

Mohammed Soliman
HEIJUNKA: THE LEVELING ART OF THE JAPANESE
AUTO INDUSTRY

Heijunka

The Leveling Art of the Japanese Auto Industry

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THE JAPANESE AUTO INDUSTRY

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Customer Demand

Takt time is a German word stands for “beat” and it is calculated as the amount of manufacturing time that is available divided by the volume of orders. Takt time is a reference number that is used to help match the rate of Production in a pacemaker process to the rate of Sales.

One of lean manufacturing’s most important calculations is takt time, or the rate of customer demand for a group or family of products produced by one process. Takt time is calculated by dividing the effective operating time of a process (be it a shift, a day, etc.) by the quantity of items that the customer requires from the process in that time period. For example, the operating time for a process is 28,800 seconds per shift. But the effective operating time is the operating time minus allowances, which can include planned downtime, lunches, breaks, team meetings, cleanup and planned maintenance. Assuming 1 hour for

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allowances, unplanned downtimes, changeovers (signify waiting waste) and other internal problems are those variables that need to be improved to have the best effective operating time. If the customer demands 420 pieces of a product during an eight-hour shift, the takt time will be 25,200 divided by 420, or 60 seconds. This means that based on the available time, on average, the customer is buying one unit every 60 seconds.

In the 1930s, the German aviation industry employed Takt for the first time as a production management tool. The idea was widely used within Toyota in the 1950s, and by the late 1960s, it had been adopted by the majority of the Toyota supplier base. Every month, Toyota assesses the takt for a process, with a modifying review occurring every 10 days. Takt time is used to properly balance supply and demand. It gives a lean production system its beating heart.

**Variation between long-term average
demand and day-to-day actual demand**

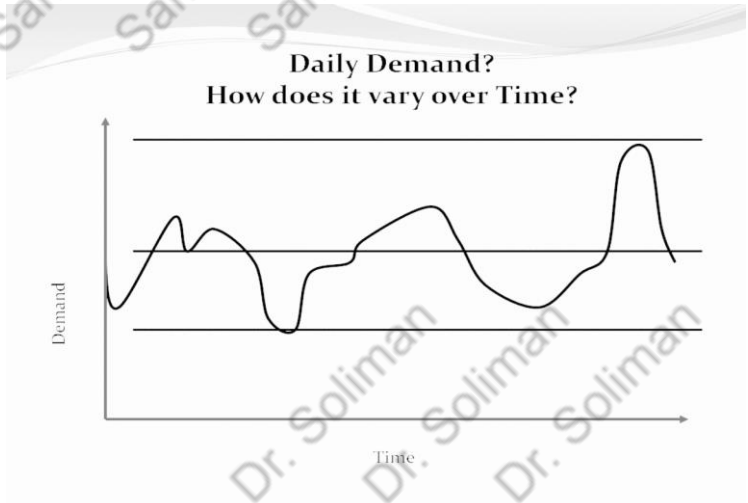
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You should check the range of daily customer demand variation by reviewing actual shipments (not orders) over the past twelve months. You cell should be able to handle sustained demand.

For occasional spikes in demand, it is generally better to operate at a steady takt time. (Based on average long-term demand) and either hold a buffer stock of finished goods (small buffer) or run some daily overtime (only per need) to ensure ability to serve customer demand.

Changing takt time from day to day is inefficient, disrupt the work pace, and increase potential for quality problems

