

WHAT IS LEAN

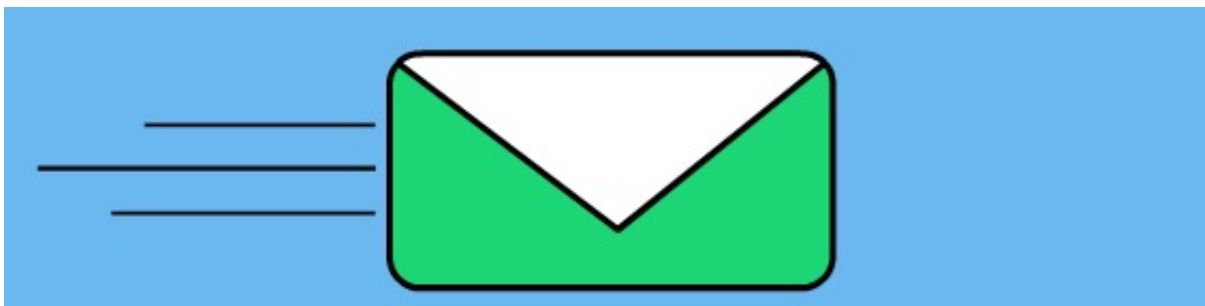
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You are here: [Home](#) / One Piece Flow and Labor Density – The Mail Example

One Piece Flow and Labor Density – The Mail Example

The famous book, “Lean Thinking” by Jim Womack and Dan Jones, recalls an **experiment** that one of the **authors** did with **his two daughters to explain one piece flow**.

One Piece flow of envelope – A challenge story.



The **challenge** was to **find the best way** to:

- 1) Fold
- 2) Address
- 3) Seal
- 4) and Stamp newsletters

so that they **could be mailed out**.

The **“efficient” way** that the **children** came up with was **batch manufacturing**.

They said that:

- A) The father should fold all the newsletters first
- B) then put the address labels on all the newsletters
- C) followed by applying the seal on all of them
- D) finally put stamp on all of them.

Even when their **father explained about utilizing one piece flow** (*the idea that one should complete one newsletter at a time by folding, applying the address label, seal and stamp*), the **children would not budge from their thinking.**

The story was detailed to **teach us the importance of one piece flow**

One piece flow is simply to make one and move one.

This is a classical view of one piece flow.

One piece flow is taught by the Lean Teachers as the best way to achieve man-hour reduction.

The traditional view of manufacturing as mass-manufacturing involves batch processing.

Batch processing leads to piles of inventory between stations.

The **best way to view this**, is from the **standpoint of one part** and **how long that one part takes to be transformed** to the finished product from **start** to **finish**. This is also the **lead time**.

Here there is a video that could help to visualize the operations.

Batch Process vs One Piece Flow

In **batch processing**, the **part waits** until all the other parts in the lot has been completed.

Then it moves to the next station, and again waits, and so on.

In **one piece flow**, however, the one piece **does not have to wait**.

It gets **transformed** into the finished product with **minimum delay**.

Utilizing one piece flow has the immediate **benefit of improving the flow**.

This will also **identify the opportunities** and **wastes that immediately become visible**.

For example, one can **easily see** which **operation needs more attention** by looking at **the WIP (Work in Process)** inventory at the station or idle of the next station operator.

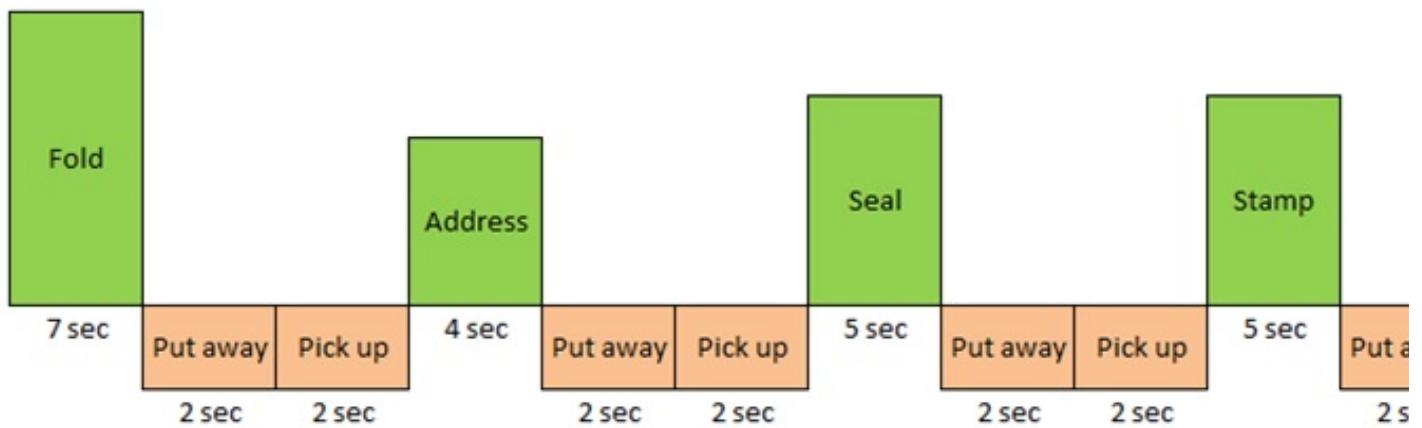
The **other benefit** that is pointed out by [Lean Production](#) is that if there was a **quality issue**, it is **contained** and **immediately addressed**.

