

## Value Stream Mapping

Value Stream Mapping a fantastic tool from lean manufacturing for making the flow of materials and information in a process visible in ways that highlight constraints and impediments so you can improve them.

While it is often attributed to the Toyota Production System, there are diagrams dating as far back as 1918 that visualise a process as the flow of materials and information in a book by Charles E. Knoeppel called, "Installing Efficiency Methods."

Value Stream Mapping was undoubtedly important in Toyota's success and played a significant role in modernising manufacturing for a great many organisations, but it really took off in the 1990s when it started to be adopted in knowledge work and especially in the technology sector.

When the flow of materials within a process are visible, as in a vehicle production line, Value Stream Mapping is easy to understand as the impacts of handoffs or delays can be seen as partially assembled parts piling up in front of the station that is most constrained. In other domains however, it can be less obvious how the value stream connects to the actual process and this can make it seem like something difficult that will not translate to immediate value or a return on investment.

It is worth noting that a Value Stream Map is not a process flow diagram. Yes, it maps the flow of value through a process and yes, it is a diagram, but it is a different way of thinking about the process and the flow. Where a process flow diagram will present multiple process pathways and visualise all the branches and options in a complex process, a Value Stream Map focuses in on a single stream of value. For complex processes you may need to produce multiple Value Stream Maps to create a Value Chain that describes how multiple value streams contribute to a business outcome.

Another key difference between a process flow diagram and a Value Stream Map is that a Value Stream Map should always start with the customer. Value is realised when the customer makes a purchasing decision, not when one area of a business delivers something to another area of the same business.

Don't let that put you off. The more opaque the system is, the more likely you are to expose opportunities to improve by applying Value Stream Mapping and the greater the payoff at the end.

One thing to bear in mind in your quest to improve a process and eliminate waste, is that you can easily get too carried away with Value Stream Mapping and it becomes wasteful in itself. For that reason, I suggest starting small and keeping it simple. Full Value Stream Mapping includes an extensive suite of standard icons and relationships between actors and actions in a process that requires a lot of practice and a significant effort.

What I present here is so highly simplified that those who are experienced with Value Stream Mapping might find they struggle to connect it to the pure practice, but it has been tried and tested with many processes across many Teams in a variety of different organisations and has always identified substantial improvements with a much smaller investment in time and effort.

Try the simplified format and see for yourself the improvements it makes visible. When you've been using it for some time and the returns are diminishing, you can investigate the practice more to see if there is more value for you in going deeper.

At the highest level, this simplified version of Value Stream Mapping is the same as the full version. You map out the steps involved in delivering something of value as a stream of steps with material and information flows indicated so you can identify delays and waste.

To start with, decide what the valuable output is that you will map. Physical products are easier to describe as you have tangible steps and visible materials. In this example, we'll map the value stream for producing a packet of biscuits.

When producing our Value Stream Map, it is better to start with the customer and work your way backwards rather than map the process steps. This way it forces us to think differently about the steps involved and helps us to be outward looking at what the customer values rather than inward looking at what we do. One great benefit of this backwards approach is that we can ask at each step, "Does the customer value this?" If not, it might be waste.

In our example, value is delivered to the customer when they purchase a delicious packet of biscuits.



