White Paper

Biting the Bullet in Tough Times…

Five Less Obvious Areas of Mid Sized Manufacturing Operations that May Be Mined for Improvement Before Business Frenzy Returns

By
Kent Vincent, MS, MBA, CIRM, 6Sigma BB

Even in tough times when they need to maximize the impact of every nickel, I and many other specialists have seen many manufacturers burning money.

How?

Well, their attention is usually drawn to the obvious, and companies in tough times usually tackle those: cutting personnel, eliminating extra programs, etc. However they may lose money in the long run if they don't attend to other fundamental changes.

Here are a few ways among others that I'm familiar with that are less obvious, yet can make serious impact on the bottom line and should be considered especially in this economy:

- Measuring the wrong quality characteristics
- Improper sequencing and execution,
- Over investing in the current "as is" environment prior to changes
- Living with business software that is sub optimally implemented or outdated.
- Overlooking opportunities to provide closer linkage between R&D and production

I write and share this report so perhaps you, the reader, might find a nugget or two for your own business. It's not copyrighted – you can duplicate it to your heart's content and pass it to whomever you think would benefit from it.

SIMPLE EXAMPLE FOR ILLUSTRATION PURPOSES
A major American candy and confectionery company was computerizing its supply chain to make things more efficient. All the information of the raw ingredients, time to ship, quality testing time, etc., were being integrated into one master system. In the process they missed one piece of information for synchronizing events: seasonal supply chain events. They almost missed Halloween! Eventually with frenzied damage control, they were able to gear up the production to meet the demand.

So, that's an obvious example, and it's such a big SNAFU that it's hardly likely your company would make that mistake: your company is not likely to miss it "Christmas season." But it can miss many smaller practices that can cause bigger glitches. "A Stitch in Time Saves Nine," as they say. Trouble at the headwaters of production can get amplified downstream.

Here are some illustrations from my experience that could contain valuable lessons for anyone involved in process manufacturing:

1. ***What you measure or assess is as vital as how well you measure it: or… "Product shipped by weight, not volume; contents may settle during shipping."***

That consumer warning on packages reminds us of every day occurrences: Focusing on one parameter while measuring another. Why would you measure volume if you were shipping weight? Well, it can get confusing.

Think of a school bus. What color is it? Yellow, right? Not exactly. It's actually a distinct mix of trace colors like red, blue, etc, which are added to the yellow in just the right proportions that makes the bus so recognizable in dim light or stormy conditions. The recognition and safety factors, so key to quality, stem from less than obvious characteristics.

Other examples abound. Let's look at another involving formulated industrial products.

At one time I worked with a small maker of low-tack hot-melt adhesive that was used to make tacky polishing cloths for the furniture and automotive industries. One day the company found product was being returned for inconsistent tack levels and poor color and appearance. The firm needed an objective, targeted measure of the quality and effectiveness of the cloth to satisfy its large OEMs and its ISO registration requirements.

The "stickiness" characteristic of the finished product was conferred by the polymer impregnated in the surface. Up to that point the company had relied upon a "thumb feel" subjective judgment of function along with a set of deteriorating retained products as visual standards for color and general appearance.

Employees thought viscosity of the molten blend at various stages was the key. Measuring that would call for some expensive, high maintenance instrumentation used carefully at precise intervals. But I suggested examining the process more closely with a disciplined experiment designed to see which process variables are clearly related to important end product characteristics.

As it turned out, viscosity was a weak predictor of quality and performance. In contrast, a low tech, inexpensive surface friction test proved to be far more effective. The company saved $6500 per device in test equipment investment along with daily operating and maintenance costs associated with the more elaborate testing method.
The subsequent QC testing program that was set up incorporated this and other straightforward measurements. These methods kept costs and quality in line and offered deeper insight into the impact of process conditions and ingredient proportions. In addition, the friction test provided a vital element of the objective "process control" requirement of QS/9000 (now 2000) guidelines.

This new approach enabled the firm to obtain compliance and satisfy vendor certification and supplier audits from large key customers and to qualify for new business.

Is your firm, large or small, simple or complex, measuring the right things for the right reasons?

2. Haphazard Sequencing of Orders and Processes Causes Waste, idle time, delays

Everyone knows the aggravation of living with the limitations and constraints of processing equipment. Only so much quantity and variety can be produced in a given period. What is less obvious is that there is often still room to adjust the sequencing and conditions to maximize throughput. These adjustments can even go a long way toward fulfilling the "lean" goals of less waste and idle time. This requires at least a little disciplined logic and spreadsheet style figuring over and above what a visual scheduling tote board, grid diagram, or other types of crib sheets can provide.

In one fluid agrichemical operation I observed, the purchasing manager, the shift foreman, and a planner/scheduler all had their own schedules. No schedule was compared with any other until after many production orders were already launched. Which one prevailed? You guessed it, a fourth in-plant "on the fly" compromise schedule based on hunches, incomplete information and last minute corrections.

