

A Study of How LEAN Manufacturing Benefits both Manufacturers and Customers

Or

What has LEAN Done for Me Lately?

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Abstract:

Our industrial roll manufacturing company has been on the LEAN Manufacturing journey for almost 2 years. While the LEAN methodology has greatly improved our productivity and efficiency, what difference does that make to our customers or to the industry in general?

This paper will discuss the ways LEAN manufacturing has changed Imperial Rubber Products and how our customers have benefited from those changes.

Introduction:

Imperial Rubber Products, Inc. and Finzer Roller, Inc are business partners. In an effort to achieve a strategic business objective, it was decided that a pilot LEAN Manufacturing program should be implemented at Imperial. Imperial was the most logical location to begin the experiment due to staffing (resident Manufacturing/Industrial Engineer) and access to a well-qualified LEAN facilitator with a proven track record.

Imperial started down the path toward LEAN Manufacturing at the beginning of September 2010. Many other industries, most notably the auto industry, had already embraced the LEAN methodology with measured success. To our knowledge, LEAN had never been attempted in the US roller manufacturing industry. LEAN Manufacturing was originally developed for high volume manufacture of similar items. Being trained as and having a BS in Manufacturing / Industrial Engineering, these methodologies were very familiar to me and made a lot sense for high volume widget manufacturers. Our company, like most roller companies, did not fit that mold.

Imperial's ability to embrace LEAN manufacturing actually began 3 years prior. Our company, through the help of one of its board-of-directors, implemented a formal Quality and Yield™ process in order to fully understand and measure our manufacturing capabilities. A manufacturing problem cannot be fixed or improved upon unless it is fully quantified. The Q&Y process helped to change the culture of our employees so that we began to quantify each and every one of our manufacturing processes. However, the Q&Y process was not enough on its own to get our operation to the point where we wanted it to be. So, with the help of a seasoned LEAN implementer and protégée of W. Edwards Deming, we began our journey.

Why LEAN:

There were several reasons why we decided to embrace LEAN Manufacturing. As mentioned above, our Q&Y process had successfully helped with identifying areas where we could improve upon our quality and our yields. This was an effective tool. But, in the end, it was only a tool. Many companies have used SPC, TQC, 6 Sigma, DOE's, etc. to help improve their companies. Each of these tools has been shown to be effective but again they are only tools. LEAN is much more than just a tool. In fact, only about 15-20% of LEAN consists of tools. LEAN is primarily a culture! Our owner realized that our company needed to embrace something larger than just the tool of Q&Y to keep our company's improvement moving forward. LEAN, with its philosophy of Continuous Improvement, met that goal.

Another reason for the change was that our lead times had grown too long. While it is not uncommon for our industry to have lead times that last several weeks, we wanted to service our customers even better. In addition to the long lead times, our on-time delivery was less than desirable.

Lastly, our manufacturing processes were not optimized. This sometimes led to careless mistakes stemming from a lack of document control and creating a legacy of "Tribal Knowledge." Because of the lack of optimization, extra manufacturing steps existed providing for even more opportunities for error. LEAN methodology applies not only to the manufacturing process but also to all of the paper work and documentation steps. Because our documentation process was not as robust as required, the information needed to properly manufacture our product didn't always make it to the machine operator.

The Goals:

Before any improvement process or methodology can start, a clear set of goals must be understood and adopted. Once these guiding principles are in place, evaluation of current state can be compared to the goal so that a plan can be formulated to reach that goal.

After a few management meetings and careful thought, our goal or our "True North" could be summed up in the following statements:

- **Highest Quality**
- **Shortest Lead Time**
- **Lowest Cost (Most Efficient Use of Resources)**

Once agreement had been reached on our controlling guidelines, we started to evaluate where we were and where we needed to go. A set of **KPI's** or **Key Performance Indicators** was identified at this time so that they could be tracked throughout the LEAN implementation and process.

One of the benefits of LEAN is that it uses a systematic approach to attain the desired goals. LEAN teaches that the 5S's are the foundation for all future improvements. We modified the 5S's and added Safety to make it the 6S's. These 6S's include:

- **Safety**
- **Sort Out** (Cleaning up and clearing out of out-dated machinery & processes)
- **Straighten** (Organizing; Everything has a correct place)
- **Scrub** (Cleaning)
- **Standardize** (Assigning specific duties to be done on a regular basis)
- **Sustain** (Discipline, Make sure not to fall back on old habits)

We started with a major **Sort Out** and **Straighten** campaign that lasted for over a month. When all was said and done, six 48 foot truckloads of "**STUFF**" were removed from our facility. Four of the truckloads were able to be recycled and two of those truckloads went to the dump. A side benefit was that we discovered we had a lot of free floor space that was available for use. Most companies see a 15 – 20% increase in their productivity after their initial application of the 5S's.