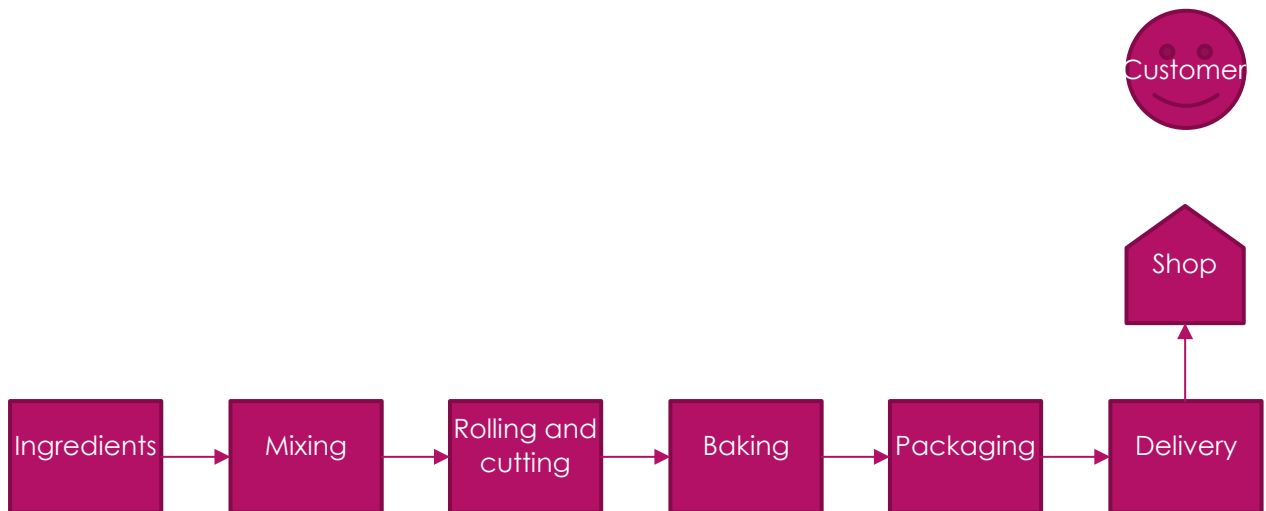
Working backward from the customer, there is a step where we deliver the biscuits to the shop the customer will buy them from.



Working backwards from there, we can't deliver until after packaging. Packaging is valuable for the customer because it allows them to buy an appropriate number of biscuits and gives them a way to take them home without breaking them.

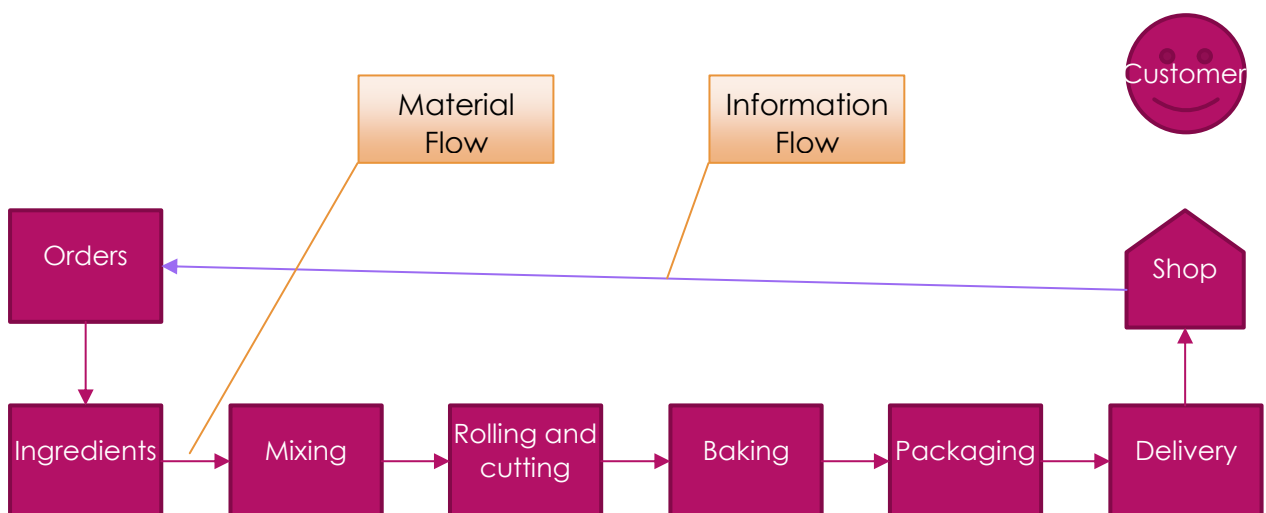
From packaging, we step back to baking, the customer values the right level of baking because it makes the biscuits much more delicious than they would be if they were under baked or over baked.

