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PRODUCTIVITY: A STUDY ON BASIC TIME OBSERVATION

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Abstract

Productivity, as such is a competitive issue whether it is concerned with man, machine or land. Productivity in production is formulated with respect to the output and the input involved irrespective of the time. In this paper of ours we have tried to put up the time factor as counted in lean manufacturing.

We will go through a step by step process, or explanation, on how to correctly and properly complete a time observation in order to arrive at an accurate and real productivity number based from accurate cycle time, or what a process is actually capable of completing in a given amount of time.

It is important to understand that when trying to arrive at a productivity rate, number, or cycle time value you can only use the time that is available.

1. If you work an 8 hour shift you do not have 8 hours available to produce parts or complete a task or tasks. Naturally employees will have break times, possibly paid lunch, clean up time, etc. You can not include those times, such as break times, when arriving at a final productivity number, or cycle time value because that time is not available.

2. When completing time observations to determine cycle times always use the time value of seconds, not minutes, but seconds. It is important to stay consistent with the time values used and as you progress in developing more efficient processes you will be looking at how many seconds of waste you can eliminate rather then minutes.

3. Another way to view this is that the fewer amounts of time, even a few seconds, of waste, and then the less variation you will have in a process as well as increasing productivity and efficiency.

So, let's put this together so it's easier to understand.

Let's say we have a normal 8 hour work day. Let's also say employees have two 15 minute breaks and a 20 minute clean-up at the end of the day. We will also say that lunch is 30 minutes but not paid for, employee clocks out, so we will not need to worry about that time.

- *8 hour work day = 28,800 seconds.*
- *Two 15 minute breaks = 1,800 seconds.*
- *20 minute clean-up = 1,200 seconds.*

Non-available production time = breaks (1,800 seconds) + clean-up (1,200 seconds) = 3,000 seconds.
Total available production time = 28,800 3,000 = 25,800 seconds.

Knowing the correct available time is important because some businesses actually figure in breaks, clean-up etc. into productivity, or cycle time values. It is not the correct way to do it because it skews the actual "real" numbers. When you're trying to improve productivity and eliminate waste you need "real" numbers to work with. Unless a business is going to eliminate all breaks and clean-up there is nothing your going to do to get that time back and thus its just plain foolish and shows a true lack of knowledge on how to correctly report on productivity.

Thirdly, when completing a time observation you want to be careful to not conduct a time observation with your fastest worker, or slowest worker. If at all possible you want to try and conduct a time observation with someone in the middle. Also, it's important to note that when conducting a time observation the employee or employees need to know in advance and understand why you're conducting a time observation. They should already be aware that you're underway with a Lean transition and the basic tools of Lean, of which time observations are a very important part of. They should be a part of the time observation and their input should be listened to and respected. The most important thing you need to let them know is you are conducting a time observation on the PROCESS and not the employee or employees.

What we have observed many times in the past is that when people are being timed they sometimes tend to speed up. You want to insure, and continuously ask *"is this pace a pace you could comfortable maintain for an entire work period?"* (i.e. 8 hour shift, etc.).

When conducting a time observation it is best to use two people, one to actually keep track of the times and the other to write down the time data. You also want to be observing the process and taking notes of any issues and/or possible recommendations for changes.

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We are going to use a very simple example in explaining how to correctly complete a time observation, more for simplicity sake rather then being in person one on one. We will be using a Standard Work Sheet and Standard Work Combination Sheet.

Tools needed for conducting a Time Observation:

- Standard Work Layout Sheet
- Time Observation Sheet
- Stop Watch & Pencil For collecting data.

For this example the following will be the process and the different task associated with the process we will perform a time observation on:

Process:
Step 1. Final assembly of an electric fan.
Step 2. Number of employees in work cell:
Step 3. One employee.

The first thing needed is to use the Standard Work Layout Sheet and sketch out the current layout of the work cell/area you will be conducting a time observation on.
Here is a sample Standard Work Layout Sheet we have done for this example we will go through.

The next thing to accomplish is to observe the process so that one can determine how to break up the process into individual tasks. It could then be easy to define that those tasks on the Time Observation Sheet in order to time each individual task.

For this example we have broken up the process into 13 individual tasks as listed below.

1. Retrieve main frame from pallet #1.
2. Retrieve motor mount from bin #1.
3. Assemble motor mount to main frame.
4. Move unit to table #2
5. Retrieve electric motor from bin #2.
6. Assemble electric motor to motor mount.
7. Retrieve fan blade from pallet #2.
8. Assemble fan blade to motor and move unit to table #3.
9. Quality check Spin blade and insure no rubs and binds.
10. Retrieve two outer shields from pallet #3.
11. Assemble outer shields to each side of main frame, and move unit to table #4.
12. Final electrical test Energize motor and insure fan blade rotates in correct direction.
13. Place completed unit on pallet #4.

If you refer back to the sample Standard Work Layout Sheet you will notice numbers by each of the

Date: _____

Standard Work Sheet

Cell:	Available time:	Taken Time:
Product:	Required output:	Entered by:

Cell Layout	#	Description of Operation Step	Time		
			Manual	Automatic	Walk
		Total:			

Flow Quality Check Standard Safety

different boxes representing the tables, pallets, and bins. These numbers correspond to the above tasks numbers.

