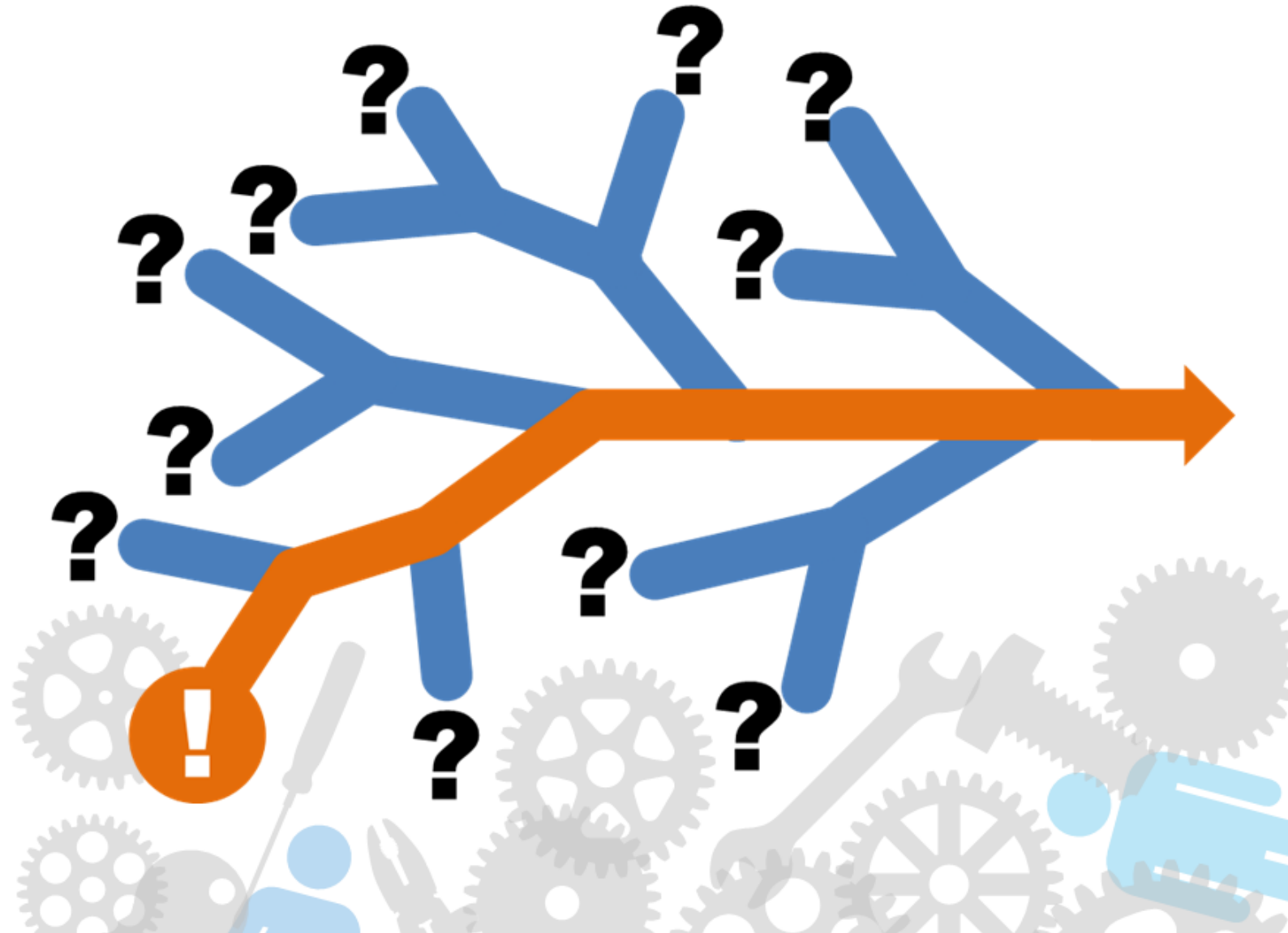
Collected Blog Posts of

AllAboutLean.com

2013

Christoph Roser



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Christoph Roser

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Other Books by Christoph Roser

"Faster, Better, Cheaper" in the History of Manufacturing: From the Stone Age to Lean Manufacturing and Beyond, 439 pages, Productivity Press, 2016. ISBN 978-1-49875-630-3

Fertigungstechnik für Führungskräfte. 2. überarbeitete und erweiterte Auflage, 293 pages, AllAboutLean Publishing, 2019. ISBN 978-3-96382-004-5 (Manufacturing fundamentals textbook for my lectures, in German)

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Preface to the 2013–2019 Collection of Blog Posts

Having successfully written my award-winning blog, AllAboutLean.com, for over six years now, I decided to make my blog posts available as collections. There will be one book of collected blog posts per year, from 2013 to 2019. This way you can store these blog posts conveniently on your computer should my website ever go offline. This also allows you a more professional citation to an article in a book, rather than *just a blog*, if you wish to use my works for academic publications.

This work is merely a collection of blog posts in chronological sequence, and hence does not make a consistent storyline but rather fragmented reading. I am also working on books that teach lean manufacturing. These will also be based on my blog, but they will be heavily edited and reworked to make a consistent storyline. The one I am currently writing focuses on pull production, and hopefully it will be available soon.

The blog posts in this collection are converted into a book as closely as I can manage. However, there are a few changes. For one, on my blog, image credits are available by clicking on the images. This does not work in printed form, hence all images in this collection have a caption and a proper credit at the end of this book. Besides my own images, there are many images by others, often available under a free license. I would like to thank these image authors for their generosity of making these images available without cost. Detailed credits for these other authors are also at the end of this book.

Additionally, a few images had to be removed due to copyright reasons. These are, for example, images from Amazon.com. My blog also includes videos and animations. However, the print medium is generally not well suited to videos and animations, and I do not even have the rights to all videos. Hence, I replaced these videos with a link to the video, and edited the animated images. On digital versions of this book (Kindle eBook, pdf, etc.), these links also should be clickable. No such luck with the print version, unfortunately.

Since my goal is to spread the idea of lean rather than getting rich, I make my blog available for free online. Subsequently, I also make this book available as a free PDF download on my website. However, if you buy it on Amazon, they do charge for their eBooks. If you want a paper version … well … printing and shipping does cost money, so that won't be free either.

I would like to thank everybody who has supported me with my blog, including Christy for proofreading my texts (not an easy task with my messy grammar!), Madhuri for helping me with converting my blog posts to Word documents, and of course all my readers who commented and gave me feedback. Keep on reading!

As an academic, I am measured (somewhat) on the quantity of my publications (not the quality, mind you!), and my Karlsruhe University of Applied Science tracks the publications of its professors. In other words, one of my key performance indicators (KPI) is the number of publications I author. Hence, I will submit these collected blog posts as publications. On top of that, I will submit every blog post in this book as a book section too. Hence, I will have over three hundred publications including seven books, with me as an author, in one year! It will be interesting to see the reaction of the publication KPI system on this onslaught 🙂. I just want to find out what happens if I submit over three hundred publications in one year 🙂. I don't know if I will get an award, or if I will get yelled at, but it surely will be fun. I will keep you posted.

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1 New Professor, New Blog

Christoph Roser, September 01, 2013 Original at
https://www.allaboutlean.com/professor/

Figure 1: Christoph Roser. (Image Roser)

Today is a very special day. As a good friend of mine calls it, it is **the start of my second life**. Yesterday was my last day as an employee in industry, and today is my first day as a university professor. And, indeed, life will be very different.

Most professors I have spoken with are extremely thrilled with their jobs. They all could not imagine doing anything else, and they love their profession. As one colleague phrased it, it is like "E*aster and Christmas on the same day—every day.*" I've never heard something similar in industry, where the mood is usually much more mixed and for many employees the primary reason to show up is to get paid.

Probably the main reason is that professors **don't have a supervisor or boss**. As long as they show up for their lectures, nobody tells them what to do. While throughout my career I had mostly good bosses, having no boss is even better! (Correction: My wife insists that she is now my only boss) Additionally, in Western industry, the standard action upon discovering a problem is to look for a responsible scapegoat, whereas in academia there is much less "blame-game" going on. I will particularly enjoy never ever again being responsible for missing parts!

In any case, I think I will fit right in. I love teaching, I love researching, and **I love my field of expertise on manufacturing organization, lean manufacturing, and anything related to it**. And, exactly because I love teaching, I also use this first day of my *second life* to start my blog, AllAboutLean.com. As the title and the URL say, this blog is on all topics related to lean manufacturing. I will discuss lean manufacturing, administration, and history with a focus on practical use in addition to the unavoidable theory. My goal is to help you organize and improve your industry. I will put particular emphasis on practical tips, how to avoid mistakes, and how to increase your chances of a successful project.

I hope you will enjoy reading this blog as much as I enjoy writing it. Anyway, let the *second life* begin!

2 What is OEE? – Definition of OEE

Christoph Roser, September 02, 2013 Original at
https://www.allaboutlean.com/oee-definition/

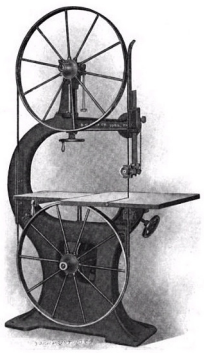

Figure 2: What is an OEE? (Image Gardner Printing Company in public domain)

OEE, the abbreviation for Overall Equipment Effectiveness (or sometimes Overall Equipment *Efficiency*), is a measure of the utilization of a machine. It is frequently used on the shop floor, often determines part of the performance-based compensation of the managers, and is by far and wide the most lied-about and fudged measurement on the shop floor.

In this first post in the series on OEE, we will look at what OEE is, and how it is defined. Following posts will detail how OEE is measured, the top three methods on how the OEE can be fudged,and what the OEE is good for and what it's not.

OEE is the relation of the number of **parts produced on a machine versus its theoretical capacity**. For example, assume a perfectly running machine that could produce 100 parts per day without any stops, breakdowns, or other delays. If, at the end of the day, the machine produced only 67 good parts, then the OEE is 67 out of 100 or 67%. This means 33 parts that could have been made were not due to different losses.

A bare-bone OEE is simply the relation of produced good parts versus the number of good parts that could have been produced. However, one of the benefits of the OEE is the detail of the reasons why the machine produced less part than theoretically possible. Hence, these losses are often also investigated.

2.1 Availability Losses

The first loss on machine capacity is the **loss on availability** (i.e., the time where the machine could have run but did not). Examples of availability losses are:

- Planned maintenance
- Breakdowns and unplanned repairs
- Changeovers
- Lack of material
- Lack of transport for completed goods
- Operator absent (e.g., breaks, bathroom time, etc.).

Planned stops or not-scheduled shifts are theoretically also an availability loss. The machine could work twenty-four hours seven days per week. However, if the operation has, for example, only two shifts for five days per week, not-scheduled shifts are usually not considered losses. Of course, if the customer demand far exceeds the capacity of the machine during these two shifts, then it is completely valid to also include the not-scheduled shifts as losses. In any case, if these planed stops are not included, they should still be kept in mind as potential capacity.

2.2 Speed Losses

The next big category is **speed losses**. The machine did run, but for some reason produced parts at a slower rate than expected. Causes of speed losses are:

- Lack of maintenance
- Wear and tear on the machine
- Incorrect operation on the machine
- Wrong settings on the machine, set speed slower than possible
- Minor idling (theoretically this is a availability loss, but it is easier to determine as a speed loss).

2.3 Quality Losses

Finally, there are **quality losses**. The machine is running, its speed is perfect, but the produced goods do not meet specification. In short, the machine is producing waste. There are three possible reasons for producing waste:

- Scrapped products (product cannot be salvaged at all)
- Rework products (product has to be reworked to be usable). While theoretically the machine capacity was not completely wasted on this part, in reality the rework usually requires more effort than doing it right in the first place. Hence, rework is usually counted as a full loss.
- Start-up losses (during ramp up of production, parts are produced but—depending on the system—may be scrapped for quality concerns or as part of the regular ramp-up procedure).

2.4 Summary

Below is an example of a machine that could have produced 100 parts, but lost 18 parts due to a stopped machine, 10 parts due to slow speed, and 5 parts that were scrapped. This gives 67 good parts where there could have been 100, or an OEE of 67%. Please note that for demonstration purposes the total number of parts was set to 100, hence the number of parts produced and the OEE is identical in this case. In reality, the number of parts may be different from 100.

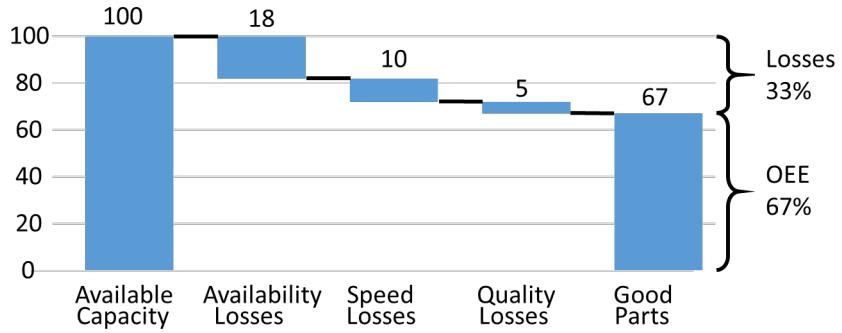

Figure 3: Example of OEE losses for a machine or process with an OEE of 67%. (Image Roser)

3 How to Measure OEE

Christoph Roser, September 03, 2013 Original at
https://www.allaboutlean.com/measure-oee/

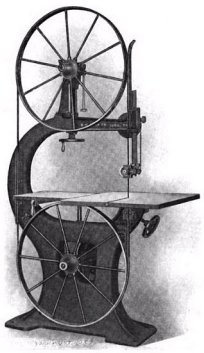

Figure 4: How to measure an OEE? (Image Gardner Printing Company in public domain)

There is quite a difference between knowing in theory **how to measure an Overall Equipment Effectiveness (OEE), and actually measuring it in practice**. This post will give crucial tips and points on how to measure the OEE on a real shop floor.

As is frequently the case on the shop floor, reliable and good data is rare. This is especially true in the calculation of the OEE since obtaining the required data is difficult. As a result, I usually **do not trust any OEE numbers on the shop floor** unless I know the calculations behind it. Most OEE numbers calculated are, in my opinion, of such low quality that they are not worth the effort. Hence, getting the data for an OEE is not quite that easy.

In the previous post, we looked at the definition of OEE, including losses of availability, speed, and quality. In this post, we will investigate how to measure OEE. Following posts will detail the top three measures how the OEE is frequently fudged, and what the OEE is good for and what it's not.

3.1 Time Basis for OEE

Figure 5: Is the shift over already? (Image Imperial War Museums in Public Domain)

The first question you have to answer is the **time basis** of your OEE calculation. Do you want to look at only the planned shifts, or do you want to consider round-the-clock twenty-four hours per day seven days per week?

In most cases in industry, the basis is the shift model. If the operation is scheduled to work two shifts five days per week, then the time basis are those two shifts for five days. However, if your system is short of capacity and unable to meet customer demand, then it may be suitable to start with a 24/7 time basis. Yet, be prepared for opposition from your people. A 24/7 time basis will make an OEE go down, so on paper it looks worse even though the system has not

changed, only the calculation. As your people may be judged by the OEE, they may have an interest in looking good with a nice OEE number (and maybe even you too).

In any case, regardless of what your time basis is, you need to figure out what you could have produced in that time.

3.2 Speed Basis for OEE

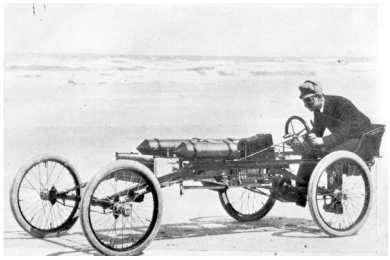

Figure 6: Speed makes a difference. (Image LeSesne, Richard H. in Public Domain)

The second important number you need is the **speed of the machine**. What could the machine produce if everything else around it is perfect? The shortcut approach is to take any number you may have on record. However, in my experience, these numbers are usually incorrect or outdated. They may be simply the average of a good day of production. However, even a good day of production has losses, and taking the average would ignore these losses. They may be based on a theoretical calculation, maybe using MTM or REFA methods, which are often much slower than a good worker and include estimates and personal breaks.

To get a good estimate of the maximum speed of a process is to **repeatedly measure the time between the completion of parts**. You will find that this time is statistically distributed (don't worry, we won't go into the statistical details here). Most times clustered around the average, some took longer, a few took much longer maybe due to a breakdown, and some were faster or much faster than the average. The goal is to get the shortest time possible. However, if you merely take the smallest value in your set of measurements, then you probably got a measurement error. It is better to sort the measurements and take the time where 95% or 90% of all measurements are slower than that time (statistically speaking, the 5th or 10th percentile).

3.3 The OEE Itself

Now you have the **time basis** and the speed basis. Dividing the time basis by the speed basis gives you the theoretical number of parts that could have been produced. For example, if you decided to analyze two 8-hour shifts per day for 5 days, you have a total of 80 hours or 4800 minutes. If your process has a maximum speed of one part every 2.5 minutes, then you divide 4800 minutes by 2.5 minutes per part and get 1920 parts that you could have produced in that time.

These theoretically possible 1920 parts are now compared with the actual production during that time. This number is usually easy to get, as even the worst plants have a rough idea of what they have produced. After all, the operator's salary may depend on it.

In the above example, let's say that you have produced not 1920 but only 1132 parts, then your OEE would be 1132/1920 or 59%. That's it.

Of course, you may also be interested in the losses that caused you **not** to produce 788 parts during that week. Now it gets a bit more challenging to get reliable data.

3.4 Digital Data Monitoring

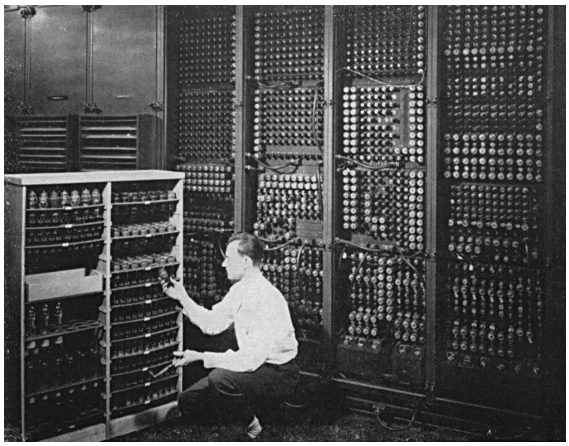

Figure 7: Digital data monitoring may help. (Image M. Weik, US Army in Public Domain)

If you're lucky, you may have a **digital data monitoring** system on your machine that makes an automatic protocol of what the machine does when. However, in my experience, even if there is a digital data monitoring system, it usually does not have enough data to calculate the losses reliably. For example, quality problems can only be detected afterward and will not be logged in the system. The process may not know if a stop was due to a missing operator or a missing machine. In all likelihood, with a digital data system you still have gaps and need to find out at least some details in a different way.

