

*General Article*

## A Contrast: VSM, JIT, and MRP-II

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Accepted 10 Feb 2015, Available online 15 Feb 2015, Vol.5, No.1 (Feb 2015)

### Abstract

*Lean Approach, now a days is gaining its acceptance in Industry, especially the Automotive Industry. The manufacturing management is eager to opt for the better alternatives for higher productions. The principles of Lean Production are more or less similar, but the procedures followed are different in exponential. The Automotive Sector is working with many form of Lean, namely, Value Stream Mapping (VSM), Just-in-Time (JIT), Material Resource Planning (MRP), Product Flow analysis (PFA), Kaizen, Total Quality Management (TQM), Total Productive Maintenance (TPM), etc., and many more. The initiative taken by the giant Toyota, well known as, Toyota Production System (TPS), has sparked the requisite of Standardization. The contrast of the forms of lean approach, are only to highlight the process and procedure objectives of VSM, JIT and MRP. The implementation plans of the all VSM, JIT and MRP, are reviewed in this paper.*

**Keywords:** VSM, JIT, TQM etc.

### 1. Introduction

#### 1.1 VSM

Lean Manufacturing is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service, value is defined as any action or process that a customer would be willing to pay for. Lean is epicentre to preserving value with less work. Lean manufacturing is a management philosophy derived mostly from the Toyota Production System (TPS) (hence the term Toyotism is also prevalent) and identified as Lean only in the 1990s (Womack, James P. *et al*, 1990; Holweg, Matthias, 2007). TPS is renowned for its focus on reduction of the original Toyota seven wastes to improve overall customer value, but there are varying perspectives on how this is best achieved. The steady growth of Toyota, from a small company to the world's largest automaker, (Bailey, David, 2008) has focused attention on how it has achieved this.

#### 1.2 JIT

This type of production system came into practice in 1980s. The Japanese people used this concept and then this concept came before the whole of the world

especially the Americans. Kanban is the key concept of JIT. JIT is based on a simple phenomenon of producing the goods in the quantity required, of the quality required and at the appropriate time. Schonberger had described JIT as complexity with simplicity in manufacturing management (Schonberger, Richard J. 1996).

The first practical application of JIT was in the Toyota manufacturing plant by the Japanese people. This was used in 1960s. In the present world, JIT is being used in almost every context of manufacturing world whether it is an automotive manufacturing plant, aerospace plant, computers, or any other manufacturing environment (Sugimori Y, 1977).

For the shop floor control, Kanban cards are used in JIT. These are the cards which are attached with the material during their flow for production. This is done with the aim to supply the right quantity at each stage. Besides controlling the shop floor activities, the JIT system is designed in a broader sense to cope up with the long term goals or strategy of the company. The other pillar of JIT philosophy is the execution of whole JIT and planning the JIT manufacturing system. It is the most important concept of JIT. JIT constitutes of number of strategies which when combined together are known as a JIT manufacturing system.

#### 1.3 MRP

Manufacturing Resource Planning is the further evolvment of Manufacturing Requirement Planning (MRP). The basic philosophy behind it is that, The

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Company should only produce the items which are needed by the customers and produce only when the customer demands them. MRP II is also known as Advanced MRP. Now-a-days, this MRP II has developed into Enterprise Resource Planning (ERP) (Sheikh Khalid, 2003).

MRP II is a management tool which is used to manage inventory, product data, the location of the product, lot size, the material required to make the products and manage the funds and human resources i.e. manpower.

The sophisticated computer systems when used along with MRP makes up MRP II in order to take into account all the data of the industry. The industrial engineering is a broad field in which computer systems have been used to make some important decisions but still there is a lot of area for the further advancement of this management tool.

MRP II system may be defined as the method which makes use of computer systems to plan and manage each and every resource of a manufacturing plant or an industry. (APICS)

## 2. Typical Description to VSM, MRP, and JIT

### 2.1 Value Stream Mapping

TPS is renowned for its focus on reduction of the original Toyota seven wastes to improve overall customer value, but there are varying perspectives on how this is best achieved (Holweg, Matthias, 2007; V. Ramesh, *et al*, 2008). The steady growth of Toyota, from a small company to the world's largest automaker, Bailey, David has focused attention on how it has achieved this (Bailey, David, 2008).

**Ulf K. Teichgräber, Maximilian de Bucourt (2010)** utilized VSM to eliminate non-value-adding (NVA) waste for the procurement of endovascular stents in interventional radiology services by applying value stream mapping (VSM). The Lean manufacturing technique was used to analyze the process of material and information flow currently required to direct endovascular stents from external suppliers to patients. Based on a decision point analysis for the procurement of stents in the hospital, a present state VSM was drawn. After assessment of the current status VSM and progressive elimination of unnecessary NVA waste, a future state VSM was drawn (Ulf K. Teichgräber, *et al* 2012).

