

**Mark Warren**

Experienced Manufacturing Professional "Discovering Solutions with People"

TPS Manual - Chapter 1, Section 1

November 11, 2017 • 19 Likes • 1 Comment

In 1970, Toyota began to share some of their production system with a select group of 17 first tier suppliers. By 1973, they began to compile a manual for the first time to explain their thinking process behind the tools that their experts shared.

This is currently a draft of translations of the manual, compiling several translations and editing for readability. One of the hurdles we have in translating is our current bias of our current understanding of lean. To reduce this bias, two of the translators have no previous 'lean' exposure.

Chapter One - Section One

Toyota Cost & Labor Reduction Method

The basic ideas of the **Toyota Production System** (TPS). TPS is a sequence of operations with an objective of improving productivity by reducing unnecessary, unreasonable and uneven activities, thus decreasing our production costs.

Although its underling ideas are based on general Industrial Engineering (IE) theories, these fundamental ideas were developed over a long period of time exclusively for the improvement of the production system of the Toyota Motor Corporation. Thus, it is not a simple application of IE theories.

In this section, rather than merely listing facts about the fundamental ideas, we would like to review the characteristics of TPS and demonstrate a few of its concepts.

Company-wide IE Directly Connected to Management

Much has been said about production management systems; however, there is no single method of "How to Make Things" that would work for every production process for all types of products.

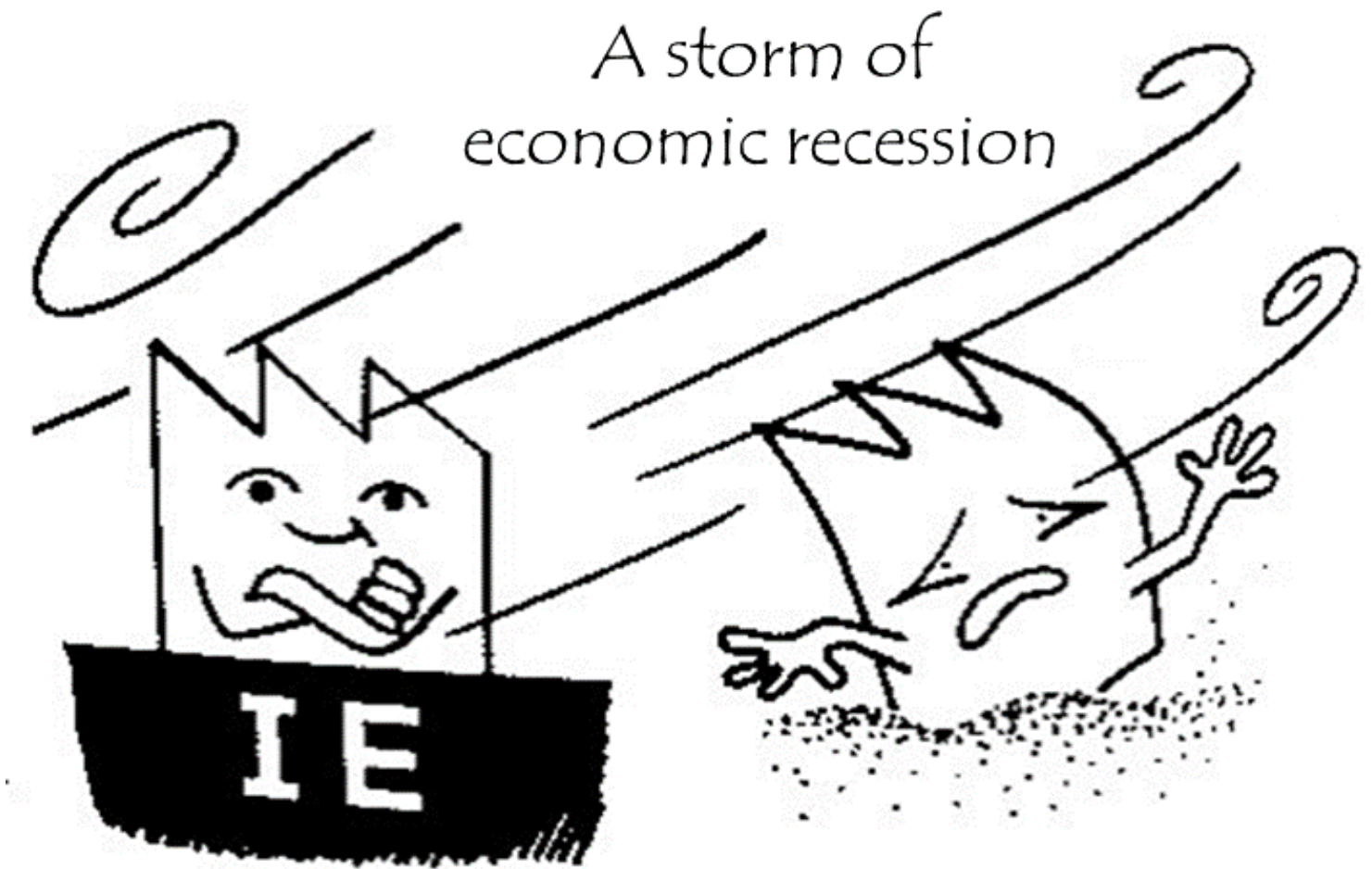
Accordingly, some companies could make a product using a single person, another would use two people, while a company that is completely unconcerned with production methods would produce it using three people.