3.5 Manual Observation

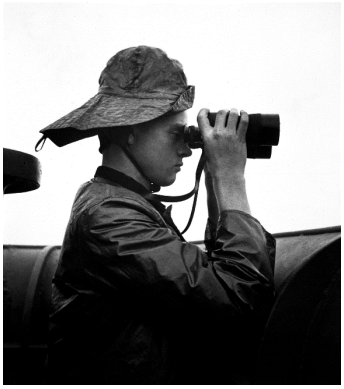

Figure 8: Manual observation is still the best. (Image Lawrence Britton in public domain)

Probably **the gold standard in OEE measurements is manual observation over a longer period**. In this observation, a separate worker is standing next to the machine to take a protocol of when the machine is doing what. He or she should write down any irregularity (e.g., when the machine stops, the operator is absent, material is missing, or products are scrapped). This will probably be the most reliable data you can get. However, this gold standard comes with a gold-plated price, as you need to pay for one operator round-the-clock to stand next to the machine to take a protocol.

If you nevertheless want to do this manual observation, here are a few practical tips:

Prepare the data monitoring very carefully, possibly with some shorter test runs. It will do you no good to have three days' worth of data that is missing crucial information.

Include the unions and operators. Observing a machine alone should be no problem, but few machines are unattended. In effect, you are making a round-the-clock protocol of what the operator does and doesn't do. Get the operators and unions involved so they understand what you are doing and why. Never do it against the will of the operators, as they have the ability to

mess up your measurement beyond usability. It helps if the person monitoring is also an operator and colleague, not an outsider or supervisor.

Be sure why you are taking the OEE. This effort in obtaining the details to the OEE losses is only useful as a first step if you plan a project to improve said losses as the second step. If the only reason for taking the OEE is because someone higher up wants a number, then there are much cheaper ways to get a number (Chinese plants, for example, are well known for simply guessing the right number). Of course, I would never suggest the possibility that this may have happened in Western industries too. 😉

3.6 Operator Records

Probably the most common way in industry to determine the details on the OEE losses is **operator records**. The machine operator takes a protocol of disturbances, which are then converted into digital records and analyzed. For practical reasons, the operators record only disturbances above a certain length (i.e., if there is a stop in excess of 5 or 15 minutes). The advantage is that this data can be obtained with little effort, only the analysis of the data requires some time. On the downside, all stops below the cut-off time are ignored and the quality of the observation may vary from operator to operator.

3.7 Making Sense of It All

During the calculation of the OEE, getting the **available capacity** and the produced parts are probably easiest. Quality losses are also often available or can be obtained by manual observation or operator records. Availability losses are a bit shakier, but manual observation or operator records can also usually give a good picture.

The trickiest part is the **speed losses**. Operator records and manual observations have difficulties picking these up. What we know for sure is that they have to be the remainder of the gap between the available capacity and the produced parts. In the example below, even if we would not know the speed losses, we could easily conclude that they are 10%, since these 10% are simply the remaining gap. While this tells us the size of the speed losses, it doesn't help in detailing the causes of the speed losses. Unfortunately, these speed losses are rarely marginal and can easily make up 30% or 50% of the total losses. In this case, you have to dig deeper into the speed losses of the machine.

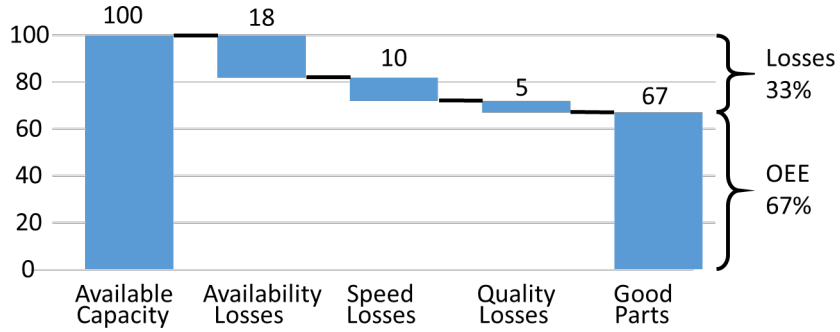

Figure 9: Example of OEE losses for a machine or process with an OEE of 67%. (Image Roser)

4 Top Three Methods on how to Fudge Your OEE

Christoph Roser, September 04, 2013 Original at
https://www.allaboutlean.com/fudge-oee/

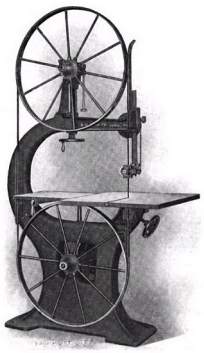

Figure 10: How to fudge your OEE! (Image Gardner Printing Company in public domain)

The Overall Equipment Effectiveness (OEE) is by far and wide **the most lied-about and fudged measurement on the shop floor**, both intentionally or by accident. This post tells you the top three different ways how an OEE is fudged, so you know which OEE to trust and which one not.

The OEE is easy in theory, but it has some practical difficulties in measuring, so even a well-intentioned OEE measurement is often flawed. Additionally, for many managers, performance-based compensation may be based on the OEE. Even if not, a good OEE gives better bragging rights. Hence, **there is a tendency in industry to inflate OEEs**.

After the definition of OEE and how OEE is measured, this post will focus on how the OEE can be fudged. In the next post we will look at what the OEE is good for and what it's not. **The reason for this post is not to teach you how to to fudge your OEE. Rather, I would like to tell you how to be cautious about other OEEs that are told to you, especially if OEEs influence your decision making**; in that case, you need to understand (potentially) manipulated OEEs that are reported to you.

As discussed in my previous post on how to measure OEEs, the OEE is based on the **number of parts that were produced** compared to the number of parts that could have been produced in a certain time (the time basis) at maximum possible speed (the speed basis). Since these are the only three numbers going into the OEE itself, these are the numbers that can be, in theory, manipulated.

4.1 How to Fudge Your Speed Basis

Figure 11: Let me tell you what exactly the speed is. (Image Bundesarchiv under the CC-BY-SA 3.0 Germany license).

The true speed of a process or machine is supposed to be the **best possible speed** that can be repeated. However, this is difficult to measure. Below are a number of options for how to manipulate this speed.

For example, it is possible to **measure merely the average speed** of a good day and use this number as the top speed. However, in this case, the average speed already includes losses. Even a good day includes some stops, delays, or defects. If, for example, the true OEE on a good day would be 80% (not an unusual number), then any "OEE" based on an 80% speed would have a 20% "*discount*".

Yet another possibility is to **use outdated data**. Processes in industry are constantly changing and frequently improving. If the "*true speed*" on record is a few months old, it is possible that the process has improved since then. Yet, if you base your OEE on an assumption of fifty parts per hour, but in reality you can already do fifty-five parts per hour, then your OEE goes up again. In similar cases the workers may have found that they can increase the speed setting of the machine without ill effect and use this to achieve their quota with greater ease.

The true speed is particularly difficult to measure in processes that involve human workers. Measuring a worker with a stopwatch leads to manipulation by the worker. In most cases, the worker may work much slower than normal, so as not to reveal the true possible speed and damage his performance bonus. Using a system of predetermined motions (for example, REFA or MTM) may also include losses already, for example contingency allowance**s**. REFA, for example, assumes a contingency allowance for technical and personal disruptions (e.g., the bathroom break). While I definitely don't want to restrict workers from going to the bathroom, the resulting stop is an OEE loss that can be avoided through, for example, another worker covering the break. However, for the purpose of calculating the OEE these contingency allowances must be excluded.

Additionally, in my experience, **predetermined motions are usually slower than a experienced worker**. In REFA, for example, a "speed estimation" is often included, which may make a difference of about 30%. Depending on the chosen number for the speed basis of the OEE, the OEE may be much different. In general, the lower the speed basis is compared to the true maximum speed, the higher the OEE.

4.2 How to Fudge Your Time Basis

Figure 12: Of course this stop was planned! (Image James Salmon in public domain)

Probably the biggest lever to manipulate your OEE is the **time basis**. The time basis is the time a machine is supposed to work. A common approach to inflate OEEs is to take availability losses out of the time basis. For example, planned maintenance is a loss, but in most plants I have seen, planned maintenance is taken out of the OEE equation. Depending on the plant, this may be another 5% OEE boost.

The same goes for breaks. Forty-five minutes of breaks during an eight-hour shift represents an OEE loss of almost 10%. It is possible to cover these breaks with a stand-in or with staggered breaks, where a colleague keeps the process running while the other worker is taking a break. Yet in most industry that I have seen, breaks are not included in the OEE. This is another 10% OEE boost. Some particularly brash plants do have staggered breaks, yt they still take these breaks out of the OEE! Not only are the 10% breaks not counted, they even make parts during these not counted 10%, inflating their OEE both through reduction of time basis and increase of number of parts!

In a similar vein, unplanned breakdowns are miraculously turned into planned stops or changeovers and may be excluded. Even **overtime** may be excluded, leading again to even more parts in not counted time.

4.3 How to Fudge the Number of Parts Produced

Figure 13: Look at what we produced! (Image Lewis G P in public domain)

In practice, **the number of produced parts are usually accurate**. In my experience, all but the worst of the worst plants know roughly what they have produced. Hence, the number of parts produced is usually rather accurate.

However, it is possible to fudge these numbers. **Communist countries in particular have shown great creativity in fudging output numbers**. The easiest way is to simply lie about the true numbers, as was commonly done in communist China. During the Great Famine 1958–1961, harvest numbers were wildly inflated. Some officials claimed that they harvested so much grain that it would have covered the field ankle deep with rice or piled it a meter high with potatoes. Even Chairman Mao, son of a farmer, eventually stopped believing these numbers. In modern industry, lying about production quantities is absolutely not recommended, as it will likely be found out and may be reason for termination.

Figure 14: Hero of Socialist Labor Stakhanov (on the right) teaching his comrade how to fudge numbers. (Image unknown author in public domain)

In the Soviet Union, another way to **fudge production numbers** was common. Rather than reporting total quantities, the quantities of one shift or one worker was reported. One particular individual, Aleksei Stakhanov, Hero of Socialist Labor, was reported to have mined 102 tons of coal in one shift, about 14 times his quota. Later he even exceeded that by mining 227 tons

of coal in one shift. This was soon followed by similar over-achievements by other workers and named the Stakhanovite movement.

Naturally, it was all bogus. The production of multiple shifts was merely counted during one shift, the output of many different workers was credited to one "Hero," or the workload was redistributed so that the "Hero" didn't produce the entire product, but merely added the last touch with everything else being prepared by his coworkers. In any case, while it looked good on paper, it was far from reality.

Finally, a last option to inflate the number of parts is to **ignore quality losses**. If scrap and rework are counted as good parts, the OEE goes up yet again. And, if the defect is found out only at the next process (or even the customer), it may not show up at all in the OEE losses.

4.4 What OEE to Expect?

Such number fudging is widespread in industry, inflating the OEE. In many cases this is not even with malicious intent, but rather defined as the company standard and done similarly across plants and processes. Yet unless you know how the time basis, speed basis, and number of parts is determined, it is pointless to compare OEEs.

In my experience, **OEEs are usually measured in a way to put the OEE in a 80%–95% range, regardless of the true performance of the process**. These numbers please the upper management, and hence they get what they want. Of course, the theoretical maximum should be 100%, as this should be the fastest possible speed. However, I have also seen countless mediocre plants happily reporting an OEE of 105% or similar. (*If I had a dollar for every OEE above 100% that I have seen … then I could take my wife out for a nice pizza*)

The question is, how would these OEEs look if they had been measured without manipulation? I have measured quite a few of them myself, and it is usually much less than the official 80%–95% (and beyond) range. In my experience, **most processes in Western industry have a true OEE in the range of 40% to 60%, not more**. Even OEEs of 30% or less are not uncommon. The difference between the true 40%–60% and the reported 80%–95% is nothing but self-deception.

The best true OEE I have seen so far was during my time at Toyota, where the true OEE is around 85%–90% (and they say an OEE above 90% means that your lot sizes could be smaller and you should do more frequent changeovers).

I sincerely hope that this post helped you to understand the value of an OEE number (or the lack thereof), and how an OEE has little value unless you understand the details behind it. I also sincerely hope that you do **NOT** use this information to fudge your OEEs, as this will not help your enterprise (albeit, depending on your boss it may help your career—or curtail it). Now, go out and improve your Industry.

5 What the OEE is Good for and What it's Not

Christoph Roser, September 05, 2013 Original at
https://www.allaboutlean.com/use-oee/

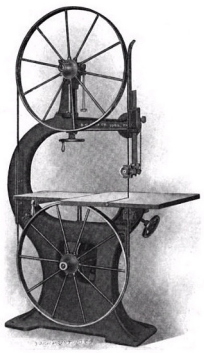

Figure 15: What is an OEE good for anyway? (Image Gardner Printing Company in public domain)

Measuring the **Overall Equipment Effectiveness (OEE)** is one thing, but before you measure the OEE you should know when and where you actually need the OEE to improve your industry. This post describes what the OEE is good for and what it's not.

There are countless OEEs measured in industry. Unfortunately, there is usually not much done with these apart from using them to evaluate management performance. In fact, this is usually a good thing since the OEE can be enormously misleading. Quick pop question … What is a better OEE: 60% or 90%? While many in industry will immediately answer that 90% is better than 60%, the truth depends on the circumstances.

After the definition of OEE, how OEE is measured, and the top three methods on how to fudge your OEE, we will now look at what the OEE is good for and what it's not. Because, in some cases, a high OEE may be the worst thing you can do.

5.1 What the OEE is Good for … and What it's Not

The OEE measures something akin to the utilization of a machine. The higher the OEE, the higher the output of parts from a machine. Hence, according to the Western mantra in industry that "*only a running machine is a good machine,*" a high OEE would be good, right? Lean manufacturing, however, has a different philosophy:

> *Produce only what is needed, when it is needed and in the amount needed. (Taiichi Ohno, Father of the Toyota Production System)*

Hence, **a high OEE without the corresponding customer demand would lead to overproduction**. And, out of all the wastes in industry, *overproduction* is the worst of them all. Overproduction leads to all kinds of secondary waste, and lean manufacturing is usually most well-known for its lack of inventory.

Of course, this doesn't mean that a low OEE is better than a high one. As mentioned above, it depends. But before we go into details regarding when a high OEE is good, I would like to point out that **measuring the OEE makes sense only if you want to change the OEE**, namely to have a high OEE. For processes where the OEE doesn't matter, there is no reason to waste energy on measuring the OEE. Hence, you should measure the OEE only where the OEE matters, and you should measure the details on the losses only if you want to gather data for an improvement project.

Having said that, there are two approaches where a high OEE is useful: for **bottlenecks and possibly for production lines**.

5.2 Measuring Bottlenecks

The bottleneck is the process that slows down your entire system. Hence, a high OEE at the bottleneck translates into a high output of the entire system. If this is matched with a high customer demand, then measuring and possibly improving the OEE is relevant.

First, assume a machine that is NOT the bottleneck but before the bottleneck itself: A high OEE will lead to a jam of parts before the bottleneck, so in this case a high OEE is bad. Now assume the system below with five processes, of which the middle one, process C, is the bottleneck. If the goal is a high OEE on process A, the likely result is a pile of material between process A and process C.

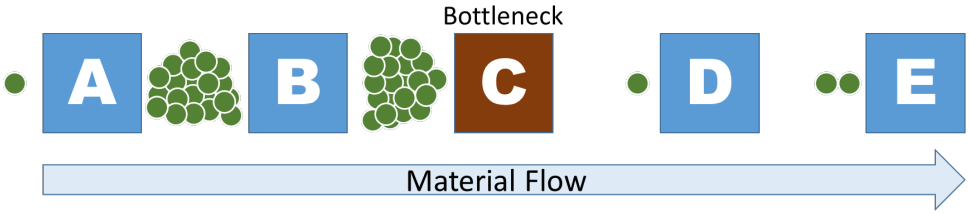

Figure 16: Jam of material before a bottleneck at machine C. (Image Roser)

This similarly applies to a high OEE in a process after the bottleneck. If you want to have a high OEE in process D, chances are you won't get it, since process E will always wait for parts from the bottleneck C. Hence, process E cannot have a high OEE due to the bottleneck being somewhere else. **Only an improvement in the OEE of process C brings an improvement of the overall system!**

Please note that the above example assumes that all processes are working the same shift pattern. Of course, different shift patterns cause changes in the OEE, but as long as process C is the bottleneck, all other OEEs are not relevant. Please also note that process C does not necessarily have the highest OEE of the processes, since process C may be the bottleneck precisely because of many losses in availability, speed, and quality. So for process C—and only process C—the OEE is of interest.

5.3 Measuring Production Lines

There is a possible variation on the OEE for the bottleneck. It is possible to measure the **OEE for the entire line**. The OEE is the number of parts produced divided by the theoretically possible number of parts that could have been produced. This *theoretically possible number of parts* can be determined through the slowest cycle time in the system.

Please note: Adjust for number of parts needed for the final product if necessary (i.e., if a car needs four wheels but only one engine, the wheel production has to be four times as fast as the engine production). Also note that **while you can measure the OEE for a production line, it is tricky to measure the details of the losses due to the interactions within the system**. In my experience, it is usually nearly impossible to accurately say why the system produced less parts than theoretically possible. Hence, the line OEE gives you only a measurement of productivity, but not a tool for improving the line.

In any case, you can measure the OEE for a production line. In this case, the same applies as for measuring the OEE in processes: **The OEE is relevant only if the line is the bottleneck**. Furthermore, in theory the OEE of a line can help you determine if you can reduce the number of shifts while still keeping output constant. However, if you want to reduce the number of shifts, the measurement of parts produced per shift is a much more useful and easy measurement than the OEE of the line.

