LSS | Academy

Guide to

# LEAN Manufacturing

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# Table of Contents

DEALING WITH LINKS ..... 4

ABOUT THIS EBOOK ..... 5

ACKNOWLEDGEMENTS ..... 6

ABOUT LSS ACADEMY ..... 8

CHAPTER 1: WHAT IS LEAN MANUFACTURING? ..... 9

CHAPTER 2: FINANCE 101 BY TAIICHI ..... 11

CHAPTER 3: THE FORGOTTEN M'S ..... 13

CHAPTER 4: WAITING ..... 14

CHAPTER 5: NO STANDARDS, NO KAIZEN ..... 16

CHAPTER 6: STANDARD WORK ..... 18

CHAPTER 7: WHY FLOW COUNTER CLOCKWISE? ..... 20

CHAPTER 8: JIDOKA - THE FORGOTTEN PILLAR ..... 22

CHAPTER 9: HEIJUNKA IN THE FRONT OFFICE ..... 23

CHAPTER 10: WHY HEIJUNKA? – PART 1 ..... 25

CHAPTER 11: WHY HEIJUNKA? – PART 2 ..... 29

CHAPTER 12: SINGLE MINUTE EXCHANGE OF DIES (SMED) ..... 32

CHAPTER 13: OEE – NOT JUST FOR TPM PROGRAMS! ..... 35

CHAPTER 14: VALUE STREAM MAPPING OVERVIEW ..... 37

CHAPTER 15: HOW TO CREATE A PQPR MATRIX ..... 39

CHAPTER 16: CURRENT STATE VALUE STREAM MAPPING ..... 41

CHAPTER 17: FUTURE STATE VALUE STREAM MAPPING ..... 50

CHAPTER 18: INTRODUCING THE KAIZEN NEWSPAPER ..... 56

CHAPTER 19: TWO TYPES OF KAIZEN ..... 59

CHAPTER 20: KAIZEN RULES: 1&2 ..... 61

CHAPTER 21: KAIZEN RULES: 3&4 ..... 62

CHAPTER 22: KAIZEN RULES: 5&6 ..... 63

CHAPTER 23: KAIZEN RULES: 7&8 ..... 64

CHAPTER 24: KAIZEN RULES: 9&10 ..... 65

CHAPTER 25: REPENT, I MEAN HANSEI! ..... 66

CHAPTER 26: IS LAYING PEOPLE OFF REALLY ANTI-LEAN? ..... 67

CHAPTER 27: SHADOWS OR REALITY ..... 69

FINAL WORDS ..... 72

RECOMMENDED READING ..... 73

## Dealing with Links

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## About this eBook

Welcome to the LSS Academy Guide to Lean Manufacturing.

This book is a compilation of thoughts related to lean manufacturing that I have accumulated over the past 13 years in both manufacturing and transactional environments. It is my humble hope you will benefit, even in a small way, from these experiences.

Since the content of this eBook is made of individual articles, it won't read like a traditional book. However, I have tried to make the topics flow as best I could.

Please feel free to share this eBook with colleagues, friends, and acquaintances. However, if you wish to copy or use the content for any purpose, please contact Ron Pereira first.

If you have any questions or comments, please email us or leave a comment on our website.

To stay up to date with the latest happenings at LSS Academy, please subscribe to our website. You can also subscribe via email by visiting http://lssacademy.com.

## Acknowledgements

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Dedicated to my wife, children, and mentors.

## About LSS Academy

My name is Ron Pereira and I believe lean manufacturing and six sigma can and should work together in harmony.

I also believe we should all learn as much as we can about both lean manufacturing and six sigma, using them as needed and when needed. That, in a sentence, is the mission of LSS Academy.

Professionally, I have held the following job titles throughout my 15 year career: Process Engineer, Process Engineering Supervisor, Manager of SCM Development & Integration, Black Belt, Corporate Master Black Belt, and finally Director of Manufacturing and CIP (continuous improvement process). I also co-founded Gemba Academy LLC with the sole mission of improving the way online training is done.

I am married to my best friend, Genni, and have been blessed with 4 amazing kiddos. We are very involved with our church and enjoy spending time with our family and friends here in Keller, Texas.

Lastly, since I grew up in the great state of Ohio I am completely obsessed with The Ohio State University football program. As my Mom says, "You can take the boy out of Ohio, but you can't take Ohio out of the boy." Go Bucks!

## Chapter 1: What is Lean Manufacturing?

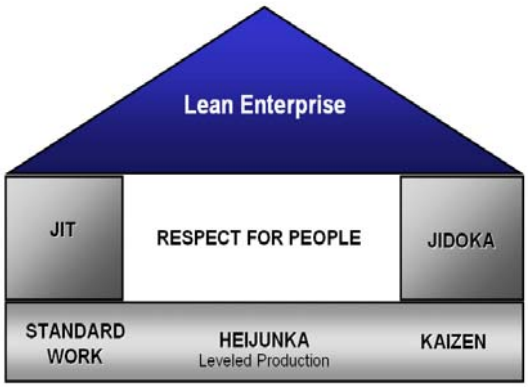
Depending on the book or consultant you are talking to, lean manufacturing has many definitions.

At LSS Academy, we believe lean is all about respecting people while eliminating the 3 M's which are muri (overburdening), mura (unevenness), and muda (non value added activity). Sadly, respecting people is often left out which turns lean manufacturing into *mean manufacturing*.

Modeled after the Toyota Production System (TPS), the term "lean manufacturing" was first coined by a group of MIT researchers in the 1980s, lead by Dr. James Womack as they prepared to write the book "The Machine that Changed the World."

**The House that Toyota Built**

A house is often used to describe the Toyota Production System. One pillar of the house represents JIT (just in time). Here we look at how to make things flow (one piece at a time preferably) using principles like takt time.




We also focus on the customer and only produce what they ask for and when they ask for it. In other words, we allow the customer to "pull" value instead of us attempting to "push" things onto them.

Finally, we never "overproduce" which is one of the seven deadly wastes.

The other pillar, Jidoka, is all about ensuring we make a quality product and eliminate, as much as possible, any opportunity to produce defects. Contrary to what some people falsely assume, lean is very concerned with process capability and eliminating defects.

At the base of the TPS house we find heijunka, or leveling. Here we work to smooth out production in such a way that allows us to better utilize our resources.

Lastly, the staples of standard work and kaizen are absolutely essential for any organization wanting to practice lean manufacturing.

Read on as all of these concepts are discussed at length.

## Chapter 2: Finance 101 by Taiichi

In Chapter Six of Taiichi Ohno's Workplace Management we read about the profit formulas.

When we think about how a company can turn a profit there are three ways to express it.

1. Price – Cost = Profit
2. Profit = Price – Cost
3. Price = Cost + Profit

For the math gurus out there you may be scratching your head as algebraically these formulas are the same. But Mr. Ohno begs to differ.

**Formula 3**

Let's start with the third formula (Price = Cost + Profit). Mr. Ohno explains that this may be likened to the government approach to setting a price. If, for example, a profit of $100 is wanted and the cost to produce the product is $200 the price is $300.

**Formula 2**

This is the trickiest formula (Profit = Price – Cost) and is where I was a bit mistaken myself. Ohno likens this formula to a company that produces luxury goods since they cannot reduce costs. I am reminded of a recent article I read about Motorola who is targeting the rich with their newest Razr like cell phone.

**Formula 1**

Lastly we come to the lean formula (Price – Cost = Profit). This formula is arranged in such a way as to say that costs exist to be reduced, not to be calculated. The thinking here is that the market sets the price and the only sure way we can increase profits is by reducing costs.

So, the key thing we must remember is there is only one thing we always have in our control. That one thing is the cost side of the formula.

Now, depending on your product or service, you may argue you have some control over the price. But, in the end the only thing you always have control over is how much it costs you to produce the goods.

## Chapter 3: The Forgotten M's

Those familiar with lean manufacturing have likely heard the word muda many times.

Muda is the Japanese word for waste and is the enemy of us all whether we know it or not.

Strangely enough muda is not the only enemy of a lean system. There are two more, less popular (at least in Western companies), M's we must also be aware of – namely mura and muri.

**Mura**

Mura in its simplest form means "unevenness." For example, mura results when your operators are told to work like crazy early in the morning only to stand around and do nothing late in the day. Heijunka may be the answer to this problem but let us save that discussion for another chapter.

**Muri**

Muri means to "overburden" equipment or operators. For example, if your entertainment center is only meant to hold 200 pounds and you place your new 425 pound super duper HD Ready TV on it we have muri. We also have other issues like a very real safety concern!

**Leads to Muda**

So the next time someone drops the word "muda" in their attempt to show you how much they know about lean you may be able to educate them on the other two M's that are just as important as the infamous muda. Of course you should be humble and polite during this education process.

## Chapter 4: Waiting

If you pick up any book about lean or attend a training course, you will likely hear how overproduction is the mother of all wastes. OK, in the truest sense it is… especially for those that manufacture any type of product.

But as I sit on this lovely airplane hoping to eventually take off, I must admit waiting seems like the worst of all wastes. In fact, at this moment in time, I could care less about overproduction!

Let's have a quick review of the 7 deadly wastes for those not familiar with what I am talking about. I am sure several consulting firms will say they came up with the acronym I am about to share… and before the lean police come for me I will admit this is not my own invention.

Here is the easiest way to remember the 7 deadly wastes identified many moons ago in Japan. Without further *waiting*, let me introduce Mr. Tim Wood.

- **T**ransportation
- **I**nventory
- **M**otion
- **W**aiting
- **O**verproduction
- **O**verprocessing
- **D**efects

If you want to get really tricky you can add the waste of "**S**kills" (meaning when you don't take advantage of everyone's abilities) which will make it TIM WOODS.

It is my opinion that the muda of waiting is the number one enemy for service related companies. Think about it… nothing is worse than waiting in line to see a movie, waiting to see the doctor, waiting to clear customs after a 12 hour flight to Brazil, waiting for your food at a crowded restaurant when your kids are hungry and cranky, etc.

So if you are in the business of serving people in any way, please takes my advice and focus on how you can eliminate waiting… your customers will appreciate it especially if you work in the airline industry.

## Chapter 5: No Standards, No Kaizen

"Where there is no standard, there can be no kaizen."

*-Taiichi Ohno*

**What does this mean?**

At its simplest level, I believe it means if you don't know how you are doing something, or if you don't do something in a consistent manner, how can you ever expect to make it better?

The nice people at McDonald's are masters at this. If you ever watch one of their "assemblers" work you will notice they make a Big Mac in a very specific manner. I am not 100% sure about this but I would imagine there is a standard way for any person, no matter where they are, to make a Big Mac.

So after 5S I cannot imagine how anyone can really do kaizen without standard work. In the next chapter we will discuss standard work in more detail but before then let me offer these tips to you to help you get started.

