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TPS Manual - Chapter 1, Section 6

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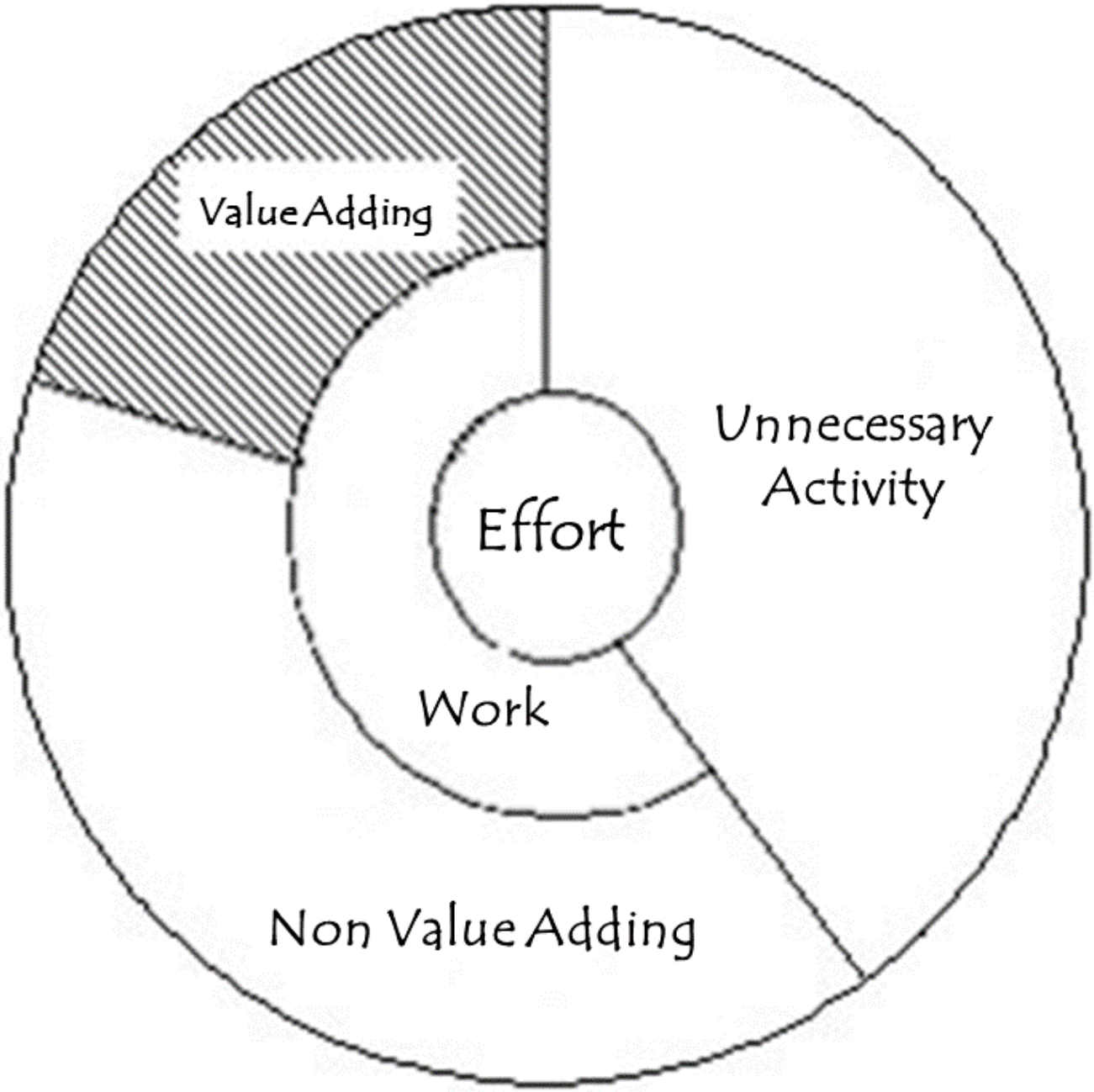
> *Section 6 - How to Promote Labor Reduction Activities*

Awareness of the details of the work in the actual workplace



To promote labor reduction activities, developing awareness in the workplace is an important first step.