5.4 The OPE: Measuring People

Figure 17: What about me? (Image unknown author in public domain)

After all the details on how and where to measure the OEE for processes, you may wonder, Can you also do this for workers? Can you also **measure the OEE for your people?** The answer is a typical lean answer: *Yes, but …*

First of all, in this case it is renamed from **OEE** to OPE. The OEE was the Overall Equipment Effectiveness (or Efficiency). The OPE was initially the Overall People Effectiveness (or Efficiency); however, this touched some sensitive nerves, as it indicates that employers treat people the same as machines, whereas people are not machines, but … well … people. Hence, while keeping the acronym OPE, it was renamed to Overall Process Effectiveness (or Efficiency) or sometimes also Overall *Performance* Efficiency. Here it is merely assumed that the process or performance includes manual labor.

Now, in theory you can measure the OPE just as you can measure the OEE, by observation and note taking (probably less through digital monitoring;-). In practice, however, as I said above, people are not machines, but … well … people. And **people do not like to be measured**, especially by their supervisors and on their job. Hence, starting an OPE measurement has a high risk of also starting trouble. Your workers may refuse to cooperate, management loses (even more) respect, and even if you get your measurements done they may be worthless since the workers staged a dog-and-pony show for you. Never underestimate how much an employee can make you believe what he wants you to believe.

So you should measure the OPE only if there is a **high level of trust and understanding on the workers' side**. Try to explain them why you and they need this data. Assure them that this is not to find out whom to fire. Convince them that this is not a way to squeeze even more work out of them. Involve their unions. Involve the workers in the project. Have the workers take the measurements themselves. And then hope that they accept and believe your motives, because otherwise your data will be garbage. Finally, stand by your promises and do not screw your workers over after you got your OPE, or loose all respect and trust from your workers.

In short, **avoid measuring the OPE unless you absolutely have to**. This also applies to the OEE, but much more so to the OPE.

This concludes my series of posts on the OEE. I hope it was useful for you and helped you avoid problems and improve your industry. **Now, go out and improve your Industry!**

6 Ancient Roman Management Techniques

Christoph Roser, September 05, 2013 Original at
https://www.allaboutlean.com/drusus-stone/

Figure 18: Drusus stone in Mainz. (Image Roser)

Ancient Romans already knew how to manage their people. For example, the Drusus Stone monument in Mainz demonstrates the importance of keeping your people both **busy** and motivated.

I've recently been visiting the nearby city of Mainz again, taking a walk in the Citadel of Mainz. One of the particularly interesting sites is the **Drusus Stone**, the remains of a Roman monument honoring General Drusus. For some, this is merely one of many Roman remains in Germany.However, you're not visiting AllAboutLean.com for Roman history – there are better sites for that.

No, for me the Drusus Stone is an example of **Roman management techniques**, which are still valid today. While the ostensible idea is to honor a Roman general, I believe there is also a hidden reasoning which will tell us much about Roman management and hence also about modern management.

6.1 The Historic Facts of the Drusus Monument

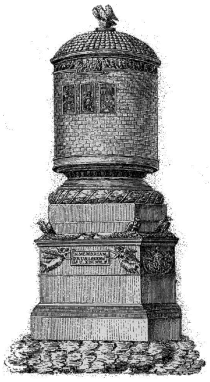

Figure 19: This is how it may have looked like… (Image Martin Bahmann under the CC-BY-SA 3.0 license)

Figure 20: Bust of Drusus. (Image ChrisO under the CC-BY-SA 3.0 license)

Let's start with the historic background. **Nero Claudius Drusus Germanicus** (38 BC – 9 BC) was the stepson of the first Roman Emperor Augustus. As such, he was able to take many shortcuts in his career path, and by the age of 26 he was commanding an army in combat against Germanic tribes. Apparently, he was very popular with his legionaries. His death, however, was nothing dramatic. He fell from his horse at age 30 and died from complications due to a broken leg.

6.2 The Hidden Management Lesson

On first glance, the facts are clear. General dead – honor him with a monument. However, I believe there's more to it than that. While hard facts are of course hard to find after two thousand years, I strongly believe the building of the monument was a **motivational activity** for the legionaries. Bored men in large groups are a sure recipe for trouble. This applied to Roman legionaries two thousand years ago just as it does to modern-day soldiers or workers. Hence, a good officer/manager keeps his men busy at all times.

It just happens to be that around 8BC – the year before the construction – the main enemies in the region were either defeated (the Sicambri) or decided that they'd had enough and moved elsewhere (the Marcomanni). As a result, there was probably much less to do for the legionaries than before. Hence, I strongly believe that building this monument was at least in part to **keep a lot of troops busy** at comparatively rather peaceful times.

Additionally, since Drusus was supposedly popular, not only did it keep the men busy, but it also **raised their morale**. They were part of something bigger, something built for eternity – or so far at least two thousand years and counting. So the commander of the Castrum Mogontiacum killed two birds with one stone: his people were both orderly and happy.

6.3 Application for Today's Managers

How does this apply to modern day management? First, I do **NOT** suggest that you assemble your men to build a 20-meter marble tower in honor of the late plant manager. The building of monuments has gone a bit out of fashion since two thousand years ago. Besides, management tends to vastly overestimate their popularity with the common worker (after all, not many tell their bosses that they do not like him/her). Hence, rather than raising morale you may instead have the opposite effect. Additionally, during Roman times building such a tower was mostly labor and not so much cash, whereas nowadays the cost of such an undertaking would be much larger. On top of that, the Roman legionaries were idling anyway, whereas your workers should actually be working.

So the message is that you should **keep your workers busy at all times**. Slow speed and idleness is the root of mischief and negligence. Your workers should work at regular normal speed (which they can sustain for a working man's career without health damage, mind you). If you do not have enough work, give them additional tasks or send them home rather than having them work at less than regular speed.

Figure 21: We appreciate your work! (Image Roser)

Additionally, while you probably should not build a monument, **you should celebrate achievements**. I have seen countless successful projects where, upon completion, management moved on immediately to the next project. Stop! Take a moment to celebrate. Gather your troops together and thank them for the work, appreciate their efforts, and give them time to cherish the achievement! And, if possible, give them a small reward. I don't mean a raise or a cash bonus, but merely a small appreciation besides words (which are cheap). For example, I usually hand out three-pound packs of gummy bears as a reward for project completion. But whatever you can think of, make sure their contribution is valued.

The methods of keeping your people orderly and motivated may have changed in the last two thousand years, but people have not. Keep them busy and appreciate their work! **Now, go out and improve your Industry!**

7 Visit to Euromold for the Latest in 3D Printing

Christoph Roser, September 15, 2013 Original at
https://www.allaboutlean.com/3d-printing/

Figure 22: 3D printed tower with internal staircase. (Image Roser)

The next Euromold trade show in Frankfurt will be in a few weeks. While the show generally presents products related to moldmaking and tooling, they also have a large section on 3D printing. This is a good time for me to talk about 3D printing and my last visit to Euromold last year.

3D printing is a up-and-coming technology that prints 3D parts in a printer as you would print a 2D sheet of paper. Hence the manufacturing goes directly from the computer to the completed part. This post discusses the different approaches in 3D printing and its possible impact from a lean manufacturing point of view. But before that, I have to get something personal off my chest.

7.1 My Visit to Euromold 2012

Last year while driving around in Frankfurt, I saw an advertisement for the Euromold trade show. Since I am particularly curious about 3D printing, I decided to take a day off from work and visit the exhibition. To my surprise, my wife found this idea interesting too and decided to tag along. We had a good day at the 3D printing trade show, learned a lot about the latest techniques, and also managed to get hold of a few 3D samples to further enrich my shelf of samples and gizmos.

I did notice, however, that my wife and I were the only people on the entire trade show floor walking around holding hands. Furthermore, my wife was frequently addressed as my assistant. The cliché was not helped by my wife being a very good-looking Asian woman. Overall, I thought we were getting quite a few strange, or even creepy looks. If any of you were at the 2012 Euromold trade show too, I just want to tell you, *It's okay, we're married!* We were just a geek couple on a date.

Now that I got that off my chest, I can talk more about the actual 3D printing.

7.2 3D Printing Technologies

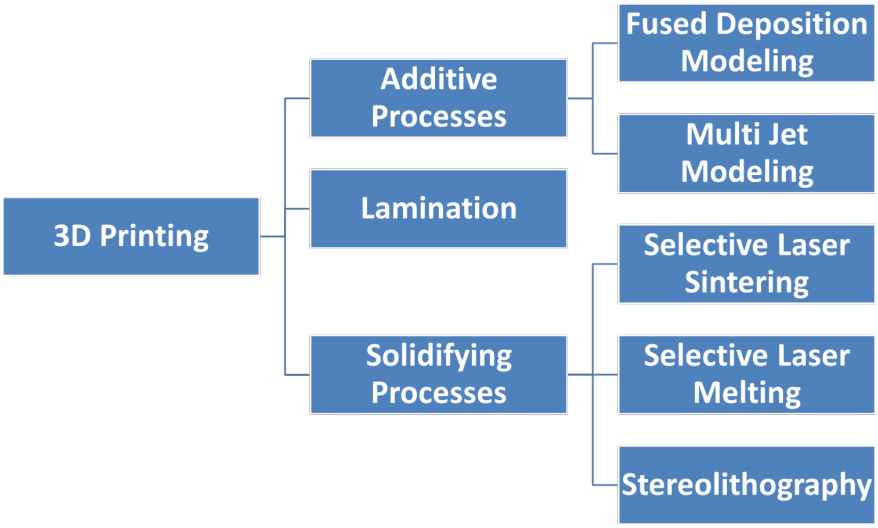

Figure 23: Overview of common 3D printing methods. (Image Roser)

There are a couple different **3D printing technologies** in use. With all of them, the part is built up in layers by a printer. These processes can generally be divided into additive processes (where material is added selectively), lamination (where layers are glued on top of each other), and solidifying processes (where an already-present material such as a powder or liquid is selectively solidified).

7.2.1 Fused Deposition Modeling

Overall, two different approaches are common. The first is adding material through a nozzle to build up the part. This is also called **Fused Deposition Modeling** or sometimes Extrusion Deposition. Basically, soft material (usually plastic, especially ABS, but sometimes also metal or even chocolate!) is squeezed out of a nozzle. As the nozzle moves over the workplate, layers of material are added, eventually building up a part.

The technology can use different colors by switching to different plastics, and it is probably the cheapest of all 3D printing techniques.

7.2.2 Multi-Jet Modeling

Multi-Jet Modeling is somewhat similar to Fused Deposition Modeling, except that there are many nozzles in one row. There can easily be two hundred or more nozzles in one row, which all pass over the product and add a new layer. You can compare this to inkjet printing where multiple jets also work in parallel. The process works with wax and plastics.

7.2.3 Lamination

Yet another technique I have seen at Euromold is **lamination**. Here, standard A4 paper (or, alternatively, endless rolls of paper or plastic film) is used to build up the layers of the part. On a sheet of paper, glue is added selectively before another sheet of paper is pressed on the first. This sheet of paper is then cut along the edges of the final product, then in a rectangular pattern around the product to make it easier to get the part out later. Optionally, a color inkjet printer colors the cut edges to give the final product not only shape but also color. The resulting object feels almost like wood. However, I'm not sure how frequently this approach is used in industry.

7.2.4 Selective Laser Sintering

Selective Laser Sintering (for metals also known as Direct Metal Laser Sintering) is probably the most significant 3D printing technique in industry. A thin layer of powder is selectively heated and solidified with a laser, then the next layer of powder is added to build up the part from layers. The major advantage of this approach is the wide range of materials that can be

used. You can sinter metals including iron, aluminum, titanium, silver, gold, and platinum (jewelry, anyone?), ceramics, and a wide range of polymer powders.

The ability to produce parts from different materials makes this technique very suitable for industry use. For example, if you need an injection nozzle, plastic will not be strong enough but titanium will be. Hence, this appears to be the most significant 3D printing technique used in industry.

7.2.5 Selective Laser Melting

Selective Laser Melting is, in principle, very similar to Selective Laser Sintering. A laser beam heats the powder. The difference is that with Sintering, the laser melts only the surface of the powder granules, whereas with Selective Laser Melting the powder is melted completely. Selective Laser Melting produces parts with higher quality material structure, whereas sintering may have small cavities inside the material. In practice, however, Selective Laser Melting and *Selective Laser Sintering* are often used interchangeably.

7.2.6 Stereolithography (Photopolymerization)

Stereolithography (or Photopolymerization*)* solidifies selected areas of liquid polymer. A bath of liquid polymer is selectively solidifed using laser, UV beams, or other sources of light. After each layer is added, the part is then submerged another fraction of a millimeter and covered with more liquid polymer before the next layer is added. However, the polymer is expensive (most materials for 3D printing are, but the polymer particularly so), and I believe it is also messy.

7.2.7 Miscellaneous Other Techniques

A number of other techniques are also used in research and industry. These include:

- **Electron Beam Freeform Fabrication**: Similar to Fused Deposition Modeling, but using metal wire
- **Electron beam melting**: Similar to Selective Laser Melting, but using electron beams instead of lasers
- **Plaster-based 3D printing**: A binding agent or glue is sprayed onto a powder, solidifying the powder

7.3 Some Observations from Euromold

The technology of 3D printing is slowly maturing. Some of the product samples on Euromold clearly have an industry purpose, such as titanium injection nozzles with complex internal geometries, aluminum injection molds, and plastic air channels.

Nevertheless, the vast majority of samples came straight from Dungeons & Dragons, with exhibition booths crawling with elfs, dragons, storm troopers, and scantily clad but heavily armed female figurines. However, creepiest by far was a 1/3rd-size color model of the head of the dealer attending the booth, including hair loss, puffy cheeks, and all. He himself was average looking, but having a small-scale replica of him staring at you was just strange.

One approach that I also found interesting was a 3D sintering printer were the material was not added on a horizontal layer but **on a 45-degree slope**. This allowed the production of infinite parts where new layers were added on one side while the complete part emerged out of the metal powder on the other side (with appropriate support so it didn't shift while the other end was being printed). Very interesting technology.

Another interesting bit was a 3D printed plastic part where the **stiffness of the part varied throughout the product**. One end of the complex plastic tube was quite flexible while the other end was stiff. This was not achieved through geometry like ribs or supports, but rather through a gradual change in material property as the part was printed. Cool!

7.4 The Future of 3D Printing

I believe that **3D printing will become more important in the future**. Already, many parts used in industry are printed rather than manufactured the traditional way. The F/A-18 Hornet fighter jet already uses ninety parts that came out of a 3D printer. 3D printers can make internal geometries that would be difficult or impossible to produce in conventional ways (imagine, for example, a cork screw shape inside of a solid block of metal). Multiple parts can be printed in one go, already assembled. Peter Schmitt, PhD student from MIT managed to print an entire clock in one go, including all gears, chains, etc. in situ.

However, while some people have already announced the end of manufacturing, this is a long way off, if at all. 3D printing is still expensive and best used for small batches of parts. Making one part is a rather slow process, so for mass production there are often more applicable techniques available. Even so, more and more parts in industry are printed, and we have certainly not seen the end of it yet.

7.5 3D Printing and Lean Manufacturing

3D printing will also certainly **help lean manufacturing**. The advantage is the speed of production. Furthermore, since little manual labor is involved, there is no benefit of printing it in China and then shipping it to America or Europe. Hence, 3D printing will increase flexibility in manufacturing. Spare parts may now simply be printed, rather than digging out 15-year-old tools and models just to build a single part. Already, 3D printing of plastic parts helps manufacturers cover hiccups in their regular supply chain. Overall, for small quantities of parts, the speed and flexibility of 3D printing will often more than offset the additional cost of the printing process.

For these reasons, I'm quite sure 3D printing will continue to spread as technology improves, speed goes up, and prices go down.

8 Make Your Plant Tour a Success!

Christoph Roser, September 22, 2013 Original at
https://www.allaboutlean.com/plant-tour/

Figure 24: Airacobra fighters and Kingcobra fighters aircraft assembly line. (Image unknown author in public domain)

There are thousands of things to see during a plant tour. However, if you really want to know how good the plant is, there are a couple of tricks on what to watch during the tour. This post will give you a few **quick but reliable metrics to estimate the performance of the plant**.

Update: Due to popular demand i have added a Lean Shop Floor Visit Checklist.

Surely you've visited a manufacturing plant before. As for me, even though I've been in hundreds of plants, I always find the experience overwhelming. There is a mass of machines, workers, parts, and tools. Additionally, a guide tries to give you an overview of the plant, usually ripe with technical terms, abbreviations, and local plant lingo that you can barely hear over the noise of the work. In short, the deluge of information easily overwhelms you, and after the tour you only remember that the machines were green (in older plants) or grey (in more modern plants). As for what you could have learned about the plant, it may have been a waste of time.

This offers suggestions to help you get the most out of your plant tour. The key of the tour is **FOCUS**! Don't try to take in everything. Rather, focus on different areas of interest. Decide what you're most interested in before you visit, and then focus on that topic. Another of my posts talks about how visitors are manipulated during a plant tour in order to keep them in the dark.

8.1 Efficiency

One area many visitors are interested in is **efficiency**—how well does the plant run? This is very important if you're a high-ranking manager visiting one of your plants, if you want to evaluate a purchase of the plant, or if you're interested in a joint venture. In these cases you want to know how well the plant is run.

8.1.1 Workers

Figure 25: One, two, three, four… (Image unknown author in public domain)

One element to focus on are the workers. **How many of them are working productively, and how many are not?** This is actually rather easy to do. Just check how many workers you can see, and how many of them are working productively in the moment you look at them. And, by working productively, I mean actually working on a product and creating added value for the customer. Here are a few things that don't count:

- Transport
- Walking around
- Waiting
- Talking

Only true "hand-on-the-metal" work counts as productive. The number of productive workers compared to all workers is a very good measure to quickly get the gist of a plant's productivity. And these numbers may surprise you. Among the best I have seen is within Toyota plants, where between seven to nine out of ten workers are actually working. This is best of bench(mark).

In an average Western plant, these numbers don't come anywhere close to Toyota's performance. In my experience, only around five out of ten workers are actually productive, while the rest may still be busy but not productive. I've even seen plants where only three out of ten workers added value to the customer. Imagine the waste if more than half of your workers do not create value for the customer!

In any case, **the percentage of workers adding value is a quick and dirty but reliable check of a plant's productivity.** It certainly beats any official numbers you get from plant management staff who mainly want to look good. Hence, official numbers are usually highly unreliable if not outright fudged.