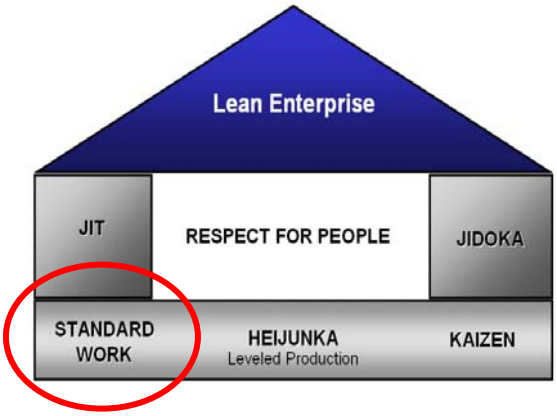
1. If you have a task or a job you do on even a semi-consistent basic (e.g. assemble a product, take care of patients, call customers, etc.) start off by writing down the way you generally do these steps.
2. Once you have the steps documented, ask someone who does the same or similar job to review the steps to see if they agree with them. If they don't, and many times they won't, discuss it with them and see if you can mutually agree on the best way to do this task.
3. Once you and your pal have the agreed steps documented work together and time each other doing these steps. You don't need an industrial engineering degree to time something. You don't even need fancy stop watches! Start with the seconds hand on the clock on your wall if you have to.

4. Once you have the steps and the times documented, see if you can come up with some standard work procedures. There are some standard “lean” templates you can use if you want. But don’t get bothered with trying to be perfect. Just get something on paper and in place.
5. Once you have the process documented, share it with others and get them to follow the steps for awhile exactly as shown in the document or documents depending on how detailed you go.

Now, when someone figures out how to do it better, and they will, change the procedures accordingly. This, my good friends, is what kaizen is all about.

## Chapter 6: Standard Work

Since the mission of LSS Academy is to offer ideas for how to align the strengths of both lean manufacturing and six sigma I wanted to discuss a topic I firmly believe all continuous improvement practitioners should practice. This topic is standard work.




There are three components of standard work:

1) Takt Time
2) Work Sequence
3) Standard Work in Process (SWIP)

**Takt Time**

Formally defined, takt time is the rate at which your customer buys a product. It is often called the heart beat of production, since once takt time is calculated all processes should operate at, or preferably a bit below, takt time.

A common mistake I have seen is when people think they can measure takt time with a stop watch. This is incorrect as takt time must be calculated as follows:

Takt Time = Net Available Time per Day / Customer Demand per Day

American football helps me remember this formula. By remembering TD for touchdown I get T (time) / D (demand). Typically, we note takt time in “seconds per piece.”

Takt Time is the law of the land and once it is understood all processes must work to this pace. Toyota, for example, operates at a takt time of around 50~60 seconds. How amazing is that?

**Work Sequence**

Next up is Work Sequence which is simply the order in which an operator performs manual operations (including walking and waiting). It is extremely important to determine the best and most efficient way for operators to perform their work. It helps ensure your process maintains consistency and stability. Whenever possible our aim should be to limit wasted motion, reaching, or any other non value added action.

**Standard WIP**

Finally, we must discuss Standard Work in Process (SWIP). SWIP is calculated as follows:

Standard WIP = (Manual Time + Auto Time) / Takt Time

When a process is operating at, or slightly less than, takt time, SWIP will usually be 1 piece. An exception to this rule would be if two sequential processes summed cycle time was less than takt time. In this case, you may only have one piece of SWIP for these two processes. If a process has a cycle time greater than takt time, SWIP will be at least 2 pieces, possibly more, depending on how the formula works out.

To learn more about Standard WIP check this post out by Jon Miller.

**Summary**

We have only discussed the basics of standard work in this chapter. There is much more to standard work including things such as the cycle time / takt time bar chart and the standard work combination sheet.

But if you understand the basics outlined in this chapter, you will be well on your way to a better and more efficient process no matter if your title is black belt or lean specialist.

## Chapter 7: Why Flow Counter Clockwise?

When designing a u-shaped cell it is often recommended that material flows in a counter clockwise direction. Why is this?

**It's about the right hand**

Research shows that most people are right handed. I have heard that as many as 85% to 90% are right handed. Why does this matter, you might wonder?

Well, when you think about what happens in a cell, we know that first we pick the product up. Since we have to "aim" so to speak to pick it up we tend to want to use our dominate hand.

Then, once we have "added value" to the product, we are ready to pass it on to the downstream process. There is not much "aiming" involved with simply placing something down.

So, with this known, we can see why having things flow counter clockwise or "left hand inside" makes sense when most people are right handed. We pick up with our right hand (when we need to aim) then put it down with our left (when no aim is needed).

**It's about the horses**

While the *right hand dominate* aspect may be the most common reason for flowing counter clockwise, there is another reason that is quite interesting.

Have you ever seen a horse race held where the horses ran clockwise? Probably not. In every horse race I have seen the horses run counter clockwise. The same thing applies for track athletes and race cars. They also move around the track in a counter clockwise manner.

You may not have ever given this much thought but there is actually quite a bit of "brain science" behind this. I must give credit to my friend and mentor, Jon Miller, for first explaining this to me. Well, he explained it to a lot of people in this post some time ago. He wrote:

> *One of the strongest reasons given for the innate "left hand inside" preference for human motion comes from brain science. According to a Professor Matsumoto, since the right brain processes spatial recognition human perception of space is stronger through the left side of vision (the hemispheres of the brain control opposite sides of the body). When you are running "left hand inside" or counterclockwise, you have better visibility of space on the left side and you are able to run more comfortably, confidently, and quickly.*

Here is a little test for you. If you don't believe this brain science stuff, head to the closest track and run a lap headed clockwise and time yourself. Then, take a rest and run another lap counterclockwise and time yourself. Chances are very good that your counter clockwise time will be several seconds faster than your clockwise time.

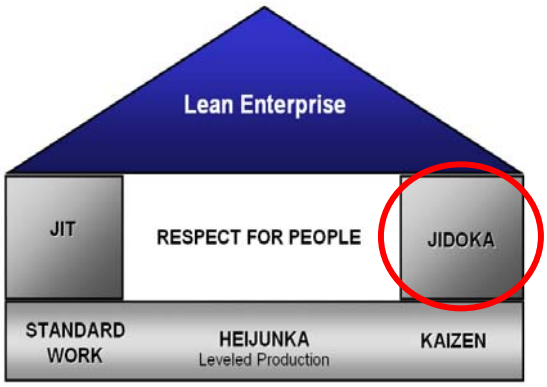
Of course you should do this a few times to make sure. In addition to learning about lean, you will be doing some great exercising… which is lean as well I guess. Yeah, I know, that was a really bad joke.

**My cell flows clockwise… am I evil?**

So what to do if your cell or cells flow clockwise? Does this mean you are not lean? Of course not. In fact, I recently talked to some folks who initially designed a cell to flow counter clockwise but after piloting it, the operators complained and offered some reasons why they preferred to flow clockwise which the engineers took into consideration and made the changes.

So, take this chapter with a grain of salt and be sure to test whatever solution you implement. In the end, the folks working on the line need to be comfortable with whatever you come up with.

## Chapter 8: Jidoka - The Forgotten Pillar




In the Toyota Production System house there are two pillars.

The one pillar most of the books are written about is JIT. You know all the fun stuff about takt time, one piece flow, and pull.

But there is an entire other pillar that, in my opinion, does not get enough respect. That other pillar is jidoka.

Toyota's website defines jidoka as follows:

> *The term jidoka used in the TPS can be defined as "automation with a human touch." The word jidoka traces its roots to the automatic loom invented by Sakichi Toyoda, Founder of the Toyota Group. The automatic loom is a machine that spins thread for cloth and weaves textiles automatically.*

There are four main steps to jidoka. They are:

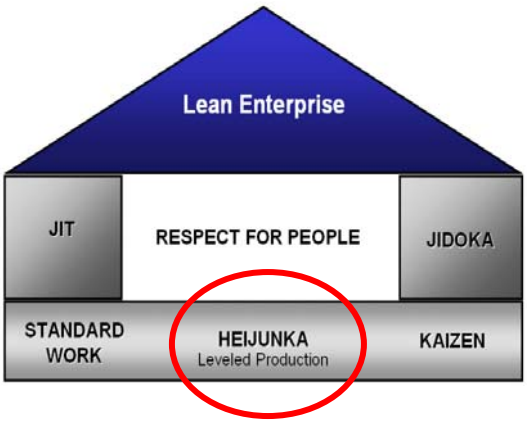
1) Detect the abnormality or defect
2) Stop doing what you are doing… something is wrong!
3) Fix the issue
4) Investigate the root cause and ensure it doesn't happen again

Poka-Yoke, or error proofing, is an excellent tool to ensure jidoka is in place. Once you identify a failure mode, the best control of all is a Poka-Yoke device. Some call this mistake proofing while others call it idiot proofing. Both work, I suppose, but mistake proofing sounds more respectful (remember a key tenet to lean is respecting people).

If you have never visited Toyota's TPS website, I highly recommend it.

## Chapter 9: Heijunka in the Front Office

In the house of Toyota, heijunka belongs in the foundation. Sadly, many people dismiss this critical lean concept explaining how it isn't relevant for their business.




Heijunka which is properly pronounced (hey-june-kah) and not (hey-junk-ah) is defined in the Lean Lexicon - Third Edition as:

> *Leveling the type and quantity of production over a fixed period of time. This enables production to efficiently meet customer demands while avoiding batching and results in minimum inventories, capital costs, manpower, and production lead time through the whole value stream.*

We normally hear about heijunka in the manufacturing environment. Assuming a factory can change over their machines in an expedient manner, (a prerequisite for heijunka) a leveled production system may look something like this. Note that (c) stands for changeover.

- AAA (c) BB (c) C (c) AAA (c) BB (c) C (c) AAA (c) BB (c) C

Compare this to the way a mass producer would likely approach this same demand structure keeping in mind their changeover time is likely much greater when compared to the lean producer.

- AAAAAAAAA (c) BBBBBB (c) CCC

**What about the front office?**

Can we apply the same, or similar, idea in the land of cubicles? Definitely. Let's see how.

One of the easiest ways to accomplish this is by using a heijunka wheel as shown in the picture to the right. In the wheel we can place the work, normally in folders, to be done in the slots in a leveled and balanced manner.

For work that needs to be done daily, the labels along the top (the pitch) may be noted, for example, in hours or 30 minute intervals. For work that needs to be done weekly we may note the particular day (Monday, Tuesday, etc.) on the label.

Another powerful approach is to place all the folders "in process" in an upright position. Then, once the work has been completed, lay the folder on its back. This is a powerful visual control that lets anyone and everyone that walks by the heijunka wheel see how things are going.

We can also store, within the heijunka wheel, standard work instructions, training records, and other documentation.

The benefits of using a heijunka wheel are many. Some of the most obvious are that people know what they are to do and when to do it. There is no more guessing or wondering what to work on next. And if an individual falls behind, they will know it immediately and can ask for help before severely impacting the entire system.

