Basic Stability is Basic to Lean Manufacturing Success

By Art Smalley

Introduction

Lean production has dramatically lifted the competitiveness of many manufacturing companies and the value they deliver to customers. What's more, encouraging news surfaces almost daily about firms embracing the central tenants of lean and driving them into nonproduction areas of the enterprise such as product development, purchasing, value-chain management, and engineering.

Despite these triumphs, many firms I visit are stuck in first gear on their initial lean efforts. They are trying to create flow but can't get traction. There are many reasons for this lack of progress. Insufficient leadership, resources, or commitment are a few of the most common. But an overlooked and recurring pitfall that I'm seeing more often is a lack of "basic stability" in manufacturing operations. Quite simply, processes can't flow because key pieces of equipment are broken down.

Toyota's Early Struggles

Taiichi Ohno, the chief architect of lean manufacturing, developed its core elements at Toyota Motor Corporation in Japan in the period between 1950 and 1955. During this five-year learning period, Ohno made experiments in the machine-intensive production shops that he managed. Key concepts such as takt time, process flow, standardized work, single minute exchange of die, and basic pull system mechanics were all tested and worked out under his supervision.

Unfortunately very little was written down about what Ohno did. Today we only hear of the success stories about lean and the impressive nature of the Toyota Production System (TPS). From interviews and conversations I've had with retired Toyota executives, I get a different perspective about how difficult it was to establish the basic tenants of lean. These comments are typical reflections:

- "Our die changeover process was terrible, and took anywhere from one to two shifts to complete. Then the initial part quality was never any good."
- "Our precision machine tools were all from Germany or the United States. Our uptime averaged 50-60% at best and we struggled with the foreign documentation and delivery of spare parts from overseas."
- "We never had the production parts that we needed when we needed them. Materials were scarce and we always seemed to make too much of the wrong thing."
- "Our employees wanted to only work one machine and work at their own pace. Virtual mountains of WIP existed between processes as machine speeds were not synchronized to customer demand (takt time) at all."

Lean implementers should draw encouragement from these early struggles by Toyota. No one ever said that making radical change and improvement was an easy process.

What Toyota learned the hard way is that in the beginning of a transformation you need lots of basic stability before you can succeed with the more sophisticated elements of lean.

Lean Implementation Sequence

Toyota has been reluctant to publish or even endorse what they consider to be the right way to implement lean. Their reluctance is well taken given our inherent human tendency to look for an easy way out or cut and paste answers from elsewhere. Toyota executives have always maintained that TPS/lean is a system of thinking and that practitioner's can best "learn by doing."

When pressed, however, veterans of Toyota comment that certain pre-conditions are needed for a lean implementation to proceed smoothly. These include relatively few problems in equipment uptime, available materials with few defects, and strong supervision at the production line level. And these are precisely the problems that I see manufacturers still struggling with today.

Obviously if we waited for all these problems to be solved, we'd never get started. The act of implementing lean elements will eliminate some of these problems. Hence, we have an inherent sequential iteration problem -- where do you begin?

A clue comes from how Toyota works with new suppliers overseas. Toyota production consultants usually follow (but not dogmatically) an implementation framework of helping to establish basic stability, improve process flow, pace work to takt time, develop pull systems, and level production. Actual implementation order depends upon the current state and Ohno's words from 50 years ago advising companies to "start from your greatest point of need." For many manufacturers, this means more work in basic stability before trying to achieve the perfect flow.

Basic Stability

So what is basic stability? In the simplest sense this implies general predictability and consistent availability in terms of manpower, machines, materials, and methods -- the 4Ms. Under each of these basic building blocks of manufacturing, Toyota tries to establish a consistent and predictable process before getting too far down the road with the latter elements of flow and takt time.

The reason is simple. Without fundamental items like machine uptime or human resources in place you cannot run a production line and achieve perfect flow or pace to takt time. For example, producing to takt time and achieving perfect flow *assumes* a sufficient level of machine uptime is in place. The same is true for the rest of the 4Ms.

How do you know if you have enough stability in operations to proceed with flow? The answer depends upon your ability to meet a few key requirements:

- Do you have enough machine uptime to produce customer demand?
- Do you have enough material on hand every day to meet your production needs?
- Do you have enough trained employees available to handle the current processes?

- Do you have work methods, such as basic work instructions, defined or standards in place?

If the answer is emphatically "no" to any of these questions, stop and fix the problem before proceeding. Attempting to flow product exactly to customer demand with untrained employees, poor supervision, or little inventory in place is a recipe for disaster.

Conversely, don't fall into the trap of using these questions as excuses for not moving forward. Remember, you do not need perfect uptime in order to meet customer demand. If, for example, assembly takt time is 60 seconds and your upstream machine process cycle time is 30 seconds then you only need some inventory to act as a buffer and slightly better than 50% uptime to begin establishing a better production flow paced to takt time. The same basic common sense applies to the other 4 Ms as well. For instance, if the line needs eight people to run and you consistently only have six people trained to do the job, then you have a basic stability problem.