For example, if you think, “The line utilization rate is fairly high under the current operation system. The manufacturing failure rate is within certain range. All in all, it looks like working quite good,” then, there will be no motivation for improvement. You are nipping off the buds of improvements.

No matter what kind of workplace it is, when observed closely, what is said to be “*work*” can be divided as shown in this diagram.

The types of work are:

- **A. Unnecessary activity** – It is not necessary in any way when doing work. They can be eliminated immediately. (Examples) Waiting time, meaningless transportation (piling up of partially-finished products, the labor of transporting two or more times, or changing hands.)

- **B. Work that produces no added value -** Work with no value-added is something that must be done under the current working conditions. (It's better to consider this to be unnecessary activity as well.) To eliminate this, we must partially change the conditions of the workplace. (Examples) Walking to pick up parts, unwrapping the outsourced parts, taking out parts from a large pallet in small amounts, or operating hold-to-run buttons.
- **C. Useful work that adds value**.

Apart from regular work, things that are done as exceptional operations outside of the standard operating procedures, like fixing a small problem that happened to the equipment or jigs, or readjusting defective products and so on reduce the value adding ratio.

The proportion of activities that directly increase the added value is surprisingly low. (All elements, except for value adding work, only increase the cost).

Labor reduction means increasing the ratio of the value-added work (profitable work). Our ideal goal is to get as close as possible to 100% value-added work.

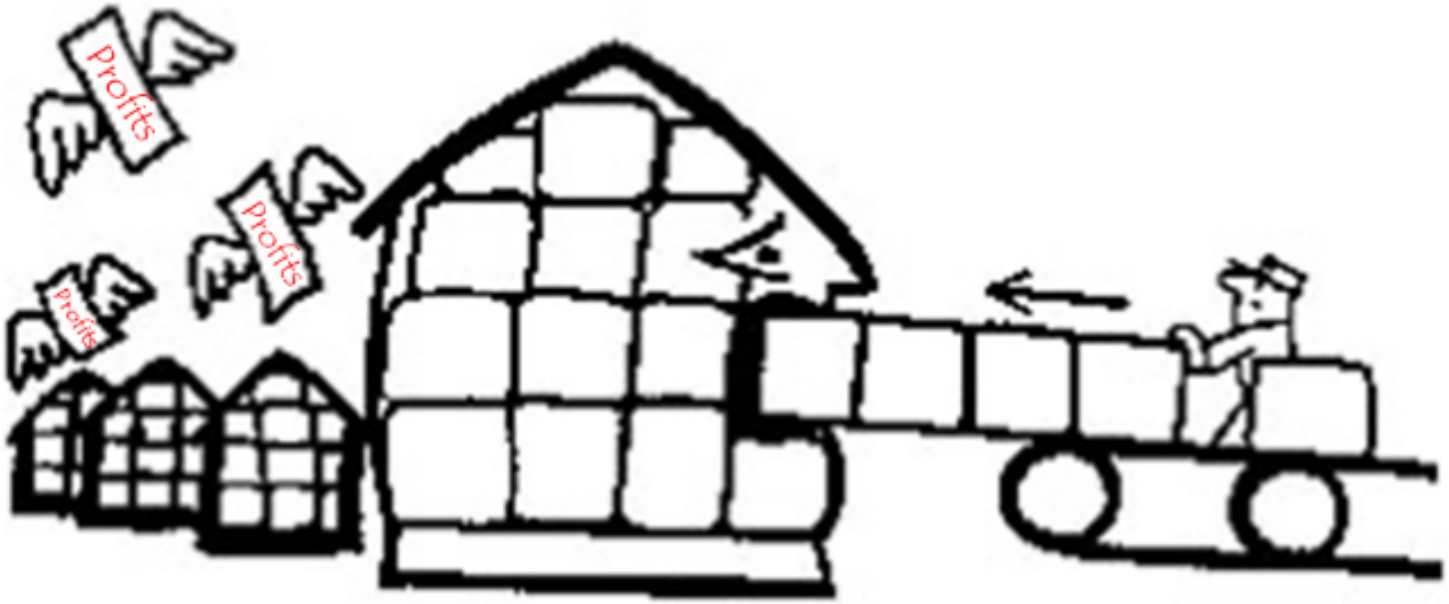
Unnecessary activity of over-production

In the previous subsection we discussed that if we closely observed the work in the actual workplace, we will find that it includes many other activities than only Value Adding work. If these unprofitable activities are clearly visible to everyone, it will not be difficult to study measures to improve the situation.

