

Theory of Constraints and Lean

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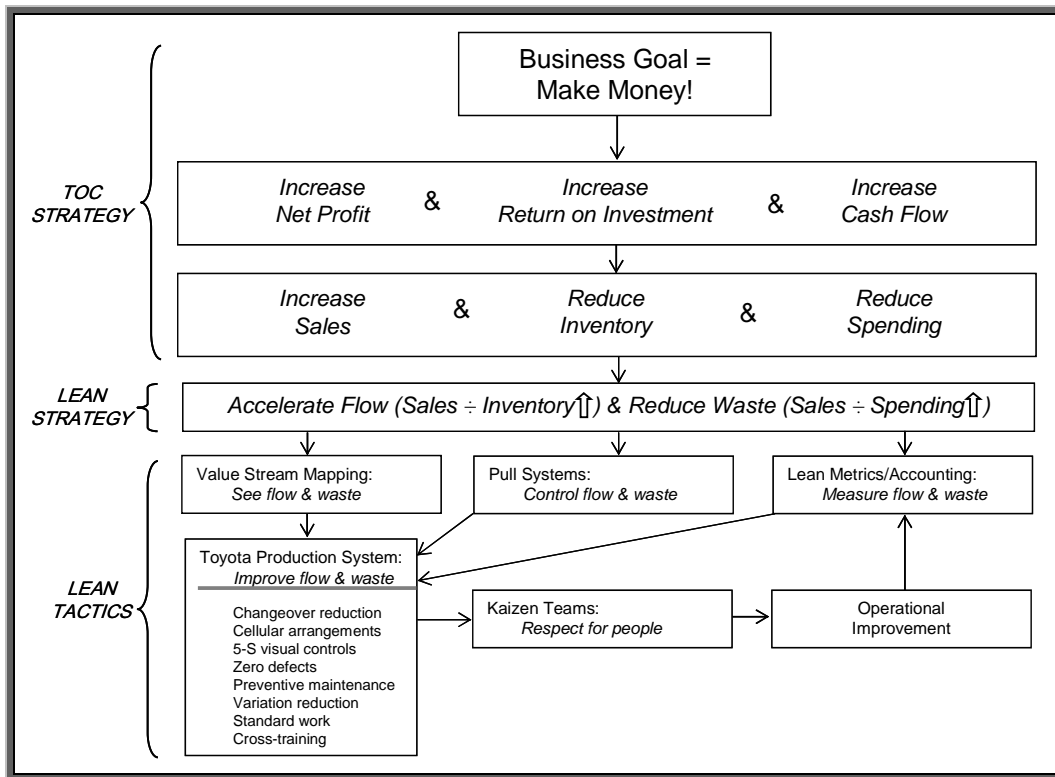


INTRODUCTION

Do you have a lean initiative under way in your company? Do you know why? Is it to reduce cost? To reduce people? Because it is the latest management technique? Or because you don't know what else to do?

As it turns out, lean manufacturing *is* the right thing to do - even if you have started for the wrong reasons! To quote Dr. Eli Goldratt, author of The Goal, "The problem with a cost reduction strategy is that there is a finite limit. You can only get to zero. With a throughput (sales) driven strategy, there is no limit!" Lean is not about cost reduction and retrenchment; it is about growth, opportunity and competitiveness.

Most companies have barely scratched the surface of lean. In order to understand the potential of lean, we need to understand not only the tactics (e.g. the Toyota Production System), we need to understand the strategy behind lean. And there *is* such a quantitative strategy which links each and every step you take directly to the bottom line. **TOC AND LEAN** shows the basic construct of our approach to lean, based on the theory of constraints.



TOC AND LEAN

THEORY OF CONSTRAINTS (TOC) STRATEGY

In The Goal, first published in 1984, Goldratt says that the goal of the business is to make money – and to make more money over time. We know that a company is making more money if the following three financial measures are increasing:

- Net profit: the difference between money received and money paid out
- Return on investment: Net profit relative to the investment required to produce it
- Cash flow: The timing of money in vs. money out

In order to make sure our operating decisions support the goal, we need to translate the financial measures to operational measures. The operational measures which support the goal are:

- Increased throughput: The rate at which money is generated through sales
- Decreased inventory: The investment in items intended for sale
- Decreased operating expense: The money spent to turn inventory into throughput

As long as these three operational conditions occur at the level at which ownership exists, cash flow, net profit and return on investment will increase, and the enterprise will make more money.

LEAN STRATEGY

What does this have to do with lean? A strategy is worthless without tactics. And lean provides those tactics. From Womack and Jones' Lean Thinking, the five steps of lean are as follows:

- *Specify value*: Value is what the customer is willing to pay for. All non-value-adding activities are considered waste.
- *Identify the value stream*: Understand the steps required to produce, from raw material to the customer, including all value-adding and non-value-adding steps.
- *Establish flow*: Wherever possible flow material from one step to the next, one piece at a time, with no inventory in between.
- *Pull*: Where flow is not established, pull material from upstream steps based on the downstream operations' actual consumption.
- *Perfection*: Continually work towards reducing waste and improving flow.