8.1.2 Machines

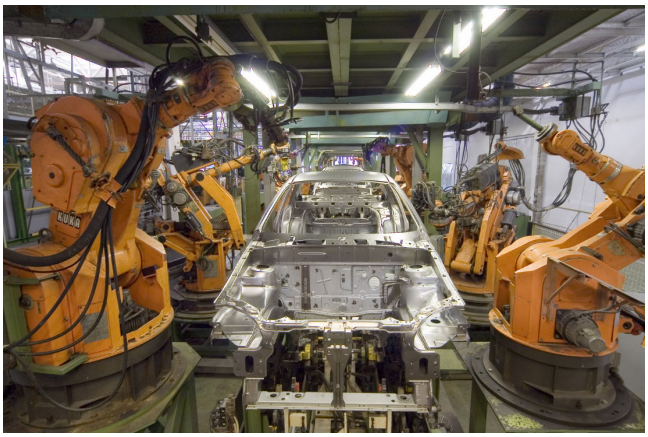

Figure 26: Hey! – Second on the left is not moving! (Image Mixabest under the CC-BY-SA 3.0 license)

You can repeat the same exercise for machines. **How many machines are actually working when you look at them?** An average Western plant may have around three to five out of ten machines actually working. Again, being under repair or set up for the next job does not count as work.

While at first glance these numbers are even lower than for worker productivity, this is actually the way it's supposed to be. Machines are usually highly specialized, whereas human workers are much more flexible. Or, as NASA put it:

Man is the lowest-cost, 150-pound, nonlinear, all-purpose [] system which can be mass-produced by unskilled labor.

Hence, it is better if your machines wait and your workers are busy than the other way around. Overall, counting workers tells you more about the plant than counting machines, but counting machines may be useful for highly automated lines (for example, robotic car body welding lines).

8.1.3 Inventory

Figure 27: A lot of stuff! (Image Axisadman under the CC-BY-SA 3.0 license)

Yet another area of interest for many visitors is **inventory**. In a Western view, lean manufacturing is often associated with low inventories. While this is an oversimplification, high inventory is an indication of a poorly run plant. It's a bit more difficult to understand the inventory situation from a plant tour, but it is possible. First of all, check for some obvious signs of dead inventory:

- Look for dates on material sheets or inventory stickers. While the vast majority is naturally pretty recent, try to find the oldest ones. I frequently find lots of boxes in excess of five years of age.
- Look for dust. The thicker the layer of dust, the older the part. Naturally, you have to adjust this for the environment (for example, two days in a foundry will create a thicker layer of dust than twenty years in a semiconductor fabrication).
- Are there any blocked stocks or stocks that are not to be used for quality or other reasons? A key telltale sign is red stickers warning against the use of the material, often giving the reason. Very interesting information!

Of course, the question of what's good and what isn't depends on the details of the business. A plant for spare parts or low-volume, high-variety production may necessarily have much older stock than a high-volume mass-production plant. The value of the product is also of interest. Where lack of hard data exists, size or weight give a rough estimate of value. Hence, a two-year-old pallet with tons of material may be worse than a two-year-old box of screws.

It's sometimes also possible to estimate the **reach of inventory**. Look at how often the inventory is moved (for example, how often someone takes out a box or a pallet). Relate this to the total inventory on hand. So, if three pallets were taken out in ten minutes' time, but the storage holds around one thousand pallets, then there are enough parts for 333 times ten minutes or around seven shifts' worth of work.

Again, doing this exercise at the incoming goods area at a Toyota plant gives around two hours' worth of material, whereas in the Western world it may be closer to two weeks' worth of material. Again, different businesses need different inventory levels.

However, be aware that your observations apply only to the material you see. It doesn't apply to the material on the road or the material stored elsewhere. **Many Western plants pride themselves on their low-inventory reach but conveniently forget to mention the outsourced but still-paid-for warehouse across the street with another two weeks of inventory.** And, for the record, carrying your stuff across the street within two days does not count as *Just in Time* delivery.

8.1.4 Order & Cleanliness

Figure 28: Of course we are top-notch clean and organized! (Image Jet Lowe in public domain)

Finally, you can look at **order and cleanliness**. If you have ever heard of 5S, that's what applies here. While not a numerical measurement, try to pay attention to the following:

- Does it look orderly?
- Are the machines, parts, and tools clean?
- Are positions of parts, tools, and movable machines marked?
- What kind of signs and markers can you see?
- Are there standard operating procedures on the machines? All of them?

Looking for these kinds of things gives you an impression of the order in the plant. However, since it is not a numerical measure, you would have to compare it with your experience from previous plant visits. Again, for a best of bench(mark) comparison, take a tour of a Toyota group plant.

8.2 Miscellaneous

8.2.1 Quality

If you're interested in **product quality**, there are also a few things you can pay attention to:

- With regard to inventory, are there any blocked stocks or stocks that are not to be used for quality or other reasons? Again, look for the red stickers! Similarly, look for the reject bins. How full are they? How often are parts discarded?
- How are the products treated? Are delicate parts banged around on a forklift?
- Cleanliness on the product itself: Does it look clean? Are there, for example, metal chips on a part that may later damage an internal valve? Are there oil stains where there shouldn't be stains?
- Do the machines look clean and operate smoothly? Toyota legend Taiichi Ohno tells a story of visiting a potential precision tool supplier only to find that the supplier was located under a train overpass, with everything vibrating whenever a train passed over. Or, in a modern sense, is there a two-hundred-ton press next to the precision milling machine?

You can also **look at documentation**. Try to find the quality metrics. Most plants have them, usually at the most important stations. How good are they? Of course, keep in mind that you're looking at a measurement made by someone else and that the definition of what constitutes a problem versus what is "*normal*" may surprise you. If you're not sure, assume the worst.

8.2.2 Manufacturing Standards

You can also check the **manufacturing standards**:

- As above, are there standard operating procedures on the machines? All of them?
- What is the date on the standard? Anything beyond six months is questionable, anything beyond one year is next to worthless.
- Do operators follow these standards?
- Look into a standard. Do you understand it? Does it seem easy to follow, clear, concise, and complete?

8.2.3 Teamwork

To judge the teamwork, have a closer look at the **team meeting corner**:

- Is there a team meeting corner?
- What documentation is there?
- Are there KPIs measured? What KPIs? Are these done by hand or printed out (a sure sign that workers are not involved and don't care about the measurement)?
- Are there problem-solving sheets?

8.3 Final Words

Overall, there a lot of things you can pay attention to. Just make sure you don't overdo it. Like the young tiger hunting for ducks, if you try to catch them all, you'll get none. Clearly **decide on your focus area and then stick with it**. Alternatively, if you're part of a bigger group, spread the responsibility. Have one person look at workers, another one at machines, and so on.

And finally, read my next post on how visitors on a plant tour are manipulated, and what you can do to see through the ruse.

9 How to Misguide Your Visitor – or What Not to Pay Attention to During a Plant Visit!

Christoph Roser, September 29, 2013 Original at
https://www.allaboutlean.com/misguide-plant-visit/

Figure 29: And here's what I want you to know… (Image Bundesarchiv under the CC-BY-SA 3.0 Germany license)

In the previous post I talked about how to have a successful plant tour and how to get the most information out of the visit. Today's post shares the tricks of the trade on **what things the plant does NOT want you to know about**.See through the ruse during a plant tour and discover how good the plant really is.

Update: Due to popular demand i have added a Lean Shop Floor Visit Checklist.

While this post could be used by plant managers as instructions to misguide their visitors, in my experience the plant managers know this anyway. This post is for Very Important People—simply called bigwigs below—to understand **how they may be manipulated**, as well as how they can counteract these manipulations. As such, this post may contain a trifle of sarcasm (o*kay, it contains a lot*). Proceed with caution.

Naturally, the people of the plant want their plant to look good. For that reason, they are very **hesitant to reveal the truth about the plant**. This is especially the case if you're a high-ranking manager (*the bigwig*) trying to decide where to invest your money or which plant to close. But even for normal visitors, looking good may help sell products, keep the plant's reputation up, and retain business. Here are a few tricks plant managers use to make sure their visitors know only what they're supposed to know.

9.1 Paint!

Figure 30*: Quick, he is coming! (Image Elizabeth Vlahos, US Navy in public domain)*

In large corporations, a flurry of activity usually starts preceding a visit from a bigwig. These activities are not aimed at making the plant good, but at making the plant *look* good. This means **painting the walls, cleaning machines and tools, and so on**.

Renovate bathrooms along the carefully planned route (the only time I ever see a bathroom renovated on the shop floor is for a bigwig visit).

Paint walls. Bigwigs surely must believe every plant smells like fresh paint.

Clean everything spotless. I have seen countless operators and supervisors spending hours on their knees cleaning machines for a bigwig visit.

9.2 Hide!

Figure 31:… nothing to see here … (Image Paperbaghead in public domain)

Anything the bigwig is not supposed to be seen is **hidden away**.

- Plan the route for the tour carefully to avoid any troubled areas.
- Close doors and access ways that are usually open for transport to hide the mess behind them.
- Put up temporary or permanent screens or walls to hide whatever is behind, lest the bigwig's eyes be fouled by a glance at a garbage bin area.

9.3 Be Busy!

Figure 32: Busy? Of course we are busy! (Image Lewis G P in public domain)

Of course, when the bigwig visits, the **machines should be running**. This should be obvious, but I was part of quite a number of visits where the machines to be visited were down. Of course, a breakdown can happen anytime, but if the downtime is due to a scheduled maintenance, a planned downtime, or simply an absent operator or missing material, then there are plenty of ways to prevent this.

Furthermore, if there is a shortage of material for the product to be observed, I have also seen complete products disassembled before the visit just to have something to assemble when the bigwig comes around.

9.4 Distract!

Figure 33: Please look at my version of reality! (Image Marion S. Trikosko in public domain)

After painting, hiding, and other measures to create a selective version of the truth, the most important measure is to **distract the bigwig**. Occupy his mind otherwise before he can see something he shouldn't. Popular measures are:

Flood the bigwig with information. Not one, not two, but at least three people from the plant join the tour so that at every moment the bigwig has to listen to someone or something. Of course, the information given does not contain anything negative or critical. The possible exceptions are some pseudo problems in order to not appear perfect and hence suspicious.

Focus the tour of the bigwig on good areas, go there in detail of all the good things, and glance over or completely avoid anything problematic. It is best to not even go there.

Make sure the bigwig doesn't talk to anybody who may reveal nasty truths. Shop floor operators should be instructed accordingly, and should refer any questions to a manager who knows what to say and what not say. However, in my experience this is rarely a risk, since bigwigs usually don't talk to little people anyway.

Finally, get the bigwig away from the shop floor as soon as possible and into a conference room where you can show him the slides that the plant management spent the better part of the last two weeks preparing and polishing. If the bigwig insists on a shop floor visit, simply print out the slides and put them on a board on the shop floor. He'll think he's doing a shop floor visit, but he still gets the filtered truth through slides.

Do all of the above and the bigwig will surely have no clue about the true situation of the plant. Unless, of course, he knows …

9.5 How to see through the ruse!

If you're a very important person (the *bigwig*) who not only wants to show his presence but really wants to understand the plant, there are a **couple of tricks to see through the ruse**. First of all, if you have not yet done so, read my post on how to make your plant tour a success. And then follow the guidelines below:

- Arrive unannounced. If the plant has time to prepare, they will. Countless hours will be spent both in the office and on the shop floor to prepare your visit. Budgets will be reallocated for fresh paint and new toilet bowls. Save your corporation the effort and money and visit unannounced or on very short notice if possible.
- Don't stick to the tour. Decide yourself where you want to go, look behind closed doors, and deviate from the carefully prepared route. Also, don't hesitate to watch an area for ten minutes or more. It's amazing what you see when you look at a process for a longer time.
- Ignore presentations in preference of shop floor time if you can. And by shop floor time, I mean real shop floor time, not just a presentation on the shop floor.
- If possible, also ignore the presenter or guides. Rather than trying to listen to official talk, focus on the shop floor as described in my previous post. I find a guide—even one with best intentions—often more distracting than helpful. If you can go on your own, then do

so. As a compromise, do one part of the tour with a guide to get the basics and then visit the shop floor again yourself.

- Talk to people on the shop floor. Not only do they know the situation best, they often don't hesitate to give you a true honest opinion. Of course, keep in mind that their viewpoints are not necessarily the viewpoints of the enterprise, but their information is useful nevertheless.

Do all this and you should get a much better view of the true situation than you're supposed to have. Don't just take over the official plant opinion. **Make up your own mind!** Now, go out and improve your Industry!

10 Lean Where You Least Expect It – Toilet Paper Origami

Christoph Roser, October 06, 2013 Original at
https://www.allaboutlean.com/toilet-paper-origami/

Figure 34: Toilet paper triangle fold example. (Image Roser)

Standardization, visual management, and process confirmation are some important elements of lean manufacturing. Here we have an example many of you are probably familiar with – toilet paper folding at hotels. This simple example can clearly demonstrate the value of Standardization, visual management, and process confirmation.

Lean principles can be found almost everywhere in industry. This is not only limited to manufacturing, but also includes health care, administration, service, banking, military, and many other fields. One particular place where I love to observe lean principles is at hotels. Surely you've noticed how they fold the end of the toilet paper at some hotels. I assume you're familiar with toilet paper, but I also believe you don't fold the paper over in your own home. So why do hotels do that? Why go through the additional effort of toilet paper origami in a place where every minute counts? The answer can be found in lean principles.

10.1 Folding the Paper looks neat!

The first reason most people come up with for toilet paper origami is neatness. It simply looks nice and professional, with no unsightly jagged edge. It is designed to impress the customer and give style and class to the hotel. It's also said to increase the tips given to housekeepers. This is particularly true with the more elaborate folding patterns. Some hotels even manage to fold a resemblance of their logo into the toilet paper. Looking neat and classy is certainly one aspect of toilet paper origami, but there is much more to it.

10.2 Missing Paper looks Bad

Figure 35: Uh-oh… (Image Roser)

Let's look at it from the other side. How could a hotel leave a bad impression to the customer, particularly in the bathroom? Assume a customer uses the bathroom, conducts his business, and

upon completion reaches for the toilet paper. Except—it's all gone. Any fanciness, style, or good impression a hotel tries to leave with the customer vanishes in an instant if there is no toilet paper when you need it. In short, *there should always be TP*.

Ensuring availability of such working materials is, of course, the responsibility of the hotel staff. They have to check if there is still enough paper left and replace rolls as needed. Basically, it would be enough to just look at the roll and decide whether to replace it or not. However, **humans make mistakes**, and overworked and underpaid hotel maids rushing from room to room to make their quota are no exception.

10.3 Visual Confirmation of Standard through Toilet Paper Folding

Figure 36: Toilet paper diamond fold example. (Image Roser)

That's where the toilet paper folding comes in. By making folding the paper part of a standard, it also ensures that there is paper. If the staff has to fold the paper, they are forced to look at the roll for at least the few seconds it takes to create the triangle. This makes them much more likely to notice if the roll is low on paper. If the roll is completely out, they can't even do the folding. Hence, this little bit of effort greatly increases the likelihood of toilet paper availability to the customer. The standard itself serves as an aid to check for paper availability.

Yet, there is even more lean in this operation. The folding of the paper also allows for a **visual management**. When checking the performance of their staff, hotel management can walk into any bathroom and see at first glance if the availability of toilet paper was checked by housekeeping. In lean terminology, this is called a process confirmation. If the hotel operates on a "*just look for TP*" standard, there is no chance for management to see if the standard was followed, unless the rolls are empty. With toilet paper origami, it is obvious.

Figure 37: Toilet paper diamond and fan fold example. (Image Roser)

Another example of lean standards in a hotel bathroom would be the arrangement of other convenience products such as toothbrushes, soaps, body lotions, shower caps, shoe shine, and so on. These are also usually arranged nicely and orderly somewhere in the bathroom.

Besides looking neat and impressing the guests, setting up this standard arrangement forces the staff to mentally go through the list of items and replace them as needed. Similarly, management can see at one glance if the staff took care of these items and if any one of them are missing.

If you want to dig deeper into toilet paper origami, there are entire websites dedicated to this topic (for example, Origami Resource Center and Toilet Paper Origami), and toilet paper origami even has its own Wikipedia article on hotel toilet paper folding. **Now, go out and improve your Industry!**

11 Japanese Multidimensional Problem Solving

Christoph Roser, October 13, 2013 Original at
https://www.allaboutlean.com/japanese-problem-solving/

Figure 38: Don't try just one … (Image Bill Ebbesen under the CC-BY-SA 3.0 license)

In the West, the standard approach for problem solving is to take a good look a the problem, after which a solution approach will pop into someone's head. This approach is then optimized until the problem is solved. However, while this often ends up with one solution, it usually is far from the best solution possible. In Japan, a very different **multidimensional problem-solving** approach is common. Rather than just use any solution that solves the problem, they aim for the best solution they can find.

There are a number of well-known Japanese problem-solving techniques for managing issues and finding their root cause. This post will focus on the multidimensional decision used to find a solution, which is surprisingly simple and highly successful but still mysterious to many westerners.

11.1 Problem-Solving Environment

Let's first review a few of the well-known methods in the Japanese problem-solving toolbox:

11.1.1 Problem Solving Overview: A3

The *A3* is named after an A3 sheet of paper, since the goal is to fit all information related to the problem solving on one sheet of paper. Ideally, the sheet should be a working document and hence handwritten, but in the West a computer document is often preferred. There is no fixed list of points that go on the A3, but it usually includes:

- A description of the problem
- The current state
- The goal of the problem solving
- A root cause analysis
- A progress status
- Confirmation of problem solution
- Organizational information like responsible parties, date, approval, etc.

11.1.2 Root Cause: 5 Whys

The *5 Whys* method is based on Taiichi Ohno's approach, at Toyota, of asking "Why?" five times in a row. The goal is not to accept the first answer but rather to dig deeper to fully understand the root cause of the problem.