In the last case, the company which used three people would likely have more warehouses, vehicles, pallets, conveyors, and other equipment. This can cause an increase in the number of indirect employees and production cost could be double (or more), making a vast difference in profits (if they are profitable at all).

We do not have concrete statistics that clarify this relationship; however, we can imagine that such difference happens in many companies. Moreover, this difference will not only be a matter of the present situation. Every single year, investment will be repeated in a similar way because the annual plans are designed based on the thinking that created the current situation.

Moreover, once the fixed costs (manufacturing plants, equipment, machinery, etc.) have been invested, these fixed costs are irretrievable even if they later turn out to have been unnecessary. Considering the serious risks of over investment, this is a significant issue for any company.

The only way to avoid the risk of over-investment is to continuously improve the production efficiency in every aspect of the operation process, reducing the basic units of consumption for labor, equipment and machinery. Then reflect these improvements in the production plans for the next phase.



Looking at things from this perspective, Industrial Engineering will have a major effect on business management. Companies that do not practice IE sufficiently are like splendid castles built on sand. The company may look successful during times of economic expansion, but during economic contractions, they can collapse as if hit by a typhoon or an earthquake.

The productivity improvement routines are an essential foundation of the corporate management system

for Toyota. All departments that are involved in production handle things in the overall most effective way. The production system is based on the following concepts:

Leveling Production Plans - If you think solely about the production efficiency at the final assembly plant, you may think it is most efficient for the plant to run only one product; however, this would rather result in unnecessary activity in the preceding stages of production.

Minimize Lot Size - Lots should be minimized in typical lot production processes, such as using a press. This is not just about the inventory piling up or increasing the labor for transport, but there is also a risk of experiencing a stock-out, caused by mistaking order priorities. And the capability of the processes could be misjudged as insufficient, which would then lead to an unnecessary extension of production lines.

To enable small lot production without causing a reduction in your production capacity or adding costs, it is necessary to improve your changeover capability.

Just-In-Time - Produce only the required items, at the required time, and in the required amount. The aim of this is to reduce the unnecessary activity of overproduction, as well as to allow you to visualize the surplus capacity at that moment.