Other examples can be found among small suppliers with two or three key operations:

Consider two consecutive interdependent processing stages with separate process durations that are somewhat predictable in advance. The sequenced stages might involve agitating, heating, curing, drying, and the like. The duration of each will vary depending on the raw material in question, the conditions chosen, even the weather (as in conveying and melting wax or other substances). This means that for a given job one process may take longer than another, while the reverse may be true with another job.

A producer of dispensing machine beverage powders was experiencing order stack ups and random waiting and idle periods as the sequence of different materials were processed. As part of the general process overview, I learned that the company had a two-stage blending and spray drying process. In this process some raw materials dissolved better than others, while some finished blends required slower, gentler drying cycles.

These next three paragraphs are a little complicated, so you may want to consult the chart that follows to help you follow the procedure as it unfolds. But the lesson is succinct.

In such cases a good way to sequence the jobs is to find the job with the shortest predicted process time for either stage. The job is then queued up first if the first stage is expected to be shorter than the second. If the second stage is to be the faster one, the job is queued up last.

The process is repeated with the list of jobs remaining, filling the sequence in from both ends toward the middle until all jobs are sequenced. An optimal sequence minimizing total process time will result.

A slight modification of this procedure using correction factors can be used in cases where the second stage can start before the first is complete, as with split orders, draw-offs, and partial batch transfers.

This approach does not require expensive or sophisticated software or more than visual comparisons and spread sheet level calculations. A step-wise development of a job sequence is shown in the chart below.

This approach also proved useful in environments such as a melt and mold sequence for wax slab preparation where melting and molding steps can alternate as bottlenecks, depending on the grade of wax and other conditions.

Note that the objective is not better equipment utilization for its own sake, but better throughput of job orders per time period—what generates revenue for the business after sunk costs have been committed. (*No one has ever been paid directly for how uninterrupted their equipment usage is, unless it's to settle a bet!*)

Job No.	1	2	3	4	5
Time, stage 1	3	5	1	6	7
Time, stage 2	6	2	2	6	5

Step	Jobs Available	Shortest stage=	Assoc. Job	Job Sequence
1	1, 2, 3, 4, 5	1	3	3 x x x x
2	1,2, 4, 5	2	2	3 x x x 2
3	1, 4, 5	3	1	3-1 x x 2
4	4, 5	5	5	3-1 x 5-2
5	4	6	4	**3-1-4-5-2**

Are there process sequences in a facility you know that could be more monetarily productive rather than merely more "efficient"? There may be a way to get that productivity without equipment upgrades or expansions or heavy number crunching.

3. Ignoring growing gaps between aging application software features and needs

Everybody's got business operations software to sell nowadays. It's tempting to avoid the complications and uncertainties of changing or upgrading. We have witnessed a deluge of specialized offerings ranging from erp, mes, and industry specific CRM systems to process control and data acquisition systems. And now internet based enterprise manufacturing intelligence (emi) to tie the loose ends together. It can all induce severe "acronymphobia", not to mention confusion and paralysis.

On the other hand, tough times require that we seize every advantage possible. How can we do that when I/T budgets are shrinking?

One approach to consider is allowing an unbiased computerized expert system help with the decision. These expert system logic tools can gauge the gap between past, present, and future needs and the capabilities of the applications in place. Best of all time and assistance can be rented on a per project basis, keeping the investment modest.

At one time, I undertook an application software assessment for a $30M metals processor. The firm served the automotive and allied industries and organized its stocked and in-process materials by attributes (size, weight, length, width, grade, etc.) rather than by sku numbers. The OEM firms using such an "outside processor" are essentially both suppliers and customers at the same time--material arrives, gets processed, and is returned to them.

Each of these circumstances limited the metal processor's ability to conform to more widely applicable manufacturing software packages. Use of the expert system evaluation tool combined with some extra research revealed that an industry specific niche ERP product for "attribute based" metals processors would work better than an initially cheaper generic ERP system that could be costly to customize, adapt, and maintain.

After selection and implementation, the estimated savings for this small enterprise was well in excess of $150,000 annually when compared to previous methods of tracking, organizing, and executing material processing that combined manual and older, less adaptable software. Savings on customization costs, both planned and unplanned, obtained by selecting the specialized rather than the generic package added time savings estimated at $100,000. Of course, no one should blame the client for declining to run an experimental generic package implementation in parallel to verify these savings!

Is there a suspicion that the capability gap between business software and requirements may be growing? Now might be the right lull in the business cycle to find out and take action.

4. Needlessly Prolonging Continuous Improvement in Two Crucial Ways

The batch flow or semi-continuous process operation at first glance seems less amenable to finding and implementing improvement opportunities than a textbook discrete "widget making" or piece part operation you may have seen. Pipes, vessels, steam jackets, or reactor chambers obscure the easily identifiable avoidable waste and "non value add" activity, and crews may tend to several activities spanning several lines rather than distinct work areas or cells. Yet, reasonable bite-sized, digestible improvements in these environments are feasible. What may make more sense, at the risk of committing heresy against lean thinking or other improvement philosophies, is to move directly to a better "future state", rather than optimizing or dressing up the "as is" state at critical points in the facility. (I will assume a little familiarity with process improvement vocabulary here, but the ideas are straightforward.)

