# Operation Excellence

April 22, 2014

# The Power of Measurements.

I recently completed an assignment where a client wanted an evaluation of one of their manufacturing operations. In this case it was a fairly detailed evaluation -- it took the better part of 3 weeks. While my analysis was pretty broad and included recommendations on bar coding, ERP systems, data collection, quoting of new jobs, etc., the main reason for the extended required time was that, for an organization that was more than 100 employees... their data was very poor. During the summary presentation I told their corporate management team that frankly, their data set was the worst that I have seen in over 30 years.

When I started the project, the CEO told me that "we don't measure much, but at this facility we do have a pretty good handle on our efficiency." That became my first clue.

This company is a high volume custom job shop assembler. As an indication of volume -- about 150 truckloads of product are processed in this facility each month. The bills of material are simple, -- one level bills, there are no full batch process operations (heat treat, plating, etc.). Some assemblies do require traceability of components. All items are date coded. Other than that, it is a pretty simple and straight forward operation. Some would call it a "trucks in—trucks out" type of business. Quality is outstanding... very few customer complaints and perhaps one or two NCMRs (non-conforming material reports) per month, primarily vendor problems incoming to this facility. This operation is ISO 9000 registered.

A few years back, they had developed an in-house system to measure and monitor efficiency. Efficiency is calculated (manually) to 3 decimal places and manually entered into a cloud based data base. Lost time on the floor is dutifully and manually recorded in buckets, as small as 4 minutes, for each job. About 2 dozen different jobs are run each day. Some of the assembly lines (cells) are automated (the pace is machine controlled) and have perhaps a dozen workers operating on the line. Other lines/cells may have one to twelve (or more) operators assembling products, and the work is flowing through the cell totally controlled by the pace of the operators.

This plant has experienced a tremendous loss in sales volume from prior years and as a result, profitability is negative. While it was recognized that in order to return to profitability more volume will be necessary, the negative results are driving plant management into a ferocious frenzy to determine **product profitability**. As an example, for estimating purposes, square footage is allocated to product cost and assigned varying dollar values if it was utilizing floor storage, versus rack storage. For estimating, labor costs are allocated to the product based on "actual" rates of various skilled operators... e.g. "That product requires 2 permanent

employees at $14.00 per hour and 3 temps at $8.50 per hour." A bid sheet for a new job might require 6 pages of detailed analysis – and yet the job might only require the labor of 4 or 5 operators a couple of shifts to perform the work.

After sorting through 13 months of daily job performance data, my conclusion was that the CEO's understanding about their having a handle on efficiency was 100% wrong. They THOUGHT they had a handle on efficiency. In fact, they were producing reports of no value.

- Plant efficiency is being measured as the average efficiency of all jobs – a job requiring one operator is weighed equally as a job requiring 12 operators. 100.0% for a one operator job and 75.0% for a job requiring 12 operators is reported as a combined 87.5% efficiency performance.
- There is no feedback or auditing of job standards. Once a job is estimated, priced, ordered by the customer, and released to production, the standard cannot be changed. If there are multiple releases (read reoccurrence of the job) – the original standard cannot be changed in the system. Even if there is an error... for example, a quantity of 6 should be a case quantity of 1 – it cannot be changed in the system.
- Across the 13 months, the recorded job efficiencies in their data base (that I combined into one "monster" Excel file) ranged from 0% to 78,000,000.0%.

This plant is run by very good people. The pace of work is excellent. It is a very clean facility and has a quality of the workplace that is better than at least 95% of the facilities that I have seen. Turnover is very low. It is a great place to work. There is evidence of teamwork, respect, and integrity – all great values.

It is a fortunate situation in that there is relatively little WIP or finished goods inventory and from a financial reporting basis, no inefficiencies are being captured and amortized into inventory cost valuations effecting the P&L statement.

**The core problem... the wrong measurements are in place**. Cost world thinking is driving this "ship" and it is headed for the rocks. They are pushing their efforts to allocate costs almost to the point of insanity.