11.1.3 Root Cause: Fishbone Diagram

Finally, there is the **Fishbone Diagram**, also known as the herring-bone diagram or cause-and-effect diagram. If you want to sound fancy, you could also say Ishikawa Diagram. Few people will understand, but it makes you look impressive. The aim is to address the problem from multiple different directions, graphically represented by a fishbone. The head is the problem, and the bones are the individual possible causes that are analyzed. The causes can be specific to the particular problem, but in industry, the following are also common:

- Machine
- Method
- Material
- Man
- Measurement
- Mother Nature

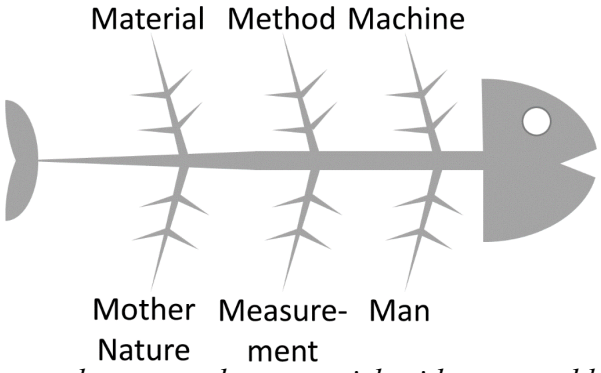

Figure 39: … in case you have some bones to pick with your problem … (Image Roser)

11.2 Japanese Multidimensional Problem Solving

As said above, in the Western world one problem solution is selected and then optimized until it solves the problem. However, in Japan, an approach with a multitude of different solutions is common. Especially for complex problems, this **multidimensional approach** yields much better results than a Western uni-dimensional way.

Let's take, for example, the development of the Toyota Prius hybrid gasoline–electric vehicle. The goal of Toyota was to develop a new highly environmentally friendly vehicle. Western car makers had long ago decided to pursue the hydrogen fuel cell as the basis for such vehicles, and spent any years in vain trying to get those vehicles functioning well even as prototypes.

Toyota, on the other hand, did not decide what type of vehicle they wanted upfront. Rather, under the leadership of Takehisa Yaegashi, they evaluated different design possibilities. In their first round, they looked at a whopping eighty different possibilities to power the car, including electric, gasoline–electric hybrid, diesel–electric hybrid, high-efficiency diesel engines, high-efficiency gasoline engines, liquid hydrogen fuel cells, gaseous hydrogen fuel cells, and many more.

They evaluated each one to some extent before they selected around thirty design options that had more potential. These thirty designs then went into the next round, with more detailed analysis, simulations, and evaluations, and were narrowed down to the ten designs that went into the last round. Those ten designs were each looked at in even more detail with even more analyses, and then the gasoline–electric hybrid emerged as the winner and the power system for the Prius model.

The resulting product was a wild success for Toyota. While other well-established car companies with years of fuel-cell research initially laughed at the weird concept, they didn't laugh for long. **The Prius became a bestseller, within two years even a profitable bestseller, and it gave a huge boost to Toyota's image as advanced and eco-friendly.** Other car makers then scrambled to copy the success, but they are still one to two years behind Toyota with their vehicles.

11.3 Do I have to come up with eighty different solutions for all my problems now?

Of course, the size of the solution space and the effort put into has to be in reason with the size of the problem. The development of a new car costs between one and six billion dollars (that's right, billion, not million). Hence, before investing enough money to buy a small country, it is well worth it to evaluate all options before placing your bet.

On the other hand, if your problem is smaller, you may work with fewer design evaluations. One problem where I have repeatedly used this approach with much success is organizing the layout of a plant or a plant section. Rather than moving all hardware around on a floor plan until it fits, I prefer to create different plans instead.

Using a **multi-functional team** with members from management, operations, planning, and production, I create multiple solutions. If the team is large enough, I even split them into groups of three to four people (a great size for teamwork) and have them create designs independently. Hence, I end up with two or thee designs in the first round. I intentionally keep the members on a very tight schedule, since at this stage I want only a rough sketch rather than a detailed and installation-ready plan. Thirty to sixty minutes is plenty for this purpose.

Next, we compare the designs, pushing people along the learning curve for this particular layout problem. Afterward the teams are mixed and given certain requirements for the second round. In my experience, after two rounds with four to six different designs, the teams have explored the possible design space much better than they possibly could have with a single design.

As a next step, we could either select the winner (inevitably one of the designs from the last row), or—my preference—have all team members come together and build the best design based on the four to six designs we have so far. Overall, with less than ten people and less than one workshop day, we create a new shop floor layout that everybody feels good with and that incorporates the best ideas out of multiple designs.

I have personally used this multidimensional approach to problem solving successfully for many different problems, including shop floor layout, part design, information flow design, efficiency improvements, and many more. This approach has never failed me.

I sincerely hope that this method will also help you with your daily work, and I wish you much success. Now, go out and improve your Industry.

12 Lean Shop Floor Checklist – Top 4 KPI to Watch in the Factory

Christoph Roser, October 20, 2013 Original at
https://www.allaboutlean.com/shop-floor-visit-checklist/

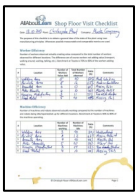

Figure 40: Check my List! PDF File at https://www.allaboutlean.com/wp-content/uploads/2013/10/AllAboutLean.com-Shop-Floor-Checklist.pdf. (Image Roser)

Due to popular demand related to my two posts on "Make Your Plant Tour a Success!" and "How to Misguide Your Visitor – or What Not to Pay Attention to During a Plant Visit!," I have created a **checklist for a lean visit to a manufacturing shop floor** for you to download. Take this checklist with easy-to-use metrics during your shop floor visit to make yourself independent of potentially misleading data given to you by the shop floor staff. Metrics include worker utilization, machine utilization, inventory reach and turnaround, and order & cleanliness.

You can Download the Lean Shop Floor Visit Checklist here.

The checklist has the most important metrics related to efficient plant operations that **can be observed quickly and without much effort**. This checklist is based on the posts:

- "Make Your Plant Tour a Success!"
- "How to Misguide Your Visitor – or What Not to Pay Attention to During a Plant Visit!"

If you have not yet done so, read these two posts beforehand. I especially recommend the latter post on how plant managers try to hide the flaws of their plants so you'll be better able to see through the ruse.

Feel free to use this checklist while visiting a shop floor. If you have any feedback or ideas for improvement, please do not hesitate to contact me.

And again, if you missed the link above: You can Download the Lean Shop Floor Visit Checklist here.

13 Seven Gadgets for the Basic Lean Toolkit

Christoph Roser, October 27, 2013 Original at
https://www.allaboutlean.com/lean-toolkit/

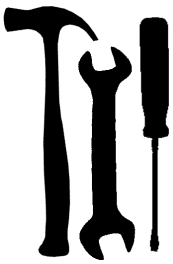

Figure 41: A lean tool box. (Image Roser)

Lean happens on the shop floor. When working hands-on in manufacturing, there are a number of items that can help you. Throughout the years I have optimized a small **lean toolkit** that I bring with me for my everyday practical work. Here are seven gadgets that help me to do lean on the shop floor.

For an Extended Lean Toolkit that I bring only when needed see my second post.

13.1 1: Focusable Flashlight

One item I find very helpful to have on the shop floor is a **focusing flashlight**. Often, when talking with others, I find the need to point out something at a working machine or process. Now, for obvious reasons, I am very hesitant to stick my fingers inside working machinery. If the safety stop works, then there will be an interruption of the process. If the safety stop does not work … well … let's not go there.

Hence I need a **pointing device** that does not interact with a machine. Initially I thought of a laser pointer. However, the laser may shine on metal parts and reflect into someone's eye. Even with a low powered laser I prefer to avoid this. Even worse, some machines have an automatic fire-extinguishing system that reacts on flashes. I don't want to evacuate the shop floor because the Halon fire-extinguishing system activated. Such things make you unpopular on the shop floor (Note: hasn't happened to me yet). Even if it the light hits only some optical sensor, it may mess up the quality of the product.

The solution: a **focusing flashlight**. The beam can be set narrow enough to point out an area on the machine, yet the light is not strong enough to interact with mechanical or biological optics. My flashlight of choice is the Led Lenser flashlight from the P series, for example the ultra compact LED Lenser P2, LED Lenser P3, or – my preference – the significantly brighter LED Lenser P5. All of these use LEDs and hence have a long battery life. Additionally, the focusing system gives a clear and precise ring of light, with a slightly blue hint around the edge. This makes pointing even easier.

As well, I've also found this flashlight very helpful when looking into dark corners, such as on the inside of boilers, pipes, or other larger products found in some factories.

13.2 2: Solar Calculator

Image of solar calculator from Amazon removed due to copyright reasons.

Often, while on the shop floor, we want to make a quick back-of-the-envelope calculation. Now some people are really good at calculating in their head – but I am not one of them. Hence, I usually carry a Cheap Solar Calculator around with me. A solar calculator carries advantage of not running out of battery power, and a cheap calculator works because its basic functions are quite sufficient for lean on the shop floor.

13.3 3: Stopwatch

Image of stop watch from Amazon removed due to copyright reasons.

The next thing I often need is a Stopwatch. One important aspect of lean is speed, and so there is often the need to measure the speed of machines, processes, transport times. and much more. I carry a digital stop watch with me for these.

However, before you whip out a stopwatch, there is one important thing to realize. In many factories, workers are allergic to stopwatches. Like anybody else, they do not want to be measured, especially not if it determines their workload or salary. Hence you should check with management, workers, and unions beforehand if you want to measure times. Only after the all-clear should you start to take times.

Also, while most modern stopwatches have lots of bells and whistles, they tend to confuse the occasional user. Try to get a simple stopwatch. A suggested search keyword here is "child friendly stopwatch"

13.4 4: Measuring Tape

Image of measuring tape from Amazon removed due to copyright reasons.

Yet another item I occasionally need is a Compact Retractable Measuring Tape . . Here, two tape features are important: compactness and the ability to lock the tape. The length is not important. My tape is only 1 meter long (I work metric), and this is quite sufficient for me. **I prefer compactness over length**.

I use the tape to measure how many rollers there are per meter on a rolling conveyor, and how many more I need to put them closer. For longer distances, I estimate by counting my steps (the average step length of an adult is around 70 cm or around 27 inches). This is good enough for an initial measurement in most cases.

13.5 5: Pens

Image of ballpoint pen from Amazon removed due to copyright reasons.

Of course, pens for note-taking are always important. I spent quite some time researching the perfect pen, and ended up with Uni-ball Jetstream Retractable Roller Ball Pens. These are simply the best disposable pens you can find outside of Japan (Japan has amazing pens!). The Jetstream dries quickly, writes smoothly and without effort, and does not bleed. It is not the cheapest pen available, but at around two to three dollars per pen it doesn't break the bank if you lose one either. Just make sure you get the retractable version, otherwise there is the risk of loosing the cap. If you use a fine point or a bold point is up to your personal preference.

13.6 6: 3×3 inch Post-it Notes

Image of post it notes from Amazon removed due to copyright reasons.

.With regard to paper, I am a huge fan of Post-it Notes, especially the 3×3-inch size. They are cheap, they fit in any shirt pocket, and they stick to many surfaces if needed. I have attached Post-its to machines, made manufacturing simulations using Post-its on a white board, and organized my notes by sticking Post-its onto other paper in my folder.

Of course, there are better options if you do intensive note-taking, but for quick note-taking on the fly I love Post-its.

13.7 7: Belt Pouch

Image of belt pouch from Amazon removed due to copyright reasons.

Finally there is the issue of where to store all this gear. Female lean experts have the ability to carry around a handbag, but for males this can look odd. Stuffing your pant pockets doesn't

look professional either. I ended up using a belt pouch and settled for the Maxpedition M-2 Waistpack, as it was big enough for my stuff but not so big that it's in the way. Plus, it had two loops for pens. This small pouch has served me well on multiple occasions on the shop floor.

13.8 In Addition: Smart phone

Nowadays most people – including me – carry a **smart phone**. Of course, this can replace the calculator and the stopwatch above. There are even custom apps (both free and paid) to support the observation of operators using an MTM or REFA system of predetermined motions. However, I like the haptics of a real calculator and a stopwatch over my smart phone, but if you prefer your mobile phone then go for it.

This **lean tool kit** has helped me many times when doing lean on the shop floor. Additionally, it also impressed my colleagues and clients. I hope this list of tools will also hep you with your work in lean manufacturing. Now go out and improve your industry.

13.9 Summary

I highly recommend the Led Lenser flashlight, M3 Post-it notes, and Jetstream pen. Feel free to choose any brand that suits you with the other tools, and please let me know if you have any additions. Don't forget to check out my other post on my Extended Lean Toolkit that I bring only when needed. I hope this list helps you with your lean implementation. Now go out and organize your industry!

14 Know Your Priorities!

Christoph Roser, November 03, 2013 Original at
https://www.allaboutlean.com/know-your-priorities/

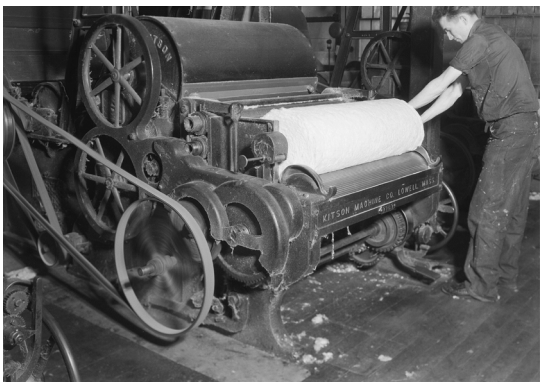

Figure 42: Is this really your focus area? " (Image Lewis Wickes Hine in public domain)"

The concept of **lean manufacturing** originated on the shop floor at Toyota. Since then it has expanded into many other areas, including but not limited to lean healthcare, lean administration, lean logistics, lean services, lean hotel, lean military, lean banking, or any lean whatever topic. There is even a lean government, albeit I am somehow skeptical on that one. Even so, most practitioners of lean work in manufacturing. Hence it comes as no surprise that most lean efforts are focused on the shop floor. However, while there is usually much improvement potential on any given shop floor, it is not necessarily the area you most want to improve.

14.1 What Else is There Besides Manufacturing?

The key question is, where is your biggest priority in your industry? Where can you generate the most *bang for the buck* with your improvement efforts? It may not necessarily be the shop floor. In a worst case scenario, your efforts may be for naught simply because you're working in an area that isn't relevant to the company's success. I learned this the hard way through working on different shop floor improvement projects for companies where manufacturing did not matter. Management attention was somewhere else. While my projects discovered significant potential for improvement and made good plans for obtaining these benefits, they failed in implementation simply because nobody higher up cared about manufacturing in that company. Yes, you read that right: **There are companies where manufacturing is simply not important for their overall success**. Naturally, in a company producing goods, it has to be done, but in terms of priority, it may rank next to tech support or site security. Sure, you do need it, but as long as it works, management doesn't care about the details. Here are a few examples of other areas which may be more important.

14.2 Logistics

Depending on your company, logistic processes may have a much larger impact on the company's success. For example, I had one key experience at a **food manufacturer**. The production plant mixed ingredients, filled them into retail containers, and sterilized the product. The plant had quite large improvement potentials. With a few changes, we could have improved plant efficiency by over 10%. However, with food manufacturing, the focus is not on production but on distribution. The product has to go to the customer while it's still fresh. New products have to be released continent-wide simultaneously. Most of the assets were tied up in the supply chain. Hence, improving the distribution of the goods had a much higher priority than actually producing them.

Figure 43: Producing cold air is even easier than producing hot air. (Image Ildar Sagdejev (Specious) under the CC-BY-SA 3.0 license)

Or let's take an even more extreme example I have seen: **Production of technical gases**. For many gases, the production process is about as simple as it can be: Open the window and cool the air until the different components become liquid. Bottle these, and your production process is done. But then the real challenge starts: getting these gases to the customer. Furthermore, after these gases have been used, you want your gas cylinder back. Unfortunately, not all customers are keen on returning these, and somehow lost (or, to be honest, mostly stolen) gas cylinders are a large part of the company's expense. Overall, a technical gas company is, at its core, more of a logistics company than a manufacturing company, and their improvement focus should be accordingly.

14.3 Construction, Research, and Development

Other companies I have worked with created their value for the customer through construction, research, and development. Key example here are **machine tool makers**. While a few machine tool makers produce generic tools, most customize their machine for the customer. Hence, designing the product is much more important to the success of the company than making it. I personally had projects at different machine tool makers, from cutting-edge technology products to decades-old technologies. In all of the companies, construction, research, and development were more important than the actual production. Don't get me wrong, production was still complex and expensive, but it was not the selling point for the customer. For high-tech machine tool makers, the customer wanted the latest and best model possible, paying a premium for having a machine that was better than the competition's. For low-tech machine tools, there wasn't so much research and development, but the customer wanted a machine that—while using decades-old technology—matched their product needs exactly. Manufacturing was merely a necessary step in the process, but the money was somewhere else.

14.4 Marketing

Other companies sell their products through marketing. There are numerous examples of general consumer products that are virtually identical except for the packaging, brand name, or marketing. Some goods even come from the same production line with the same raw materials, production techniques, and workers, but merely have a different packaging. Even so, the customer is willing to pay a premium for fancy advertising. Key examples are many **food products** or spare car parts.

Figure 44: Say hello to your new friend. (Image Cary Bass under the CC-BY-SA 3.0 license)

In some cases, this marketing impact can be next to hilarious. In 1975 there was a pet rock craze—you could buy a simple, ordinary rock in a box at a premium price as a pet. The product was no different than any other rock you could pick up off the street, yet 1.5 million of them were sold. This is quite an extreme example where production is nothing and marketing is everything.

14.5 Services

Another aspect that may be very important to customers is service. There are certain products where, for example, the up-time is highly significant. An example of this is **web site hosting** for businesses. Installing (or, so to say, producing) the hardware is a minor aspect of the value for the customer. Much more significant is that the system is up and running around the clock. If there is any problem, the customer wants a technician to fix the problem immediately, and the customer doesn't care if it is 4:00 a.m. on Christmas morning. Again, manufacturing has to be done, but other than it being done, it is otherwise of little significance compared to other aspects of the business.

14.6 To sum it up …

Overall, before you start any improvement project, you need to **find out what really matters for your business**. It may be manufacturing. In fact, manufacturing is quite important for many businesses. However, it may also be something else. As shown above, there are many examples where other areas are much more significant than manufacturing. In reality, it is usually a mix for most companies. The key point is that you should be aware of your company's priorities and invest your improvement effort where you can get the most benefit for your business. Take a minute and think about what your customers value most in your company. Now, go out and improve your industry!

