Production Leveling

Overview of Module

As we learned in the pull lesson, one of the 6 kanban rules is that production must be leveled or smoothed. In fact, Mr. Fujio Cho, of the Toyota Motor Corporation once said, “In general, when you try to apply the Toyota Production System, the first thing you have to do is to even out or level the production.

The concept Mr. Cho is referring to is called heijunka. Defined, heijunka refers to a system of production smoothing or leveling by both volume and mix.

To better understand why heijunka is so important, we need to introduce two new concepts.

The first is mura or unevenness. The most common example of mura is varying customer demand. Just when you think you understand what your customer wants, they change their mind. This is mura, or unevenness.

As a result of mura, we often see companies overburdening employees and equipment throughout the month and year. This is called muri or overburdening.

Perhaps the most famous muri scenario is the hockey-stick-effect where there isn’t much work to do early in the month. Then, in the final week of the month or quarter things get crazy as employees are asked to work mandatory overtime in order to make the month.

And as result of both mura and muri your suppliers are deal with what is called the bullwhip effect. Just like a small flick of the wrist can create a violent force at the end of a bullwhip, even small variations in customer demand (as shown by the black line) can create immense pressure throughout the supply chain (as shown by the red line).

There are several types of production scheduling techniques employed within most companies. We’ll discuss three different scenarios in this lesson.
Lot Production Scheduling

The first is commonly called lot production scheduling.

In the example to the right, the demand has been leveled week to week. The green race cars with the biggest demand, 17 per week, are made early in the week in order to satisfy the majority of the customers. There’s a changeover on Wednesday that results in some lost production time, then the line switches over to making the 8 yellow buses. On Friday morning, after the orders for the yellow buses are complete, there’s another changeover and the 4 red sports cars are built.

Weekly Leveled Production

Second we see leveled production on a weekly basis. In the example to the left we see the demand is still leveled to produce in weekly lot sizes, but the production mix has been leveled across the week so that there is a mix of products being produced across the week.

The mix is still not as flat as could be with daily Heijunka, but the fluctuation is much less than monthly leveling.

Notice the dramatic increase in the number of changeovers required to accomplish a leveled mix sequence. We went from 3 changeovers per week in the unleveled production schedule, to 11 changeovers. That’s close to a 4X increase. This is why the ability to changeover quickly and produce in small lots are prerequisites to Heijunka.

Daily Heijunka Production

Lastly, we arrive at a daily heijunka production schedule. As you can see to the right, instead of building all the green cars in one long production run we are smoothing things out as we level both the volume and mix within each day.

With this said, changeovers have now increased to 21 per week! This is from a beginning of only 3 per week. The need for quick
changeovers (SMED), supported by good 5S, reliable machines (TPM) and stable processes is now absolutely crucial.

**Benefits**

There are many benefits to implementing heijunka including:

- We make what the customer wants, when they want it or Just in Time. This also helps us to dramatically reduce the amount of slow moving or obsolete inventory.
- Next, since production now follows a pattern and the leveled mix provides a more stable workload, it becomes possible for smooth one-piece flow and Standard Work to be established. This in turn reduces cost and improves quality.
- Finally, we’re able to smooth the signals throughout supply chain. This leveled demand also allows our suppliers to reduce their inventories, deliver set quantities on a routine basis, and avoid the bull whip effect.

**Terms**

- **Heijunka**: Refers to a system of production smoothing or leveling by both volume and mix.
- **Mura**: Unevenness. Often used to describe the way customer demand varies day by day and month by month.
- **Muri**: To overburden. As a result of mura, employees are often asked to work mandatory overtime at the end of the month. This is mura. Can also refer to overloading equipment.
- **Bullwhip Effect**: An observed phenomenon in forecast-driven distribution channels - sometimes referred to as the whiplash effect.
- **Heijunka Box**: One of the most common approaches to implementing heijunka is with what is known as a heijunka box. Along the top of the box is the time period, in this example hourly. Then the different product families and their subsequent kanban cards are placed in each row.