You would fill out the section of the Time Observation Sheet labeled task with the above outlined tasks. You are now ready to begin collecting the individual times for each task.

You'll notice on the Time Observation Sheet under the label "Observed Time" there are 10 individual boxes from left to right. You want to time each task for at least 10 cycles, or iterations. This is done to first see how much variation there is in the process and to give you a better understanding of what may be the overall time for the individual task. If there is a lot of variation from one cycle to the next it tells you that your process is not repeatable and thus has a lot of waste associated with it. Later on when you move to the Future State of a work cell you will want to root cause the reason for variation in order to eliminate it from the process.

Time Study Observation Sheet

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Department			Operator								Analyst				Total Time	No. of Obs.	Avg. Time	Most frequently reading	Minimum reading	Rating	Normal Time
Operation			Foreman								Date										
No.	Element	Unit Produced	1	2	3	4	5	6	7	8	9	10	11	12							

In any regards, for the time being, while conducting a time observation for the Current State you will want to look at the 10 individual times for a particular task and determine a good time to use. You do not want to simply take the 10 time data numbers and average them because you're then introducing waste, or hiding waste, in the numbers.

Our example does not have a lot of variation but if you had variation, for example,

your time data for an individual task was (in seconds) 5, 8, 20, 9, 18, 6, 22, 7, 8, 12 you might want to consider using the value of 8 or 9 seconds since it appears to be what might be capable if there wasn't the issues causing the variation you see with this example. If you were conducting a time observation for your Future State you would want to address, and root cause, the issues causing variations in times to correct them.

What you will be looking for on individual tasks times is patterns, or repeatability. If you look at the first task on my sample Time Observation Sheet you would notice the time appears steady, or close to repeatable, with the exception of number 4 being high due to a problem. Other then that it hangs around 4 seconds. When you're doing the time observation you want to note any fluke (coincidental) time data number, such as above with number 4, and when you sit down to determine what time value you will use you will want to ignore any fluke time data.So now you have your Time Observation Sheet filled out with tasks you are ready to begin taking time data. If you use a stop watch, like one that can be found in the Understanding Lean Store, they have the capability of splitting the time. In other words, as your timing and hit the lap button it will freeze the time between the last times you hit lap and now. It will also continue to time and this is why we have the stop watches that have the spilt time capability in the Understanding Lean Store.

The Observer (one collecting time data) will determine where in the process they will tell the Timer (person doing the timing) to give them the time data. The Observer will tell the Timer when to begin timing and when the Observer is ready for time data they should tell the Timer "mark". Mark will be the keyword for when to hit the lap button, read the time, and tell the Observer what that value is.This is a brief example to give a better idea:

Observer "Begin timing."
Timer Starts timing.
Observer "Mark"
Timer (hits lap button) states "5 seconds."
Observer "Mark
Timer (hits lap button) states "8 seconds."
Observer "Mark"
Timer (hits lap button) states "27 seconds."

After you have done a few time observations it will get much easier. Now that you understand how to actually conduct a proper time observation let's talk about how to use the time data collected. *Please refer to the sample Time Observation Sheet.*

As you can see all the tasks have been timed and data taken. Under the column labeled "Task Time" is the overall time value given for each individual task. At the bottom of the sheet is a box with Total Time, in this example the Total Time is 223 seconds. The 223 seconds is our Cycle Time, which is the time it takes to complete one complete cycle of all the tasks required to assemble an electric fan.

In this example we know it generally takes 223 seconds to accomplish all the task required for the final assembly of an electric fan. Right off the top it tells us we are capable of producing 16 electric fans an hour (3600/223 = 16).

So what exactly is, or would our productivity numbers? Since we know our cycle time we can calculate our productivity numbers very easily. All we need to know is how much time is available in a work day.

*If our standard work day is 8 hours we have 28,800 seconds. If there are two 15 minute (900 * 2 = 1,800 seconds) breaks and 20 minute (1,200 seconds) of clean-up at the end of the day we are now down to 25,800 total seconds available for production. Simply divide 25,800 seconds by cycle time of 223 seconds and you arrive at 115 electric fans can be produced in an 8 hour shift. Now, you want to use whole numbers and always round down. In this example (25,800/223 = 115.69) you still round down to 115 since your not going to complete another unit.*

Now using this information correctly is very important because some businesses do not use it correctly. Let's say you have a partial hour in the day, the hour with a 15 minute break. Your productivity number for that hour would be (3,600 900 = 2,700 seconds) so (2,700/223 = 12 units). If a cell produced 12 units in that hour it would have had 100% productivity. In an hour with no break etc. your productivity number would be (3,600/223 = 16 units).

The above is very simple to understand and very simple to figure out but you would be amazed at how some businesses don't have a clue on first, how to figure out what their actually capable of producing and second how to calculate it if they did know.

The only way to truly know what your processes are capable of is to document reality. With the above information you now have the information and ability to determine what your different processes are actually capable of. If you do not use the above information and document reality within your own business and depend on numbers from where ever they may come from you will always be using bogus numbers and will never know what you're actually capable of and thus will continue to flounder around wondering why you can't seem to ever get 100% productivity.