## Throughput Accounting/Lean Accounting!

I was surprised with the financial background of the company's management team that the term "Throughput Accounting", was unknown to them. "Lean Accounting" was also unknown. My surprise was magnified in that from a total corporate culture perspective, a Lean initiative was one of 5 stated corporate goals for all of their locations. I did not meet the individual, but I was told that they have a Corporate Director of Lean Initiatives in their organization.

If your google "Throughput Accounting" you will get about 3,650,000 hits in 0.19 seconds. Google "Lean Accounting" and the results are 20,400,000 hits in 0.37 seconds. These terms seem to be widely known. While some might disagree with me... for all practical purposes, these two terms are synonymous. Both define "product costs" as being only the totally variable costs – material, freight, commissions, etc. for an item. All other costs, labor, IL, rent, utilities, salaries, insurances, etc. are considered "Operating Expense" and recorded as a period cost – no allocations to individual items.

To the company's credit... they do have the term "VAM" (Value Added Manufacturing) in their daily work vocabulary ... and they do define VAM as many experts define "Throughput" (I spell it "Thruput" as it requires 3 less key strokes ☺ ).

Throughput = Thruput = VAM = Sales Price – Raw materials

## The power of using Thruput (T) and Operating Expense (OE) for decision making.

My feeling is that every member of the work place community should understand these terms. Not only should they understand their definitions – they should consider Thruput and incremental Operating Expenses (OE) in almost every decision that they make. The power of these two items is explained in the following real life example that I witnessed in this particular plant.

During my assignment, one morning, a new job had been released to the floor. As I walked by, it was obvious that the cell team was "struggling" a bit and trying to get up to speed. (My Iphone has a better stopwatch app than I ever had with a real stopwatch as a practicing Industrial Engineer – ) So I stood back about 30 feet from the line and "put my Iphone on it" and did a quick study. As Yogi Berra once said, "You can observe a lot by just watching."

- The work pace of the assembly cell was not machine controlled.
- There were 9 operators in the work cell/line.
- I observed that 20 units required 18 minutes to assemble and pack. I was told that, "the rate is 2 per minute" – they weren't hitting that target!
- Everyone was busy – especially because a "consultant" was obviously observing them – still work was queuing up in front of the last operator in the cell.

The job estimator came out to the cell and asked me, "How are they doing?".. I told him that they were averaging 0.9 minutes per unit.. with 9 operators that equates to 8.1 labor minutes per assembly. He then told me, "well, I had the job estimated with 12 operators not 9". [12 operators finishing 2 units per minute would be 6 minutes of labor per assembly.] The line was operating at about 75% efficiency to his standard– 74.1% as would be recorded in their data base.

The Production Superintendent came up and started to help the team rebalance the tasks between cell operators. I walked away.

I returned about an hour later and again put my stop watch on the line. The results were that 20 units took 14 minutes to assemble and pack. But now there were 10 operators in the cell. It was better. The Production Superintendent said, "...we are meeting rate!" --- well, not exactly. They were running at 0.7 minutes per unit with 10 operators... 7 labor minutes per assembly. The cell was operating at about 86% efficiency (85.7%). Again, while better, the parts were still queuing up toward the end of the cell.

- The problem was that the solution was not being evaluated on the basis of Thruput (T) and Operating Expense (OE). Specifically, how much *incremental* Thruput could be generated with the addition of some *incremental* Operating Expense?

Let's look at the method to do this:

The VAM or Thruput -- (Sales Price minus the Raw Materials) was $5/unit. Actually the Raw Materials were owned by the customer, my client was being paid $5 to assemble and pack each assembly.

At the Job Estimator's rate, 12 people would assemble 120 units per hour. If we use $15 per hour for the operators (I can multiply by $15 in my head much easier than the actual rate of $12.76!). We have the following:

Thruput (T) – Operating Expense (OE) = Cell Profit

- Thruput (T) = 120 units/hour * $5/unit = $600 of Thruput per hour
- Incremental operating expense would be 12 operators * $15/hour = $180 per hour.
- Cell "profit" would be $600 T - $180 OE = $420 per hour

Based on my first observation with only 9 operators, the cell was generating the following results:

- ($5/unit * 66.7 units per hour) = $333/hour Thruput
- Incremental operating expense was 9 operators * $15/hour = $135 per hour.
- $333/hour Thruput - $135/hour Operating Expense = $198 "Cell Profit" per elapsed hour.