Then we get to rolling and cutting, mixing the biscuit dough and having the ingredients, all valuable in the endeavour of providing biscuits to our customer.



This gives us the basic flow of materials, we haven't performed any analysis on those materials or how effective the flow is yet, but the material flow is emerging.

The only information flow we have so far is from the shop back to our ordering system, the customers themselves don't place their orders in our system.

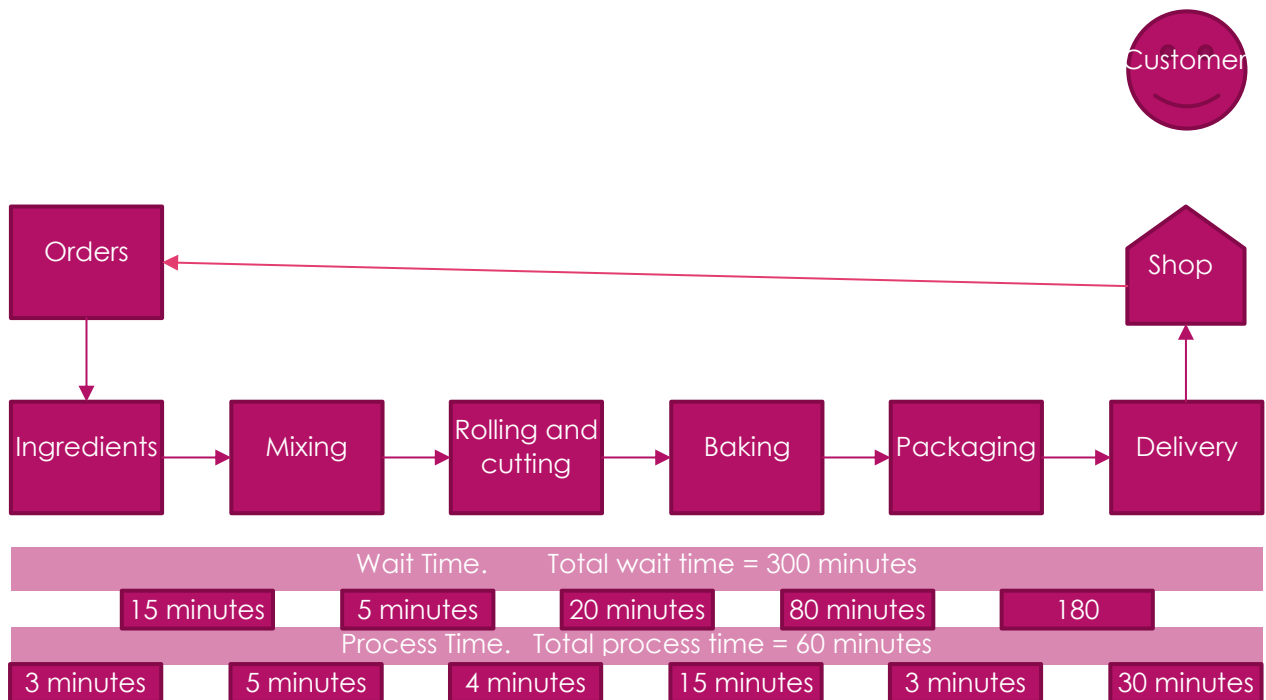


We now have the basic Value Stream Map in place, but we still need to use it to perform some analysis on the effectiveness of the value stream before we can identify improvements.

One of the easiest analyses to perform is to measure how long it takes on average for each step in the process to be completed. This will highlight how much time is

spent within the overall process on those activities we've identified as being valuable to the customer.

The next step, while we're measuring how long things take, is to measure how long it takes between things. On average, how long does the item of value wait after a step is complete before it is picked up by the next step.



Now we can see that there is 1 hour spent doing things in the process and 5 hours spent waiting in between doing things, for a total production time of 6 hours.

Adding up all the time spent actively doing things in the process gives us the **Total Process Time**, this indicates the investment of effort or materials in the product. Each step in the process is a potential candidate for improvement.

