



Concept of Heijunka

Akshay M. Ramekar¹, Vivek D. Muneshwar², Ajinkya S. Kute³, Ashish M. Choube⁴

Student, Mechanical Engineering, JDIET, Yavatmal, India^{1, 2, 3}

Assistant Professor, Mechanical Engineering J.D.I.E.T, Yavatmal, India⁴

Abstract: Production leveling is a new concept in the industries. Day by day the production is decreasing so we have to implement new techniques in production system. The heijunka is new concept for production leveling. It is a technique for reducing the Unevenness which in turn reduces waste. The goal is to produce intermediate goods at a constant rate so that further processing may also be carried out at a constant and predictable rate. Where demand is constant, production leveling is easy, but where customer demand fluctuates, two approaches have been adopted demand leveling and production leveling through flexible production. To prevent fluctuations in production, even in outside affiliates, it is important to minimize fluctuation in the final assembly line. The final assembly line should never assemble the same automobile model in a batch. Instead, for the level production, assembling a mix of models in each batch and the batches are made as small as possible. The lean manufacturing is also use to increase production rate by eliminating the waste. also takes into account waste created through overburden and waste created through unevenness in workloads. In lean manufacturing the inventory get reduces also the space consumption reduces by the reducing the inventory. Large corporations use production leveling to help them trim expenses in a variety of ways, many of which benefit companies that produce thousands of items or large-ticket products. Small business owners can also benefit from a more steady production flow in ways that not only reduce costs, but also improve quality and customer satisfaction. Understanding the benefits of level production manufacturing can help you assess your operations and improve your processes.

Keywords: Heijunka, demand fluctuation, batch, inventory.

I. INTRODUCTION

Heijunka, also known as production smoothing or Production leveling is a technique for reducing the Unevenness which in turn reduces waste. It was vital to the development of production efficiency in the lean manufacturing. The goal is to produce intermediate goods at a constant rate so that further processing may also be carried out at a constant and predictable rate.

Heijunka is defined as “The distribution of production volume and mix evenly over time. Heijunka converts uneven Customer Pull into even and predictable manufacturing process. Heijunka is generally used in combination with other key Lean principles to stabilize value flow. Heijunka is a core concept that helps bring stability to a manufacturing process.

To prevent fluctuations in production, even in outside affiliates, it is important to minimize fluctuation in the final assembly line. Our final assembly line never assembles the same automobile model in a batch. Instead, they level production by assembling a mix of models in each batch and the batches are made as small as possible.

The "flow"(or smoothness) based approach aims to achieve JIT (Just in Time), by removing the variation caused by work scheduling and thereby provide a driver, rationale or target and priorities for implementation, using a variety of techniques. The efforts to achieve JIT exposes many quality problems that are hidden by buffer stocks; by forcing smooth flow of only value-adding steps, these problems become visible and must be dealt with explicitly.

II. PRODUCTION LEVELING

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Where demand is constant, production leveling is easy, but where customer demand fluctuates, two approaches have been adopted: demand levelling and production levelling through flexible production.

Many companies today are working toward the ultimate lean goal of continuous or one-piece flow. They want to be able to make just what the customer wants when they want it. Instead, what we often see is a “hurry up, then slow down” build-to-order approach. Customers’ orders vary from sending them home the next due to light orders. This environment can also create large amounts of inventory, hidden problems and poorer quality. What many organizations fail to do is the difficult process of creating a true balanced lean workflow. This is the Toyota concept of heijunka, leveling out the work schedule.

Heijunka is the leveling of production by both volume and product mix. This system does not build products according to the actual flow of customer orders. Heijunka takes the total volume of orders in a period and levels them out so the same amount and mix are being made each day. In a true build-to-order system, you build products A



and B in the production sequence of customer orders (e.g., A, A, B, A, B, B, B, A ...).

To achieve the benefits of continuous flow, companies must level out the workload. Heijunka will eliminate waste by leveling your product volume and mix, but most importantly, will level out the demand on your people, equipment and suppliers. Without leveling, waste will increase as people are driven to work like mad and then stop and wait, just like the hare.

