You Have a Machine Oriented Process – What is Your X Factor?

Manufacturing Cycle Efficiency (MCE) is a great way to determine how much of your product Cycle Time (CT) is actually Non-Value Add time. If you take action that increases your MCE and reduces your CT, you have helped your department and your company because you have most certainly removed waste from your process. However, in a department that is populated by machines, MCE may not be the only measurement that you might want to use.

The theory about how to best "utilize" your machines involves engineering logic that has certainly changed over the years. Back in the 70's, 80's and even the 90's, there were those that subscribed to the theory that, in order to justify the purchase of expensive machines, it was absolutely necessary that those machines run product as close to 100% of the time as possible. If a department manager didn't keep the machines running, the accountants would issue a bad report card.

Of course, in order for the machines to remain utilized, it was necessary to release sufficient product to the line to keep the machines "fed". Engineers would do exhaustive studies to determine just how much product was needed in front of the machines to ensure that the machines were never starved for product to run. It was better to be safe and have more than enough than to starve the machine for work.

While this scenario gave comfort to the accountants, it usually created a disaster for production. Those of us that subscribed to Just in Time values preached the concept of "Effective Utilization" as opposed to standard utilization to our management. Standard utilization is measured by determining the percentage of production time that the machine was putting out product. But what if there was no requirement for product? How can you keep a machine running if there is no product to run? Well, that manager's report card would be adversely affected under those conditions.

On the other hand, if you had enough product to keep your machines utilized 50% of the time and you actually ran your machines 50% of the time, your effective utilization would be 100%. Getting the accountants (in those days) to believe that production was actually getting 100 percent utilization from their machines was a tough sell.

Determining how many machines was needed to meet not only the present demand, but a projected demand, was one thing. Presenting a case to management for the purchase of those machines was quite another. In some of the companies that I have worked with, it was a common belief to be safe rather than sorry. Being safe meant purchasing the bigger, faster machines which also meant more expensive.

Once the machines were purchased (during good times), several things could happen to muddy the waters. If orders stopped coming in at the expected rate, it was suddenly discovered that too many machines had been purchased and utilization would deteriorate. It could also be true that only one super big super fast machine was purchased and although this machine was advertised as able to handle

the load, problems here and there caused it to constantly cause product to back up. The super machine was now a bottleneck.

Too often, the quest for utilization causes companies to make decisions that adversely affected manufacturing's ability to produce product in a timely fashion. Now if you are like me and believe that putting excess WIP on the floor in order to keep a machine fed is the equivalent of hitting your hand with a hammer in order to relieve a headache, you must then say that there has to be a better way of dealing with the issue. If you do, you are right. But since hindsight is always "20-20", once a machine is purchased, the deed is done. Unless you are able to correct that situation economically, it is time to ensure that whatever decision that happens next is in the best interests of manufacturing. Too often this is not the case. Too often, manufacturing is given restrictions or requirements that inhibit its ability to produce product just to compensate for poor machine purchasing decisions.

Releasing orders to manufacturing that have incomplete kits or releasing orders that don't have a requirement are two examples of hurting manufacturing. All you accomplish in those cases are to cause WIP to build up on the floor. There are only three things that can happen to WIP that is sitting on the floor unattended, and two of them are bad. The only good thing that can happen to that WIP is NOTHING! WIP sitting around causes all product CT to increase because it takes resources to manage the WIP and it takes up needed space. Quite often product quality is affected. Parts from kits sitting around are used on other product in order to get that product out. Product is often damaged by contact and handling and even corrosion. As I said, a number of things can happen and all of them are bad.

When employees start borrowing from one kit to feed another they are creating an endless loop that almost always eventually results in a serious problem. When product is built based on the assumption that it will eventually be needed, it could well end up as scrap or just sit around in finished goods and get marked off eventually. All of this is a waste and could be avoided by using decisions based on a proper production value set.

But the problems experienced could have nothing to do with the decisions made by upper management and engineering. They may have made the proper decision and manufacturing is the one that doesn't have the proper value set. Good decisions may have been made with the machines but manufacturing makes production decisions that are misguided.