## Chapter 10: Why Heijunka? – Part 1

B.D. asked, *"You're talking about HOW to do heijunka, but I'm not seeing WHY."*

Great comment B.D. I will attempt to answer the why here this evening. Let's dig into the manufacturing side of things tonight and tomorrow night I will write about heijunka in the front office.

**Taiichi's Take on Heijunka**

First, let's start with some words of wisdom from a man of immense wisdom.

> *"The slower but consistent tortoise causes less waste and is much more desirable than the speedy hare that races ahead and then stops occasionally to doze. The Toyota Production System can be realized only when all the workers become tortoises."*
>
> *- Taiichi Ohno*

**Heijunka Review**

Last night we introduced the basic concepts of heijunka. Let's assume a company generally sells equal amounts of two particular products – A and B.

A mass producer would likely tool up and run a giant pile of A's, switch over and run another giant pile of B's. These evil people… OK, they are not evil just misguided, normally live by the mantra "build it and the orders will come." Funny thing those orders… when we want them to come, they rarely do. And when we are not quite ready, they flood in.

In this same situation, a lean producer would likely attack this demand as follows: ABABABABABABABAB. If you are new to lean, this is perhaps the most counterintuitive thing you have ever seen. I will grant you this… I really struggled with heijunka myself. But by keeping an open mind and actually seeing it work, I came to believe.

**So Why Heijunka?**

There are many reasons for implementing heijunka. I will touch on a few that helped me understand this concept.

First, building in huge batches is not optimal for many reasons. One that impacted me greatly at my previous company (a mobile phone manufacturer) was that customers change their mind – a lot.

For example, if I thought I needed 100 red toasters, 50 blue toasters, and 25 green toasters this month based on hard orders and a forecast, I may set off and build all 100 red toasters first, then all the blue, and last but not least those shiny green toasters.

This is all well and good until the worst thing that could ever happen to a mass producer happens.

Let's say we are on red toaster number 98 and our friend Sal, from sales, calls and explains, "Hey buddy, great news! I just got our customer to commit to 200 blue toasters! Isn't this great? I mean we are making a killing on the blue toasters. Oh, yeah, and Ron (I sheepishly answer yes) they only want 25 red toasters now so can you just tweak that little MRP system of yours and make it happen? Thanks buddy. You're the best."

While this may be great news for Sal, I am now stuck with a bunch of red toasters. Granted, we may sell them next month. But now we enter that dangerous game of "demand gambling" and the good guys rarely win this bet.

Now, had we leveled production as previously discussed, we may have only produced a few red, blue, and green toasters enabling us to be much more flexible and not be stuck with all the red toasters. Truth be told, even lean producers get nailed with demand changes… but these situations are few and far between as compared to what mass producers deal with.

**Additional Benefits**

There are many more advantages to heijunka.

The "bullwhip" effect is common in mass production circles. The slight twist of the wrist (i.e. demand) can create a massive strike at the end of the bull whip. This means even small demand variations can wreak havoc throughout our plant and especially with our suppliers.

When we level production, the entire value stream, including our suppliers, can cope much better.

Heijunka also allows us to schedule resources (equipment, employees, etc.) in a more balanced manner. Instead of having employees stand around in January or February, when demand is lower, and then watching them run around like maniacs and paying "mandatory" overtime in October and November during the peak season, we can level the demand producing the same or similar amounts throughout the year.

In some cases this may mean overproducing and carrying a small amount of inventory during the slow seasons as we prepare for the peak season. While not the perfect situation this is far better than the alternative.

There are many more advantages I am not discussing. There are entire books written on the topic. But these are a few of the biggies that helped me get over the heijunka hump.

**Challenges to Heijunka**

What about the challenges to heijunka? Dr. Jeffrey Liker explains that implementing heijunka is a "*self inflicted choice*." Sounds painful, eh?

What Dr. Liker means is that when we implement heijunka, and one piece flow for that matter, we can no longer allow things like long changeovers to exist, or to produce defect after defect, or to basically hide behind the piles of inventory mass producers do. These crutches are gone.

But even with these challenges, heijunka yields far more advantages once the system is working as a smooth machine. Now, let's discuss heijunka in the front office.

## Chapter 11: Why Heijunka? – Part 2

In chapter 10 we discussed why we would use heijunka in a manufacturing environment in response to a reader's question. Now, let us focus in on why we would want to use heijunka, or leveling, in an office environment.

This could be a very short chapter as I could say we use heijunka in the office for the same reasons we use it in manufacturing. But as you probably guessed, I will not be taking that approach in this chapter.

**Leveling in a Restaurant**

One place we can see the importance of leveling in a non-manufacturing environment is at "sit down" restaurants. Normally when you walk into your favorite steak house, (I prefer Saltgrass) there is a person standing there studying a diagram/layout of the restaurant. Since there are a finite numbers of waiters and waitresses (and tables for that matter) each customer must be carefully seated.

If care is not taken, a particular waiter may be stressed to the max while another waitress may be standing around complaining as she is not making any tips. Also, customers may grow frustrated as they see their waiter running around and taking a long time to fill up their drink while the waitress is off talking with her mates.

Thus, normally customers are seated in a balanced/level manner. Eventually, on busy nights, all tables may become occupied in which case leveling flies out the door. Now we enter into the world of queuing theory.

**Leveling Office Work**

On the shop floor, we produce widgets of some type. In an office we also create widgets. Only these widgets are things such as invoices, quotes, BOM's, drawings, etc. In some industries these front office tasks may even be a constraint. So understanding how to be level or smooth work in the front office area is equally, and in some cases, more important than the shop floor.

**Accounts Payable Example**

Let's see how leveling could help an accounts payable department. In this situation the widgets being produced are invoices. The AP clerks could just fly by the seat of their pants and all work on whatever they want expediting the "hottest" item when someone yells loud enough.

Or these same clerks could determine how many invoices they generally process in a week or month. From this, they could calculate the takt time (available time / demand) and pitch (takt time x packout quantity or in this case reasonable amount of invoices needed at any one time). Armed with this information, they could use a heijunka box or heijunka wheel to level the amount of work each AP employee is expected to do.

Bob, for example, would now be able to look at the heijunka wheel and know exactly what he was to do and when to do it. This will help him pace his work and also ask for help if he falls behind. This would be similar to a Toyota employee stopping the line when a problem is noticed.

**Balancing Act**

Many times, people like Bob have other tasks to do in addition to processing invoices. All these other items can and should be taken into consideration when determining how to level-load his responsibilities. Nothing is more frustrating to an employee than being asked to do 12 hours of work in an 8 hour day.

In this sense, the waitress and AP clerk are more alike than many people realize.

**Additional Resources**

To be sure, heijunka is one of the more advanced lean concepts. You would not normally begin your lean journey by implementing heijunka.

Instead, focusing on value stream mapping, standard work, flow, pull, and defect reduction first is wise. With this said, when you are ready to look at heijunka let me offer the following articles/books as excellent resources.

- Creating Level Pull
- SME Heijunka Article
- Wikipedia Explanation
- Superfactory on Heijunka

# Chapter 12: Single Minute Exchange of Dies (SMED)

One of the core principles to making a lean system work is Single Minute Exchange of Dies (SMED). You may also hear it referred to as "Quick Changeover" especially in western companies.

**Common Misconceptions**

Contrary to what some think, SMED is not just for the folks on the shop floor. I once heard an individual state, "We don't use dies here so SMED is not relevant." SMED is a concept and is just as relevant in the front office. And no… huge dies are not required!

Another common misunderstanding stems around the term "single minute." Some take this to mean that a changeover must happen in 60 seconds or less. This is not, and never was, the idea around SMED.

Instead, our aim is to reduce the time it takes to switch from the last "good" part of product A to the next "good" part of product B in less than 10 minutes (generally).

**7 steps to SMED**

Depending on which book you read or expert you talk to, there are generally around 7 steps followed when improving changeovers.

1. ***Observe the current process.*** An extremely valuable tool to help with this step is the video camera! Be careful though as in some countries video cameras can get you into hot water with worker unions, etc. So be sure to check all the local regulations. Also, be sure to ask the people you plan to video tape for their blessing. You can make friends and enemies at this stage of the game… I recommend you aim for the friendly side of things.
2. ***Categorize INTERNAL and EXTERNAL activities.*** This is perhaps the most important concept behind SMED. Internal activities are those that can only be completed when the

machine or process in question is not running. You cannot, for example, change the bit on a running drill. At least I don't recommend it! External tasks are those things that can be done while the machine or process is running. For example, you may be able to knock out the paperwork required, gather tools and materials, and essentially get everything you need ready before the machine or process stops.

3. ***When possible convert internal activities into external activities.*** Are there things we can do while the machine is running so we don't waste time once it has stopped? My Mom used to make me lay my clothes out for school the night before so I wasn't searching for socks in the morning. She was teaching me SMED and I didn't even know it. Bless her!
4. ***Make the remaining internal activities flow.*** For tasks that cannot be moved externally, our next focus is to do them as fast as possible. Think of the pit crew for your favorite racing team. They have mastered this step! Also, if we need to screw things down, how can we reduce the number of turns required (i.e. shorter bolts, wing nuts, etc.)? And do we really need 28 bolts holding the fixture in place? Maybe. Maybe not. Of course, do not jeopardize anyone's safety. But often times no one has asked why there are 28 bolts!
5. ***Similar to step 4 we also need to optimize the external activities.*** Again, think about making things flow as efficiently as possible with no stopping, waiting, or defects.
6. ***Document the new procedure so it is repeatable and reproducible.*** Is it possible to video an excellent changeover so new employees can watch it and learn from it? Of course, having things written down in words is important but seeing it on video may really accelerate the learning experience of a new associate.
7. ***Pursue Perfection.*** As with all things lean and six sigma… we must constantly work to make things better and faster. A good strategy is to attempt to halve the current changeover time. So if it takes you 2 hours today, aim to get it down to 1 hour after the SMED kaizen event! Our ultimate aim may be to change things over in less than 10 minutes but this probably won't happen immediately.

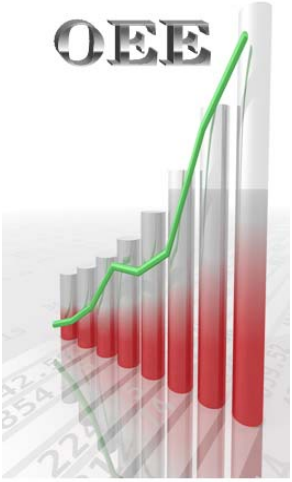
**Summary**

In order to make things like level-loading (heijunka) a reality, we must be able to change our machines over quickly.

There are excellent books on this topic that go into much greater detail than I have here.

Finally, Jon Miller has written on this topic here. And the good men over at Evolving Excellence have some excellent food for thought here.

## Chapter 13: OEE – Not Just for TPM Programs!




If someone were to force me into a corner and only allow me to use one metric in my plant, I would have to choose Overall Equipment Effectiveness (OEE). The reason I would pick it is simple… it is really 3 metrics in one! Here is a quick summary of how this powerful metric works.