Scientific Attitude

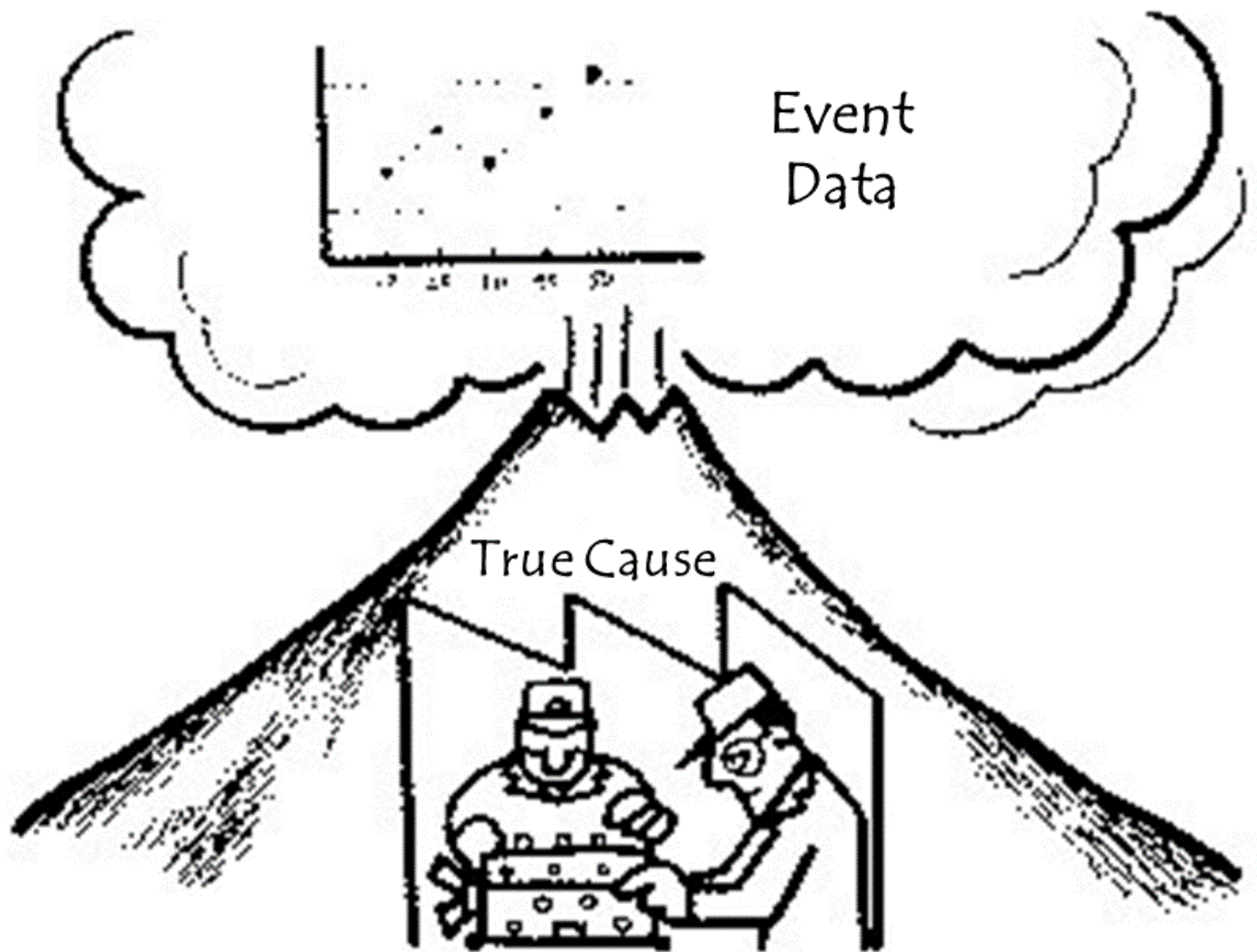
In the workplace, problem solving must clearly follow the following steps: the actual situation is the starting point, investigate for root cause, and then develop a solution. In other words, when it comes to the workplace, facts are regarded as most valuable.

For example, regardless of how much data you are shown, it is difficult to grasp the actual situation of the workplace from data. If a defect occurs, finding it out from data (reports) would mean a delay in taking countermeasures.

Even worse, due to misrecognition of the true cause of the failure, you may also fail to prevent the recurrence of the failure.

There is no place better than the actual workplace where you can grasp the real situation properly of what is happening there. When there is a failure, you can contain it immediately; it is easier for you to find the true cause, and take immediate measures.

In TPS, when it comes to the workplace, we regard the real facts to be more accurate than data.



When you have a problem and your process of finding out the root cause is insufficient, countermeasures you design will also be out of focus. That is why it is necessary to use the 5-Whys method, and ask yourself “Why, why, why...,” until you find the real cause.

To make this method work, you should keep the following points in mind:

Make Details of the Problem Obvious - If the problem is known, it is relatively easy to implement countermeasures. The hard part is finding out what the problem is. That is why we use various tools to signal a problem.