15 The Tale of Taylor and Gilbreth

Christoph Roser, November 10, 2013 Original at
https://www.allaboutlean.com/taylor-gilbreth/

Figure 45: Frederick Winslow Taylor (Image unknown author in public domain)

Figure 46: Frank Bunker Gilbreth Sr. (Image unknown author in public domain)

Modern workplace management undoubtedly started with **Frederick Winslow Taylor** (1856–1915), who almost single-handedly created modern industrial management. He was the first to measure industrial work and apply the results to improve efficiency. Even so, efficiency was greatly improved by Frank and Lillian Gilbreth (1868–1924 and 1878–1972 respectively). Unfortunately, Frederick Taylor and Frank Gilbreth were at war with each other. This post looks into the history of how the conflict started, and how Lillian Gilbreth resolved the conflict after their deaths.

15.1 Frederick Winslow Taylor

Frederick Taylor is considered to be the **father of modern management science**. While it was intended for him to study law at Harvard, he instead became a machinist. Starting on the shop floor, he established the entire field of scientific management, often named after him as "Taylorism."

His most famous showcase project was the optimization of workers loading pig iron onto carts at the Bethlehem Steel Company. Through his methods he increased the loading of iron from 12 ton per day to 47 ton per day – albeit modern research showed that he was definitely fudging his numbers there.

In any case, he established the entire field of scientific management by measuring work and trying to improve efficiency.

15.2 Frank Bunker Gilbreth

Like Taylor, Gilbreth started out by working with his hands, in this case as a bricklayer. He started to optimize bricklaying methods, significantly improving the speed of bricklaying, and found himself soon working as a consultant in the field of Taylorism.

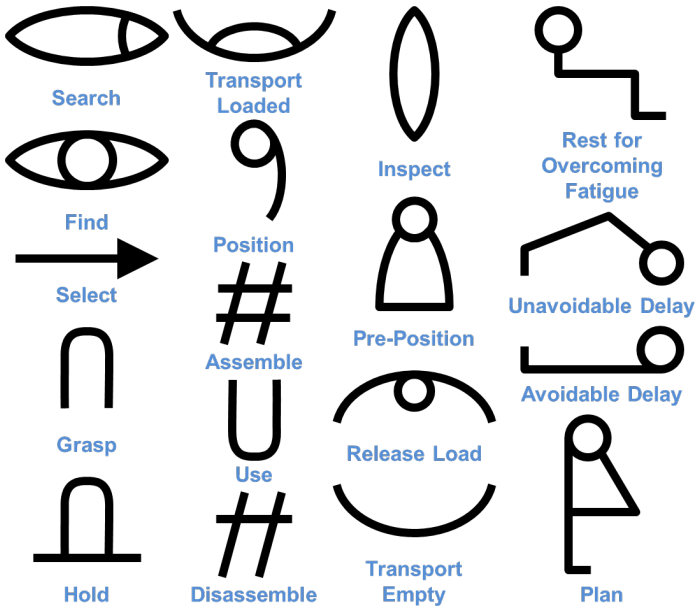

Figure 47: Gilbreth's 18 Therbligs. (Image Roser)

His major contribution was to **divide all human work up into a number of individual motions**, which he called Therbligs, and then optimize these motions to improve efficiency. For example, with bricklaying he created an adjustable scaffold so that the bricks, the worker, and the wall are always at the same height, and hence the worker does not have to bend over or reach up.

He also optimized surgeons' work, establishing the now-common method of a nurse handing the instruments to the surgeon rather than the surgeon turning around and looking for the right tool. By reducing the duration of operations, he increased the chances of patient survival, saved thousands of lives, and pissed off the surgeons after they found out that he used the same methods for bricklayers. Surely those holier-than-thou doctors deserved better than to be compared to a bricklayer. 🙂

Overall, his work was the basis for any system of predetermined motions in use nowadays. His work was also a perfect addition to Taylorism.

15.3 The Conflict

Taylor was good at optimizing work. But even more than that, he was stubborn. Anybody who wanted to work with Taylor had to agree with him or be prepared for an endless fight – and it didn't matter who paid who's salary. Taylor would not hesitate to fight his employers and clients over the right way to do things.

As such, he quarreled with many other researchers. He did initially give Gilbreth credit for his work, but he soon started to quarrel with him too. Taylor considered his methods unsuitable. After Taylor's death, his Taylor society even kicked it up a notch, and Gilbreth found himself under constant academic fire from the much stronger Taylor society. They took the approach from Gilbreth – thank you very much – but attributed it to their own society while at the same time trashing Gilbreth.

While Taylor had established a large society of followers, Gilbreth was working only with a small group. Hence, after Gilbreth died, it looked like the Taylor society has won. However, there was one woman who made a difference!

15.4 Lillian Moller Gilbreth

Figure 48: Lillian Moller Gilbreth. (Image Richard Arthur Norton in public domain)

Lillian Gilbreth was a power-woman. She not only studied at university – a rarity for women around 1900 – but even got a Ph.D. in psychology. She also significantly contributed to her husband's research and was one of the first female engineers and the first industrial psychologist. For example, she significantly contributed to the layout of the modern kitchen. Previously, a kitchen had a working table in the center, with shelves on the walls. Hence, women (and it was mostly women in the kitchen in 1920) had to turn around every time they needed something. Lillian Gilbreth established the modern kitchen layout with workspace around the walls, and shelves for tools and ingredients above and below.

She also **gave birth to twelve children**, eleven of whom reached adulthood. If you've ever had a child, you definitely appreciate the work necessary to raise eleven of them! But then, she and her husband also used their skills in organizational efficiency in the upbringing of their kids (if you want to know more, there is a great book, *Cheaper by the Dozen*, which was also made into a film in 1950).

After the death of her husband, she managed to promote her husband's work, consult these methods in industry, and make peace with the Taylor society. Not only did the Taylor society end the conflict, they even acknowledged the contributions of the Gilbreths and praised their work. It is mainly due to her work that the name Gilbreth is now recognized as a major contributor to modern workplace efficiency.

16 Extended Lean Tool Kit for Shop Floor Improvement Projects

Christoph Roser, November 17, 2013 Original at
https://www.allaboutlean.com/extended-lean-toolkit/

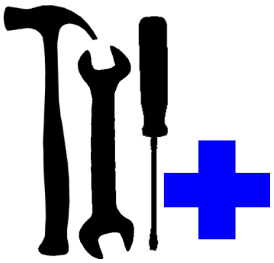

Figure 49: My Extended Lean Toolkit. (Image Roser)

Due to the popularity of my lean tool kit, I present you here my extended lean tool kit. These are items and tools that I frequently use for lean manufacturing on the shop floor, but as opposed to the items from the lean tool kit, I bring these along only if I know I will need them.

16.1 Long Measuring Tape

One of my more common lean projects is to optimize a shop floor. In this case it may help to measure longer distances more accurately than by counting steps. For this I use a 100-foot measuring tape. I find that 100 feet (or 30 meters) is a good compromise between the size of the wheel and length of the tape. If I ever need to measure more (hasn't happened yet), I would just have to measure twice.

However, I am also toying with the idea of getting a laser distance measuring tool. Haven't tried this yet. If you have used a laser tool for shop floor optimization, please let me know. I would love to hear about your experience with it.

16.2 Street Chalk

Yet another tool that has helped me to optimize a shop floor is chalk. This is an excellent aide to mark positions on the shop floor and to help visualize the layout. Whenever I do shop floor optimization, I bring some chalk along. At first I used simply used common blackboard chalk, but these were not strong enough and I ended up with lots of broken chalk.

I soon found the solution: Sidewalk Chalk. Designed for children and lean experts of all ages, they are able to resist quite some abuse and rough treatment before breaking. Additionally, they make nice, strong lines that are visible even from a distance. They even work on less-than-clean floors, as long as the surface is not completely covered with dirt, water, or oil. Naturally, they must not be used in a clean-room environment such as a semiconductor plant, but other than that, they are extremely helpful for shop floor layout optimization. I find that a small box lasts me quite some time. After all – different from kids – I do not need to paint the entire factory floor in different colors but merely add lines and markings. However – similar to kids – I still lose them every now and then. 😉

16.3 Post-it Notes of All Sizes

Yes, I know. I already mentioned these in my first post about my lean tool kit. However, I use way more than just the simple 3×3-inch Post-its. I love to use self-adhesive cards of all types for presentations and workshop management. Besides the already mentioned 3×3-inch Post-it, I also use larger 4 x 6-inch notes, or even full-size Post-it flip charts. Using these, I often cover all walls and windows with notes and create a workshop war room. I also experiment with different shapes, sizes, colors, and stiffnesses; printed lines vs. blank; squared paper; and other variables to find the perfect Post-it for the specific tasks.

16.4 Masking Tape

It is a versatile product that I use for markings on the floor, tables, or machines; attaching notes and flip charts to walls and machines; and attaching things while building a mock-up of an assembly station or production line. For me, the one-inch-wide tape works best and has the most uses. It also is a cheaper alternative to the admittedly rather pricey Post-it flip charts.

16.5 Camera and Tripod

For many workshops, it helps to take videos of the shop floor. It is much easier to optimize change-over processes and assembly processes by looking at videos. To take good videos that don't look like an earthquake is in process, you need a camera tripod. Any reasonably good product will do here, as long as it is high enough to be used while standing on the floor.

As for the camera, any current camera is equipped with HD resolution (1920 x 1080 pixels), so a camera you already have would probably be fine. You may even be able to mount your smartphone on a tripod. Just have a backup plan ready in case you get a phone call. For that particular reason I prefer a separate dedicated camera.

Of course, taking videos of workers should be done only after clearing this with workers, management, and unions. Similar to stopwatch timing, workers are allergic to being videoed. If you (and plant management) want their cooperation, I strongly recommend discussing taking videos with them before actually taking videos.

16.6 Clipboard

If you plan to take more extensive notes on the shop floor, I suggest using a clipboard. Having a firm writing surface makes this task much easier, especially if you use the excellent Uni-ball Jetstream Retractable Roller Ball Pens. As for the clipboard, any reasonably good product will do.

I hope this list helps you with your lean implementation. Now go out and organize your industry!

17 Internal Threat to the Toyota Production System Due to New Hiring Practices

Christoph Roser, November 24, 2013 Original at
https://www.allaboutlean.com/toyota-hiring-practices/

Figure 50: Mutual trust still valued at Toyota? (Image TommyV50 under the CC-BY-SA 3.0 license)

Toyota with its **Toyota Production System** is the archetype of lean manufacturing, which also makes it to one of the most successful companies on earth. This success is due to outstanding cooperative management at Toyota; however, recent changes in hiring practices threaten the Toyota Production System.

17.1 Toyota – Mutual Respect for Anybody

One of the key factors in the success of Toyota is the **ability of their managers to extend mutual respect to everybody**. They listen not only to their bosses and customers but also to their shop floor workers and suppliers. Objections originating from the shop floor are heard and valued, and taken seriously during decision making. There is a strong sense of cooperation.

Okay, this now sounds like a marketing blurb from any generic Western company. But at Toyota, this was true! In Western companies, instructions and orders flow down in hierarchy, and information flows up (sometimes sparingly and filtered at every level). At Toyota, however, workers and suppliers have a strong say in management decisions.

As a result, **workers and suppliers usually value their work with Toyota**. In surveys of automotive suppliers, Toyota is usually considered the best customer, with this being attributed to their "hard but fair" attitude. Other automotive makers usually receive damming criticism, because everything is about money.

17.2 Example: The Aisin Fire Case

There are countless hard-to-specify but valuable benefits. For example, in 1997, one **Aisin Seiki Co**. factory burned down. This factory was the main source for a brake valve for Toyota, providing 99% of all such valves. Due to the low stocks at Toyota, within a short time all twenty auto plants in Japan stopped working. Outside experts estimated a stoppage for weeks, with costs and losses piling up quickly. It was estimated that each day would cost Japan 0.1% of its industrial output.

Even so, five days later the Toyota factories were up and running again. While the fire was still burning, Aisin and Toyota set up a crisis team, sent 400 engineers to Aisin, and alerted their network of suppliers to the problem. Within hours, other suppliers started to evaluate the possibility of making these complex valves, stopping other orders to make tools, set up machines, and work around the clock to produce these valves. Soon, factories that usually made sewing machines or other parts produced these valves. Toyota was able to start production again

a mere five days after the fire, losing only two full days of production. All plants were back on full schedule within a week.

The kicker: **The question of money or payment was never asked by the suppliers.** They trusted the people at Toyota. And Toyota was worth their trust. Besides paying all expenses, Toyota added a bonus of about $100 million for their efforts.

(Just for a second, imagine managers at Volkswagen or GM paying $100 million voluntarily on top. In my opinion, probably unlikely.)

17.3 Japanese Values in International Business

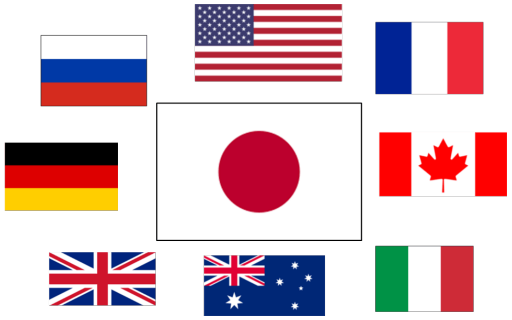

Figure 51: Flags around Japanese flag. (Image Roser)

This Toyota management style of trust and respect works very well in Japan and – I believe – also abroad. However, the Japanese way of listening and cooperation often makes them feel weak when dealing with non-Japanese. In particular fast-talking American businesspeople sometimes make it sometimes difficult for the Japanese to be on an even footing.

In business meetings, fast-talking Americans often dominate the discussion, with Japanese participants mostly listening. It's easy to say who will get the better end of the deal. Overall, many Japanese businesspeople worry that they are too nice or soft during international negotiations.

17.4 Changes in Hiring Practice

Possibly as an attempt to counteract this perceived weakness, Toyota has recently **changed its hiring practice**. Toyota is one of the top companies in Japan, and this allows it to pick the very best from the supply of new workers. Recently, they started to focus on hiring less cooperative and more pushy people. Rather than selecting cooperative recruits, they pick the egoistic ones – those who have to be right and want to push their agenda through.

This may be good for international negotiations, but it will be less beneficial for the very social basis of the Toyota production system. Mutual respect and cooperation is reduced, and the new way will be **"my way."** Already, changes can be seen at Toyota. While before it was absolutely valid to object upward in hierarchy, this is no longer so. If a manager objects, then there is nothing the subordinate can do – except wait until a new manager comes in a few years.

I see this as a very troubling development, one that can threaten the Toyota Production System and, by proxy, the entire success of Toyota.

17.5 Denso – The New Toyota?

There is one company in the Toyota group that manages to stick to the old ways. While most companies in the Toyota group have gone the way of Toyota Motor (or worse), **Denso Corporation** still maintains its culture of trust and respect. At Denso, workers on every level have the ability to change the mind of their supervisors and managers without fear of a management backlash. The underlying culture of the Toyota Production System is still intact at Denso.

Even more, Denso tries to protect its culture from the new breed of managers at Toyota Motor. Most companies within the Toyota group have a very active exchange of workers and managers. Transfers between Toyota group companies are as frequent as transfers between divisions in Western companies. Denso, however, no longer sends its managers to Toyota Motor, instead trying to protect the values that permeate the entire **Toyota Production System** – or shall I now say the Denso Production System?

Sources for the Aisin example:

- Valerie Reitman, "Toyota Motor shows its mettle after fire destroys parts plant," Wall Street Journal, May 8th 1997
- Toshihiro Nishiguchi and Alexandre Beaudet, "The Toyota Group and the Aisin Fire," MIT Sloan Management Review, Fall 1998

18 Hell is Other People – Workplace Conflict between Managers and the Managed

Christoph Roser, December 01, 2013 Original at
https://www.allaboutlean.com/toyota-hiring-practices/

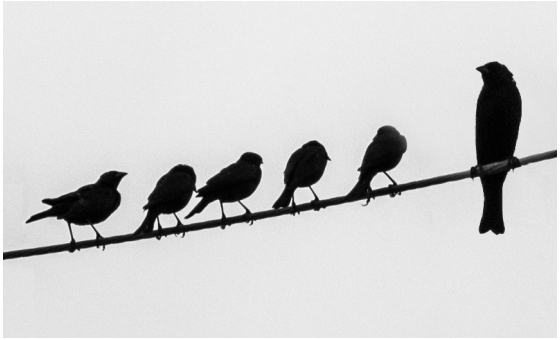

Figure 52: The boss and the bossed ..." (Image Tomascastelazo under the CC-BY-SA 3.0 license)"

Throughout the history of industry, there has been a **constant conflict between managers and subordinates**. For some reason, we just don't get along well with each other. Or, as philosopher Jean-Paul Sartre phrased it, "Hell is other people." In fact, large advances in mechanization and automation were due to managers wanting to take power away from workers or to get rid of workers altogether.

18.1 Examples for Technical Innovation to reduce Workers Influence

There are numerous examples in industry, where conflicts led to more automation and organization to de-power or eliminate workers:

- Honoré Blanc (1736–1801) developed the first interchangeable parts for musket production in France. While this would have significant benefits for repairing weapons in battle, the primary reason was to take power away from strong-minded independent weapon smiths.
- Louis-Nicolas Robert (1761–1828) developed the first continuous paper-making machine (the Fourdrinier machine) primarily to get rid of annoying workers.
- Frederick Winslow Taylor (1856–1915) stated that "it would be possible to train an intelligent-gorilla so as to become a more efficient [worker] than any man can be."
- Henry Ford (1863–1947) complained, "Why is it every time I ask for a pair of hands, they come with a brain attached?"
- Management in the chemical industry was faced with a wave of strikes during the 1950s. They were absolutely thrilled when they found that their computers and automated systems allowed them to run at near full capacity without any workers but only the managers.
- CNC machines during the 1950s and 1960s also lured many customers with the dream of becoming independent of headstrong specialists.
- The CEO of General Motors, Roger Smith (1925–2007), invested the insane amount of $45 billion in robotics to reduce labor cost. The press voted him to be **CEO of the Year 1984**. After his endeavor failed spectacularly, he was soon voted to be one of the Top 10 Worst CEOs.
- Foxconn in China wants to buy one million robots from 2013 onward. The official cause is cost savings, but robots also have the advantage that they do not jump to their death from the factory roof, as many Foxconn workers did.