**The 3 Pieces of OEE**

OEE looks at 3 areas:

1. ***Performance:*** Here we compare the actual output with what that particular piece of equipment should be producing. We are really focusing in on what we call "speed losses." For example, due to the hardness of a particular material the lathe may need to run at a slower speed than normal. So, in a given day a machine should produce 100 widgets but at the end of the day it only produces 85 widgets so we have a performance of 85% (85/100).
2. ***Availability:*** Here we look at how much time is available to run the machine (taking out breaks, etc.) and how much we actually ran the machine. With availability we are primarily looking at our losses associated with downtime. Things like setup time, machine breakdowns, and startup losses are common culprits of availability losses. So, if there were 7 hours available to run the machine and we actually ran 6 hours our performance is 86% (6/7).
3. ***Quality:*** Lastly OEE also looks at quality. If 80 out of the 85 widgets were acceptable (5 bad) we have a quality score of 94% (80/85).

Once we have our three percentages we simply multiply them together to get our OEE. In our example, we have an OEE of 69% (85% x 86% x 94%).

Depending on which book you read or consultant you talk to you will hear various opinions of what "world class" OEE is. I work with the thought that if you have an OEE of 80% or more, you are doing well. Really well, actually!

**Not Just for TPM Programs!**

One thing that bothers me immensely is how some people think OEE is just a maintenance thing. If we go back to the aforementioned books and experts, we mostly hear about OEE in the TPM (Total Productive Maintenance) chapter or training module. This is fine as OEE and TPM definitely go together.

But, let me just get on my soapbox for a bit. OEE is arguable to most holistic productivity metric known to mankind. So if you think the maintenance guys are the only people that should be driving OEE with their TPM program you are dead wrong.

Anyone and everyone that cares how many widgets are produced in the plant should care about OEE. The operator should care (and be intimately involved in capturing the data). The line supervisor should care. The quality manager should care. The plant manager should definitely care. The maintenance team should care. Even the controller, who wants to see all the cash flowing on the financial statements, should care. Heck, your significant other, who wants to see you employed for a long time, should care about OEE! It's just that important.

Here is a free video and OEE calculator you can download. And yes, I know, it is in the TPM section of this website. C'est la vie!

# Chapter 14: Value Stream Mapping Overview

One of, if not the single most powerful lean tool available to us is value stream mapping (VSM). The reason it's so powerful is because of its relevancy.

You see, it doesn't matter if you are an accountant who sits behind a desk, or a nurse caring for the sick, or an assembler building a Toyota Camry - value stream mapping can help you see wasteful activity in a new way. I guarantee it.

**Definition of a Value Stream**

A value stream can be defined as all the steps – both value added and non value added – required to take a product or service from its raw materials state into the waiting arms of a happy customer.

**VSM Overview**

Initially, value stream mapping can seem a bit intimidating. There are lots of funny looking icons and zig zaggy lines that upon first glance seem to do nothing but confuse things. But once you understand what you are looking at you will be hooked forever.

Like most things related to lean and six sigma there are some general steps to follow when we create value stream maps. Here is how I do it.

**Step 1: Identify the Product Family**

The first step I recommend you take is to identify the product family you wish to map. The tool to use for this is a PQPR (Product Quantity / Product Routing) matrix. This tool will help you identify which product or in some cases products to focus in on.

I cannot stress how important this step is. I have seen too many excited people run out and start mapping the first product or process they see. While value stream mapping anything is better than nothing you definitely want to focus your efforts on the most important areas first.

**Step 2: Create a Current State Value Stream Map**

Once you identify what to map you and your motley crew must set off and create a current state value stream map.

As the name implies we are interested in how things look today. We are not interested in how things "should" look or were "designed" to look. No, we want to draw reality onto a piece of paper.

The piece of paper is a key point. While I am a big advocate of using software to draw our final maps up, I cringe when I see people attempting to go straight to the computer.

A stopwatch, oversized piece of paper, pencil, and good eraser are all you need at this point.

**Step 3: Create a Future State Value Stream Map**

Now that we have a better understanding of the current state of affairs, which is typically one eye opening experience by the way, we are ready to draw a picture of how we would like things to look in the future.

Typically, as an example, we aim to make things flow and reduce the amount of inventory or waiting in between steps.

It's at this point when people get to dream a little. You know, create the ideal working place.

**Step 4: Create an Action Plan**

Now that we know how things are working today and how we would like to see them working in the future it's time to form a plan.

There are a variety of templates available for this. The key is not which kaizen newspaper or A3 report you use – instead it's that you and your team know exactly what needs to happen and when it needs to happen.

In short, we form the plan… then execute the plan!

## Chapter 15: How to Create a PQPR Matrix

In order to garner maximum benefits from your value stream mapping efforts, it is important to take some time up front in order to identify the product family you wish to study and improve.

The first tool I recommend you look at is a product quantity matrix. The basic premise here is that you should target your higher volume products for improvement first. Here is a 2 step roadmap for doing just this.

1. Collect production output data – both in units shipped and sales figures. As a starting rule of thumb I recommend attempting to collect 6 to 12 months worth of data.
2. Create a Pareto chart with this data in attempts to identify where to focus first (e.g. highest volume products).

In some cases you may have two results. The first place "winner" based on units shipped may be product ABC. However, the first place "winner" based on sales dollars may be product XYZ. In these situations it is up to the management team to make the call as to where to focus.

Since this is all based on historical facts, you can tweak this method ever so slightly by including forward looking forecasts. But be careful… since the only thing certain with a forecast is that it's certain to be wrong.

**Product Routing Matrix**

If the results of the product quantity matrix are inconclusive we can look at another tool – the product routing matrix.

With this tool we are interested to learn how each product family moves through the process. For example, do certain products pass through the exact same machines? If so, we can actually group them together and create one set of value stream maps covering both products.

**Combining the Tools**

| Units Shipped | Sales ($k) | Steps / P/N | Casting | Machining | Assembly | Paint |
|---|---|---|---|---|---|---|
| **2498** | $ 1,866 | ABC | X | | X | X |
| 324 | $ 234 | HIJ | | X | X | |
| 48 | $ 58 | MNO | X | | X | |
| 1865 | $ 2,133 | QRS | X | | X | X |
| 1107 | **$ 2,200** | XYZ | X | | X | X |

While each of these tools can work well on their own, it is my opinion they are at their best when working together.

In the picture above we see that ABC took the prize for most units shipped, and XYZ made us the most money.

Then, when we looked at the routings we saw that ABC and QRS actually went through the same manufacturing steps. Further, product QRS was a close second place on sales $ and third place for units shipped.

So, in this example the team decided to map product ABC and QRS together.

**Summary**

That's really all is there is to this tool. Obviously, real life examples will be far more complex than my simple scenario. But the process you use should be no different.

Lastly, this same process works in front office/transactional environments as well. Instead of looking at machines you may instead look at how a piece of paper flows through the office (e.g. which functional departments touch it).

# Chapter 16: Current State Value Stream Mapping

***"Whenever there is a product for a customer, there is a value stream. The challenge lies in seeing it."***

*-Learning to See, Lean Enterprise Institute*

In this chapter we will discuss how to go about creating a current state value stream map.

**It is what it is**

The key to creating an excellent current state VSM is to document what you actually see with your own eyes. We are not interested in how the process is supposed to work, or was designed to work.

Instead, we are interested in how the process is performing today. Will the process change a bit tomorrow? Sure. But that's OK.

**Fun with Icons**

I remember the first time I saw a value stream map. I wondered how anyone could benefit from it. It was a bit messy, and I didn't know what any of the little shapes and icons meant. In short, I was a bit intimidated by the whole experience.

Luckily, I had some great instructors and I did quite a bit of self study to get past my initial fears.

So, the only way you will not be a bit intimidated (assuming you have never seen a VSM before that is) is to study a bit and practice, practice, practice. There are really only a hand-full of icons you will always use. And for the rest, you can use a cheat sheet like I do!

To help you along, I found this website that offers good (and free) explanations on many of the key VSM icons you will need to know. Another excellent resource is this VSM Quick Reference Guide from our friends over at Gemba Research.  It's not free, but definitely worth the money.

**It's time to create the map!**

OK, let's learn how to create a current state value stream map. To help you visualize things I have created a fictitious example of a peanut butter and jelly sandwich factory.

Our PB&J manufacturing company goes by the name of KB&R Inc. For those interested, that's the first letter of each of my three kid's names!

**Step 1: Calculate takt time.** Don't proceed until this step is done. If you don't remember how to calculate takt time this free resource should help you along.

In our example, we have a daily demand of **700 pieces** with the following arrangement.

- Hours per shift: 8
- Break minutes per shift: 30
- Shifts per day: 1
- Days per week: 5

I recommend you practice punching this out. But in case you don't, I'll tell you the takt time is 39 seconds per piece. In other words, we need to produce a PB&J sandwich every 39 seconds in order to satisfy customer demand.

**Step 2: Get a pencil and BIG eraser.** The best value stream maps have eraser marks all over them. Please, I beg you; don't use a pen when drawing these.

**Step 3: Have a big piece of paper ready.** Your standard 8.5"x11" piece of paper won't cut it. Personally, I prefer the 11"x17" paper size. It's big, but not too big to carry around.

Finally, while I will be drawing the value stream map using software in this article, I recommend you always draw the map on paper first. Then, when you are ready to share your masterpiece with senior management you may choose to go for the software.

**Step 4: Walk the process front to back.** Quickly walk the process with your team in order to understand the general flow. It's important to also define the start and stop point of the process. Don't attempt to take on too much. Remember, we eat an elephant one bite at a time.

**Step 5: Draw in the customer box / details.** In the top right hand side of the paper we draw the little saw topped box representing our customer.

We also note their monthly and/or daily demand along with the takt time as calculated in step one.

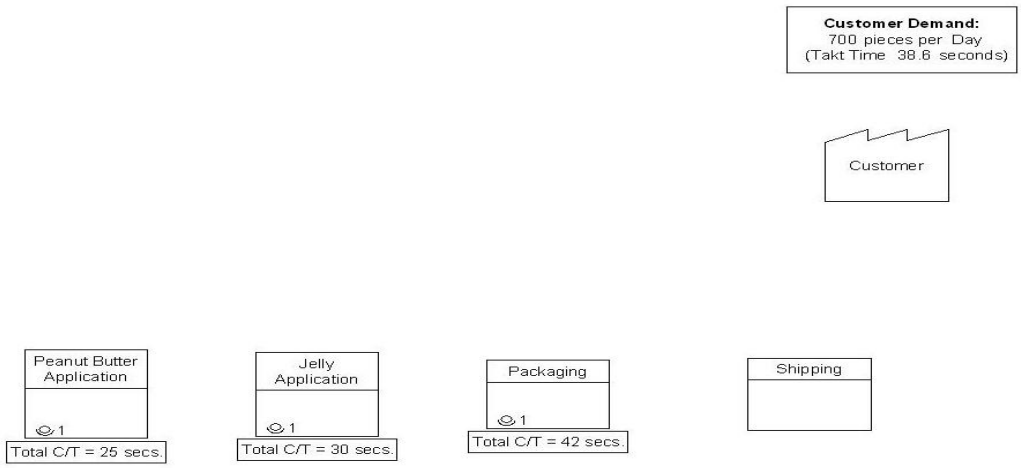
**Step 6: Go to the end!** Next, we start at the END of the process and begin drawing the map back to front. And don't forget about that eraser. You will need it. I recommend you nominate a scribe and have them draw the map for the team.