A. LEVELING BY VOLUME

If for a family of products that use the same production process, there is a demand that varies between 800 and 1,200 units then it might seem a good idea to produce the amount ordered. Toyota's view is that production systems that vary in the required output suffer from mura and muri with capacity being 'forced' in some periods. So their approach is to manufacture at the long-term average demand and carry an inventory proportional to the variability of demand, stability of the production process and the frequency of shipments. So for our case of 800-1,200 UNITS, if the production process were 100% reliable and the shipments once a week, then the production would be with minimum standard inventory of 200 at the start of the week and 1,200 at the point of shipment. The advantage of carrying this inventory is that it can smooth production throughout the plant and therefore reduce process inventories and simplify operations which reduces costs.

B. LEVELING BY PRODUCT

Most value streams produce a mix of products and therefore face a choice of production mix and sequence. It is here that the discussions on economic order quantities take place and have been dominated by changeover times and the inventory this requires. Toyota's approach resulted in a different discussion where it reduced the time and cost of changeovers so that smaller and smaller batches were not prohibitive and lost production time and quality costs were not significant. This meant that the demand for components could be leveled for the upstream sub-processes and therefore lead time and total inventories reduced along the entire value stream. To simplify leveling of products with different demand levels a related visual scheduling board known as a heijunka box is often used in achieving these heijunka style efficiencies. Other production leveling techniques based on this thinking have also been developed. Once leveling by product is achieved then there is one more leveling phase, that of "Just in Sequence" where leveling occurs at the lowest level of product production.

C. DEMAND LEVELING

Demand leveling is the deliberate influencing of demand itself or the demand processes to deliver a more predictable pattern of customer demand. Some of this influencing is by manipulating the product offering, some by influencing the ordering process and some by revealing

the demand amplification induced variability of ordering patterns. Demand levelling does not include influencing activities designed to clear existing stock.

III. DIFFERENCE BETWEEN TRADITIONAL PRODUCTION AND LEVELED PRODUCTION

A traditional production process focuses on manufacturing in large-sized lots. The idea is to manufacture the maximum number of products in one lot. A lean production process focuses on producing as the latest market demand.

This typical unleveled method creates four problems:

- Customers usually do not buy products predictably. If the customer decides to buy the large product early in the week the plant is in trouble.
- The risk of unsold goods that must be kept in inventory.
- The use of resources is unbalanced.
- There is an uneven demand on upstream processes.

By reducing the changeover time and employing other lean methods, the plant is able to build the products in any order it wants to on its mixed-model assembly line.

The four benefits of leveling the schedule are:

- Flexibility to make what the customer wants when they want it.
- Reduced risk of unsold goods.
- Balanced use of labor and machines.