Less than ½ the value of the initial estimate!

After the Production Supervisor improved the manning, my second observation with 10 operators producing 85.7 units per hour, the cell was generating the following results:

- ($5/unit* 85.7units per hour) = $428/ hour Thruput
- Operating Expense =10 operators* $15/hour= $150/hour
- $428/ hour Thruput - $150/hour Operating Expense = $278 "Cell Profit" per elapsed hour.

Better – a much improved efficiency 84.7% but only about 66.2% of the targeted profit contribution rate.

I suggested to the Production Superintendent that he should probably add one more operator... and that by doing so, the cell could probably get another 30 units per hour (one additional unit every 2 minutes). He was now fully focused that the parts that were still queuing up in front of the "cell's constraint", at the end of the line. If that rate could be achieved with one additional operator ... then the math becomes:

- Incremental Thruput = 30 units * $5/unit = $150 more Thruput per hour
- Incremental Operating Expense for 1 more operator = $15 more operating expense per hour
- Further Incremental Profit = $135 per hour

So by adding 2 operators from the base case at a total incremental cost of $30 per hour... we would generate about $418 "Cell Profit" per elapsed hour... an improvement of over $1,700 per shift with just 11 operators! This amount is also an improvement of **7.3 x over the incremental Operating Expense**. By the way, IMHO the 11 operator line looked as though it could run with 105% efficiency.

The following table shows the 3 scenarios:

| # Operators | Units Produced per elapsed hour | Efficiency | Cell Profit per hour | Cell Profit per shift (8 hours) |
|---|---|---|---|---|
| 9 | 66.7 | 74.1% | $198/elapsed hour | $1,584 |
| 10 | 85.7 | 85.7% | $278/elapsed hour | $2,224 |
| 11 | 115.7 | 105.2% | $413/elapsed hour | $3,304 |

## By adding 2 operators and comparing the results, 11 operators versus 9 – efficiency improved 31 percentage points – but profitability more than doubled!

(I realize that with scheduled breaks... the yield would be slightly less as you probably only get 7.2 hours per shift... put the comparison is still very valid!)

If you were to **annualize** the improvement $ effect that we observed in just this one cell – it becomes a very impressive number (by the way, they have 7 different operator paced cells in this facility – and during some months of the year they run these cells on multiple shifts)! ☺

Even if the 10 operator set up had been able to run at 100% efficiency (and everyone would be feeling that they were doing a great job!), the Cell Profit would have been only $350 per elapsed hour.

Now, armed with the data of $Thruput/unit and a guesstimate as to the *incremental* OE ... the team could make much better decisions ... perhaps it would have been wise to add even more operators to the line if the *incremental* $Thruput were sufficiently more than the *incremental* $OE!

Selling Price

- Raw Material (truly variable costs)

= Thruput

- Operating expense

= Profit

That is pretty simple math folks and it provides decision makers with much better tools for making decisions – even at the lowest level of the organization.

It is not that our team members are stupid or can't be trusted with the data; we are forcing them to obey rules that sometimes don't make sense to them and violate their strong intuitions. The power of having correct measurements cannot be overstated!

If we give the members of our work place community better data (both the correct and more accurate data); they will willingly accept responsibility and take more ownership of the outcomes. "People are good." That is a "good thing".

Efficiency measurement is the worst hoax perpetuated on the industrial workplace in the last century + of time.

So, how is that Lean initiative that you may have started a couple of years ago working for you? Is your firm seeing these magnitudes of improvement results or are you like 95% of the companies that have failed Lean Initiatives (96% fail per a study credited to Auburn University). In my opinion, a lean initiative that has only achieve the implementation of a 5s process is a failed lean initiative!

It may come down to:

What is the cost of having someone come in and help us restart our process of ongoing improvement?

Versus

What is it costing us if we don't have someone help us to restart our process of ongoing improvement?

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"Profound knowledge must come from outside the system – and it must be invited in."

--W. Edwards Deming

All the best!

Jim Covington

www.jpcovington.com

Jim.Covington@Inwave.com

815-988-5404