Another trick is to ask each person on the team to map it out so you can compare and consolidate when you get back to the room. Yet another trick is to have the team divide and conquer as you send some off to map the beginning section, some to the middle, and some to the end.

There are many ways to do this. Experiment and do what works best for your situation.

**Step 7: Focus on the material flow first.** Focus on the material flow side of things first (bottom portion of the map). This includes the process boxes and data boxes.

Regarding the data boxes, if you don't have all the data perfectly collected on the day of the mapping exercise just do the best you can. You can always assign homework to go back and validate the figures later.




In fact, even if you think you have solid data, I urge you to validate your measurement systems to make sure we can trust the data. If you want to get really tricky state both a measure of central tendency and dispersion. You won't see this advice in most lean VSM books… I guarantee it!

After studying the KB&R manufacturing process for an afternoon we learned that each process step is staffed with 1 operator. We also collected cycle time information at each step. Additional "homework" will be to collect information such as defect rates and changeover times.

**Step 8: Add the Inventory/Wait Times.** Once you have all the process and data boxes in, it's time to add in inventory and/or waiting times. These are the little yellow triangles with an "I" in the middle.

For inventory, we simply count the number of pieces in between the processes and note them under the triangle.

We also want to convert these pieces into days' supply. To do this, we divide the number of pieces by the average daily demand (which we used to calculate takt time).

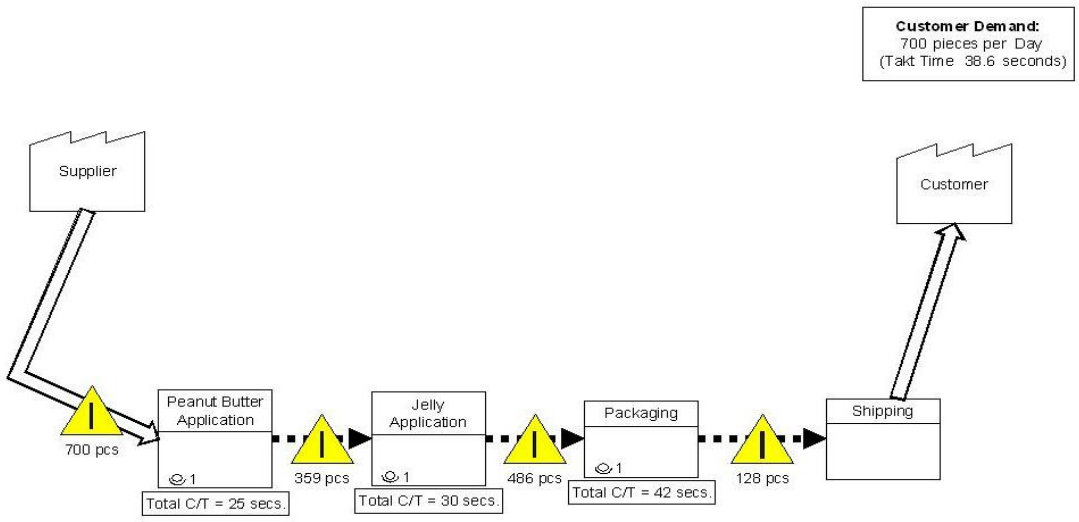
So, if your average daily demand is 10 pieces and you count 20 pieces of inventory in between process step A and process step B you have 2 days' supply (20/10) in between the two processes. We will note this number on our timeline (to be added in a future step).

Lastly, don't attempt to map every part number! Choose one or two key components to start with. You can always add more to the map later.

In our example, we chose to simply count two pieces of bread as one subassembly since they move together down the production line.

Also, we are not accounting for the peanut butter and jelly "raw material" at this point since KB&R's expert supply chain team negotiated a killer consignment stock deal with Sam's Club so this inventory is quite low on the line.

During the study, we learned that, as one example, there were 486 sub-assemblies (972 pieces of bread) in between the jelly application and packaging stations. This equates to 0.69 days' supply (486 units / 700 daily demand).



Lastly, during the walk through of the process we noticed that each process step seemed to be working in isolation. In other words, the lady working at the peanut butter application seemed to produce as many units as she could and then pushed them along to the jelly application process.

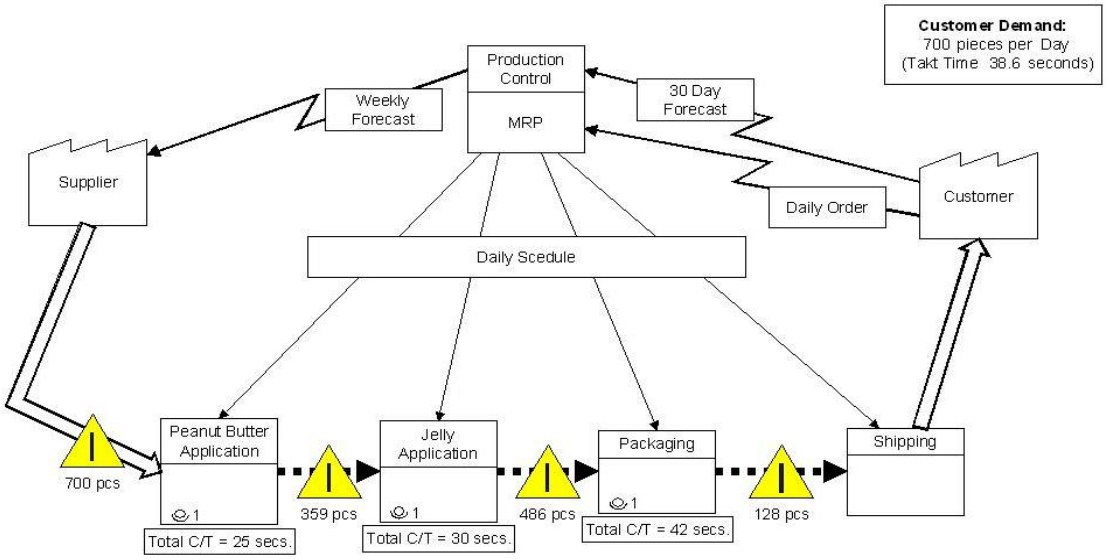
This “push” process is found in just about every mass production process known to man kind. When we see this pushing action we note it on a VSM with a dashed line through the yellow inventory symbol.

**Step 9: Draw in the information flow.** This step is what really separates a VSM from traditional process maps in my opinion. You see, in addition to learning about how material flows we also want to understand how information flows.

For example, we want to know it is moves about electronically? If so, we use a lighting bolt looking arrowed line. Is it communicated manually? If so, we use a straight arrowed line.

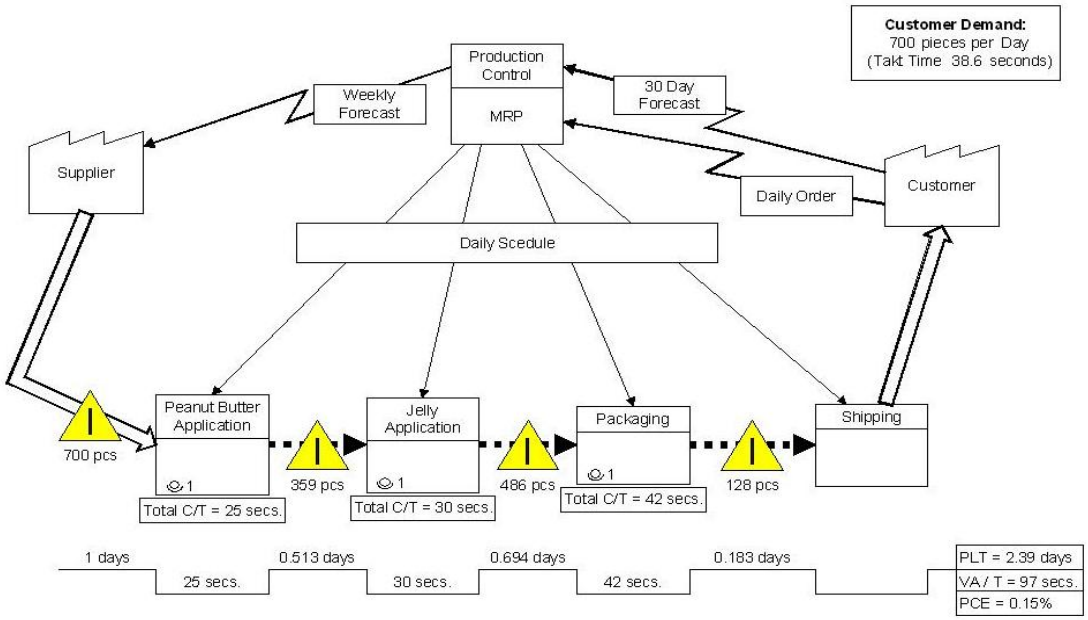
During this step we also draw in our production control box. For many, this box will include the letters “MRP” in it. In most mass production systems we typically see several manual information (straight) lines coming out of the MRP box aimed straight at each process step box.

In our example, we learned that production schedules each process step in isolation. In other words, each work station gets its unique production schedule. We draw this using straight “manual” information lines.




We also add in the information flow from our customers as well as to our suppliers. In our example, we learned that PB&J's customer sends 30 days electronic forecasts as well as electronic daily orders. Conversely, PB&J sends its bread supplier an electronic weekly forecast.

**Step 10: Add in the timeline.** We can now add the timeline to the bottom of the value stream map. This saw tooth looking line helps us separate the value added cycle time (taken from data boxes) from the non value added time (days' or hours' supply info).




The last step in the process is to sum up all the "value-add" cycle times and note them at the end of the timeline. Likewise, we also sum up the "inventory" times and note that on the timeline.

In our example, the total value add cycle time sums to 97 seconds and the total non value add "inventory" time sums to 2.39 days! We call the total inventory time the production lead time (PLT).

To calculate the process cycle efficiency (PCE) we divide the value-add time by the PLT. When we do this we get a PCE of 0.15%. To gain a better understanding of the PCE statistic let me refer you to this article.

**Summary**

And that's it my friends. You just created a current state value stream map. This may seem a bit daunting initially, but with just a little practice you will be a current state VSM drawing machine!

Up next, we will see what improvements we envision for this process as we draw up a future state value stream map.

# Chapter 17: Future State Value Stream Mapping

**I Have a Dream!**

The process of creating a future state VSM can be quite exciting as creativity and excitement merge together. It's time to dream a little as we work to create better, safer, more productive workplace. And, please be sure to have some fun during the process!