For instance, within the work done by a group of people, everyone spends some time waiting, or doing meaningless temporary movement of items. In a production line like this, if we eliminate the unnecessary activity and redistribute the work activity, reducing the number of people won't be that difficult.

However, this is rarely the case. It is not that there is no unnecessary activity; rather, it is that the unnecessary activity is hidden and invisible. The most common issue on sites is the excessive advancement of work. Because operators work on the next unit during the time that should be counted as waiting time, the unnecessary activity of waiting becomes invisible. This process repeated over and over again ending up with stocks piled up in the middle and end of the lines.

To make matters worse, additional tasks arising from the over-production, such as moving these stocks to other places or re-stacking them neatly make it even more difficult to distinguish the unnecessary activities.



In TPS, this is called unnecessary activity of overproduction, and among the numerous types of unnecessary activity, we regard this one to be the one that must be avoided the most.

The classification and explanation of the types of unnecessary activity are described in detail in Chapter 2 so, we will omit it here; however, the unnecessary activity of overproduction is different from the other types of unnecessary activity, in the sense it hides other types of unnecessary activities.

From the viewpoint of improvement, the other types of unnecessary activities give us clues, while the unnecessary activity of overproduction conceals them, and works in the direction of obstructing improvement.

The first step to promote labor reduction activities is to eliminate the unnecessary activity of overproduction. For this purpose, the line should be improved by establishing rules that prevent overproduction and by imposing restrictions with the equipment (such as a full work equipment). Only when you accomplish this, will the flow of things return to its original form.

As things that you need began to be produced individually, as they are needed, unnecessary waiting time becomes visible and noticeable. Once the production line reaches such a state, it will be easy to apply the routines mentioned at the beginning of this subsection: eliminate unnecessary activity → redistribute work operations → decrease the number of people.

The Concept of Takt[1]

To avoid overproduction and produce only what is needed, when it is needed, it is necessary to know the time "when" it is needed.

The concept of "takt" is important. Takt is the amount of time that should be allotted to produce one product. For instance, the product must be made in X minutes and Y seconds. This is derived from the required number of products.

In a simple formula, it would look like this:

$$\text{Takt Time} = \frac{\text{Operating time available per day}}{\text{Required number of products per day}}$$

A common error in calculating takt happens when you use current equipment capacity, facility capacity or available labor.

For instance, “Our equipment has this much capacity, and we have this many people, so how many minutes would it take us to produce a single item?” This is what they consider their Takt time to be. This is a completely wrong understanding of the concept of takt in TPS.

There is less flexibility in the equipment capacity as they are fixed to some extent, but, line capacity may be increased or decreased by adjusting the number of people.

Work can be carried out by the minimum number of operators only when the takt is calculated based on the correct understanding of it.

If you try to produce as many products as possible at the maximum capacity under ideal conditions, you will end up with overstock and this will not lead to any labor reductions.

When you have determined the appropriate takt, what should you do so that it’s accurately followed? Details will be explained in another section. Follow these guidelines:

(A) In the case of line work: draw a separator line on the conveyor to mark a section designated to one product. The conveyor should flow keeping to the regulations: one product in one section.

(B) In between the processes: employ visual signaling methods. For instance, place a sign or tag (Kanban) and make it a rule not to be allowed to conduct the work before the tag (Kanban) is taken off.

For more details on Kanban, see Chapter 4.

The role of Kanban[2] is in the process to prevent overproduction by informing the required needs to the preceding process. This should be well understood.

