Eliminate Waste and Increase Value

By Six Sigma Qualtec

You don't need a dance partner to Poka-yoke, but it does help to have a supportive management team. No, Poka-yoke isn't a new dance; it's Japanese for mistake-proofing and it's a key tool in a proven methodology for achieving remarkable efficiency in manufacturing and services businesses. Known as Lean, this methodology depends on a simple, but powerful, principle: eliminate waste.

Waste is any activity that does not provide value to the customer. A worker walking long distances across the office to move a credit application to the next stage of the process wastes time. Unnecessarily large buffer stocks waste working capital. Production bottlenecks that idle downstream workers waste human resources. Above all, waste wastes money. And customers don't want to pay for your waste.

Everywhere work is occurring, waste can be found. Sending an installation team to an installation site twice to install a high-speed line because the information needed at a customer premise was incorrect or incomplete is wasteful. So is rejecting a customer request for installation because the application had errors in it that incorrectly indicated that this service was not available at that location. Cost per install goes up and revenue goes down.

By implementing Lean in your organization you can eliminate waste and bring products and services to your customers better, faster, and cheaper. Conventional wisdom says you can achieve any two of those goals, but not all three:

- Better and faster but not cheaper
- Faster and cheaper but not better
- Better and cheaper but not faster

Lean has shattered that paradigm. By eliminating wasted time, materials and expenses, by reducing non-value adding activities, and by increasing speed and output, you can achieve all three simultaneously. And when coupled with the highly statistical techniques of Six Sigma to further reduce process variation, Lean can produce levels of efficiency previously thought impossible.

The benefits of both Six Sigma and Lean are not limited to manufacturing. Some of the greatest gains in efficiency and performance are now being achieved through the application of these techniques in service organizations. Service companies might not produce widgets, but they certainly follow processes, both formal and informal, that are connected in order to provide value to a customer who is willing to pay for the service. When service companies learn how to manage processes with the same rigor as the best manufacturers, they too can derive the benefits of better, faster, and cheaper. But success requires the hard work and commitment of each of your employees – and a thorough understanding of both Lean and Six Sigma principles.

The Toyota Production System

Lean has its roots in Toyota Production System (TPS). In the 1950s, Toyota realized that if they could improve work process so parts arrived on the production line "just-in-time" for assembly they could reduce their huge and expensive inventory levels, thereby lowering cost while improving product quality. As they reduced inventory levels, they found that the glut of parts had been hiding many broken processes. Once they removed the excess inventory from the production process they were then able to create tools and techniques to solve the problems they had uncovered.

This cycle has continued with Toyota continuously improving itself. In fact, Toyota may be one of the most efficiently run production operations on the planet. Astonishingly, Toyota had neither a blueprint to follow nor another company to emulate. Painstakingly and relentlessly, they developed many of the principles that today we call Lean and that manufacturing and service businesses are employing with similar success. Those principles begin with value. The widely recognized term "Kaizen" refers to the Japanese principle of continuous improvement that pervades companies like Toyota.

Understanding Value

In Lean the value of a product or service is defined solely by what the customer actually requires and is willing to pay for. Processes that deliver the product or service to the customer fall into three major groups:

Value-added activities create the precise solution that the customer requires. An activity adds value if it is performed in a process that the customer is willing to pay for, it is done right the first time, and it transforms the product or service.

Non-value-added activities are those activities that aren't required but still occur. Anything that adds unnecessary time, effort, or cost is considered non value-added and may be defined as waste. To put it another way, waste is any material or activity for which the customer is not willing to pay. For example, testing and inspecting are obvious areas of non-valued-added activities. Customers expect the product or service to be correct; they don't care whether you consumed a day or week in getting it right as long as it performs as promised. A process is also identified as non-value-added if the step in the process does not change the output in terms of form, fit, or function.

Value-enabling activities don't add direct value for the customer, but they are necessary. For example, government regulations don't add direct value but you must comply with them to stay in business. Nevertheless, the waste in these processes can be reduced, often through complete process redesign using tools such as Design for Six Sigma.