How to Achieve Stability

To achieve basic stability, you should concentrate on four key elements corresponding to the 4Ms.

1. Manpower

Basic stability starts with a well trained workforce. Fortunately employees tend to know their jobs very well or we would all be in serious trouble. However, Toyota in the 1950's learned some basic techniques about supervision in production and how to further improve the skills and capabilities of work teams. Specifically, they adopted an industrial training program that the U.S. used during WWII called Training Within Industry (TWI). It had three specific job training components for production supervisors -- job instruction, job methods, and job relations. Each component was a ten-hour course that taught practical supervision skills.

Job instruction (JI) taught supervisors how to plan for the correct resources they would need in production, how to break down jobs for instruction, and how to teach people safely, correctly, and conscientiously. Job methods (JM) taught supervisors how to analyze jobs and make simple improvements within their realms of control. Every activity was considered for improvement. Supervisors learned to question why an activity was done this way, and if it could be eliminated, combined with something else, rearranged, or simplified. Job relations (JR) taught supervisors to treat people as individuals and solve basic human-related problems in production rather than to ignore them.

Taken together these three courses helped supervisors create a basic routine, discipline, and sense of fairness in work teams. Fifty years later, these same TWI courses and fundamental tenants constitute the basis for training supervisors and work teams in Toyota.

2. Machines

You do not need equipment with perfect uptime, but you must know your customer demand, the capacity of your process, and the actual average output.

Toyota uses a basic document called the process capacity sheet to measure the true output potential of a process during a typical shift. If you have theoretical capacity as well as demonstrated capacity to meet customer demand then there is no problem. It is only when you have no demonstrated capacity to meet demand that you have a basic machine stability problem. For example, if customer demand is 700 units per shift and your actual output is only 500 units despite having the capacity for 1000, then you need more availability.

In cases such as these Ohno actually had people stand at the problem machine for the entire eight-hour shift and record the production plan versus actual amount in small increments, such as 15 minutes to one hour. At the end of the shift, all the losses and the actual reasons why were identified in a Pareto chart. Simple and quick meetings were convened if necessary and improvement plans put into place. This is the quintessential respect for "gemba" (Japanese for actual work site) in Toyota.

3. Materials

In general the goal of lean is to reduce waste and shorten the timeline from when an order is received until the time it is produced. Normally this requires the reduction of inventory in the value stream. If you suffer from basic instability, however, you might need to increase inventory in the short term in some places or in some instances.

The reason is because with some processes you can flow production one by one or in very small amounts. For batch processes, however, some amount of inventory is required to cover for the time when other parts are running, or tools are being changed.

The amount of inventory you need is composed of what Toyota calls cycle stock (the amount of inventory to cover average demand and the lead time to replenish it), buffer stock (inventory to cover variations that might exist in your downstream or customer demand), and safety stock (inventory to cover the losses such as scrap or downtime that you currently have). Failure to account for this necessary buffer and safety stock in an unstable environment will actually harm the production line efficiency.

Two pieces of advice that I received in Toyota strike me on this topic. First, not all inventories are waste. Only inventory beyond what is needed to run the process is waste. Second, inventory often exists as a symptom of a problem in the process. Solving the problem earns you the right to reduce the inventory.

4. Methods

Finally, achieving basic stability requires having standard methods for manufacturing. The key point here is the definition of a standard. The normal definition is that a standard is a rule or way to do things. The unintentional side effect is that people are not encouraged to question or change the rule. "We do it this way because that is our company standard" is a phrase I often hear.

The definition of a standard in Toyota is slightly different. A standard is a "rule or a basis for comparison." A standard is nothing more that a tool to measure how we are doing something and refer to when we want to make a change. Lean thinking is about changing work methods in order to eliminate waste and make improvements. The standards are what we use to measure and compare our changes so that we know if the new way is better or not.

This improvement thinking is ingrained in all employees at Toyota from day one. Everyone is encouraged to make changes. However change is only implemented and maintained if it beats the old standard and, thus, is properly called kaizen.

Summary

There are many other elements of basic stability in Toyota under each of these four headings. For instance, methods could be expanded to include five S, visual control, the already well known standardized work chart, and other simple work management tools. And we could add a fifth M for Metrics as well.

The final point is this: Like many of us today, Toyota once struggled mightily with establishing lean production. Along the way, it discovered that you need a healthy dose of basic stability before you can advance to other elements of lean. Much like we need to crawl and walk before we can run, companies often find that they need to improve their basic stability before perfecting flow and pull.

Art Smalley helps companies implement lean through Art of Lean, Inc,. and as an author and faculty member of the Lean Enterprise Institute (LEI), where he teaches workshops on Achieving Basic Stability and Creating Level Pull. He is the author of the LEI workbook Creating Level Pull on how to create a lean production control system for multiple product families in a facility. Art was one of the first foreign nationals to work for Toyota Motor Corp. in Japan and spent the majority of his Toyota career helping transfer its production, engineering, and management systems to facilities around the world. He subsequently joined Donnelly Corp., (now part of Magna Inc.) and later McKinsey & Company.