The next major tenant of LEAN is to eliminate the **8 Wastes**. Reduce or eliminate the waste and your process will immediately improve in efficiency. Companies with a mature LEAN implementation program enjoy productivity gains on average of **400%**. The **8 Wastes** include:

- **Transportation**
- **Inventory**
- **Motion**
- **Waiting**
- **Over processing**
- **Overproduction**
- **Defects**
- **Intelligence**

Once there is an understanding of what waste is, a process can be analyzed to look for and eliminate it. That was exactly what was done next. Through that process, we determined that some of our equipment needed to be moved and work cells needed to be

formed. This cell formation reduced the wastes of **Transportation, Inventory, Motion, Waiting, Over processing, Over production, and Defects**. It also decreased “finger pointing”. One operator was now responsible for multiple operations and could not blame defects on the operator before him or after him.

Obstacles:

Even though LEAN has continued to prove itself as a useful tool over and over again, there are many obstacles that can prevent it from fully benefitting a company or its customers. As mentioned above, LEAN is much more than a collection of tools and techniques. Again, only about 15-20% of the successful transformation can be attributed to technical aspects. The other 80-85% of a successful LEAN transformation is attributed to culture change.

While LEAN principles are relatively straight forward and appeal to common sense, the problem is that the application of these principles in many cases goes against the status quo of a given manufacturing facility. If LEAN is being applied to an existing facility, then there is a factory full of people that can tell you why “it won’t work like that” or “that’s not the way we do it here.” As mentioned above, I myself was a major obstacle to implementing LEAN in the beginning. I knew the LEAN principles but I didn’t think that it would be successful in our company which is primarily a “one off” job shop. We didn’t manufacture enough of any one item to qualify for standard setups.

The next major deterrent to a successful LEAN program is the implementation itself. The so called “Implementation Syndrome” plots the normal progression of a LEAN implementation. It can be a very difficult process to start. In fact, LEAN implementation can be seen as a negative bell curve. The process can be frustrating in the early stages to the point where those involved would like to just give up and go back to the “good old days” before LEAN. It is at these times when it is crucial that top management is fully signed on and ready to move forward no matter what. This is usually the stage where people give up and say “We tried LEAN and it didn’t work.” This happens to every company who implements LEAN. This phenomenon is illustrated in the graph below:



I can say this happened to us on different occasions. If it wasn't for the full buy in from the owner of this company, the LEAN process could have been stopped on several occasions due to perceived lack of return on investment or efficiencies not realized. In the end however, persistence paid off.

The Benefits to Our Customers:

Most of the time, companies begin a LEAN program with the idea of benefitting themselves. The nice thing about LEAN is that if it is implemented correctly, your customers benefit as much or more than the company itself. Customers' benefits come in the form of:

- **High Quality Products**
- **Predictable Delivery Schedules**
- **Stable Pricing**
- **Responsive Customer Service**

Because product defects are waste and waste is targeted for elimination in LEAN, the natural out-come is that production is set up in a way to prevent defects. If defects are not created in the first place, the customer by default gets a defect-free, high quality product. The longer that LEAN is practiced, the lower the defect rate becomes. Before the process was started, our RMA rate was 3% of units produced. Our current RMA rate is 0.3% of units produced and many of those returns were manufactured before our LEAN process was fully implemented.

The roller industry directly supports other diverse manufacturing companies. These companies cannot produce their product when their process rolls are out of the machines. This means that in many cases, our customers' down time is directly related to our ability to perform the work that is required on their roll and get it back to them. Because this work is so time sensitive, it is critical that our customer can count on our delivery schedules. When we began the LEAN implementation, we were startled to learn that our Complete and On-Time Shipments (COTS) rate was approximately 50% (You can't fix a problem that is not measured). This meant that half of the time our customers would not get the rolls delivered to them when we told them it would be done. Whether it was one day late or more, it was not complete when we told the customer it would be. Our average COTS percentage year to date is at **96%**. For the last two months, it has been at **98%**. Obviously, this is a huge win for our customers because they can count on the fact that the work will be done on time. This confidence in turn allows them to schedule their maintenance without having to wonder if their schedule will be compromised.

Another benefit to the customers of companies that practice LEAN is superior products at competitive prices. In any area of manufacturing or service, the market for that product or service sets the prices the customer pays for that product or service. This becomes even more evident when the amount of business decreases and many competitors are trying to land the same sale. Because LEAN dictates continuous improvement, the

company utilizing it eventually becomes the most efficient it can possibly be. This means that if several businesses are providing similar services, the one that practices LEAN should be able to offer the superior product at the market set price range. This is a win for the customer.