The sum of all the times in between customer value adding activities provides the **Total Wait Time**, this indicates how much time is lost to waiting in the process. Sometimes delays are significant enough that they not only add to the time it takes before the customer receives the value, they can also degrade the value invested previously. Imagine if it took 4 weeks between baking and packaging, the product may no longer be fresh enough to sell.

Some delays are intentional and essential. The delay between baking and packaging for example, might be necessary in order for the biscuits to cool down.

Adding the Total Process Time to the Total Wait Time, gives us the **Total Lead Time**, this is the time it takes between the requested order entering our system and the final product being in the hands of the customer, in this case the shop. Total Lead Time is the metric against which we will measure our improvements. If we were to define an experiment that we expect will improve the process, the 'one metric that matters' would be Total Lead Time.

With an understanding of the Total Process Time and the Total Lead Time, we can calculate how much of the Total Lead Time is invested in value adding activity through a number called the **Activity Ratio**.

The Activity Ratio highlights the efficiency of the flow through your value stream. It's expressed as the percentage of Total Process Time within the Total Lead Time.

$$\text{Total Process Time} / \text{Total Lead Time} \times 100 = \text{Activity Ratio}$$

Don't worry if your Activity Ratio is very low, that indicates that you have a lot of opportunity to improve and you will probably find opportunities to create significant improvements with very little investment. It's common to see Activity Ratios at 10% or less, indicating that people might be extremely busy but the valuable customer outcome they are working on is idle most of the time.

With the basic flow and an understanding of the time investments in place, we can start to ask ourselves some questions for each step in the process and each delay.

- Does the customer want us to do this thing?
- What does it mean for the customer if we don't do it at all?
- Can someone else do it?
- What could we do differently to improve one of our steps?
- Is there a way to eliminate or reduce one of the delays?
- What changes if we do two of them together to eliminate the delay?

These are just a couple of thought prompters, the questions you ask will depend on the thing that you're doing and will be different in a product manufacturing process than they will in a service delivery process.

The answers to those questions will help you to identify improvements, even if you only go this far with Value Stream Mapping, you will have exposed potentially enormous improvements. One Team I worked with a few years ago was able to reduce their total production time by more than 90%, with just the high level map similar to the example, their customers were over the moon, the Team was happier and the value they returned to the organisation dramatically increased just by making the process visible.

To continue with the map, your next analysis is to understand quality.

Many processes check the quality of the output only after all steps are completed, but if a defect occurs early in the process the time and materials are invested in steps further down the process to a product that is already defective.

A quality process has checks at every step of the process.

Sometimes a defect emerges that doesn't result in the product being thrown away, but necessitates it being returned to an earlier step in the process for the defect to be rectified. Having to fix defects means double handling and can be extremely wasteful.



