

LeanSigma: Performance Improvement for Papermakers and Paper Machine Clothing Suppliers

In a globally competitive marketplace, the paper industry continues to find itself facing increasing pressure to continually improve its efficiency, product quality, and cost structure. The industry's customers are requiring less inventory on site, shorter lead times, a flow of innovative products, higher quality, and reduced costs.

Due to this pressure on mills, paper machine clothing suppliers are faced with these challenges as well. A LeanSigma partnership has proven to be one of the best practices available for meeting these challenges and improving business performance.

LeanSigma combines methodologies from Lean Manufacturing and Six Sigma. The "Lean" is about elimination of waste. The "Sigma" (from Six Sigma) uses the Define, Measure, Analyze, Improve, and Control (DMAIC) process - emphasizing data and statistical tools to improve processes and sustain the improvements (see Section 7.7 Common Terms).

LeanSigma was first implemented in manufacturing, but is now used in virtually all business processes. Any business process can benefit from the implementation of LeanSigma, so the term "Lean Manufacturing" can also be equated with "Lean Business Process" or "Lean Enterprise."

In a LeanSigma partnership, typically the paper producer selects a key supplier to help address an issue or opportunity. The two partners define a project of manageable scope together and then calculate the potential economic savings or gain. If the calculation projects a good economic return, and the scope

can be accomplished in a relatively short time frame (typically three to six months), the project moves forward and a project team is selected. The LeanSigma tools described in this chapter are used to achieve the desired results and also ensure long-term sustainability of the savings or gain.

LeanSigma is widely accepted and frequently used within the paper industry. Paper companies are developing LeanSigma skills in-house and are routinely working with suppliers on LeanSigma projects. Figure 7.1 shows a typical LeanSigma team meeting. In Section 7.5, real life (but de-identified) examples of LeanSigma projects involving paper companies and a paper machine clothing supplier are highlighted:

1. Sheet defects and breaks in the press section
2. Sheet formation quality
3. Machine efficiency and sheet quality
4. Fiber losses (waste)
5. Sheet quality and breaks (waste)
6. Reduction in quotation turnaround time to improve customer service
7. Supply chain management and working capital reduction



FIGURE 7.1 LeanSigma team meeting.

7.1 LeanSigma Overview

LeanSigma is an integrated system to streamline a business approach and drive the implementation of Lean Manufacturing and Six Sigma. Its focus is on improving quality and efficiency throughout a business or process by identifying and eliminating non-value adding activities and waste.

The purpose of LeanSigma is to establish common operating concepts and utilize proven techniques that all team members can implement and adhere to such that they move forward in unison. This offers different organizations and teams the opportunity to collectively learn from one another and share their best practices.

7.2 Lean Production/Manufacturing - Defined

Lean Manufacturing or Lean Production (simply "Lean") is a systemic method for the elimination of waste ("Muda") from within a business process. Lean also takes into account waste created through overburden ("Muri") and waste created through unevenness in workloads ("Mura"). Working from the perspective of the client that consumes a product or service, "value" is any action or process that a client is willing to pay for.

Essentially, Lean is centered on making obvious what adds value by reducing everything else. Lean Manufacturing is a management philosophy derived mostly from the Toyota Production System (TPS) and identified as "Lean" only in the 1990's. TPS is renowned for its focus on reduction of the original Toyota seven wastes to improve overall customer value, but there are varying perspectives on how this is best achieved. Waste is defined as any activity that takes up time, resources, or space, but does not add value to a product or service. According to TPS, there are seven different forms of waste, as follows:

1. Overproduction (sometimes referred to as the worst kind of waste)
 - Operations continue after they should have stopped. There are excess quantities, inventory stockpiles, extra storage facilities needed, etc.

- An example in the paper industry would be producing paper for which insufficient customer demand exists.
2. Waiting time (inactivity in a "downstream" process because an "upstream" activity does not deliver on time)
 - Caused by unbalanced workflow, i.e., labor waiting on machine or materials; machine waiting on materials or labor, equipment breakdowns.
 - An example in the paper industry would be waiting for crane time during a paper machine clothing change, since paper machine downtime is very expensive.
 3. Transportation (the unnecessary movement of materials and products)
 - Adds time to the process during which no "value" is added; goods can be damaged.
 - An example in the paper industry would be lowering the total cost of supply by using local supply chains versus obtaining an initial lower purchase price from a remote supplier.
 4. Excess processing (that does not add "value")
 - Rework, reprocessing, handling and storage, over-designed processes, or processes that could be combined or eliminated.
 - Examples in the paper industry include excess broke or downgrading paper.
 5. Inventory
 - Excess not required for orders: raw materials, Work-in-Process (WIP), finished goods, etc.
 - An example in the paper industry would be an excess of anything that draws down working capital, such as paper machine clothing inventory.

6. Excess motion

- Without good process flow, extra steps will be taken to accommodate inefficient layout, defects, reprocessing, over production, having too little or too much inventory.
- An example in the paper industry would be a paper machine clothing change where roll movement is excessive and excess motion is evident.

7. Defects (poor quality/rework/pure crap)

- Products or aspects of service or production that do not conform to specification or customer expectations such as customer claims, rework, credits, lost sales, or missed shipments.
- Examples in the paper industry would be edge cracks and defects on finished rolls.

7.3 Six Sigma

Six Sigma is a system for identifying and removing variation in processes and/or products. It combines continuous improvement tools to focus on processes, analyze and compare them, and objectively assign resources to those processes requiring the most attention.

Six Sigma measures variations in processes and normalizes them so that comparisons between processes can be made. Once comparisons are made, objective decisions can be made as to where to place resources for better performance.

Reduction in variation is a way to link different departments together. Every process has variations which can cause rework, waste, additional labor, and increased costs. By focusing on variations and concentrating efforts on reducing them, the workload, as well as costs, can be reduced.

The primary tools used in Six Sigma include:

1. Process Mapping: Identifying the flow of events in a process as well as the inputs (x's) and outputs (y's) in each step of a process. A process map graphically

shows the complexity of a process and helps identify both value adding and non-value adding activities.

2. Benchmarking: Identifying gaps between an operation and the best-in-class. The benchmark can be within the company or against external leaders (either the best in the industry or best globally among all industries).
3. Theory of Constraints: "Any resource whose capacity is less than the demand placed upon it" is a constraint, according to Eliyahu Goldratt. A constraint can be determined by two methods: mathematically calculating rates of production, or by visually observing the process map, which highlights "bottlenecks" in the process.
4. Kanbans/Strategic Inventory: A Kanban is a sign or indicator that serves as a signal that the next process either has adequate resources (materials or labor) for the process to continue or needs more resources so the process does not "starve" by having nothing to process. Strategic Inventory is the placement of materials or labor throughout the process to avoid introducing any of the seven forms of waste identified earlier.
5. Single Minute Exchange of Dies (SMED): Directly from the Toyota Production System, it is also referred to as a quick changeover. This is a method of analyzing manufacturing processes and then reducing the materials, labor, and time needed for equipment setup, including the exchange of tools and dies.
6. Total Productive Maintenance (TPM): A series of methods that ensures every piece of equipment in a production process is always able to perform its required tasks so that production is never interrupted.

7.4 Implementation Strategy and Deployment

Overview of Implementing LeanSigma

There is no single defined method for implementing and deploying LeanSigma. Factors to be considered are organization size, organi-