Finally, since a fully implemented LEAN process extends to all operations; from the manufacturing floor to the front office, customers using LEAN minded companies can expect to experience high levels of customer service. The elimination of waste in the front office is also the path to improvement for a company. This elimination of paper work waste allows a company to keep better track of its jobs working their way through the process.

Every day, a representative of Sales Management, Engineering, Pre-Production, Manufacturing, and Customer Service, walk the manufacturing floor in our GEMBA walk (LEAN term referring to a daily management walk). After the GEMBA walk, everyone involved with that meeting is updated on all aspects of what is happening in the facility simultaneously. In this way any issues that can impede the progress of a job is dealt with daily to keep things moving. Also, in this way, Customer Service is fully informed on the status for a given customer and has immediate answers to their questions.

One of the outcomes of the GEMBA walk is the opportunity to examine the various aspects of our operation that are preventing LEAN improvements from progressing. When an opportunity for improvement reveals itself, we can use PDCA (Plan, Do, Check, Act). This scientific methodology allows us to keep moving forward on our continuous improvement journey.

PLAN

Establish the objectives and processes necessary to deliver results in accordance with the expected output (the target or goals). By establishing output expectations, the completeness and accuracy of the specification is also a part of the targeted improvement. When possible, start on a small scale to test possible effects.

DO

Implement the plan, execute the process, make the product. Collect data for charting and analysis in the following "CHECK" and "ACT" steps.

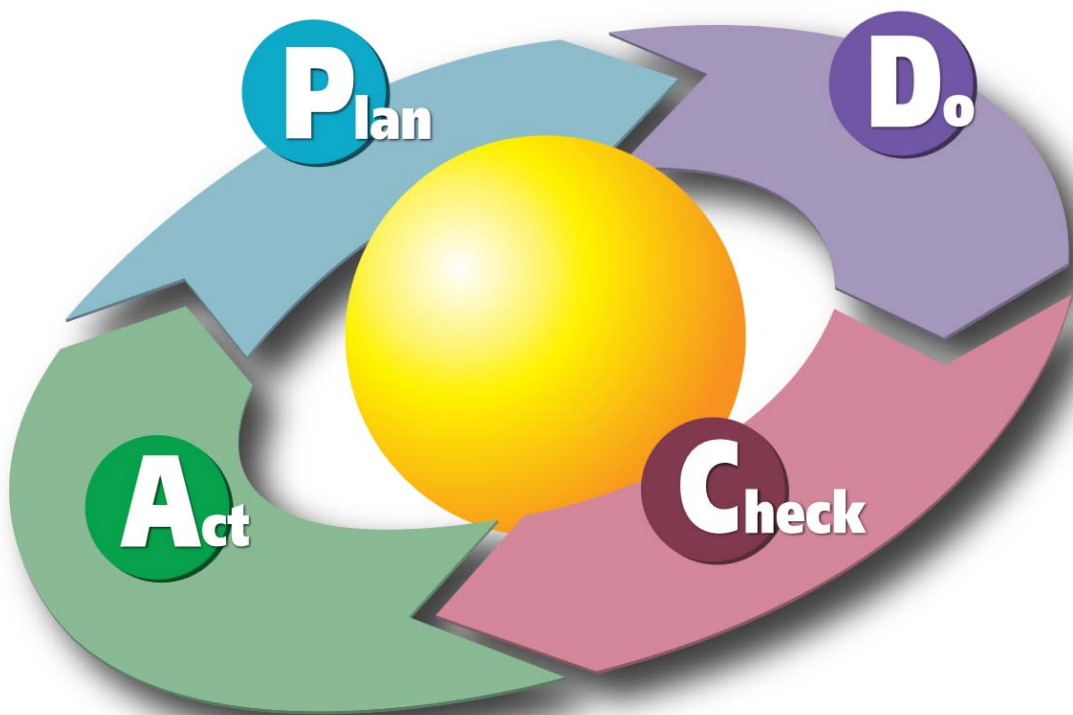
CHECK

Study the actual results (measured and collected in "DO" above) and compare against the expected results (targets or goals from the "PLAN") to ascertain any differences. Look for deviation in implementation from the plan and also look for the appropriateness/completeness of the plan to enable the execution i.e., "Do". Charting data can make this much easier to see trends over several PDCA cycles and in order to convert the collected data into information. Information is what you need for the next step "ACT".

ACT

Request corrective actions on significant differences between actual and planned results. Analyze the differences to determine their root causes. Determine where to apply changes that will include improvement of the process or product. When a pass through these four steps does not result in the need to improve, the scope to which PDCA is applied may be refined to plan and improve with more detail in the next iteration of the cycle, or attention needs to be placed in a different stage of the process.