Redistribution of Work

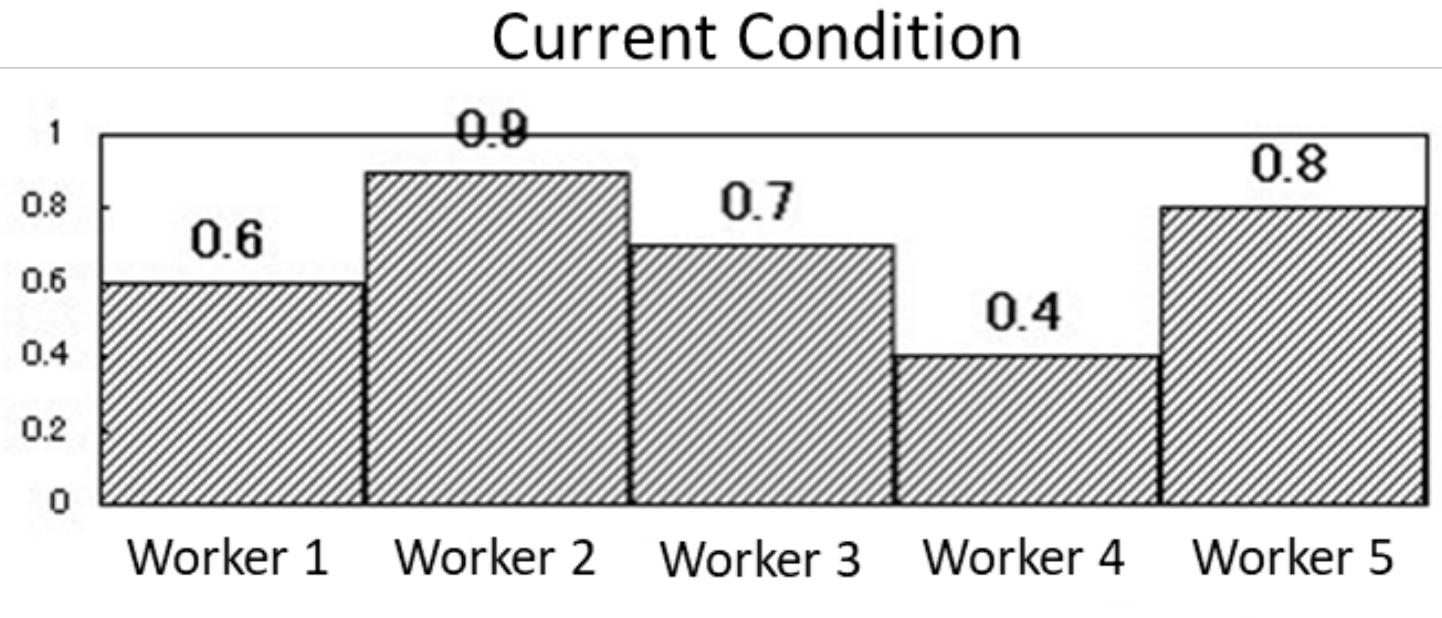
By limiting the ability to overproduce, the unnecessary activity of waiting will become visible in the workplace.

Next, work that does not directly produce added value as defined in Section 1 (requires awareness of the details of the work done in the actual workplace) should be improved immediately, starting with those that don’t cost much money and don’t affect the preceding production process.

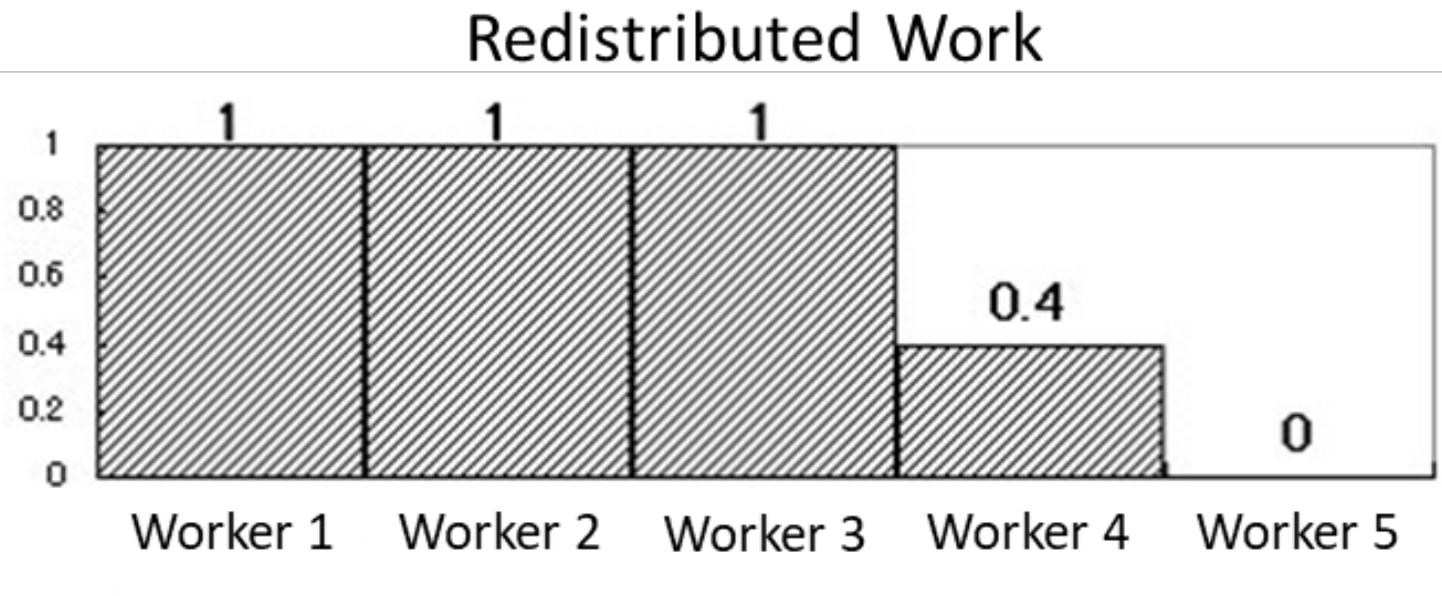
For example, when people need to walk to pick up parts, we should move the shelves that contain the parts and eliminate the walking time. After adjusting the line like this, we redistribute the work of all the people.