To illustrate, it may make more sense to skip the work area neatening and straightening and “quick hit” efforts called for by work place clean up (“5S” in Japanese buzzword speak) and “kaizen” incremental improvements and proceed right to the new “to be” process setup. The existing human work space is external to the process, after all, and may even prove irrelevant after changes are made

A hand-blended, barrel and drum scale stamping lubricant blender that I assisted made the leap to an automated mass flow meter based blending system. This mini-scale operation found that neatness and reduced clutter naturally followed in the wake of this upgrade once the frantic pace of manual rework and adjustments abated. It can be more heartening to the team to make manageable, meaningful changes of this sort rather than trivial or elementary ones or to make pointless changes that are destined to be quickly displaced by others.

A food microbiological sample testing facility client had a congested arriving sample area, an immovable, fixed walk-in incubator that handles many samples at once, and other sample prep, scaling, and sequential repetitive processes surrounding it. The facility needed a way to relieve the receiving area choke point and get samples processed faster to service critical customers better. Through our help they found that adapting continuous production flow techniques to “pull” products downstream in the lab, eliminate unnecessary unproductive movement, and properly manage incubator capacity and timing provided almost instant relief to the receiving area. Business was solidified and billable volume increased, while workers got home earlier and avoided burnout. Time spent on sprucing up the receiving or first stage processing area beyond removal of safety hazards and some basic mistake-proofing would not have yielded comparable benefits and would have postponed genuine improvements.

Similar benefits were obtained in a small continuous pasteurized fluid beverage facility. Here, ironically, manual clean up paraphernalia created more clutter until better planned continuous runs of product reduced the frequency of changeover and disruptive cleanup steps.

A second cause of prolonged improvement initiatives is attempting to painstakingly streamline every identifiable sub process area in a larger production or paperwork process regardless of its impact on the whole. More often than not there are crucial sub processes that govern the performance of the entire process—either in rate of production, build-up of work-in-process queues, or control of quality. Zeroing in on them will help limit the risk of creating locally optimized processes that don’t contribute to overall performance. In the lab case above, speeding up the rate of completion of final testing steps that occurred after the incubator stage, while possible, would have only tightened a few isolated late stage sets of procedures. Improving the batch handling of samples through the incubator, on the other hand, made a significant impact on the overall effectiveness and efficiency of the lab. Note that making the incubator use itself more efficient was not the objective. It even paid to leave it partially full in some instances to maximize completion of the most vital samples.

Even more dramatic examples occur among plant floor operations where certain steps involve bottlenecks or "rate limiting" steps. Finding all improvement opportunities is a good long-term continuous improvement objective, but only a critical few may yield success in the short run.

Are there a "significant few" areas for improvement being overlooked while the "trivial many" are under study? It may pay to take a look.

5.   Missing Ways of Bridging R & D and Production Activity and Data Domains

While discrete manufacturing environments seem like naturals for integrating design and manufacturing what with CAD, shop assist drawings, and tightly orchestrated engineering change orders, the situation is murkier in process manufacturing. Complex formulations and lab scale chemistry, biology, and material science can lead to many loose ends on the way from R&D to production such as separate bills of materials, recipes, or approved formulae, not to mention separate quality and performance measures. Scale-up pilots that show unexpected cause and effect relationships among variables and observed quality or performance contribute more complexity.

One confectioner I worked with experimented with multiple methods of monitoring chocolate liquor viscosity and solids concentration for the purpose of controlling and adjusting end product characteristics. I worked with them to construct an open loop data communication link between the lab and the liquor and sugar tank farm areas to make adjustments in full-scale special product runs. This approach avoided the typical delays and lags that normally require chasing and catching already processed product to make changes. Eventually, the close link-up allowed R&D to fine-tune the in-process recipe to obtain a richer, smoother mouth feel product that commanded a better price and profit margin. Later modifications were made to QC testing to make spot checks on the same product. That effort brought QC and R&D into closer alignment on their methods and priorities, bridging a gulf almost as serious as that between R&D and production. Benefits really started to kick in once business volume picked up again, leading in turn to even greater growth as a result of improved market satisfaction with the product.

Careful combinations of procedures and technologies can bridge functional gaps, delays, and cultural "brick walls" that can seem insurmountable or be deemed simply "part of the landscape". Might there be a few applicable to your environment?

Kent Vincent, Principal, Industrial Systems and Reengineering Services, APICS CIRM and Six Sigma Black Belt, is an operations consultant focusing on the supply chain, production, and R&D methods that characterize small to mid-sized process and repetitive industry clients. He is also versed in laboratory quality control regimens, data management, and laboratory methods. He holds advanced degrees in Operations and Agricultural and Life Sciences with a chemistry undergraduate. His divided loyalties extend to part time college teaching in both Chemistry and Operations Management Methods. He is published in both fields. For further information call 630-369-8068 or access www.isandr.com and isandr@usa.com.