In this **example**, only **one operator** is involved.

If he is doing **batch processing**, **one single** newsletter gets handled an additional **eight different times**.

In between each operation of fold, address, seal and stamp, the newsletter gets put away and th

picked up at different times. This example is shown below.



The Labor Density

In this article I am going to look at **one piece flow** from a **Labor Density** standpoint.

The real meaning of **man-hour reduction improvement** was best **explained by Taiichi Ohno** father of **Toyota Production System**, as Labor Density.

Labor Density is the ratio of work to motion. Work is the actual value-adding labor content, and motion includes all the movement that the operator goes through to complete the step.

Labor Density = Work/Motion

The most efficient way one can increase Labor Density is to decrease the denominator by removing all of the extra motion that does not add value.

The goal is to have 100% Labor Density;

in other words, there is **no wasted motion**.

The concept of labor density also illustrates **the flaw in the thinking of adding more labor will more throughput**.

Adding more labor (more operators) **does not do much to the labor density** other than perhaps decrease it since the increase in the number of operators can actually increase motion and wait time.

In the example of the newsletters discussed above, we can then calculate the labor density once we sum up the work and motion elements. The labor density is **total work elements/(total work elements + total wasted motion elements)**.

Labor Density = $21/(21+14) = 60\%$.

We can thus see that we are **far away** from achieving the goal of **100% labor density**.

When we incorporate **one piece flow with one operator**, all the **wasted motion** of putting away and picking up **will go away**, pushing us to near 100%.

This raises an interesting question.



What if we were to use four operators and still utilize one piece flow?

Thus we will have **one operator each for each operation** of fold, address, seal and stamp.

For clarity, let's **ignore the waiting time** due to the **line not being balanced**.

Interestingly, even though we are utilizing one piece flow the **labor density is still about 60%**.

This is because the **wasted motion of picking up and putting away are still there**.

This would indicate that for this specific job, you should utilize one operator only. If **you need to use more operators**, each operator **should work on separate parts from start to finish**.



Hitoshi Yamada, a disciple of **Taiichi Ohno**, called this “**Single Stall Production**”.

Using one operator makes sense in this example, particularly because the motion of picking up a putting away takes almost the same amount of time for most of the operations.

When the **same operator is doing all the operations**, there is **no fumbling** or **rearranging the part**.

Some of the **benefits of Single Stall Production** include **improved morale** and **quality**, and the opportunity for **kaizen** (continuous improvement).

The operator is in control of the quality of product since he is responsible for the entire process.

The exposure to all the steps in the Lean Process **sparks creativity for kaizen**.

With more operators working on the product from start to finish at separate stalls, there is more opportunity for kaizen since the operator is not just doing one step alone repeatedly.

As the **lean leader** in your organization, you should **play around with these concepts** and do much **experimentation** as possible.

Increasing operators in the **hopes of increasing throughput does not always work** as we in the example above.



The Supervisors' Challenge

Taiichi Ohno's **favorite challenge to the supervisors** was to get the **same output using one operator**.

This challenge pushed the **supervisors** to be **creative and more aware** of all the **wastes in the operation**.

Thinking in terms of **labor density** and **one piece flow** is very important to truly attempt to **eliminate all of the wastes from the manufacturing processes**.

Always keep on learning...

Written by Harish Jose for www.whatislea.org

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