When distributing work within the takt time, only assign value adding work and the work that can't be currently eliminated.

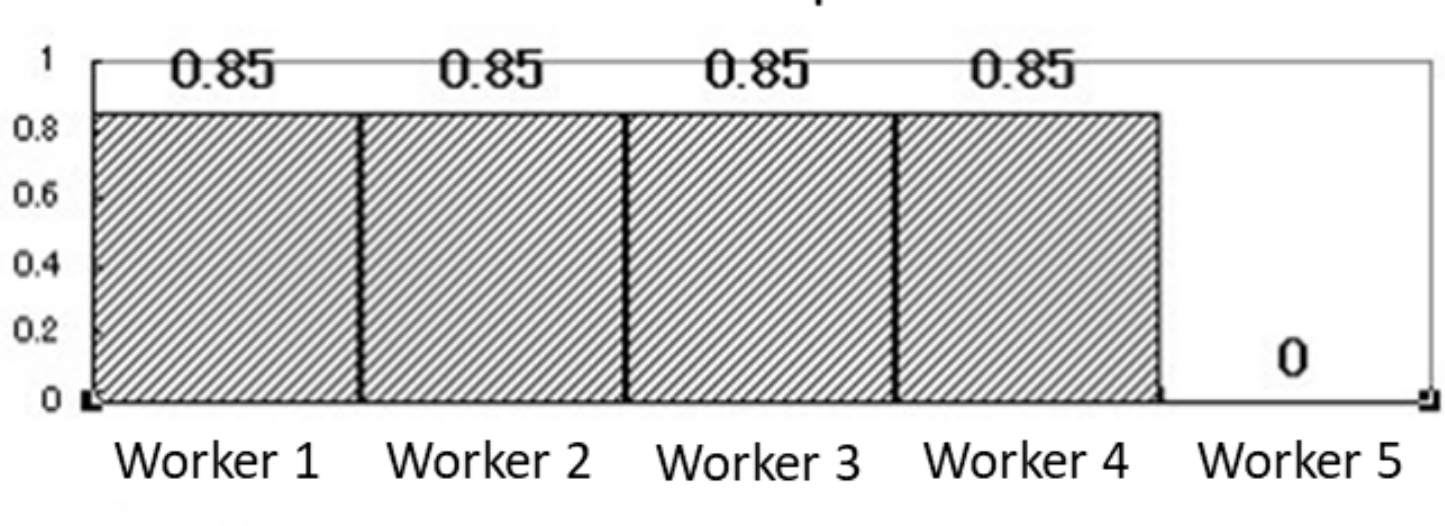
If we simply explain this using a diagram:



The current work distribution becomes;



It is important to note that the surplus time of worker 4 must not be equally redistributed.



The reason for this is that the equal distribution of the surplus obscures the unnecessary activity that had been clarified and made visible to everyone where the problems were and conceals the need for further improvement.