The figure below illustrates the PDCA process:



The Benefits to Our Company:

As mentioned above, our customers have benefitted from LEAN. We have also benefitted from LEAN. Here is a list of some of the benefits that have been realized:

- **Reduced Internal & External Rejects**
- **Improved COTS Percentage**
- **Overall Lead Time Reduced**
- **Lower levels of Backlog**

- **Improved Working Environment**

Lean has allowed our company to reduce both internal and external rejects. Obviously it is imperative that the customer does not receive defective products. That would be our outside defects or our RMA's (Returned Materials Authorized). It is equally important not to have internal rejects as well. Both count for lost raw materials and lost labor costs. Both are WASTE! Our LEAN methodologies have been able to help us reduce our internal and external reject rates to below 1% of products manufactured. While this is a fantastic rate, LEAN dictates that we continue to pursue lower reject rates. And we are.

COTS (Complete and On-Time Shipment) is a measure that is important to both the customer and the company. For the customer it is a measure of the company's credibility. For the company, it is a measure of how well its processes can be scheduled and held to that schedule. Before starting LEAN, our COTS percentage was nothing to brag about. It was due mostly to the fact our work was not efficiently scheduled and no efficient way to follow the work through the manufacturing process existed. By setting a goal to improve our COTS, we were forced to develop an efficient way to schedule and track our products throughout their time in our facility. The good news is that we are on target at 98% COTS. As mentioned before, LEAN says that is nice, but it needs to be improved upon.

Another benefit of LEAN is our overall reduction in lead time. It is important to note that COTS and lead time are not interchangeable. Lead time is the amount of time a product takes to make it through its process. COTS is concerned with the time a product was promised to its customer. At Imperial, we have many different lead times based upon the scope of work that is needed to be completed. For instance, currently there is a 5 day lead time for industrial roll regrinding. If the roll needs a new cover and a grind, then it is 7 days. If the roll needs a new cover and journal repair, then our standard lead time is 9 days. LEAN has been able to help us set these lead times and then work to and exceed these goals. For example, before LEAN our lead time for a new cover and grind was about 15 business days. Currently those same rolls have an average lead time of 5.7 business days.

LEAN has helped to reduce our level of backlog. Before starting LEAN, our employees enjoyed seeing over a month's worth of business sitting around the plant in backlog. The conventional wisdom was that as long as there were rolls around the facility, it meant they had job security. What they didn't understand was that all of that backlog was wasted cash, wasted storage area, and wasted opportunity for timely manufacturing. As it stands now, the rolls come in, they are received, and they are worked on within a few days. No magic happened to make the backlog levels drop, it was simply an outcome from reducing lead times and improving our manufacturing paperwork and processes.

Finally, LEAN has helped to improve the working environment. By following the 6 S's, the manufacturing floor is **Sorted, Straightened, and Scrubbed** continually. This mindset helps to keep things neat and tidy on the manufacturing floor and allows for unobstructed visual management of our processes. It is easy to go to each station and know exactly what is in that cell and what will be completed that day. All of the work

that is moving through our facility is placed in specific areas that designate their order in the overall manufacturing process. This eliminates confusion and “hunting” for the next job.

Conclusion:

LEAN manufacturing has greatly benefitted both Imperial Rubber Products and our customers. It has helped to streamline our manufacturing process and recently it has begun to move its way through the front office. Both the Sales department and Engineering have begun to implement LEAN in different areas of their departments. Our rejects levels are lower, our lead times are shorter, and our On-Time deliveries are approaching 100%. At times, it was difficult to make progress toward our LEAN goals, but, in the end, our efforts have helped our customers receive better service, higher quality products and in shorter lead times. LEAN has helped our company remain strong during a very difficult economic period and enabled us to seek new business where we were unable to service properly before.

Above everything else, LEAN means culture change! A culture that demands Continuous Improvement no matter how much improvement has been made. Without that culture change, LEAN will fail! Tools can be used to help measure progress but they are only a small component of LEAN. LEAN is a way of thinking and doing. It is a process that is never complete no matter how far a company has come. When a customer works with a company that has truly embraced LEAN, it will be evident in way they are treated. LEAN companies share the same goals and cultures. This way of thinking permeates all levels of doing business.

It goes without saying that the pilot program at Imperial has been and continues to be a great success. As a result, Finzer is currently implementing the LEAN manufacturing process throughout their entire company. I could go on and on about how LEAN has benefitted both our customers and our company. The greatest proof of this hypothesis is the fact that since the beginning of this year, our company has added 80 new customers to date. The vast majority of these customers have come to us through referral because of the word of our other customers' level of satisfaction of service. As far as I'm concerned, that says it all.