**Krisztina Demeter, Zsolt Matyusz (2011)** discussed how companies can improve their inventory turnover performance through the use of lean practices. According to his main proposition, firms that widely apply lean practices have higher inventory turnover than those that do not rely on Lean Manufacturing. However, there may be significant differences in inventory turnover even among lean manufacturers depending on their contingencies (Cox, A., 2002).

**Zoe J. Radnor, Matthias Holweg, Justin Waring (2012)**, adopted process improvement methodologies

from the manufacturing sector, such as Lean Production. In this paper they report on four multi-level case studies of the implementation of Lean in the English NHS. Their results showed that the work generally involves the application of specific Lean 'tools', such as 'kaizen blitz' and 'rapid improvement events', which tend to produce small-scale and localised productivity gains. Although this suggests that Lean might not currently deliver the efficiency improvements desired in policy, the evolution of Lean in the manufacturing sector also reveals this initial focus on the 'tool level'. In moving to a more system-wide approach, however, they identify significant contextual differences between healthcare and manufacturing that result in two critical breaches of the assumptions behind Lean (Zoe J. Radnor, *et al* 2012).

### 2.2 Material Resource Planning

The basic technique of reference models is that a questionnaire is made having questions which can reflect the present state of the company. These questions are answered by the professionals in the specific departments on the basis of the data available to them. There are various answers from each department which are then gathered to make it in the table or chart format. These tables clearly indicate the state of the whole company. This is then compared with the reference models and calculations are done to get the theoretical performance of the industry. These questionnaires were first developed by Aquilano and Chase in 1991 but with the passage of time, these undergo certain modifications and adaptations according to the situations and type of industry. Every industry has certain different departments and every department has certain principal aspects. In these questionnaires, those principal aspects are grouped together and divided into levels depending upon the improvement. The key aspects that are covered by these questionnaires are the flow of manufacturing, manpower planning, inter-relationship or co-ordination between several departments inside the company, structure of the product, and schedule of production. As said above, there is a large and diversified data to be analysed and gathered together, so to achieve the goals, this is done with the assistance of Information Technology i.e. with the help of computers. With this, the data can be analysed quickly and moreover the data can be accessed when and wherever required by connecting every department through computer systems. This also helps in somewhat automation of the system (Vollmann, Dixon and Nannu, 1989). These people made a tool for the diagnosis and analysis of the production plant in which prime factor was measurement requirement. The questions were designed in such a way that main indicators were measured and then their deviation from the said standard or required standard was measured. If we pay attention to this, the goals can only be achieved if the standard model, to which all the

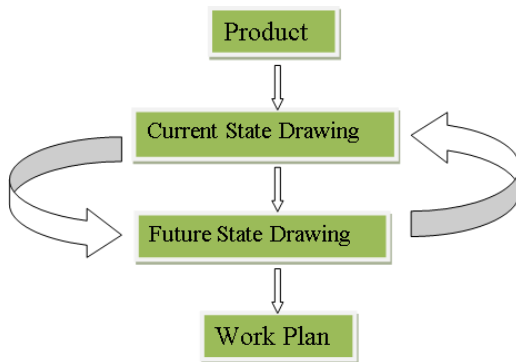


Figure 1: Steps of VSM

values are compared, is accurate otherwise we are doing wrong calculations and are deviating from the objectives. Thus the reference model is a crucial part which should be paid attention to. Another analyst whose name is Jackson proposed another diagnostic tool in the year 1996 which depends on scoring the answers to the questions. The goal of doing this questionnaire is dragging the industry towards lean manufacturing.

### 2.3 Just-In-Time

Closely associated with lean manufacturing is the principle of just-in-time, since it is a management idea that attempts to eliminate sources of manufacturing waste by producing the right part in the right place at the right time. This addresses waste such as work-in-process material, defects, and poor scheduling of parts delivered (Nahmias, Steven, 2001). Inventory and material flow systems are typically classified as either push (traditional) or pull (just-in-time) systems. Customer demand is the driving force behind both systems. However, the major difference is in how each system handles customer demand. Just-in-time is a tool that enables the internal process of a company to adapt to sudden changes in the demand pattern by producing the right product at the right time, and in the right quantities (Monden, Y., 1998). Moreover, just-in-time is a critical tool to manage the external activities of a company such as purchasing and distribution. It can be thought of as consisting of three elements: JIT production, JIT distribution, and JIT purchasing. More details are given for each in the following sections.