Furthermore, if all the four workers continue working with the surplus of 0.15 (day), which is the unnecessary activity of waiting, even if it is only for 10 days, this will reset their pace of work. When the next improvement is carried out, they may have a psychological resistance feeling that their work has been increased and become harder.

In our example, as the result of putting together and redistributing the work that had been done by five people, the same work is now carried out by 3.4 people according to calculations. Since there is no 0.4 person, it is still one person.

In other words, it's a situation where we've been able to reduce one person, and reduce the work of another to only 40%.

As described earlier, by reallocation of the work, one person has been reduced. The next thing is to reduce the odd work of person number four.

Our next goal is performing improvements that eliminates the 0.4 person's work. What shall we do to fulfil this 0.4 work without using a person? We focus on that and come up with a variety of proposals.

Among these plans, there are ones that cost money, like "autonomation" of equipment, as well as plans that don't cost much money like making a small chute to shorten the waking time, or making the pallets smaller, and putting them within reach.

At this stage, it's important not to choose an excessive plan. The purpose is to eliminate the of 0.4 person's work. The most appropriate plan is the one which cost least and is easiest to implement.

With this, the work that used to be done by five people, using a relatively small sum of money, can now be done with three people.

Next, re-examine the production line one more time. If you look closely, you may discover unnecessary activity that has been overlooked. Or possibly, you will find work which is considered non-value-added, which we have no choice but do in the current situation; but since it doesn't add value, it makes you rethink about whether it's possible to stop doing it somehow.

Once you gather these issues together and improve the situation, the challenge is, "can we take out another person?" This time, it won't be as simple as before.

If all the possible plans cost too much or affect the preceding/subsequent production processes, perhaps it cannot be realized now. However, by persistently observing the workplace every day while being aware that "there's a problem here," you might come up with a great idea.

It is also possible that the awareness of the issues would help achieving the improvement as new needs arise in the future, for example, when the takt has been changed according to the sales or when there is a facility change due to a model change. It is important to work patiently without giving up, even if it cannot be improved immediately.

Sequence of Improvement

In the previous section, we explained the method to proceed with improvement in this order: Redistributing work by eliminating unnecessary activity → Applying improvement to labor fractions → Further review.

Looking at this as described in the Section 1, the process can be explained:

(A) Immediately eliminating unnecessary activity,

(B) Reduction of work that does not add value, starting from the ones that can be most easily handled,

(C) Leave the Value Adding (VA) work as it is.

When proceeding with labor reduction, difficult parts in **(B)** can be handled by spending money. In the case of the VA work in **(C)**, it is possible to cut down on personnel by autonomation (Jidoka) if the need arises. In other words, all the works **(A)**, **(B)**, and even **(C)** can be subject to improvement. Depending on the situation, we might need to implement all of them.

When performing labor reduction activities in the workplace, it does not necessarily have to be done in the order as explained in the preceding paragraph, as far as you keep the following things in mind:

It is more likely that you can improve faster when you conduct the activities concurrently.

What you should be careful about is the order you carry out: you should conduct the work improvement first, and then do the equipment (or facility) improvement.

The improvement plan can be roughly divided into "work improvement" and "equipment improvement."

"**Work improvement**" includes setting the rules of workplace, redistributing work, and specifying the locations of things.

"**Equipment improvement**" includes installing devices, and automating equipment.

When carrying out the improvements, keep in mind that you should start with the work improvement and complete all work improvements, before carrying out any equipment improvement.

The reason is:

(A) Equipment improvement costs money. The objective is to have fewer people. If we spend a large sum of money on equipment improvement, when we could have done fine with work improvement, it could be said that we chose the wrong method.

(B) Equipment improvement cannot be undone. Equipment improvement can end in failure even if we thought it was the best way during planning.

Essentially, there are some elements involved that can be carried out only through trial and error. If something goes wrong in work improvement, you can easily make changes in the specific part of the process. On the other hand, however, if anything does not work well in the equipment improvement, you will then lose the money that has been invested for the improvement.

(C) Equipment improvement in a workplace that didn't fully undergo work improvement, is likely to fail.