Objective of Problem-Solving should be Clear - Improvement is based on need. The root cause must be identified, and then solved. Countermeasures taken without fully investigating the root cause would be merely a provisional measure, which does not lead to the prevention of reoccurrence of the problem.

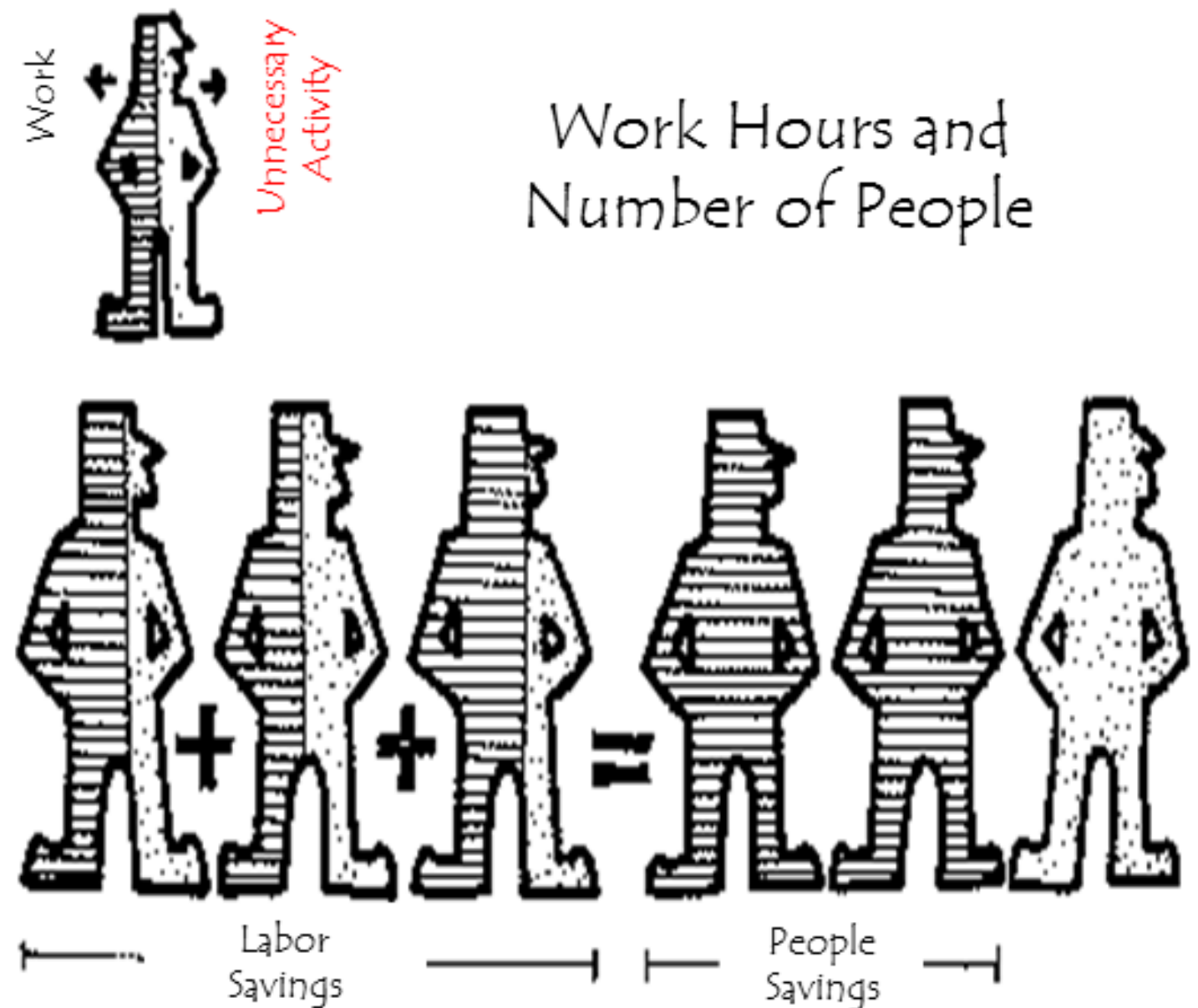
Take Countermeasures for Every Single Failure - Even the failure occurs only once in a 1000, if you have facts, you can investigate its cause, and take preventive measures. It is vital to be able to spot the infrequent defects that are likely to go unnoticed.