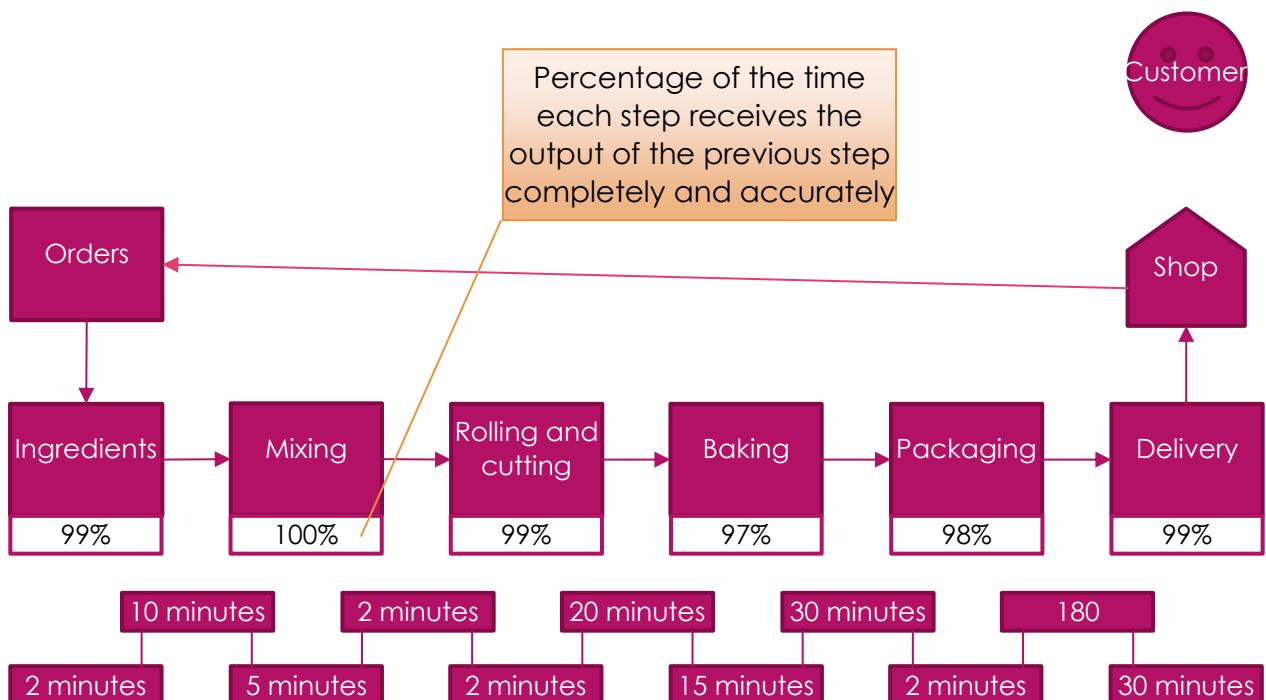
QUALITY IN A SERVICE OR  
PRODUCT IS NOT WHAT YOU PUT  
INTO IT. IT IS WHAT THE CLIENT OR  
CUSTOMER GETS OUT OF IT.

PETER DRUCKER

Implementing quality checks and feedback loops at every step in the process reduces waste and delivers higher overall quality.

Looking at each step, how often does it get done incorrectly? The easiest way to see this is to look at how often the following step has difficulty completing its task because the input it received was either incomplete or inaccurate. You can add a measurement of how often a process step delivers its output with full completion and accuracy by assessing how it is received by the next process step.

The measure of how complete and accurate an input is to a step is called, "Percent Complete and Accurate," abbreviated to %C&A. If there is a problem with the input a step receives 5% of the time, then its %C&A would be 95%.



%C&A is an indicator of potential improvements that can greatly reduce waste. The cost of a step having a low %C&A is often more than you might think because you've invested in the step that caused the problem, the step that found the problem, and then had to either perform rework or throw the product and all the time and materials invested into it away.

Looking at the overall quality is simply a matter of multiplying the %C&A together so it rolls up into a single number, this is called, "Rolled %C&A," in our fictitious example above, we'd get:

$$99\% \times 100\% \times 99\% \times 97\% \times 98\% \times 99\% = 92\%$$

Even when we see reasonably high %C&A measurements for each step, it can create an overall quality measurement that is surprisingly low. 92% indicates that 8% of the time, the output we are delivering to customers doesn't make it through our process in one go.