Equipment improvement can most likely fail due to its inflexibility, when implemented in the workplace where organization and standardization of working processes has not been fully done

For example, if we automate a press in a work site with poor raw material management, the molds and automated equipment could fail right away because of contamination by foreign materials. If we end up assigning someone to watch over the automated machine to solve this problem, then this can't be considered as labor reduction.

For these reasons, TPS emphasizes you do the work improvement before the equipment improvement. It should be noted that this concept is also true in the case of promoting "automation" (Jidoka).

Originally, autonomation, or automation with a human touch (Jidoka), was equipment improvement with an objective of reducing the cost (labor reduction). However, there are a relatively large number of cases where autonomation became something like an objective, and implemented without considering the progress of work improvement in the workplace.

If the work improvement was insufficient, the expensive autonomation causes troubles and unnecessary activity; for instance, making defective product by lots, considerable decrease of the operation rate due to frequent machine troubles, or, the machine cannot be operated without an operator.

Careful consideration and reflection are needed on how to proceed the autonomation.

Other Important Points

We have explained above about proceeding with labor reduction. In the end of this section, we want to add a few more points.

Part of this will be discussed further in the next section, we will summarize only the main points.

Make the problems visible

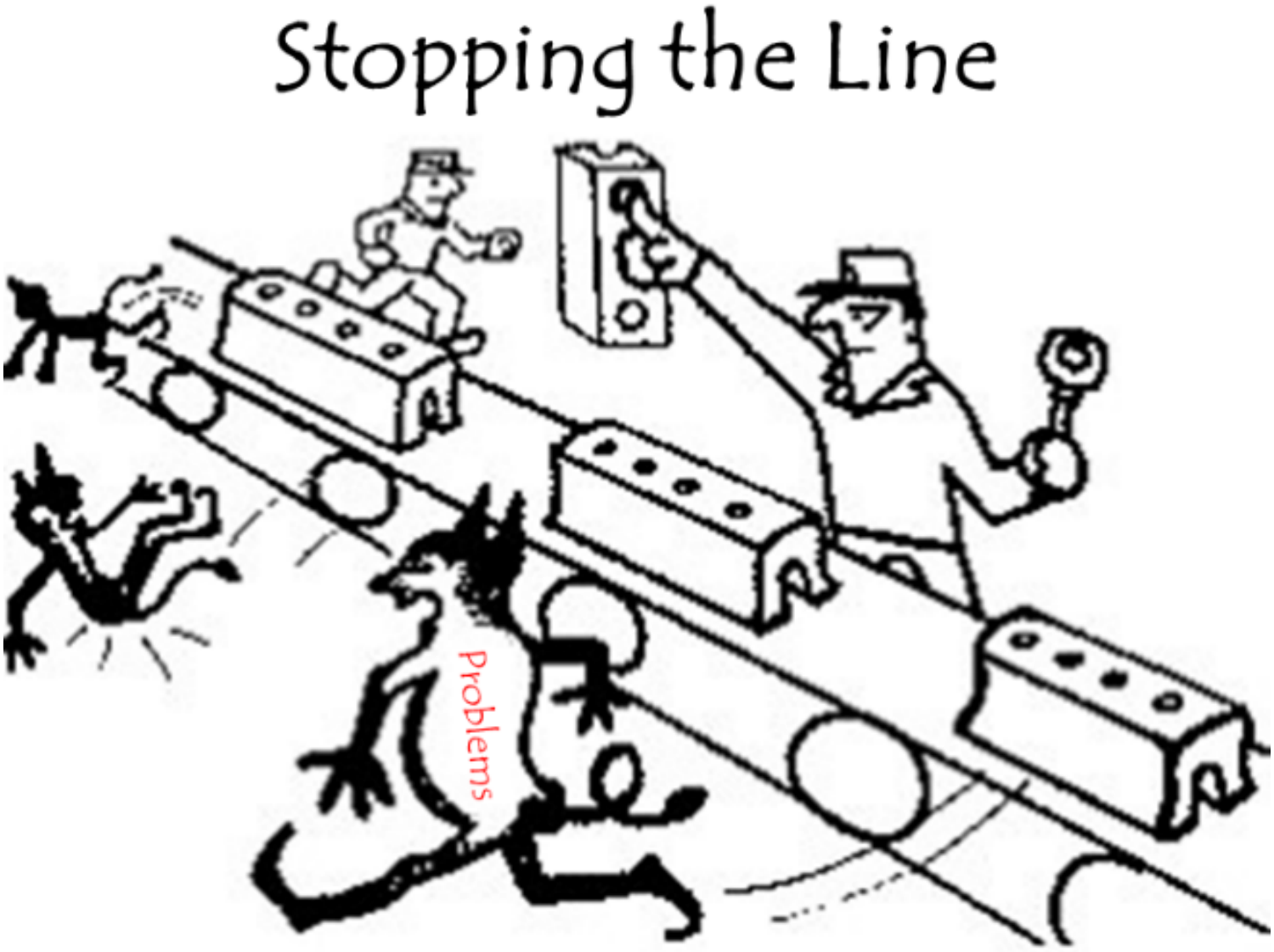
It is important to keep the workplace well organized and standardized so that the problems are clearly visible and recognizable to everyone.