In sum, management is frequently upset and unhappy about the quality of their workers. While it is not politically correct to say so, many managers dream of a **lights-out factory**, where

machines work on their own and no workers are needed at all. They envision that "no worker" also means "*no trouble.*"

18.2 Lack of Communication between Management and Employees

Of course, in the same way managers are unhappy, workers are also unhappy and upset about their management. As some workers are difficult to handle and may have a lack of social skills, so do the managers. There is a tendency in Western management to mismanage people, ignore their needs, and show them little or no respect. There always needs to be two to fight.

18.3 People as an Asset

Workers can also be a great asset. The skill and experience a worker brings to the firm can greatly benefit the company. Toyota manages to values workers opinions and uses their knowledge for the company's benefit (at least until recently, see my post "Internal Threat to the Toyota Production System Due to New Hiring Practices").

When I am working on a project to improve some operations, I always have extensive talks with the people who do these operations. In my experience, white-collar workers have been asked about such issues before but blue-collar workers have rarely or never been asked about these problems. Yet, it is the blue collar workers who often have some of the best ideas on how to fix things. A lot of expensive consulting could be avoided if managers would just ask their people for ideas. Even so, for some reason, it rarely happens.

Figure 53: Small rewards can go a long way! (Image Roser)

If you work in industry, trying to improve a process or operation, go to your people now and ask them for their opinion. Not only will you probably get some good ideas (mixed with some not-so-good ones, of course), but you will also earn more respect from your people for simply asking them their opinion. Also, if the project works out, don't forget to thank them. And, if you really want to leave an impression, award them with a big bucket of gummy bears! No go out and **improve your industry!**

19 Ten Rules When to Use a FIFO, When a Supermarket – Introduction

Christoph Roser, December 08, 2013 Original at
https://www.allaboutlean.com/fifo-vs-supermarket-part1/

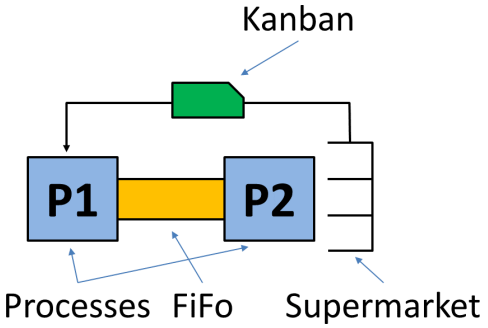

Figure 54: FIFO vs. Supermarket (Image Roser)

It is generally accepted knowledge that a lean manufacturing pull system uses both FIFO lanes and supermarkets to manage the material and information flow. However, there are few guidelines on when to use a supermarket and when to use a FIFO lane. This post is the first of a two-part series that will give **ten general rules of thumb for when to use a supermarket instead of a FIFO lane.** The second post will go into more detail about the ten rules.

In this first post, we'll cover some of the basics. In short, **you should use FIFO lanes whenever there is no reason for supermarkets.** However, there is one hard rule when to use a supermarket and a number of situations when a supermarket may be better. These are all explained in much more detail my next post, but for the impatient reader, here is the list of the ten rules for supermarkets:

- Supermarket for process specific lot size differences (the only hard rule)
- Supermarket in front of the customer
- Supermarket if material flow splits up into different directions
- Supermarket between very different cycle times
- Supermarket between different shift patterns
- Supermarket when creating different variants
- Supermarket for merging of material flows
- Supermarket for large distance between processes
- Supermarket in the case of high demands on flexibility and reaction time
- Supermarket for change of responsibility

19.1 The Basics

Before we go into detail about what to use when, let's just quickly review what a FIFO lanes and a supermarkets are, and how they combine into the information and material flow in a Kanban loop.

19.2 FIFO Lanes

Figure 55: Ford Model T assembly line 1913. (Image unknown author in public domain)

FIFO stands for "First in – First Out." The first part that goes in is the first part that goes out. There is no overtaking of parts. There is usually a limit to the number of parts in a FIFO lane. When the line is full, the previous process stops.

As such, production in a FIFO lane is **very easy to manage**. Only the first station needs to know what product to make. All other stations simply make the products they receive from the previous station. Overproduction is avoided through the limited capacity of the FIFO lane.

19.3 Supermarket

Figure 56: A spice shelf in a supermarket. (Image Blink in public domain)

In manufacturing, a supermarket is a series of parallel FIFO lanes sorted by product. The name comes from the normal retail supermarket. The key of a supermarket (both retail and manufacturing) is that taking out any part or product gives a signal to replenish this part (a so-called Kanban). Hence, a supermarket also aims to keep all parts in stock, while at the same time avoiding overproduction. Compared to a FIFO lane, **a supermarket takes more effort to set up and manage**.

19.4 Information and Material Flow in a Kanban Loop

FIFO lanes and supermarkets can be combined with processes to create an information and material flow loop. The image below gives a simple example using symbols commonly used in industry.

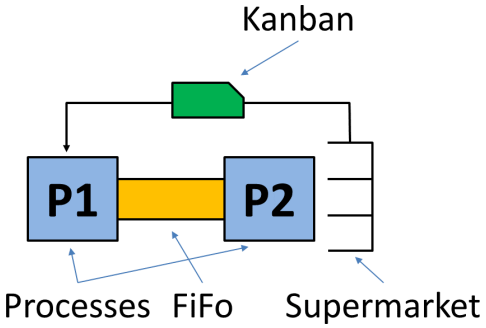

Figure 57: Basic information loop with FIFO lanes and supermarket. (Image Roser)

19.5 The Question – When FIFO and When Supermarket?

Usually, good **lean manufacturing systems are split into different information and material flow loops with a supermarket at the end**. Hence, a good lean production system uses primarily FIFO lanes and supermarkets. The big question, however, is when do you use a supermarket and when do you use a FIFO lane. Below are four possibilities with three processes. You can make a big loop over all three processes, split the processes into two loops, or even split the processes into three separate loops with one loop for each process.

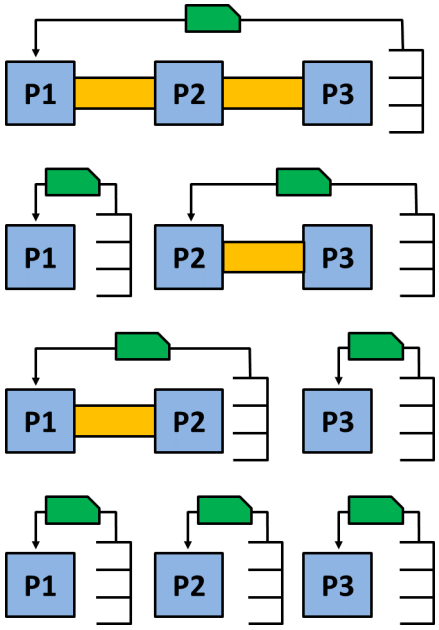

Figure 58: Kanban loop options for three processes. (Image Roser)

After covering these basics about supermarkets and FIFO lanes, my next post will go into more detail about when to use a FIFO and when to use a supermarket.

PS: If you need an academic citation, you can check this paper. Please note that the numbering of the ten points is slightly different, but covers the same ground.

Roser, Christoph, and Masaru Nakano. "Guidelines for the Selection of FIFO Lanes and Supermarkets for Kanban-Based Pull Systems – When to Use a FIFO and When to Use a Supermarket." In Proceedings of the International Conference on the Advances in Production Management System. Tokyo, Japan, 2015.

20 Ten Rules When to Use a FIFO, When a Supermarket – The Rule

Christoph Roser, December 15, 2013 Original at
https://www.allaboutlean.com/fifo-vs-supermarket-part2/

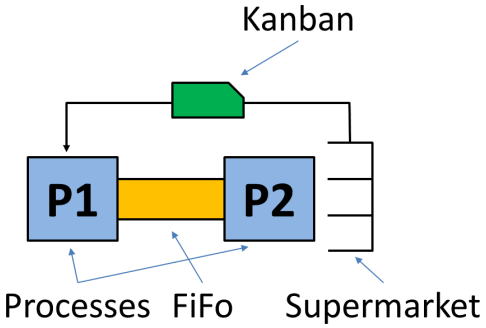

Figure 59: FIFO vs. Supermarket. (Image Roser)

Lean manufacturing pull systems use both FIFO lanes and supermarkets to manage the material and information flow. In my previous post we covered the basics about supermarket and FIFO lanes. Now we go into details about the **ten rules when to use a supermarket instead of a FIFO.**

To decide when to use a FIFO and when to use a supermarket, here are some guidelines in order of priority. In sum, **use a FIFO unless there is a good reason to go for a supermarket**. However, there are sometimes good – and sometimes very good – reasons to use a supermarket instead of a FIFO. The ten reasons to use a supermarket are:

1. Supermarket for process specific lot size differences (the only hard rule)
2. Supermarket in front of the customer
3. Supermarket if material flow splits up into different directions
4. Supermarket between very different cycle times
5. Supermarket between different shift patterns
6. Supermarket when creating different variants
7. Supermarket for merging of material flows
8. Supermarket for large distance between processes
9. Supermarket in the case of high demands on flexibility and reaction time
10. Supermarket for change of responsibility

As a general rule, **you should use a FIFO lane whenever there is no reason for a supermarket**. A FIFO lane is much easier to control and manage. Establishing a supermarket usually requires more work to both implement and keep it running smoothly. Hence, unless there is a good reason for a supermarket, you should use a FIFO lane. Therefore, make your Kanban loops as big as possible unless there is a reason for a supermarket. As for the details on the ten reasons for supermarkets, read on…

20.1 The Ten Rules for Supermarkets

20.1.1 1: Use Supermarkets for Lot Size Differences

To the best of my knowledge, there is only one situation where a decoupling of the material flow through a supermarket is absolutely necessary – and this is a self-made constraint that can easily be avoided: **process specific lot size differences** (i.e., when the lot size changes from one process to the next). To be more precise, this is necessary if the lot size of the first process is not a multiple of the lot size of the next process. Below are a few examples to illustrate the point:

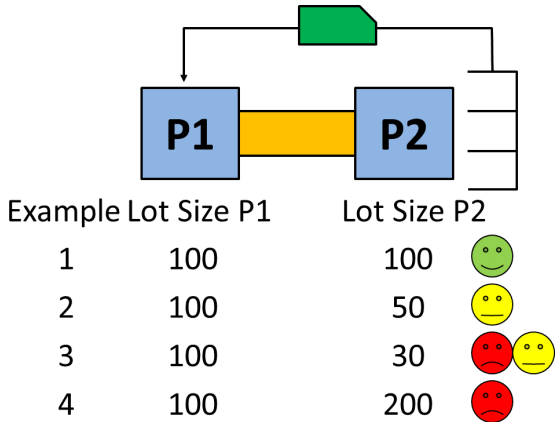

Figure 60: Examples of different lot sizes for kanban loops. (Image Roser)

If the lot sizes are equal as in example 1 above, then there is no problem whatsoever. If the next process has a lot size that is an even fraction of the previous process (example 2), then there is also no problem. In effect, the second process is forced to have the same lot size as the first process.

Lot size differences, however, are a problem if the second process doesn't have an even fraction lot size, as in example 3. If you need to use exactly this lot size of 30 every time (e.g. a batch process that fits exactly 30 parts), then there will be either ten parts left uncompleted of the lot size of process 1, or the lot size of process 2 will be short by twenty parts. If the lot size of 30 is only a minimum requirement it will be less of a problem, since you can always increase it to the required number of parts.

Finally, if the second process has a larger lot size than the first process, as in example 4, then there is a risk of not completing a full lot with the second process.

Overall, it is advisable to keep the same lot size throughout the entire Kanban loop. In any case, this hard rule can easily be avoided by adjusting lot sizes throughout the process, and I find this to be a rare constraint in my practical work.

20.1.2 2: Supermarket in Front of the Customer

In almost all cases, it is strongly recommended to have a **supermarket in front of the customer**. In other words, the last process in your organization should be followed by a supermarket. Hence, the customer can order whatever he wants and you have a reasonable chance of having the product available. The exception is custom-made products for individual customers.

20.1.3 3: Supermarket if Material Flow Splits Up into Different Directions

Another strong reason to decouple the material flow using a supermarket is **a material flow that splits up**. If some parts go in one direction and others in another direction, then a supermarket will make things much easier.

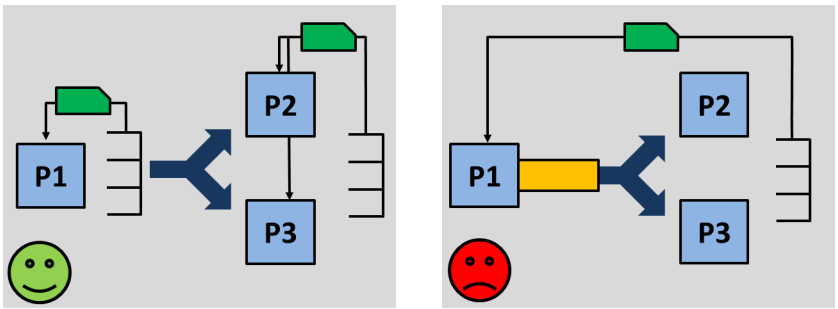

Figure 61: Splitting material flows with kanban loops. (Image Roser)

This can be managed without a supermarket, but if you use a true FIFO there is a significant risk that one of your two subsequent processes will be starved of material. For example, if at

the end of the FIFO lane is material for process P2, then process P3 would have to wait until the next material for P3 comes down the FIFO lane. If idling processes are okay with you, then it is a possibility, but I do strongly recommend against it.

20.1.4 4: Supermarket Between Very Different Cycle Times

A supermarket is also strongly recommended if two processes have very different cycle times. Coupling processes with different cycle times using a FIFO lane will lead to a lot of waiting time for the faster process. On the other hand, if the process would be decoupled using supermarkets, then the faster process may work on other products in the meantime. If the preceding process is faster, it would be similar to a split of the material flow (see above). If the succeeding process is faster, it would be similar to a merge of the material flow (see below).

Hence, if it's okay for the faster process to include idle times, then it's okay to use a FIFO for processes with different cycle times.

20.1.5 5: Supermarket Between Different Shift Patterns

Figure 62: Illustration for shift patterns. (Image Roser)

Similar to different cycle times, it is recommended to **decouple the material flow using supermarkets for processes with different shift patterns**. For example, if one process works one shift per day and the other process works two shifts per day, then a supermarket may help. In this case, the first process has to stockpile enough material to get the second process through the second shift. This material is required regardless whether you use supermarkets or FIFO lanes.

The advantage of supermarkets, however, is flexibility. If problems pop up during the second shift, a supermarket may provide an alternative material, whereas a FIFO lane is stuck with the material in the lane – unless, of course, you manually override the FIFO principle and pull parts out of the middle of the FIFO lane. Overall, a supermarket will give you more flexibility here when compared to a FIFO lane.

20.1.6 6: Supermarket When Creating Different Variants

A supermarket may also be advisable if the subsequent process creates different variants of the product. For example, if the first process makes housings and the second process adds different elements to the housings. For the same housing, different elements can be added. Hence the second process makes more variants based on the material received from the first process.

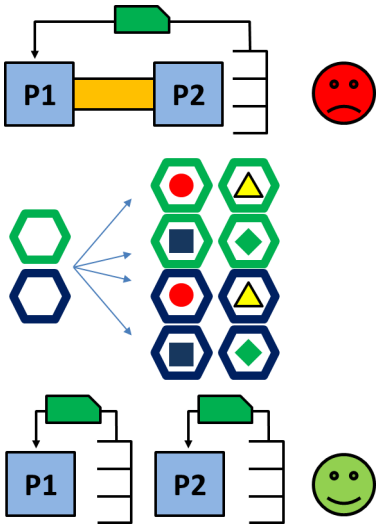

Figure 63: Example of creating variants. (Image Roser)

In a FIFO lane, the process knows what to produce through the parts coming down the FIFO lane. However, when differentiating into variants, the information has to be conveyed separately (for example, through an attached paper). Secondly, this decision has to be already made in the first process. Hence, all parts coming down the FIFO lane are already earmarked for a certain variant even though the part physically does not require it yet.

It can be done, but a supermarket may be an easier option here. A supermarket avoids the complexity of conveying additional information along the FIFO lane. Additionally, you have the flexibility to use a part in the supermarket for any variant you choose.

20.1.7 7: Supermarket for Merging of Material Flows

A supermarket may also be helpful if **material flows merge**. The critical aspect here is the timing of the merge of the two material streams. If you can get the timing right, two FIFO lanes can merge. In this case, it's important that there are always the right matching parts at the end of the FIFO.

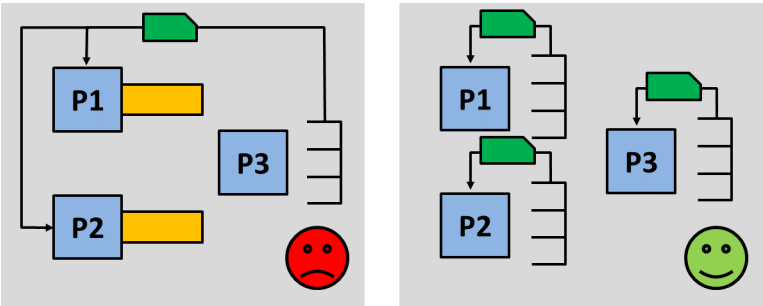

Figure 64: Merging material flows. (Image Roser)

For example, Toyota uses two merging FIFO lanes when installing seats in cars. Whenever a car comes down the assembly line, the matching seat has to be at the end of the merging FIFO lane for seats. It is doable, but tricky. With Toyota, there are just too many seat variants to justify a supermarket.

However, if you can avoid this while using a supermarket, you can significantly reduce your organizational effort and your risk of things going wrong.

20.1.8 8: Supermarket for Large Distance Between Processes

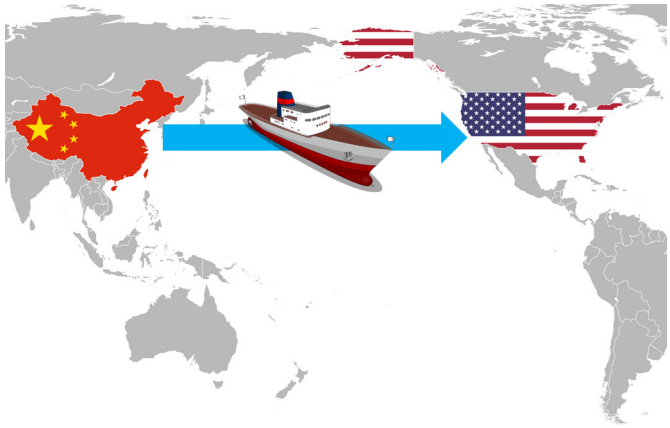

Figure 65: Do not use FIFO here! (Image Roser)

FIFO lanes work very well with processes in close proximity to each other. The farther apart the processes are, the easier it may be to use a supermarket instead of a FIFO. Over longer distance it requires more effort to keep things in FIFO and to know what is coming down the lane. Hence, **for longer distances it may be better to use supermarkets**.