One of the biggest problems in machine oriented processes is associated with how they do their setups. I have worked with companies that, if there were ten machines and ten employees, there would be ten different ways of doing the same setup. In my book, I explain the Team Setup technique that I teach that goes all the way back to 1980 when I first studied the works of Shingeo Shingo in his book on SMED (Single Minute Exchange of Dies). I will not expand on that here other than to say that if there is a proper way of doing a setup, then everyone should be doing that setup the same way and if someone comes up with an improvement on any part of it, then everyone should benefit from that improvement. Setups are NVA any way you look at them and the faster (and better) that they can be completed, the better off the company will be. It is standard policy for me to say that if it is necessary to reduce setups, I can guarantee that the amount of reduction is no less than 50 percent, and it will happen quickly.

Another problem that I have seen in virtually every company that I have worked with is created on the production floor and usually by supervisors, leads and sometimes engineers. When a problem occurs with counting the number of widgets coming off of the machine or even inspecting the product going into or out of the machine, somebody may decide that the best way to solve the problem is to "temporarily" double count or double inspect. Another example of this is that when a worker makes a mistake the whole department has to do what they call a "buddy check". Each of these examples is bad for manufacturing and it is likely that they never go away. I have worked with companies that had these things going that were not discovered until they were exposed through process mapping. There are numerous more examples that I could give you and as I said, I have seen them everywhere. The point I want to make is that other than those people actually doing these things, there is nobody else that knows that many of the problems that are associated with the machines themselves are actually created on the production floor.

I have seen production problems that were actually caused by the engineers that were trying to find a solution to a machine problem. An engineer might go out to the floor and ask a machine operator to take data or just fill out some kind of log (temporarily). I remember talking to an operator that was taking data and when I asked him how long he had been taking that data, he told me that he had been taking it for several months. The data that he was taking had to do with certain "quality" checks. When I approached the engineer, he told me that he didn't need the data anymore. He looked at the data for about a week and then forgot about it. The reason that I was talking to the operator in that case was because that particular department was the bottleneck department. Crazy but true.

When middle and upper management look at their processes, they most likely look at bottom line reports and presentations by lower level managers. If a machine department isn't putting out enough product, they (management) usually associate the problem with resources or training. They either need more machines or more people to run them or perhaps they need a better training program. Their bottom line orientation leads them to conclusions that probably won't work and will certainly not give them quick and permanent results. They just don't know what they don't know. You can never know where the solutions really are until you know every little detail of your process because the real truth will stay hidden until it is dug out through analysis. Process mapping and simulation modeling are great tools to get management to understand the real reasons and solutions for their problems.

In a machine oriented process there is a measurement that helps you to understand how well you are performing. The measurement is known as the X-Factor. The letter "X" is a symbol for "Multiply" in this case. The equation is: **X = CT/RPT, (**RPT = Raw Process Time). CT is the total time from the moment the product is AVAILABLE to the department until the product is available to the next department or distinct process step. RPT is the defined as the actual amount of machine time needed to produce the product. It does not include time taken to complete setups, load or unload the machine or to deal with machine interventions. It also does not include any quality checks, counting, paperwork or anything else that the operator does that slows the CT. It is simply the time the machine itself needs to complete its job. Queue time in front of and behind the machine counts in the CT, not in the RPT.

To determine the CT, you use Little's Law (CT=WIP/Output) so that in order to compute the X Factor, don't try to do it one widget at a time. Look at X Factor over time (Total output daily or hourly). If the total cycle time of the product from input to output is 90 minutes per widget, and the RPT is 30 minutes, you have an X Factor of 3. If that is true, you have an X Factor that is world class. Most likely you will see an X Factor of more than 15 and many times will be 30 or more! That means that your CT is 30 times longer than your RPT!

If your X Factor is high, it is an indication that you have too much NVA in your process. Start looking at how much WIP is at the front and back, and how often you ship your product to your internal customer. If you ship 50 widgets per hour and your X Factor is 30, your CT is much too long. You should look to cut down on WIP, reduce setup times and look for wasteful process steps.

The most important thing to get from this is that just like manual assembly lines and other processes, machine oriented departments can find that they have problems and will often come to the wrong conclusions as to how they should deal with those problems. Employing the correct values and using the proper tools will help you to fix your problems. Technology helps sometimes. Added resources help sometimes. Automation helps sometimes. The only thing that ALWAYS works is process simplification through the elimination of waste and NVA. And to top it off, it's much cheaper than any of the preceding solutions. Amazing isn't it?

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