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Future demand and variation

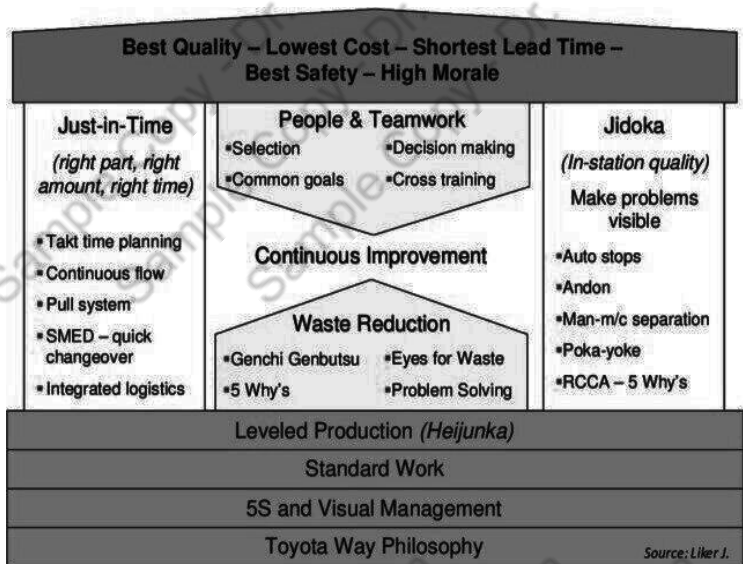
It can be difficult to make accurate forecast far in advance. When future demand is uncertain it may be wiser to add capacity in steps as increased demand actually materializes rather than designing your pacemaker process now on peak demand that may not appear.

Leveling the product volume, mix and sequence

Since customers don't order in a stable or predictable way, producing in a leveled

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schedule has been the foundation of Toyota production system. The Heijunka method is covered in this book. In real life, customers don't order the same mix and quantity of parts every day. Changing the demand every day (as a try to follow customer demand in order hourly or daily) can create many wastes and issues in the value stream.



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Just-in-Time	Heijunka
Meets requests from customers	100% satisfaction of client demand throughout a period of level output
Less finished goods in the inventory	Use finished products inventory to offset brief spikes in demand
High supplier production variability and fluctuating customer demand upstream	Supplier stability and overall supply chain inventory reduction
Periodic overtime	Time-saving measures
Bullwhip effect is induced	Calm upstream

What is Muda, Mura and Muri?

Muda is the Japanese word for waste. Muda is anything that uses resources but offers the customer nothing in return. Most activities are waste, or "muda," and can be divided into two categories. Although type one muda does not provide value, it is inescapable given the production assets and technologies available today. An illustration would be checking welds for safety, that type we also call necessary non-value-added activity. Type two muda does not add value and can be quickly eliminated. An illustration is a process in a process village with disconnected phases that may be swiftly converted into a cell where unnecessary material moves and inventory are no longer necessary. A very small portion of all value-stream activities truly generate value as perceived by the client. The most effective way to boost business performance is to stop doing the numerous unnecessary things.

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The seven wastes in lean manufacturing are those non-value-added steps that create obstacles to the flow of the stream, add cost to the product, reduce quality, and delay the delivery to customers.

For example, suppose there is a manufacturing process consisting of several processes, such as cutting, casting, assembly, handling, maintenance, inspection, and changeovers. The added value works, which involve making what customers need, are just a few processes: cutting, casting, and assembly. The others are those non-value-added works that need to be removed or minimized to improve the process. The seven wastes define those non-value-added works in terms of transportation, inventory, motion, waiting, over processing, and over productivity. The eighth waste is the underutilization of human capabilities, or untapped human

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potential. To usually remember them, try to remember this word TIMWOOD.

Transportation: it is about material handling. It involves all material movements from the supplier to the customer. What creates wastes in the manufacturing process is the movement of parts between the process lines. It adds more cost on the product and could affect external customers directly, causing a delay in orders delivery.

Inventory: it is one of the greatest wastes. Inventory issues are greatly affected by the production style. But the improper sales forecasting and the bad procurement planning are also reasons for inventory problems.

Reducing the inventory storing value has become the main goal of any industrial company. The just-in-time (JIT) theory and approaches like Kanban have been utilized to serve the manufacturers' demands in

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reducing the inventories, produce only what is needed and when needed while keeping a little buffer for emergencies.