Smoothed demand on the upstream processes and suppliers

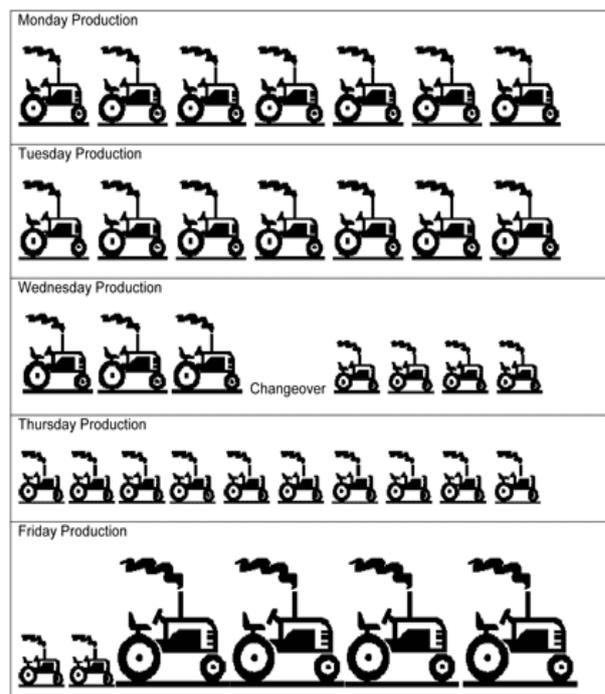


Fig.1. Traditional Method

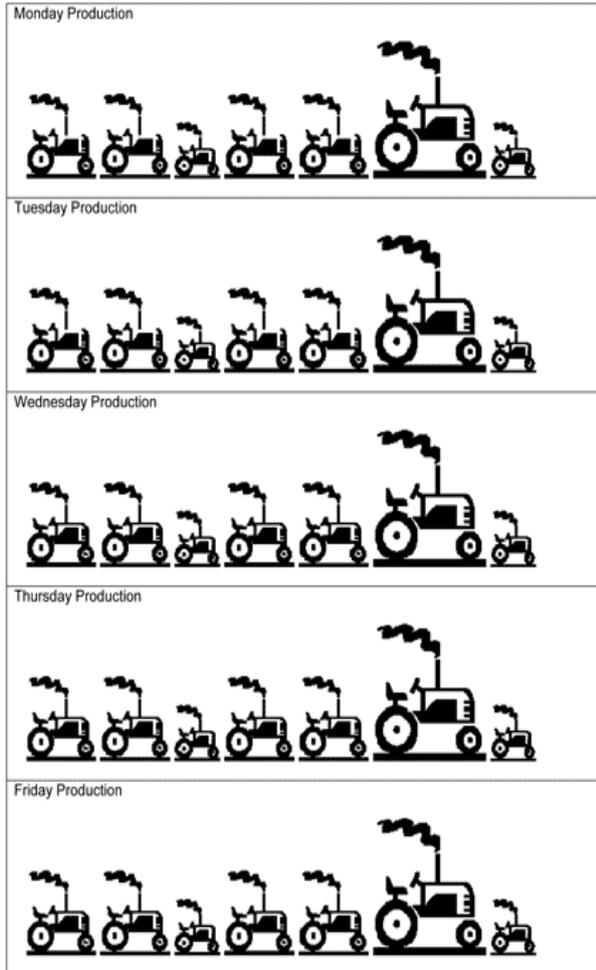
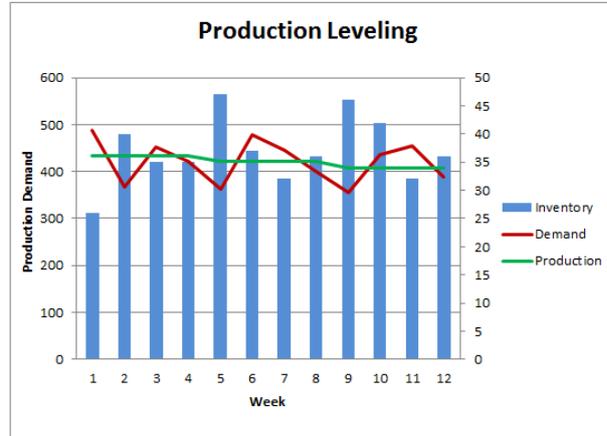


Fig.2 Leveled Production



IV. THE NEED OF HEIJUNKA

There are a number of reasons for implementing Heijunka:

- Product Leveling
- large batches of the same product may reduce set-up times and changeovers, but usually result in:
 - long lead times
 - swelling inventories
 - greater opportunities for defects.
 - excessive idle time and/or overtime.

An even of products is critical to avoiding these impacts

- Production Leveling
- Remember the “Beer Game”? Fluctuations in demand (Boller or “Bullwhip” Effect) are often highly amplified and delayed throughout the supply chain.
- Responding to fluctuating customer demand can result in increased overtime or idle time.
- Variable production schedules can be stressful = Unhappy workers.
- more level production volume eases these complications

V. BENEFITS OF HEIJUNKA

Specific advantages to be derived from this type of system are much more than just about reducing waste. The most specific advantage has to be the flexibility that this system invokes within the company, ensuring that the customer can get exactly what they want, at a specific time that they need it. This ensures that the customer is kept satisfied and therefore ensures the longer-term financial stability of the company. Due to the fact that there is no over or indeed under production, there is no risk that such a surplus of items will be made that will never be sold, so general efficiency is promoted.

Therefore, the correct implementation of the system provides **predictability** by leveling demand, **flexibility** by decreasing changeover time and **stability** by averaging production volume and type over the long term.

Let us take an example of production leveling for production of twelve (12) week

WEEK	TOTAL DEMANDS
1	4878
2	3672
3	4536
4	4230
5	3618
6	4788
7	4464
8	3996
9	3546
10	4356
11	4536
12	3888



$17136 \div 4 = 4329$

$16866 \div 4 = 4217$

$16326 \div 4 = 4082$

WEEKLY LEVELED PRODUCTION (4-WEEK LEVELING)
4329
4329
4329
4329
4217
4217
4217
4217
4082
4082
4082
4082



VI. IMPLEMENTATION OF HEIJUNKA

One way to achieve leveled production is by implementing **takt time**, which means basing the production rate on an estimate of how many units per units of time must be processed at each work center in order to meet market demand.