If the problem is clear, it makes easy for all to think ideas of improvement together.

Do not be afraid of stopping the line

In the process of improvement, a temporarily confusion may cause line stops. If you are too afraid of stopping the line, it will not be possible to improve the current situation.

Instead of fearing line stops, you should consider them as the springboard for further improvement. It is important to take a quick measure so that the line can be operated without causing stops.



During the process of improvement, it is necessary to not hesitate to stop the line to clarify and solve the problem. This may cause a decrease in the production quantity and the staff may feel upset.

In the assembly line of a certain company, a supervisor achieved improvement by following this method.

During the process, the production quantity that had been 2,000 pieces per day went down to 1,500 pieces per day and the stock was quickly reduced.

Having been criticized by their boss, they started to waver inside. They kept believing that this was the only way to achieve improvement. Because of this persistence, in about ten days, that line became able to assemble 2,600 pieces per day.

While the supervisor of the neighboring line thought about how stopping the line even temporarily will decrease the efficiency, and will be a loss to the company, so they didn't allow their operators to stop it.

The improvement of the former line made the unnecessary activity of the latter line obvious. The difference between the lines became large enough even for everyone to notice it.

This is an example that has happened, but you must think thoroughly about how, inside Toyota, or even the lines of its suppliers, the lines that have relatively little unnecessary activity and high efficiency, don't fear line stops.

How to reduce manpower required

Even you have a great improvement plan, it is difficult to realize it without cooperation of the operators. To make the significance of the activities fully understood by the operators and to obtain their cooperation, the following points must be considered.

(A) Help the operator recognize that they have time to spare. An operator who has waiting time, should be allowed to idle for a while without doing anything. By doing so, it will become apparent that they have some spare time. There will be no strong resistance or opposition when they are assigned an additional task.

(B) When reducing people, reduce the best personnel first.

We often make the mistake to reduce the person who is difficult to control or those who are not good at or not familiar with the operations. By doing this, the person concerned may never show any development no matter how much time passes, and will become conscious of the opinions or expectations of others, and will resist them.

Reduction of the person who is doing poorly leads to a decline in morale. By reducing those with the good results, you can obtain active cooperation of others.[3]

[1] Takt is a German musical term for beat. Here we use it to pace the required production rate.

[2] The kanban card is a demand signal to the preceding process that materials have been consumed and need to be replenished. The Kanban System was developed to control inventory visibly as would happen on a dedicated conveyor system. With a conveyor, you can visually see when you need to add materials to the

feed and it limits how much you can add. Kanbans should not be used between activities that have visual contact.

[3] Takehiko Harada details this in “Management Lessons from Taiichi Ohno”. The best performer is removed and assigned the task of assisting with further improvements, thus this becomes a reward for making improvements.

> *To be continued...*

Section 7 - Labor Reduction and Supervisors

We are running a series of experiments to see if we can duplicate similar learning and improvement curves that Toyota and their suppliers achieved. The 1973 TPS Manual explains Toyota's thinking in very simple manner that is easy to understand. The manual also references the TWI programs, but does not go into much detail. This may be because the programs were publicly taught (by JITA) and assumed to be common knowledge.

We are compiling an annotated version of the 1973 TPS Manual + sample implementation sequences that we have found to be most effective + step by step instruction on using the tools.

If you want to hear more about the experiments and when the results will be available, you can sign up here. or contact me directly: Mark Warren (mark.tesla2@gmail.com)

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1 comment

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··· 7h

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