Granted, you can also make a FIFO over longer distances, but in my experience it often complicates things. This is true the larger the distance is. Having parts shipped from one end of the plant to the other may still be doable by FIFO, but if you import parts from China to the USA, I strongly recommend not using FIFO through ships and airplanes.

Besides the effort necessary to keep FIFO alive over longer distances, the time needed for transport is also an important factor. A supermarket keeps you more flexible than a FIFO, and you can easily change from one product to the next in the following processes. For larger distances you may even **consider two supermarkets, one at the sending end and one at the receiving end**.

20.1.9 9: Supermarket in Case of High Demands on Flexibility and Reaction Time

The wider the span of a Kanban loop, the easier the system is to manage. However, a wide span also increases the lead time (i.e., it takes longer from the time the Kanban signal is sent out until the completed product comes back).

Therefore, **if you need a system that reacts quickly, it may be advisable to make the Kanban loops not too big**. Smaller loops can react quicker to changing customer demand. This is especially important if you have many low-runner products that you don't keep in stock and produce only as needed.

An interesting question here is the effect on the quantity of work in process (WIP). How is the WIP influenced by the number of Kanban loops? The longer the loop, the more Kanban you need to cover the replenishment time. A shorter Kanban loop has less replenishment time and hence less stock, but you need more loops. I did quite a few calculations on that and – in short – it doesn't make much difference. Overall **WIP does not change much if you make one big Kanban loop or multiple smaller Kanban loops**. True, there are some differences, but it depends heavily on the system. For some systems there may be less WIP with one big loop, while other systems may have less WIP with multiple small loops.

20.1.10 10: Supermarket for Change of Responsibility

Figure 66: It's human nature… (Image Samuel William Fores in public domain)

The final reason to opt for a supermarket instead of a FIFO lane is if there is a change in responsibility. If the material flow leaves one department and enters other departments, a supermarket may make things easier.

From the simple point of the material and information flow, this would not be a requirement; but whenever there are people involved, things are rarely simple. A supermarket to decouple the material flow can keep responsibilities more separate. **This has nothing to do with hard facts but everything with things like "**my turf" and "*your fault."*

If there are FIFO lanes across department boundaries, there is a risk of the first department carelessly *throwing things over the wall* and the second department equally as carelessly throwing information back. Neither will help the overall operations of your plant. A decoupling using supermarkets can keep these systems more separate.

Again, from a purely logical point of view, this may not be necessary, but I have seen many plants where such **blame games** were a part of everyday life. Judge for yourself if this may be a factor worth considering with your plant.

In sum, in most cases it is possible to use both a supermarket or a FIFO lane. In general, a FIFO may be easier, but there are cases when a supermarket may be less trouble. I hope these guidelines helped you to decide between supermarkets and FIFO lanes. If, in your opinion, I missed a reason, please let me know. **Now go out and improve your industry!**

PS: If you need an academic citation, you can check this paper. Please note that the numbering of the ten points is slightly different, but covers the same ground.

Roser, Christoph, and Masaru Nakano. "Guidelines for the Selection of FIFO Lanes and Supermarkets for Kanban-Based Pull Systems – When to Use a FIFO and When to Use a Supermarket." In Proceedings of the International Conference on the Advances in Production Management System. Tokyo, Japan, 2015.

21 Simple Triangle Kanban System for Office Supplies

Christoph Roser, December 22, 2013 Original at
https://www.allaboutlean.com/simple-kanban/

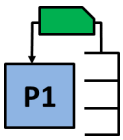

Figure 67: Example of a kanban Loop with one process. (Image Roser)

Kanban systems are a huge help in industry, ensuring a steady availability of parts and products without excess stock. However, Kanbans are not necessarily limited to industrial use. In this post I will describe a **simple Kanban system for office supplies**. This system is also sometimes known as triangle kanban. One benefit of this system is that it will improve the availability of pens, paper, and other supplies. However, a second major benefit is that this provides a risk-free opportunity to train your people in creating and using Kanban systems.

21.1 Simple Kanban System for Office Supplies

The principle of restocking office supplies is similar to restocking industrial parts and products. At one point you order more, and some time later the products will arrive. It also has the same problems as with industrial parts. When you find out that you are out of stock is usually when you need the goods. Hence, taking control of the information and material flow can help. However, while you can establish a full-blown system with Kanban cards on all packages, defined rules for supermarkets, calculate the number of Kanban, establish lot sizes, and many other details, this feels **overdone to merely order pens**.

Hence, simplicity is the key. Usually, office supplies are rather inexpensive. Hence, while minimizing inventory is usually a big deal in industry, the effort is usually not worthwhile to save a few pens. The bigger problem is running out of pens. Let me explain to you my method using my most favorite Uni-ball Jetstream Retractable Roller Ball Pens as an example. Here's what I do:

Figure 68: Triangle kanban example for pens. (Image Roser)

I have a number of boxes of pens in the office supply cabinet. Only the last box has a colored laminated Kanban card attached. On this card it says:

If you open this box, put the card on the assistant's desk.

Assistant: Re-order three boxes Uni Ball Jetstream Pens in Blue, Number xyzabc.

As a result, whenever we are down to the last box, the assistant is informed to reorder more pens. The assistant collects this and other cards and, once per week, orders office supplies. When the supplies arrive, the assistant sticks the card on the last box using adhesive tape, and the cycle can start again. Since all people in the office are informed about this system, it has worked flawlessly for me for many years.

In industry such single kanban systems are also known as triangle kanban, since the kanban is often triangular shape. The number of parts after the triangle kanban has to cover the time until the system is able to restock the inventory (the replenishment time).

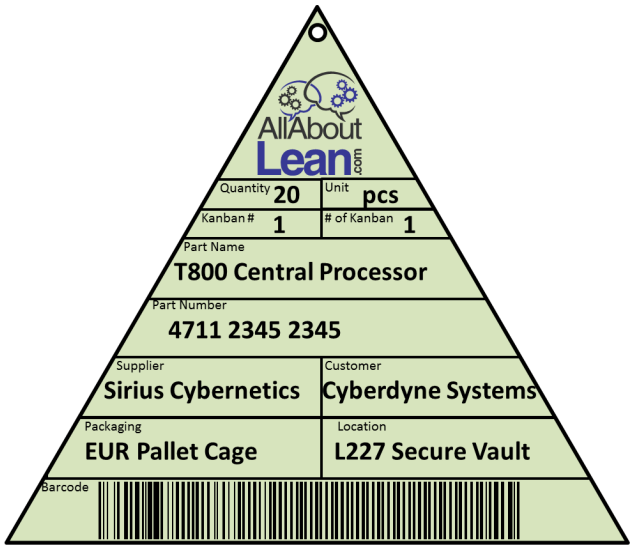

Figure 69: Example of a triangle kanban (Image Roser)

21.2 Examples of Products for Simple Kanban Loops

There are many different examples for products that can be managed using such a simple system. One major category is **office supplies**. Pens, papers, scissors, staples, markers, etc. can all be managed using such a system to avoid stock-outs. In truth, a stock-out in pens is usually not critical. People generally have multiple pens, and if the blue one is out then they just take a black one. Of course, it is a problem if pens are missing, but compared to other problems on the shop floor these are minor.

Much more serious is another stock-out in the office: **Coffee!** Many office workers seem to be unable to work without this stuff. And, for some reason, substituting tap water doesn't help. However, you can use the same simple system for coffee supplies. The last box of milk has a card, as does the last pack of coffee beans, sugar, and so on. Since I've been using this system, I've never had a stock-out on coffee, which probably would have much more serious consequences than a stock out on pens :-).

Yet a third instance where I use this system is for **printer ink** at home. I have multiple packages of ink in different colors. The last one has a Post-it attached, telling me to reorder magenta, blue, yellow, or black. Again, if your printer strikes due to low ink, it is usually a most inconvenient time. Luckily, with using this system, it has not happened so far.

21.3 Benefits of this Simple System

The system is actually quite simple. The last box has to be enough supplies to last until new supplies have arrived. If you have a larger office, you may add the Kanban to the second to last box.

The colored card with the instructions is usually **self-explanatory**. Even people new to the office have no problem using this system. Usually, I have multiple boxes in the system before the Kanban. In theory, only one box would be needed to cover the replenishment time. Having multiple boxes, however, allows for a less frequent reordering, saving time for the assistant. The time to order one box is the same as for ordering three boxes. Due to the (usually) low value of the goods, the time saved is worth the extra stock.

This is especially true when ordering printer ink at my home. I usually order a year's worth of supply, so that I have to go through the hassle of ordering and picking up ink parcels only once

per year rather than every month. Overall, the system is **very little effort for small and low value goods, yet ensures good availability of material**.

21.4 A Great Training Opportunity

I cherish this method also for a second reason: It is an **excellent example to teach your people Kanban**. The system is very easy to understand, very visual, and requires no fancy computer support. Yet it contains all the important elements of information and material flow. Both supply and demand can have fluctuation that have to be covered. Information and material flow is standardized. The replenishment time can be estimated to see how many boxes you would need.

Most importantly, this is much more than a theoretical class room exercise, but a real-life working system with which your people interact on a daily basis. Hence, there is usually much more motivation to do it right. I hope this post was helpful for you.

Now go out and Organize your Industry!

22 Value Stream Mapping – Why to Start at the Customer Side

Christoph Roser, December 29, 2013 Original at
https://www.allaboutlean.com/vsm-start-at-customer/

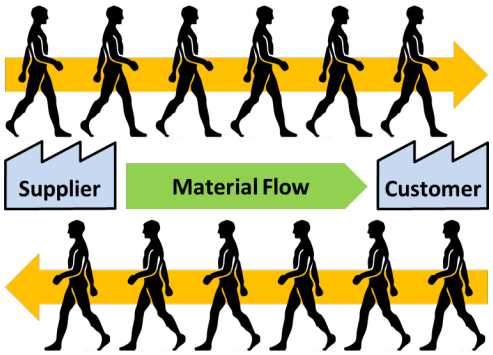

Figure 70: Which way? (Image Roser)

Have you ever been to a value stream mapping workshop? If so, you may remember the insistence of the coach to start any mapping activities at the customer side (the end) and then work your way backward (to the beginning). Yet, if you would ask why, you would get only some vague answers about this way being better, more lean, or just the way Toyota does it. In this post I want to go into more detail about whether it may be beneficial for value stream mapping to start at the customer side, and why.

22.1 Lean – The New Religion

Many people are so convinced of this that they would not do anything on the shop floor unless it is started at the customer side. Yet, if you ask about the reasons for this you will get a very vague answer. In sum, the reasons for starting at the customer side are usually not known but considered part of the **lean religion:** *If Toyota does it, then it must be good, and we will do it too, even if we don't understand why!*

In my view, this approach goes totally against the Toyota Production System, where you should use common sense first and foremost and do only the things that you thoroughly understand. But fear not, AllAboutLean.com is here to help. I will give you the key reasons for starting plant tours and value stream mapping at the customer side…

22.2 Top Five Reasons for Walking from the Finished Goods to the Raw Materials

First of all, starting a value stream mapping or a plant tour by **walking from the customer or finished products side toward the raw materials does indeed have some benefits**. However, these benefits are overall not as significant as they sound, and in my view are often over-emphasized to impress the uninitiated. They do bring some advantages, but it is also completely possible to walk through the plant in the other direction.

22.2.1 Mental Weight to the Customer

Starting at the customer side gives **mentally more weight to the customer**. If in your business the customer is important (and it should be), you can put your money where your mouth is. It is one small part of setting the attitude and changing the mindset in your organization.

22.2.2 New Thinking Through Different View

Most people habitually walk through the plant from the raw materials toward the finished goods. For the people in the plant, this is the way they see and understand the plant. By walking through the plant in the opposite direction, you are forcing them out of their normal behavior patterns.

You require them to **behave differently**. Maybe, just maybe, it may also make them think differently. Maybe they notice something new simply because of the (minor) additional mental effort to do things the other way. It may be worth a try.

22.2.3 See the Information Flow in Pull Systems

In value stream mapping, we try to describe both the material and the information flow. In a typical plant, the material flow is rather easy to see. Just follow the parts. The information flow, on the other hand, is more difficult to see. It may be electronically, or through paper, and much less obvious than the material flow.

In a push system, information is handed out centrally. Hence, it makes no difference which direction you walk if there is a push system. In a pull system, on the other hand, information flows in the opposite direction of the material flow. Walking in that direction enables you to follow that information. For example, if you are at a supermarket, try to find out where the Kanban goes. This will give you a much better understanding of the information flow, but only if you walk with the information from the customer to the supplier.

22.2.4 Understand Branches in Material Flow

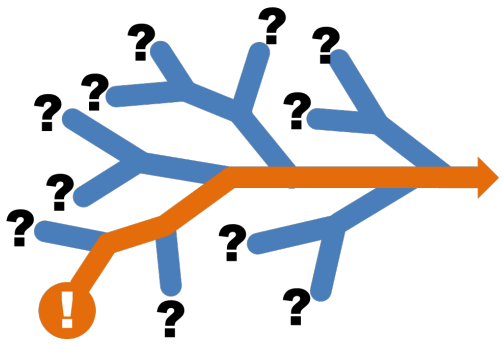

Figure 71: Where to turn? (Image Roser)

Assume you don't know the plant and walk along the value stream from raw materials to finished goods. Usually, someone from the plant accompanies you and gives you the tour of the plant. This guide also usually picks the starting point on the value stream. There is a chance that at one point, another component merges with the product, and that other component may be more interesting. Now you may have wasted time by walking along the less-interesting value stream.

If you start on the other side, however, you could, at every branch, pick the direction in which you want to follow the value stream towards it source. That way you could have a **more meaningful view of the value stream**, so it is beneficial to start at the finished goods.

In reality, however, most products have one key component, and your guide usually starts with those. Additionally, most people I have seen on plant tours would never dare to change the *official* route, or ask critical questions. This is one of the reasons why it is so easy to misguide visitors. Overall, starting at the customer side may be better, but it is also not a big deal.

22.2.5 Sound Smart

The last reason, honestly, is kind of lame. The last reason for starting at the customer side is simply that **it makes you sound smart**. You seem to know something that others don't know. (I told you it is a lame reason!) It is especially popular with consultants. Nevertheless It enhances your credibility and may give you more leverage to change things (unless, of course, the others read AllAboutLean.com, too). Such things are not to be underestimated. On the other hand, if this is the only reason for starting at the customer side, then that would be pretty sad.

22.3 Examples When Maybe NOT to Start at the Customer Side but the Supplier Side

Overall, starting at the customer side and walking toward the supplier side is not a huge benefit. But then, it is not a huge inconvenience either. Hence I usually start at the customer side and walk toward the supplier side for value stream mapping and plant tours.

However, there are also a few instances where this direction is suboptimal.

22.3.1 Understanding the Physical Production Process

If you don't care about material and information flow but simply want to know how the product is made, then walking from the supplier to the customer is more insightful. For us, building a product piece by piece comes easier than the reverse process. Hence, if your interest is the product and not the production, then start on the supplier side.

22.3.2 Implementing Pull

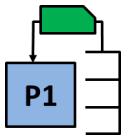

Figure 72:Simple kanban loop (Image Roser)

Implementing a pull system increases availability and reduces inventory. Most larger factories have multiple loops to create the finished product. If you convert a system from push to pull, you probably have to create multiple loops. For this you have to start somewhere. Many plants start at the customer side since it is flashier and gives more brownie points with upper management.

However, for a Kanban loop or any pull system to work, it is critical that there's a good availability of raw materials. Kanban systems quickly fall apart when there is frequent lack of materials going into the pull system. So you have to ensure that material availability is good. One possibility is more inventory – which will not go over well with management regardless of how necessary it is. The other possibility is starting the pull loops on the supplier side. If the first raw material supply is steady, it allows you to create a solid next pull loop. Hence, for implementing Kanban and pull systems, it may be better to start at the supplier side – although the customer side is fancier.

Overall, in my view it is a small advantage to start from the customer side. However, this is not a huge benefit, and if you prefer to start from the supplier side, you will probably have very similar results. I hope this post showed you some reasons for starting at the customer side and some examples when not to. If you think I missed one, please let me know.

Now go out and improve your industry!

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24 Author

Figure 73: Christoph Roser (Image Roser)

Prof. Dr. Christoph Roser is an expert for lean production and a professor for production management at the University of Applied Sciences in Karlsruhe, Germany. He studied automation engineering at the University of Applied Sciences in Ulm, Germany, and completed his Ph.D. in mechanical engineering at the University of Massachusetts, researching flexible design methodologies. Afterward he worked for five years at the Toyota Central Research and Development Laboratories in Nagoya, Japan, studying the Toyota Production System and developing bottleneck detection and buffer allocation methods. Following Toyota, he joined McKinsey & Company in Munich, Germany, specializing in lean manufacturing and driving numerous projects in all segments of industry. Before becoming a professor, he worked for the Robert Bosch GmbH, Germany, first as a lean expert for research and training, then using his expertise as a production logistics manager in the Bosch Thermotechnik Division. In 2013, he was appointed professor for production management at the University of Applied Sciences in Karlsruhe to continue his research and teaching on lean manufacturing.

Throughout his career Dr. Roser has worked on lean projects in almost two hundred different plants, including automotive, machine construction, solar cells, chip manufacturing, gas turbine industry, paper making, logistics, power tools, heating, packaging, food processing, white goods, security technology, finance, and many more. He is an award-winning author of over fifty academic publications. Besides research, teaching, and consulting on lean manufacturing, he is very interested in different approaches to manufacturing organization, both historical and current. He blogs about his experiences and research on AllAboutLean.com. He also published his first book, “Faster, Better, Cheaper,” on the history of manufacturing.

Prof. Dr. Christoph Roser is an expert for lean production; Toyota, McKinsey, and Bosch Alumni, and professor for Production Management at the Karlsruhe University of Applied Sciences. He is interested in everything related to lean manufacturing, bottleneck detection and management, as well as historic developments of manufacturing. His first book is “Faster, Better, Cheaper” on the history of manufacturing.

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