Be Practical

There are two aspects to being practical. One is that the approach should be step-by-step measures. You

can set a high goal, but your practice toward this goal should be performed step-by-step. The second is to attach importance to results.

Based on these ideas, we think as follows:



Start from Work Improvement to Equipment Improvement - General sequence is, people improvement (training), then process (including layout), then equipment, then design. (More details in Section 6)

“Man-hours”, “number of people”, “labor cost saving” and “labor saving” - In calculations, you can say 0.1 hour, or 0.5 hour saved. However, you still need one person even for the work of 0.1 hour. Therefore, if a job for one person is reduced by 0.9 hours, this would not result in a reduction in labor costs. Only when the number of people are reduced, will true cost reduction be achieved. So, the improvement of labor must focus on reducing the actual number of people needed.

Reducing the number of people should be put into context. When Taiichi Ohno began actively developing TPS, Toyota took about nine times as many people to produce a vehicle as Ford. You will see a strong theme throughout TPS for improving the efficiency of production and they do this by counting the number of people it takes to do the job.

In the case of introducing automated equipment, if you achieve 0.9 person's work worth of labor-reduction, 0.1 person's work remains (often for keeping an eye on the machines), then no reduction in people will be achieved despite the investment in equipment. This is sometimes referred to as labor-saving; a reduction of the number of actual working people that leads to a practical cost reduction is differentiated from "labor-saving" and is called "people saving".

The Difference between "Automation" and "Autonomation" - With 'automation' a machine may run by itself, yet still need a person watching it to stop the machine when something goes wrong. When 'autonomation' is added to the machine, it has the ability to detect the same problems that the person guarding the machine would do, and automatically stopping the machine when a problem was detected. (More details in Chapter 2)

Checking is Reflection - The improvement is finished when the intended results are obtained. When you don't get results, it's often because of unfinished work.

Try the improvement idea at the workplace to see how it performs; check the results; improve the things still not working correctly, and then check again. By repeating this process, your improvements can provide favorable results.

The checking process is a step to reflect on the results of your work, rather than simply implementing ideas.

Economic Efficiency is the Criteria for Everything

The purpose is the reduction of costs. Therefore, the basis of the assessment is "whether this is economically beneficial or not?"

As for practical thinking, we have the following points:

The operation ratio of equipment is decided by the required production amount - This is emphasized to prevent falling into the wrong way of thinking about the sunk cost concept which suggests that you must make full use of facilities that have already been purchased, or else it will lead to loss.

For the same reason, in the case of multi-machine handling, we follow the same concept in focusing on the work of people, not the machines. (More details are discussed in Section 2 as well as Chapter 2)

Spare Capacity Allows you to Practice - People who have fixed work hours will receive the same salary whether they have nothing to do (pretending to work) or practice improving the setup process when they have no work to do. (More details in Section 2)

Clear Position of Workplace

We regard the whole workplace as a single organism. The workplace is not, just a group of hands that have

entrusted their brains to management. Essentially, the workplace should play the main role. It's unacceptable for engineering to act as the boss for the actual workplace. What is important is to emphasize the autonomous action of the workplace.

To this purpose, the engineering division should fulfill its role by supporting the weaknesses in the actual workplace where they lack information or skills. They should do this without weakening the responsibility at the workplace.

Emphasize the Capacity of Adapting to Change

Plans may often change; what matters is having a production system that can adapt immediately when plans change. An adept workplace capable of handling that.

| *To be continued...*

Section 2 - Labor Reduction and Cost

For more information, contact Mark Warren (mark.tesla2@gmail.com)

Written by



Mark Warren

Experienced Manufacturing Professional "Discovering Solutions with People"

1 comment

[Sign in](#) to leave your comment



Ashok Motwani

Seeking Consultancy opportunities as a...

... 4h

Many thanks dear [Mark Warren](#) for sharing such treasure. Looking forward to more information in future, so it can be learned & applied.

Like **Reply**

