

Demand Driven Lean

Because of the dramatic impact that Lean Thinking has had on the world of manufacturing, it is important to understand the strengths and weaknesses of Lean Scheduling techniques such as Heijunka and Kanban.

As most people know, the Toyota Production System (TPS) was developed by Toyota to eliminate waste from manufacturing processes. Lean Manufacturing is a philosophy built around the best practices of TPS. Since waste is defined as any activity that does not provide value to customers it is steeped in common sense.

Lean Manufacturing focuses on 7 Production Wastes (Muda):

- 1) Transportation
- 2) Inventory
- 3) Motion
- 4) Waiting
- 5) Over-processing
- 6) Over-production
- 7) Defects

These 7 wastes negatively impact throughput, manufacturing costs, lead-times and on time deliveries.

Toyota analyzed what they defined as Value Streams (all the activities required to produce a specific product) and concluded that the traditional factory floor layout of functional work centers and batch and queue production practices were the major drivers of the 7 manufacturing wastes. Their solution was to develop a number of process improvement methodologies that transform the factory from functionally based work centers to product based work cells and production lines. Toyota then replaced batch and queue practices with continuous flow production.

Continuous flow is also referred to as one-piece flow. The most basic definition of one-piece flow is that parts move through production from step to step with no work-in-process (WIP), one piece at a time. It works best in combination with the Toyota cellular layout in which both assembly operations and equipment are arranged in the logical sequence of production.

Lean employs the TPS visual scheduling techniques of Heijunka and Kanban to schedule continuous flow production. Heijunka level loads production based on actual demand and daily rates, while Kanban uses the depletion of inventory buffers to trigger demand signals.

Early adopters of Lean, seeking to remain competitive and frustrated by their complex ERP System's inability to improve manufacturing performance, were attracted to the underlying simplicity of Lean and its reputation for manufacturing excellence. Usually these companies were manufacturers that had low mix, high volume demand patterns, such as automobile suppliers. These early adopters initially achieved noticeable improvements in their manufacturing performance.

As word spread about the success of Lean implementations, manufacturers who did not fit the Lean template of low mix, high volume demand patterns, began to launch Lean initiatives. More often than not, initial operational benefits gave way to missed deliveries, material shortages, poor machine utilization and a growing sense of confusion throughout the organization.

What is not common knowledge is that many of the companies that did fit the Lean template were experiencing similar problems. Industry studies of Lean implementations confirm that many Lean initiatives did not sustain their initial benefits, especially in the area of customer service. As Lean thinking evolves in response to this reality, Lean initiatives are focusing less on cost reduction and more on improving customer service, specifically improving how to connect variable demand patterns with manufacturing execution. This demand driven focus is an important step in achieving sustainable Lean benefits.

Manual Heijunka and Kanban are fundamentally sound scheduling systems for continuous flow production. The problem is that most companies are not able to achieve continuous flow for their Value Streams because they are still using batch and queue processes to manufacture component parts. The challenge for these companies is to achieve a balanced connected flow, not continuous flow. Our conclusion is that most of the problems are caused by manual Heijunka and Kanban which were not designed to support more complex Value Streams and variable demand. Kanban in particular is not able to resolve scheduling problems that require sequencing.

Below is a list of Kanban limitations that we have identified:

1. *Not Immediately Connected to Current Demand Patterns*
2. *Too Slow to React to Change*
3. *Too Manually Intensive (resizing, expediting, lost cards)*
4. *Unable to Intelligently Prioritize and Sequence Upstream Resources*
5. *Decision Makers have No Visibility*
6. *One way Communication – No Feedback Loop*
7. *No "What-if" functionality*

Our conclusion is that in order to improve customer service and react to demand variability, Lean scheduling needs to be smarter and faster.

APS technology, on the other hand, was designed to handle complex Value Streams and variable demand. It can synchronize the schedules of numerous machine cells and production lines in minutes... not days while offering the ability to evaluate multiple what-if scenarios. APS systems manage complex sequencing rules, sequence dependent setup times and multiple constraints (such as machines, operators, tooling and materials). This functionality is necessary to achieve balanced connected flow and improve production throughput in complex Value Streams. An additional benefit is that APS provides the data needed to support decision making at different levels of the organization... not just on the shop floor.

Demand Driven Lean combines the best of both worlds because APS connects Lean Thinking to customer demand providing manufacturers with a complete system that;

- automates Heijunka scheduling to level load production

- synchronizes multiple constraints such as machines, operators and tooling.

- synchronizes the flow of materials and component parts coming from upstream work cells

- uses sequencing rules to minimize changeover times and wait times at upstream work cells

- eliminates non value added activities needed just to maintain ERP

- extends Visual Control Systems to provide company-wide visibility

- automates complex line sequencing requirements

- improves operational decisions by simulating multiple what-if scenarios

This article tells a story about two independent groups of pioneers who were both motivated by the limitations of ERP to find a better way back in the early 1990's. The Lean group was spearheaded by Toyota and over the last 20 years they have had an enormous impact on the performance and profitability of countless manufacturers worldwide.

The Finite Scheduling group which eventually became the APS group concentrated on developing a better technology that was designed to handle real world scheduling problems. The success of APS and the need to use this technology to improve Lean is becoming obvious.

Demand Driven Lean with APS will take Lean thinking to the next level.