Motion: it refers to the ergonomics in workplaces. The operator needs to have his tools and parts handed to him in exactly the right orientation to eliminate wasted walking and handling losses

Waiting: is the time waste factor, and it involves the following activities: Wait for material, wait for spare parts, wait at quality inspection points, wait for a service, wait for maintenance, wait for repairs, wait for break-downs, wait for instructions, wait for tools, wait for spare parts, wait for change over, wait due to machine speed issues or speed losses (machine is not cycling properly). 5S is one of the keys to reduce motion and waiting wastes.

Overproduction: productivity and inventory issues are related. Over productivity creates

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most production wastes. Making more product than is actually needed or over the capacity of the selling department is a waste of money in enormous rates. Using takt time precisely is the key to eliminate over production and inventory. Leveling the product volume and type adds value to your takt time and to your customer.

Over Processing: refers to doing unnecessary steps in the process. Having standard work in place is necessary to eliminate this type of waste.

Defects: Products that do not meet quality standards and result to rework. Defect is a quality issue. Quality is so important for customers; this is really what keeps any organization in business.

Defects are not only in the production process; they can also be seen in any other process, such as the maintenance process. For instance, if a maintenance repair has

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been carried out and the fault rapidly returns, this indicates a defect in the repair process. Standardizing the work process is the foundation of quality.

Mura is the word for unevenness or variance in Japanese. These are inconsistencies in business operations, which, in terms of business processes, cause changes in production. Employees may be overworked during high demand periods in order to meet demand, then become idle when demand declines as a result of changes in production or processing. Uneven workloads can also cause waiting and an accumulation of work-in-process inventories. Overworked workers are more likely to release flaws from the production stream. If you look closely, Mura's existence will bring you to Muda.

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Muri is the term for burden in Japanese. This is referred to as overtaxing people and equipment in the context of business processes. These include, but are not limited to, machines operating at 100% of their capacity and personnel working extra hours to accomplish goals. These occurrences frequently result from Mura's presence. Employees and robots are occasionally required to exert effort that is beyond their capacity due to variations in the pace of work. Muri then leads to Muda as well. Inadequate workloads for workers and equipment could result in flaws and downtime, which can result in too much work in progress inventory and waiting.

The phrase "Muda, Mura, Muri" exposes those responsible for ineffective business practices. And in order to provide value to customers, we must address all three.

In my book the seven deadly wastes and how to remove them from your business, I present in details how to eliminate the

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Muda. In this book, our main focus will be on eliminating Muri and Mura by applying Heijunka technique.

Heijunka

Heijunka is a Japanese term that means leveling. The method works by leveling both the production volume and the product mix. It doesn't build products according to the actual flow of customer orders, which can swing up and down widely, but takes the total volume of orders in a period and levels them out so the same amount and mix are being made each day. Heijunka is a technique that helps reach the defined takt time and adds value to it.

Most of suppliers try to follow the lean principle of making to order. But since customer demands can never been stable, and is naturally unpredictable, irregular and vary significantly, following the customer demand in sequence will cause a lot of issues such as:

1. Placing an uneven demand on up-stream processes. Taking the example of a crystal factory that makes small crystal

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stones for the use in women accessories. The demand was 200 in Monday, 80 in Tuesday, 100 in Wednesday, 100 in Thursday, and 20 in Friday. Meeting this demand in sequence means high utilization of machines, people, and all available resources in Monday, and underutilization in Friday. It is really not possible to run production in an environment like this while achieving lean targets. Instead, the crystal producer would use heijunka to level demand by producing 100 stones every day.

2. There is a high chance of not meeting the customer demand especially when the situation involves different types of stones. The example comes from a crystal manufacturing factory in Egypt that was producing different sizes of crystal stones. The factory was producing the 2mm stones at the first week of the month, followed by the 4mm in the second week, the 6mm in the third week, and the 8mm in the last week. If the customer demand for one or two sizes changed, for example, the customer can demand the 4mm at the start of the month,