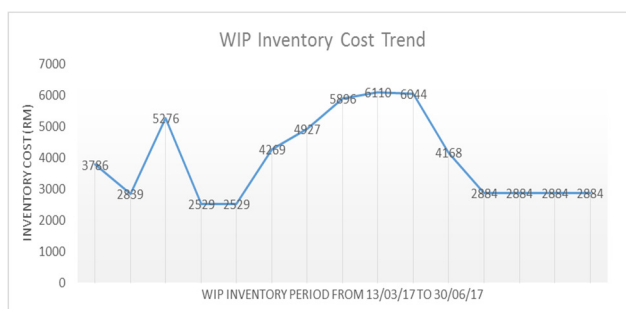


Fig. 5. WIP Inventory Trend



Fig. 6. Supermarket Racking

4. Conclusion

This case study of the implementation of lean management initially established the holistic condition for the operation through value stream mapping and identifying the waste based on the lean philosophy and deploying the appropriate lean techniques to eliminate the waste. In this case study, the improvement in the WIP inventory level within the production line is a first step on the lean journey and continues to identify non-value-added (waste) activities for continuous improvement. This improvement will correlate with cost improvements and productivity increases, thereby enhancing company performance.

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