In the last article we documented the "current state" process of our fictitious peanut butter and jelly sandwich factory. We learned the following.

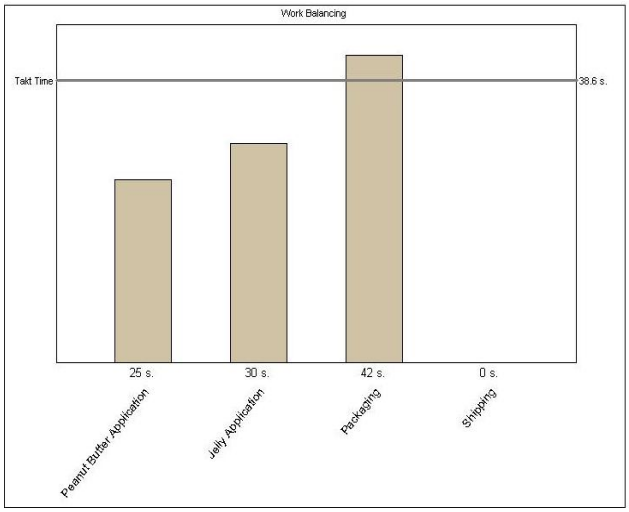
- We have a production lead-time (PLT) of 2.39 days
- The total value added time (VA/T) is 97 seconds
- The process cycle efficiency (PCE) is 0.15%

Obviously, we have room for improvement. And while this is a completely fabricated example, I think you will find similar opportunities in your operation.

Let's see what improvements we foresee.

**Step 1: Create a Cycle Time / Takt Time Graph.**

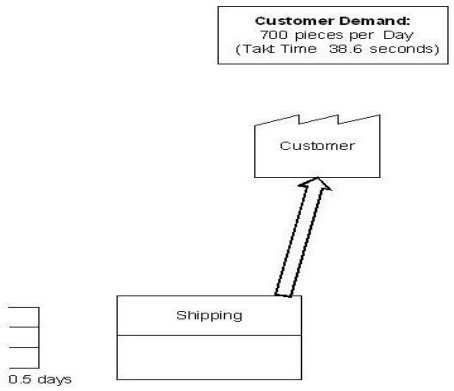
From the data collected and calculated during the creation of the current state VSM we are able to draw a cycle time / takt time graph. This graph simply compares the individual cycle times to the overall takt time of our process.




This is an important step as it will help us make decisions as to how and what to improve in future steps. Click the above picture to see what this looks like for our example.

As you can see, both the peanut butter and jelly application steps are under takt time. The packaging step, however, is over takt time and is cause for alarm. In its current state, we are not capable of meeting customer demand without the use of overtime.

**Step 2: Decide if you will build to stock or make to order.** Next, we must decide what type of distribution model we will develop. Will we build to a finished goods supermarket or ship directly to the customer?




In our example, we only produce one product and customer demand is relatively stable. Therefore, it would make the most sense to develop a make to order model. This means we would only produce what the customer wanted, when they wanted it.

Now, since most companies produce more than one product and battle inaccurate sales forecasts, building to a finished goods supermarket often makes the most sense.

One normally asks, “Isn’t this just building up inventory… one of the 7 deadly wastes?” The answer is yes. But, the key difference is we are controlling the inventory levels instead of the inventory levels controlling us.

So, for sake of example, we will assume the folks at KB&R, Inc. decided to implement a finished good supermarket where they will hold 0.5 days’ supply of finished stock (a.k.a. PB&J sandwiches) before shipping as demonstrated in the picture.

**Step 3: Calculate Optimal Crew Size and Implement One Piece Flow.** Currently, the operators at KB&R work in isolation. You could say they all work to their own drum beat. Whenever possible, our goal as lean practitioners, should be to get all operations producing to the same beat – namely takt time.

As we learned in step 1, both the peanut butter and jelly application cycle times are under takt time while the packaging step is over. This needs to be addressed.

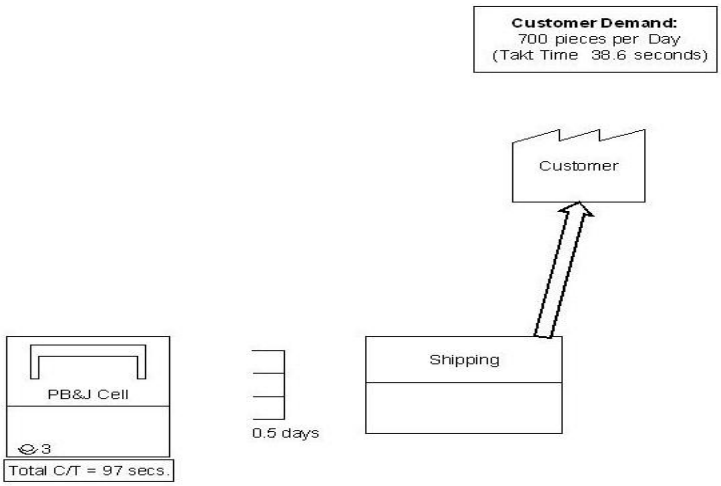
The solution is to rebalance the work and implement one piece flow. The team first determined the "optimal crew size" for the entire sandwich making process.

To do this, the team took the total cycle time to produce a sandwich (97 seconds) and divided it by the takt time (38.6 seconds). This resulted in an optimal crew size of 2.5 operators. Since we cannot have 0.5 persons they rounded up to 3.

If the team is ever able to reduce the total cycle time to less than 77 seconds the crew size could be trimmed to 2 persons, freeing up the additional resource for other value adding tasks.

Next, the team worked with their lean sensei and designed a **u-shaped cell** where all 3 operators would work in a **one piece flow** manner. Once the work was redistributed the team was able to produce a PB&J sandwich approximately every 32 seconds. The total time for the first sandwich to be complete is still 97 seconds.

There are various ways to note a u shaped cell in a VSM. One of the most common is to simply draw a small U inside a process box as shown below.

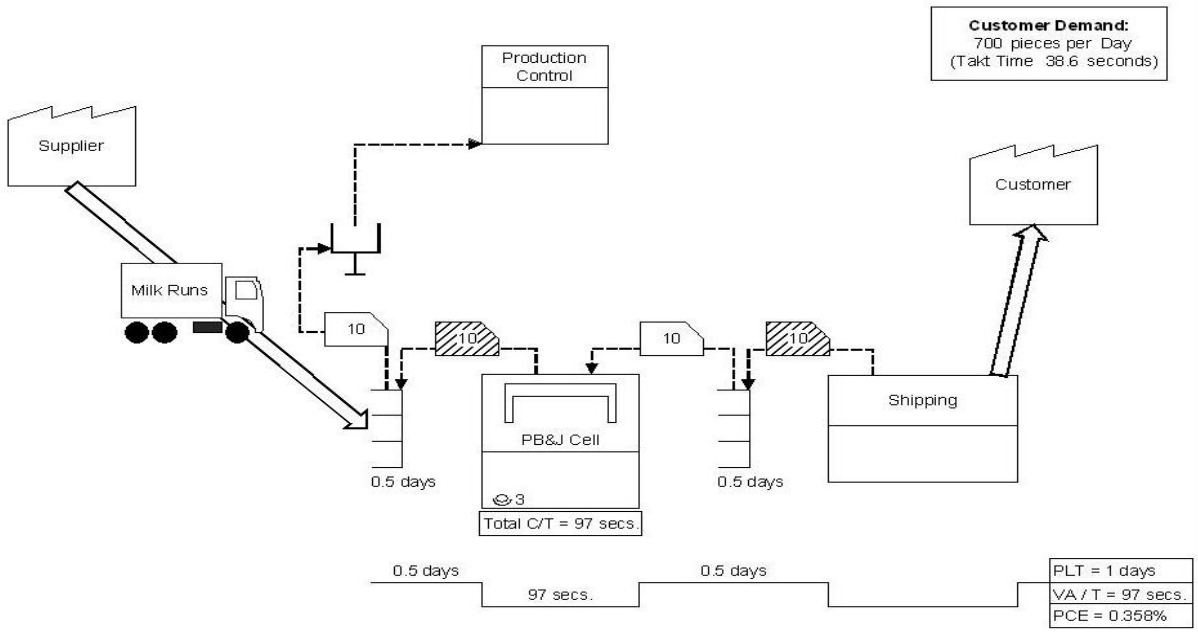



**Step 4: Pull when One Piece Flow is not Possible.** Anytime we build to supermarkets we must have a way of signaling when to produce and when not to produce. There are a variety of ways to accomplish this. The easiest way is to use kanban.

Without going into great details on how to size and implement kanban, let me explain it this way.

When a customer places an order for 10 PB&J sandwiches, which we will assume is the standard pack-out quantity, a "withdrawal" kanban for 10 sandwiches is sent to the finished goods supermarket. The shipping clerk pulls off a "pallet" of 10 PB&J sandwiches and ships them to the customer.

This now leaves a “hole” in the supermarket. Therefore, a production kanban (white on a VSM) for 10 sandwiches is sent back to the u-shaped cell. This production kanban basically says, “Hey, we just shipped 10 sandwiches and need to plug the hole! Make us 10 more please!”

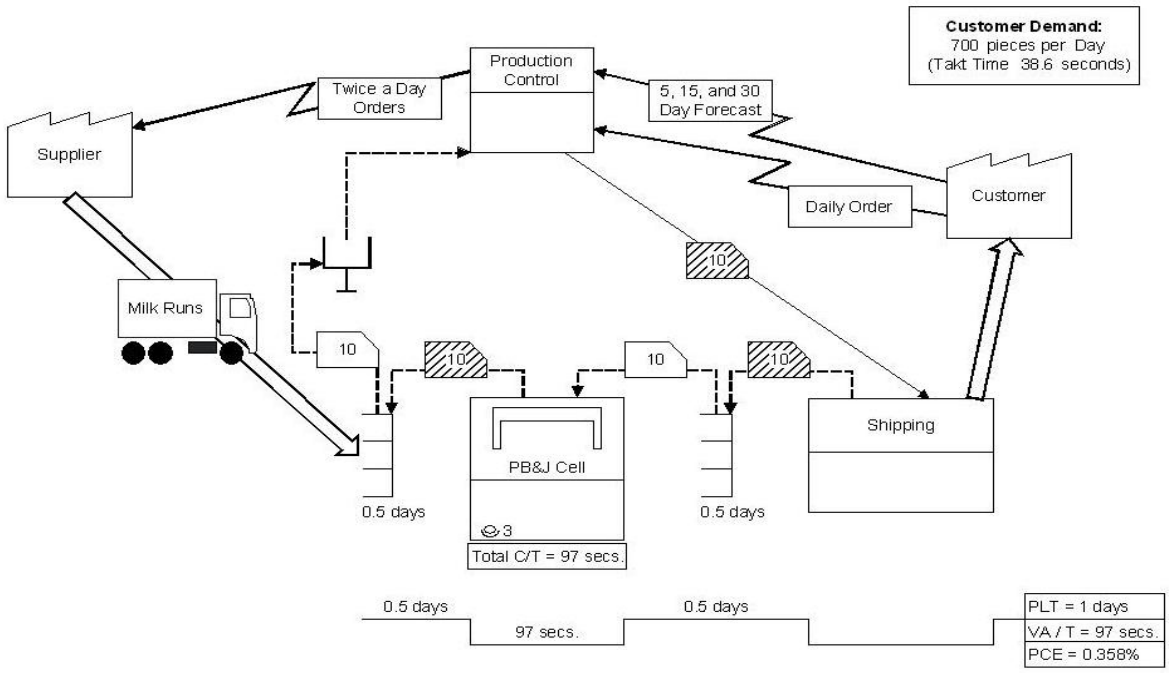



Additionally, the supply chain team has worked with their supplier and negotiated frequent milk runs, or scheduled deliveries. This allows the team to only hold 0.5 days of “bread” in a WIP Supermarket before the u-shaped cell. Again, kanban and a kanban post (goal post symbol on VSM) are used to replenish this WIP supermarket.