Some of the benefits of JIT are (Monden, Y., 1998):

1. Eliminating unnecessary work-in-process, this results in reduction of inventory costs.

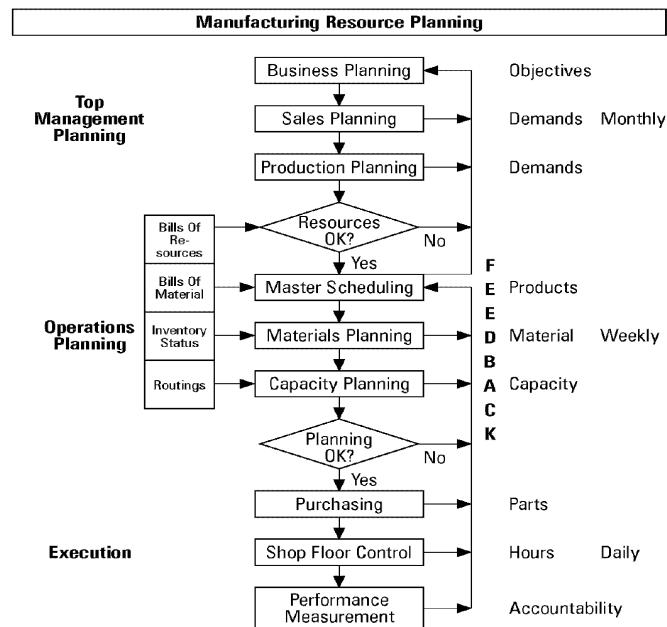


Figure 2: Functioning of MRP II System

2. Since units are produced only when they are needed, quality problem can be detected early.
3. Since inventory is reduced, the waste of storage space will be reduced.
4. Preventing excess production can uncover hidden problems.

### 3. A contrast to VSM, MRP, AND JIT

It is shown in figure 1. The functions are shown in figure 2.

### Conclusion

The ever growing demand and supply equation not only giving boost to Industrial set-ups, but also making the Industry o think in other way to make the process **LEAN**. The new technologies and techniques are now growing with new peripherals and are expanding their horizons and perimeters to new peaks and strengths. Also, the hybrid systems are being introduced to different and complex system industries, where many aspects along with the production, quality, and standardization are of concern. New techniques are the key to the problems emerging from the rising and raising standards of Industries, which will only be answered later with the time, and have to wait for the coming technology, technique and solutions from the role players and may be another technique waiting to get introduced.

### Future scope

Many other techniques are available and need to be compared in order to get many more such results, which can try to answer few more aspects and may play an important role in solving the queries related to

them. Few of such are CIM, TPM, ERP, KAIZEN, SIX SIGMA, etc., etc.

## References

- Womack, James P.; Daniel T. Jones, and Daniel Roos (1990), *The Machine That Changed the World*, Macmillan Publishing Company, Canada.
- Holweg, Matthias (2007), The genealogy of lean production. *Journal of Operations Management* 25 (2), 420–437.
- Bailey, David (Retrieved 19 April 2008), Automotive News calls Toyota world No 1 car maker. *Reuters.com*, Reuters.
- V. Ramesh, K.V. Sreenivasa Prasad, T.R. Srinivas (2008), Implementation of a Lean Model for Carrying out Value Stream Mapping in a Manufacturing Industry, *Journal of Industrial and Systems Engineering*, Vol. 2, No. 3, pp 180-196
- Ulf K. Teichgräber, Maximilian de Bucourt (2012), Applying value stream mapping techniques to eliminate non-value-added waste for the procurement of endovascular stents, *European Journal of Radiology*, 81, e47– e52.
- Cox, A. (2002), Radically Eliminating Waste, *World Mining Equipment*, January-February, 2002.
- Zoe J. Radnor, Matthias Holweg, Justin Waring (2012), Lean in healthcare: The unfilled promise?, *Social Science & Medicine*, 74, pp. 364-371.
- Schonberger, Richard J. (1996), *World Class Manufacturing: The Next Decade*, The Free Press, New York.
- Sugimori Y, Kusunoki K, Cho F, Uchikawa S. (1977), 'Toyota production system and Kanban system Materialization of just-in-time and respect-for-human system', *International Journal of Production Research*, Vol. 15, Iss. 6.
- Sheikh Khalid. (2003), 'Manufacturing resource planning (MRP II): with introduction to ERP, SCM and CRM', *Tata McGraw Hill Publishing Ltd.*
- Nahmias, Steven (2001) *Production and Operation Analysis*, 4<sup>th</sup> ed., Mc Graw Hill Irwin, New York, NY.
- Monden, Y. (1998), *Toyota Production System-An Integrated Approach to Just-in-time*, 3<sup>rd</sup> edition; Norcross, Georgia: *Engineering & Management Press*.
- Content from the Thesis work of Nitin Pandhi (October, 2012), *Application of Value Stream Mapping (A Lean Manufacturing Tool) in an Automotive Industry*, Punjab Technical University, Ludhiana (Punjab).
- Content added from the Thesis work of Sandeep Singh (May, 2011), *Evaluation of Techniques for Manufacturing System Analysis*, Teesside University, Middlesbrough, U.K.