Takt time sets the pace of production to match the rate of customer demand, and becomes the heartbeat of any lean production system. As the "pacemaker" of a lean system, takt time is essential to the smooth flow of work through production cells, and is a key factor in planning and scheduling work.

By using takt time, production can be leveled to either a set level or to between a minimum and maximum level. These levels can be set in a computer system for any date and any period length, from a day upwards. Leveled production results in a steady demand pattern, which ensures a predictable, smooth schedule and avoids capacity bottlenecks.

This simplifies planning and control (since every day in the plan within the leveled period is basically the same), creates stability in production, and gives operators a far better understanding of what they have to do each day and how they are performing against goals and targets. It also makes life easier for upstream suppliers who can be passed stable schedules.

VII. CONCEPT OF LEAN MANUFACTURING

Lean manufacturing or lean production, often simply "lean", is a systematic method for the elimination of waste within a manufacturing system. Lean also takes into account waste created through overburden and waste created through unevenness in workloads. Working from the perspective of the client who consumes a product or service, "value" is any action or process that a customer would be willing to pay for.

Essentially, lean is centered on making obvious what adds value by reducing everything else. For the lean manufacturing the important thing is to reduce the waste to improve overall customer value, but there are varying perspectives on how this is best achieved. The steady growth of production, from a small company to the world's largest automaker, has focused attention on how to achieve this success.

The original seven muda are:

- Transport (moving products that are not actually required to perform the processing)
- Inventory (all components, work in process, and finished product not being processed)
- Motion (people or equipment moving or walking more than is required to perform the processing)
- Waiting (waiting for the next production step, interruptions of production during shift change)
- Overproduction (production ahead of demand)

- Over Processing (resulting from poor tool or product design creating activity)
- Defects (the effort involved in inspecting for and fixing defects)

For lean production this seven waste we have to control by which the production.

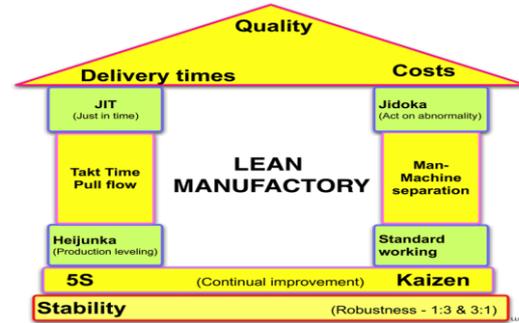
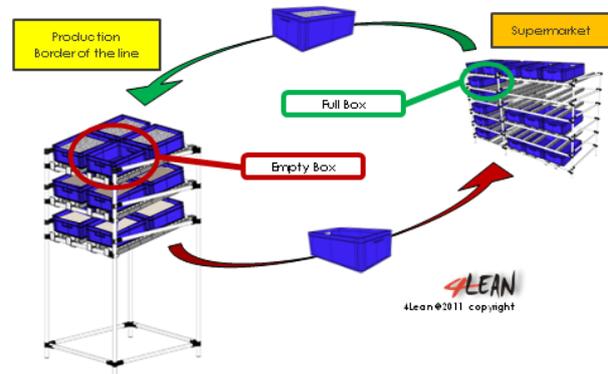


Fig. 3 Lean Manufacturing.

VIII. TWO BIN SYSTEM

The 2 bin system is designed to prevent the production line of running out of components, from emptying a box until the next cycle of supply.



IX. JUST IN TIME MANUFACTURING

Just-in-time (JIT) manufacturing, also known as just-in-time production is a methodology aimed primarily at reducing flow times within production as well as response times from suppliers and to customers.

- Improved overall productivity and elimination of waste.
- Cost-effective production and delivery of only the necessary quantity of parts at the right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources.
- JIT is dependent on the balance between the supplier's flexibility and the user's flexibility.
- JIT is accomplished through the application of elements that require total employee involvement and teamwork.



- Delivering smaller quantities more often can reduce inventory levels.

X. CONCLSION

Implementation of concept of heijunka is the result in improved overall productivity and elimination of waste, cost-effective production and delivery of only the necessary quantity of part at right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources, reduce inventory levels, also human efforts and time. In every industry safety is big factor which is cover by the less inventory and single flow method. The production is levelled by implementing the concept of heijunka.

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