Finally, the implementation of kanban has allowed the team to turn off the MRP portion of their ERP system… and leagues of lean angels sang “Hallelujah!”

**Step 5: Improve Communication and Schedule a Pacemaker.** So far we have gone a long way to improve the flow of material and manpower. Now, let’s zoom in on the information side of the equation.

Rather than scheduling each process “on an island” the lean approach is to schedule one process. We call this process the pacemaker process since it sets the pace for the entire system.




By definition, the pacemaker is typically defined as the process step closest to the customer whereby everything after it flows. In our example, this would be shipping since the supermarket after the u-shaped cell technically impedes flow.

So, we will aim to schedule production at shipping. Once shipping gets the instructions as to what to do they will alert the upstream processes via kanban.

Additionally, the team has decided to ratchet up the communication with its customers and suppliers. This two-way communication will help all parties prepare for things like demand fluctuations.

**Summary**

On paper we have made some sizeable improvements. Production Lead-time (PLT) has gone from 2.39 days to 1 day, and the process cycle efficiency (PCE) has gone from 0.15% to 0.358%.

Next up, we will discuss action planning and how to go about closing the gaps between the current state and future state.

## Chapter 18: Introducing the Kaizen Newspaper

Here is a sobering fact… short of uncovering lots of opportunities we haven't accomplished much up to this point. A skeptic could say all we have done so far is draw some nice pictures.

With this said, the most important aspect of the value stream mapping process has yet to be started. That aspect is actually making changes and bridging the gap between the current state and future state VSM.

There are many approaches to this and even more templates available. I am a simple man, and thus prefer to keep things as easy as possible. As such, I know of no better tool to help with this phase of the game than the kaizen newspaper**.**

**Extra, Extra Read all About it!**

The kaizen newspaper is a simple template that states the following:

- **The Problem Statement.** Simply put, what is the problem we are addressing. To help ensure you are stating your problem statement properly I highly recommend you keep things SMART.
- **The Objective.** What is the goal or point of the initiative? Again, think SMART when stating the objective. Don't just say we want to make it better. How much better? What does success look like?
- **The Owner.** Who is leading the initiative? Seeing your name on a huge piece of paper hung on the wall can be a poweful motivator!
- **The Due Date**. When will the initiative be complete? Since kaizen never ends you may choose to simply state the date the act/adjust phase begins.
- **The Phase.** Here we note what phase of the plan, do, check, act/adjust (PDCA) we are in. If you are more of a six sigma organization you can easily replace PDCA with DMAIC. Do whatever works best for your business.

Here is free kaizen newspaper template to get you started. Feel free to tweak it as you see fit. Some like to add in things like the type of waste you are attacking, etc.

**Revisiting KB&R's PB&J Sandwich Factory**

The team at KB&R has lots of work to do. They have decided to list out their plan of attack using a kaizen newspaper. Rather than showing the detailed kaizen plan, here are the highlights.

First, they are going to design, build, and then test the new cell that will operate in one piece flow, paced to takt time. They will do this "offline" in such a way that production is not impacted.

Next, they will also work to properly size the FG and WIP supermarkets and associated kanban. They have hired a lean consultant to help them with this since this is very new territory to them.

During the development of the pull system the production planning team will determine how they will move away from their old MRP manner of scheduling each work station. Instead, they will now schedule the pacemaker process.

Finally, the way KB&R communicates with its customers and suppliers will change. To accomplish this, meetings have already been setup in order to work this process out.

The team has broken these tasks done and assigned owners using a kaizen newspaper. This newspaper has been printed out on on a plotter sized piece of paper and hung on the wall for all to see.

**Summary**

Taking action is the most important part of value stream mapping. If all you do is draw up a current and future state VSM and leave it sitting in drawer you have wasted an enormous amount of time.

Will the finished product (post kaizen) look exactly like your future state VSM? Probably not. But as long as improvement is being made you are on the right path.

**Last Piece of Advice: Be Speedy!**

My last word of advice is this… be speedy! A current state VSM can be done in 1 day. The future state VSM should start that same day… or at the latest the next morning. Don't, I plead with you, think you will get to the future state VSM next week. That is the kiss of death!

Finally, once the future state VSM is complete and the point kaizen events are identified, set aggressive goals. I have seen tremendous transformations occur in 4 days! These lighting fast transformations are culture changing to say the least.

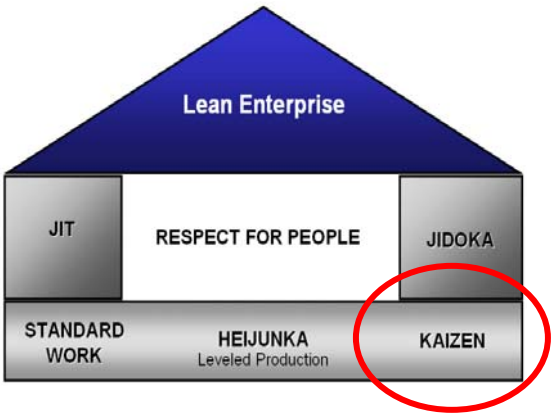
**Recommended Reading**

To continue your VSM learning journey you may consider checking out these resources. They have helped me a lot over the years.

- **Learning to See.** This is the bible on value stream mapping. It teaches you how to "see waste" in a new way.
- **Creating Continuous Flow.** After learning to see waste we must learn to make value value flow. Learn all about creating cells in this workbook.
- **Creating Level Pull**. Learn all about kanban in this excellent resource.

# Chapter 19: Two Types of Kaizen

**Buzz Words**




The word kaizen has become a buzz word galore. You will hear about how people are "doing kaizen" or running a big "kaizen event" next week. Many times folks are in fact executing kaizen's in an attempt to make things better and I applaud them.

In addition to the infamous "kaizen mind set" there are at least two, possibly more, types of kaizen events I am aware of: point kaizen and system kaizen. Let's discuss them in this chapter.

**Point Kaizen**

From my experience the most common type of kaizen practiced is called point kaizen.

These kaizen events typically come about as the plant manager is walking through the shop (a great thing by the way) and notices a mess in cell 4. So he or she finds the supervisor of the cell and discusses it.

The supervisor gets the hint and launches an immediate 5S kaizen event in the area. Great stuff to be sure… but we must be careful lest point kaizen consumes us and we lose focus on the entire system.

**System Kaizen**

System kaizen, in contrast to point kaizen, comes about when this same plant manager realizes that their flagship product line is suffering from a growing past due backlog, too much inventory, and overall poor morale from the folks adding value to the product.

With this in mind, he or she works with the team in developing both a current state value stream map and then a future state value stream map. This future state value stream map is a

view of how the team wishes to see things working in a pre-determined time frame (e.g. 3 months, 6 months, etc.).

Things like tidying things up via 5S, creating model cells, and implementing WIP and finished good supermarkets may be some of the things needed in order to reach this future state.

**System Kaizen leads to Point Kaizen**

What the team soon realizes is that the 2 day value stream mapping "system kaizen" exercise lead to the identification of multiple "point kaizen" events. And once these point kaizen events are successfully complete, the team should be much closer to their future state vision.

So, while point kaizen is never bad, I feel it extremely important to mention the need to first look at things from a "system" perspective before worrying about things on a "point" perspective.

## Chapter 20: Kaizen Rules: 1&2

These next few chapters are about all things kaizen. I personally believe kaizen is the key to long term success – both professionally and personally.

Often times we associate the word kaizen with "kaizen events" which are short improvement initiatives that last around 5 working days. For example, we may run a 5S kaizen event one week and TPM kaizen event the next.

However, in addition to these specific events, kaizen is a philosophy for how you operate on a day by day, hour by hour basis.

Along these lines, I will be sharing 2 specific "kaizen rules" each chapter which I hope brings you closer to the kaizen way of life.

**Rule 1: Challenge the status quo**

Rigid, dare I even say conventional, thinking can be deadly. A true kaizen mindset requires us to think beyond common sense. If something is broken, we must fix it. However, even if something is working, we must study it to see how it can be even better.

**Rule 2: Think of how to do it instead of why it can't be done**

I recently wrote on this very topic of why a concrete head can be so detrimental to improvement.

We must enter a "how it can be done" mindset instead of why it cannot be done mindset. The former is essential if we are to make any serious, long lasting change.

This manner of thinking must also be taught to our associates. If everyone adopts this "how to" mindset, change can occur rapidly.

## Chapter 21: Kaizen Rules: 3&4

In the last chapter we discussed the first two rules of kaizen. Now we will discuss excuses and perfection.

**Rule 3: Stop making excuses. Start questioning current practices.**

When we encounter a defect or failure, we should not make excuses or play the blame game. Instead, we must go to the gemba to see what is really happening.

Does the worker know how to do their job? Are there visible work standards? Have all the workers been trained? Does the work area resemble the living quarters of a pig?

If there are gaps in any of these areas, the leadership must assume responsibility and remedy the problem. Perhaps some 5S and Standard Work is a good place to start.

If everything seems in order we must realize that no standard is infallible so perhaps we need to improve them (standards) after some hansei.

**Rule 4: Don't seek immediate perfection.**

For many of us, we want it all and want it now. However, aiming for immediate perfection is not the kaizen way. To be sure, perfection is our ultimate goal but it will never be achieved with one single initiative (or ever).

Our mission, if we should choose to accept it, is rapid improvements again and again. These quick improvements create momentum that is difficult to stop. And this, my friends, is when kaizen is at its best.

## Chapter 22: Kaizen Rules: 5&6

We continue with our multi-part kaizen rules series.

**Rule 5: Correct mistakes at once**

If you are walking through your office, factory, or even home and spot an abnormality, you should make every effort to remedy the situation immediately.

Don't wait to call a meeting or form a project plan and improvement committee. As Dr. James Womack says in his book, "Lean Thinking," JUST DO IT! Many times this may mean implementing a temporary solution (i.e. a Band-Aid) until a more permanent solution can be established.