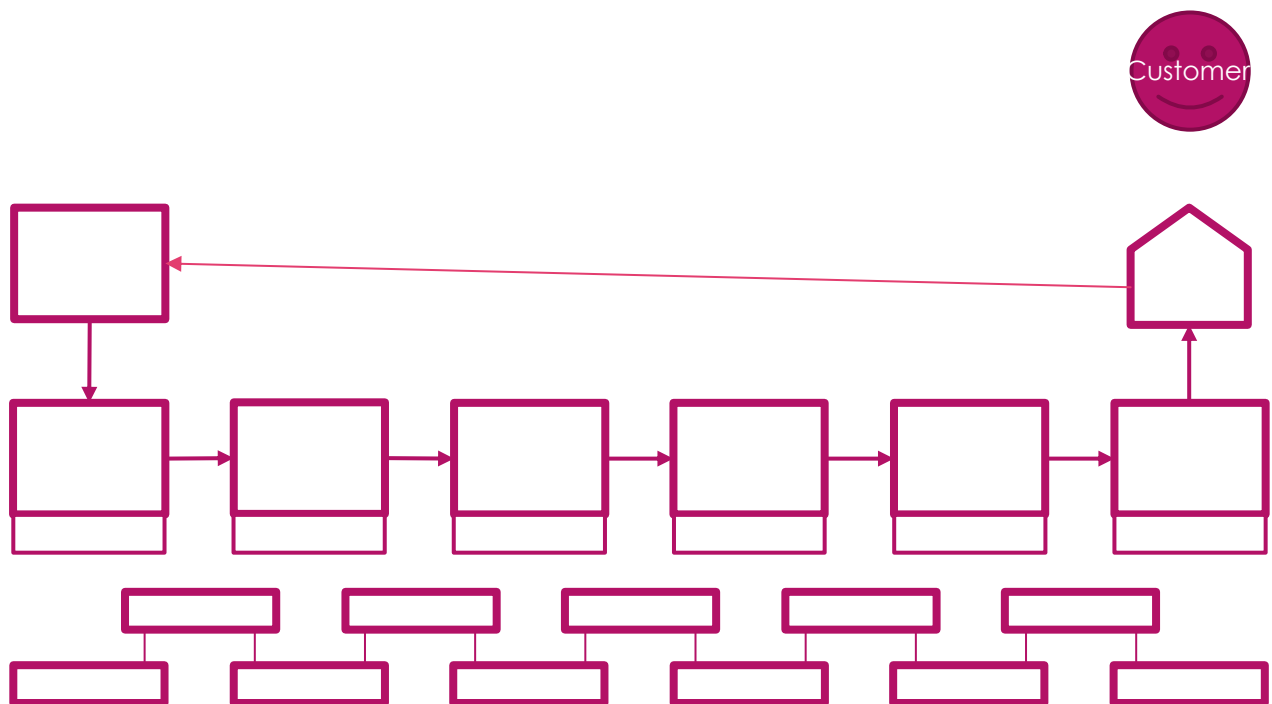
When your %C&A measurements go down to 60% or 70%, your Rolled %C&A can get very low indeed, meaning your valuable output only gets through your process in without rework a small percentage of the time.

I've seen Teams with Rolled %C&A in single figures which can be quite startling for them because previously they only measured quality at the end of their process they've never seen the quality of their process in this way.

Don't be disheartened if you do end up with a low number for your Rolled %C&A, this is probably the first time you've made it visible in this way. It's a good thing to see the true quality of your process, because now you have it visible, you can do something about it.

## Activity

Thinking about a valuable outcome that you work in or on, map out the steps as a value stream. Map it out on paper if you need more steps than the diagram below.



1. Map out the steps involved between someone wanting it and them having it. Start from the customer and work backwards.
2. Identify the material flows and the information flows.
3. Enter the process time for each step, use your best guess if you don't have actual metrics, this exercise is more about practicing the technique than it is about creating a comprehensive value stream map. Add them all up to get the Total Process Time.
4. Enter the wait time between each step, once again, just use your best guess if you don't have access to real data. Add them all up to get the Total Wait Time.
5. Add up the Total Process Time and Total Wait Time to get the Total Lead Time.
6. Calculate the Activity Ratio by dividing the Total Process Time by the Total Lead Time and multiplying by 100.
7. Next, add the Percent Complete and Accurate that each step receive it's inputs
8. Multiply all the %C&A together to derive the Rolled Percent Complete and Accurate.

What emerges for you in practicing Value Stream Mapping, even if it was only with guesses instead of real data?

What surprises you in reviewing the map you created? Does the activity ratio seem low because you know everyone is always busy? Or does the Rolled Percent Complete and Accurate indicate a lower overall quality than you thought you had?