So, the goals of lean appear to be to improve flow and reduce waste. And, these lean goals have a direct quantitative connection to the goals of TOC.

For example, if we undertake an effort to improve flow, how do we know if we are making more money as a result? Let's suppose we implement a manufacturing cell via a kaizen event, so we can move material directly from one step to the next, eliminating the inventory in between. Let's further suppose that this allows us to eliminate twenty hours a week of material handling effort.

If we were able to eliminate inventory from the process, while maintaining current production and shipment levels, that means that the ratio of sales to inventory has increased. We make more money.

What about the twenty hours a week of material handling? This would make us more money only if it improves the ratio of sales to spending. Unless we are able to lay off half of a material handler, we have not reduced spending, and we do not make more money. However, if the material handler is able to spend the twenty hours saved

producing more products we can sell, then we have an improvement in the sales to spending ratio, and we make more money.

So, the lean strategy supports the goal of making more money in two ways. The first is by improving flow, or the ratio of sales to inventory. The second is by reducing waste, or the ratio of sales to spending. This is the clear, quantitative connection between TOC and lean. If the ratio of sales to inventory does not increase, or if the ratio of sales to spending does not increase, you are not making more money. Simple as that!

LINKING STRATEGY TO TACTICS

Lean provides several linkages to help identify specific shop-floor (or office-floor) activities that will contribute to the bottom line.

- A value stream map (VSM) is a diagram of all of the steps, both value-adding and non-value-adding, required to produce a product from raw material to the customer. A properly constructed current state VSM reveals the causes of discrepancies between the time spent adding value for the customer and the total time it takes product to get through the value stream. This provides a powerful focusing mechanism for our improvement efforts on the path to a leaner future state.
- Pull systems provide control over the overall flow through the value stream. This is provided, of course, that the pull system is quantified to account for constraints in the flow. Such constraints may include short customer lead times, lumpy customer demand, long resource changeover times, resource downtime, and quality yield to name just a few. If the flow is correctly quantified, we have another focusing tool.
- Lean metrics (and accounting) are based on the total output of the value stream (sales), the lead time through the value stream (inventory), and the total cost of the value stream (spending). When we see the ratios of the three metrics move in the wrong direction, root cause analysis will lead us to corrective action. Again, another power focusing tool.

TOYOTA PRODUCTION SYSTEM

So, we have several effective tools for identifying specific actions we can take to make more money. But what sort of actions? Fortunately, the Toyota Production System provides many of the tools we need. These tools generally include:

- Changeover reduction: Reducing the amount of time it takes a resource to switch from one product to a different product
- Cellular arrangements: The location of processing steps immediately adjacent to each other
- 5-S visual controls: Workplace practices conducive to visual controls and on-the-spot decision making
- Zero defects: Perfect quality at the source
- Preventive maintenance: Improving resource uptime
- Variation reduction: Improving predictability in processes
- Standard work: Precise procedures and sequence for work, established by the operators themselves
- Cross-training: Becoming proficient in more than one skill in order to facilitate material flow

Of course other tools exist, such as Six Sigma, error-proofing, or takt time analysis. But, the priority of their application should be based on which ones have the greatest effect on the bottom line. Note that pull/kanban is not listed here as one of the TPS tools. This is because, if you are in business to make money, pull systems are best used as a strategic linkage for focusing value stream improvements – not as a tactical tool.

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KAIZEN

Once we have identified specific improvement opportunities with VSM, pull, or lean metrics, how do we deliver them? This is the function of kaizen events.

A kaizen is a group activity, usually lasting several days, in which a team identifies and implements a significant improvement in a process. It usually includes:

- Initial analysis of the process, including event area selection, team selection, and development of a contract and a mandate
- Kaizen event, including training in the lean tool, process analysis & baseline measurement, development & implementation of new processes, and formal presentation of the process and accomplishment
- Follow up, including debugging the process, assuring timely completion of all remaining action items, and assuring the new process is institutionalized

The TPS tools identified by value stream mapping (system kaizen) are usually applied via events (point kaizen) involving the associates who actually add the value, with help from support functions as required. This respect for people is one of the keys to a lasting lean culture.

CONCLUSION

So, we've identified improvement opportunities, trained our associates in TPS tools, and conducted kaizen events to implement the improvements. How do we know we have achieved the improvements? That is, are we making more money?

Remember the three strategic linkages – VSM, pull and lean metrics? If we have actually made an improvement, we will see a higher ratio of value-added to non-value-added time in our value stream maps. Our pull system will downsize the inventories required to maintain flow. And, our lean metrics will show improvements in the ratios of sales, inventory and spending. Now we have a closed-loop system that ensures that our lean efforts are focused on the bottom line!