Obviously, if the problem is more complex, we will need to enlist the help of others and properly document things. But we must be careful to not plan for days or even weeks while a problem continues to punish us day in and day out. Stop the bleeding and then get the patient to surgery.

**Rule 6: Don't spend money on kaizen**

Many times the best solutions cost nothing at all. It's easy to fall into the trap that new equipment or technology will take away all our problems.

But if you take the time to really study the problem, you may be in position to improve things without spending a penny, pence, etc.

If, after exhausting all other alternatives, you realize you need to spend some money the capital expenditure justification should be easy as you explain the many ways you attempted to solve the problem on the cheap.

Once you do get approval to spend some money, it may be time to head to Staples with credit card in hand.

## Chapter 23: Kaizen Rules: 7&8

We have officially rounded the corner on our kaizen rules series.

**Rule 7: Wisdom is brought out when faced with hardship.**

I cannot explain this rule any better than Matthew May, author of the excellent Elegant Solutions blog, recently did here.

**Rule 8: Ask "Why?" five times and seek the root cause.**

I enjoy solving complicated problems using ultra sophisticated tools. It's fun and exhilarating when you build a predictive regression model that confirms again and again.

But guess what? Most problems don't require things like regression to be solved. Instead, all we must do is ask why 5 times.

It almost sounds too good to be true and I could offer some examples here starting with something like "why are you pouring saw dust on the floor" which would lead you to tell me about the leaking oil, which would result in several more "why" questions until we identified the root cause.

## Chapter 24: Kaizen Rules: 9&10

These past few chapters have been about all things kaizen. Let us finish off the list in this chapter.

**Rule 9: Seek the wisdom of ten people rather than the knowledge of one.**

Lone Rangers are a thing of the past. No matter how brilliant you are, I assure you that listening to others, and I mean really listening, will accelerate your kaizen efforts ten fold.

**Rule 10: Remember that opportunities for kaizen are infinite.**

So far, we have discussed 9 rules to kaizen. If you remember only one of them, I hope it is this last one - kaizen is a mindset and never ends.

**Summary**

For those familiar with the book, *Gemba Kaizen* by Masaaki Imai, you may notice an interesting relationship between these ten rules and the ten rules he shares. Yeah, they are the same rules but with my comments added. So if you haven't read this book, I really recommend you pick it up and give it a good read.

## Chapter 25: Repent, I mean Hansei!

I never seem to stop learning from my friend, Jon Miller. I wanted to write a post about hansei and thus decided to dig around to see what other bloggers had to say on the topic. I typed hansei into Google and mid way through the first results page, I saw a link to Jon's blog on this very topic – imagine that! After reading Jon's post, I was enlightened to say the least.

I have always used the term hansei in the same way I might use the word reflection. It seems this may not be the best translation of the term after all.

You see hansei should always be used in the spirit of what went wrong even though in some cases we think everything went great. Jon writes, *"Where people in the U.S. or Europe might celebrate the completion of a project with an office party, and maybe PowerPointing some lessons learned, the Japanese would have a somber hansei-kai and then drown their hansei sorrows in drink."*

There seems to be a fine line here as you can reflect and come to the same thing as described above. But you can also reflect and say, "hmm… fancy that happening, eh?" This type of reflection is not what hansei is about. Jon goes on to explain a better English word for hansei may actually be repent. You know, like repent and believe all ye wasteful sinners!

I must admit there are aspects of the Japanese culture that depress me a bit. I may be way off but it often seems they are never satisfied, never happy, and never content. Perhaps this is the true secret to Toyota's success. After all, many companies are "doing lean" but few get the results Toyota does. Why is that? Perhaps hansei is in order… the real hansei that is. You can read Jon's entire hansei post here.

## Chapter 26: Is Laying People off Really Anti-Lean?

We often hear how companies "apply lean" and subsequently lay-off hundreds, even thousands, of people. Here is another example. In this article we read:

> *Companywide, employment is down sharply. Telect now employs 747 people worldwide, down from about 830 a year ago and 2,300 at its peak in 2000. In the past year, it has implemented lean-manufacturing strategies at its plants in Texas, Mexico, and Poland and now can achieve the same production level with fewer people, he says.*

So let me ask a hypothetical question. Let's say you, a lean enthusiast, are named CEO of a mid-sized manufacturing company.

Let's also assume your market has turned down and the constraint is clearly outside your plant.

Let's also assume you need to improve cash flow, reduce inventory, improve OTD, and most importantly improve employee morale.

Next, let's assume the company you inherited was poorly managed before you came on and is not even a decent mass producer.

Lastly, let's assume that the previous management (who the board fired) went on a massive hiring frenzy over the past few years in hopes of improving things by throwing bodies at the problem.

Now then, let's imagine you come into this situation (as CEO) and immediately implement lean and six sigma principles. On time delivery improves, inventory turns have doubled, cash flow is improving, and morale is on the way up.

All is good with one exception.

After calculating the optimal crew size for each area (leaving in the ability to meet some expected increased demand) you realize you have too many employees.

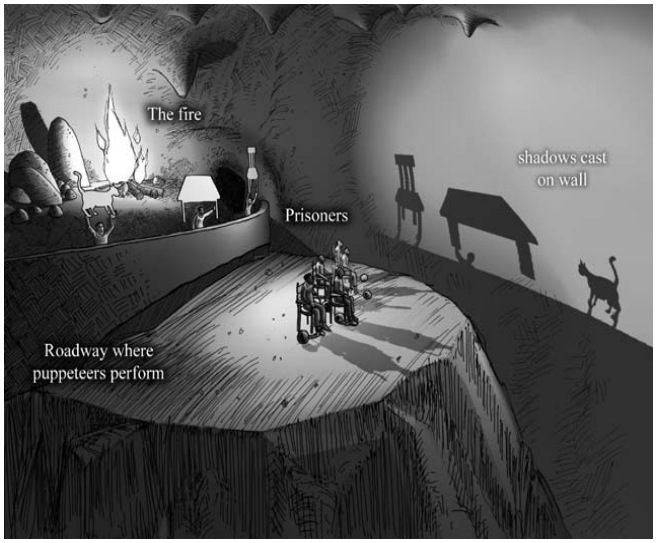
In fact, your calculations show you need 250 employees (both direct and indirect employees) to run the plant and you currently have 425.

The reason you have so many employees is again due to the previous management who went on the massive hiring frenzy the past few years.

What would you do?

*Note: This article garnered lots of passionate feedback via the comments section. Be sure to check them out! And don't be shy about speaking your mind as to how you would handle this situation.*

## Chapter 27: Shadows or Reality




One of my passions in life is to learn. As such, I have begun 2008 by ditching books about leadership, lean, and six sigma (for now).

In their place, I have decided to study philosophy which may make you want to yawn… but I would be less than truthful if I didn't admit to finding the topic fascinating.

Plus if you study people like Taiichi Ohno (chief architect of Toyota Production System) you will notice his teaching is rich with philosophical thought.

So in this chapter I'd like to discuss one of Plato's famous allegories as I see a tremendous relationship between it and the many challenges we as continuous improvement practitioners face.

The gist of the allegory goes something like this.

**Imagine a Cave**

Plato asks us to imagine a cave. Inside the cave are people chained to the ground. These people cannot move and are only able to look forward at a wall. Directly behind them is a fire burning which subsequently shines light into the cave.

**Shadows on the Wall**

Now then, as people on the "outside" walk by the cave, shadows are cast onto the walls. The cave inhabitants have seen the shadows all of their life and as such believe them to be reality.

In fact, they believe these shadows are all there is to life. And since the shadows are the only thing the cave inhabitants have ever seen, who could really blame them.

**Unshackling the Prisoner**

Plato then asks us to imagine someone from the outside world entering the cave and unshackling one of the prisoners. The prisoner is then allowed to exit the cave. The bright light of the sun almost blinds the prisoner and they quickly run back into the cave completely shaken with fear.

Eventually, the curious prisoner ventures back outside and realizes that what he thought was reality was in fact only shadows on the wall. The person then attempts to explain this new amazing reality to the other cave inhabitants.

Sadly, the other inhabitants don't want to hear anything about some fantastic outside world. They have grown comfortable with their life and don't appreciate this excited person's attempt to destroy the only reality they have known.

**What about You?**

So, let me ask you a few questions. As you move forward with your life – personally and professionally – how many shadows are you mistaking for reality?

And as it pertains to continuous improvement, how many cave inhabitants are battling you as you attempt to unshackle them and show them a new reality?

Group think and attitudes like "this is the way we have always done it" and "you wouldn't understand… our business is different" may in fact be nothing more than shadows on the wall.

Our challenge, if we should choose to accept it, is to unshackle these modern day prisoners showing them a far more excellent reality.

## Final Words

Well now, this little project turned into a bit more than I anticipated! Initially I planned to cover both lean and six sigma in this eBook. But once I got into it, I realized there was just too much lean-related material to choose from so I decided to make this the lean edition.

I will release a six sigma version as well so keep your eyes out for that. With this said, I hope you enjoyed my first attempt at something like this. I welcome your feedback as to how I can improve this type of resource in the future.

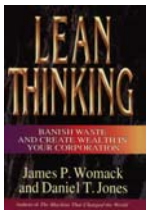
Until then, please be sure to come back for the latest and greatest happenings at LSS Academy.

One way to ensure you don't miss anything is to subscribe to our full feed RSS. You can also subscribe by email and have new articles sent directly to your inbox.

## Recommended Reading

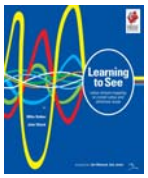
**Taiichi Ohno's Workplace Management**

One of my all time favorites. In this book we enter inside the mind of the chief architect of the Toyota Production System. A must read.



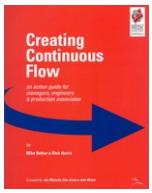

**Lean Thinking**

This was one the first lean books I read. It changed me and helped launch me onto my existing career path.



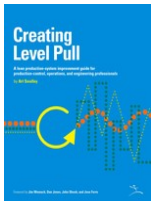

**Learning to See**

This is the bible on how to create value stream maps. It teaches you how to "see waste" in a new way.



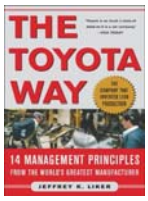

**Creating Continuous Flow**

After learning to see waste you must learn how to make value flow. This is the book to teach you how.



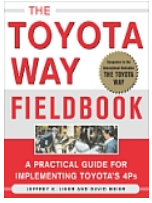

**Creating Level Pull**

Once material is flowing we must think about pull. Learn all about kanban in this excellent resource.




**The Toyota Way**

A true masterpiece. Dr. Liker goes inside the company that started it all and shares how Toyota does what it does.




**The Toyota Way Fieldbook**

The sequel to the The Toyota Way. In this book we take a deep dive inside the tool box that is lean manufacturing.

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Guide to

# LEAN Manufacturing

RON PEREIRA