A breakdown of the ratios of these three types of activities in an organization can provide an eye-opening index of performance. Research at the Lean Enterprise Research Centre (LERC) in the United Kingdom determined the ratio of activities for typical manufacturing and service companies before implementation of a Lean program.

	Manufacturing	Service
Value-Added Activities	5%	1%
Non-Value-Added Activities	60%	49%
Value-Enabling-Activities	35%	50%

Peter Hines and David Taylor: Going Lean. Lean Enterprise Research Centre, January 2000

In short, up to 60 percent of the activities at a typical manufacturing company and 49 percent at a typical services company could potentially be eliminated.

Understanding Waste

Lean is based on the premise that anywhere work is being done, waste is being generated – and waste is the enemy of value. Through a continual focus on the identification and

elimination of waste, Lean tools help a business optimise its processes. To help identify waste, the Lean philosophy breaks down waste into seven specific elements. In any system, waste can be qualified into one or more of these elements:

Waste of Correction –

The quality of your product or service can be only as good as the quality of the worst component. The waste in a process is magnified by the cost associated with finding and correcting the error as well as the costs incurred by delaying further output while waiting for the correction to be made. Defects relate to both quality and time. In addition to physical defects, which directly add to the costs of goods sold, defects may include errors in paperwork, provision of incorrect information about the product, late delivery, production to incorrect specifications, use of too much raw material, or generation of unnecessary scrap.

Waste of Overproduction –

This is the worst kind of waste because it hides other types. Overproduction means unnecessarily producing more than is demanded or producing it before it is needed. Both types of over-production increase the risk of obsolescence, the risk of producing the wrong thing, and the possibility of having to sell the excess items at a discount or even discarding them. Overproduction can occur because people involved in a process inflate their numbers to cover potential need and because processes are designed with an expectation of a certain rate of failure. The waste of correction is often amplified by overproduction. Not only do you generate the mistake once, but unknowingly you generate the same error multiple times.

Waste of Over-processing –

This occurs through processing, such as excessive levels of approval for a purchase requisition, that provides no value to the product or service. Of all the types of waste, this is often the most difficult to identify. Examples would include typing memos that could be handwritten, painting fixtures that are internal to equipment, making colour copies when black and white would do, and performing machining work that goes beyond expressed specifications. The waste of human and material resources is akin to employing a surgeon and an operating room to remove a splinter. Both kinds of resources cost money and when you over-process, you unnecessarily consume resources.

> "There are many times when non-value-added motion can be combined with another part of the process to reduce the overall cycle time"

Waste of Conveyance –

Conveyance adds no direct value to the product. Therefore, it is vital that you convey material and information only when and where it is needed – that is the essence of "just-in-time." Conveyance includes any movement of materials or information – whether it is from one workstation to another or one continent to another – that does not add any value to the product. Every time you move a product or a document you add cost to creating it. Unfortunately, the added cost does not translate to added value. You cannot charge your customer more because you have shuffled your products around the organization or around the world. To preserve profit margins you must minimize conveyance.

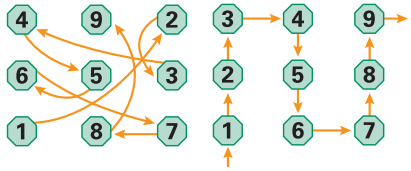
Waste of Inventory –

Inventory is a drain on an organization, adversely affecting cash flow and often masking poor processes. Waste of inventory increases overhead and hides quality issues in finished goods or work in process. It also means having unnecessarily high levels of raw materials, works-in-progress, and finished products. Extra inventory leads to higher inventory financing costs, higher storage costs, and higher defect rates. Of course, in order to remain responsive to the customer's requirements and ensure control of variance, you must maintain minimum inventory levels. Excess inventory, however, disguises issues like unacceptable changeover times, downtime, and operator inefficiency because there is no sense of urgency to produce product since there is plenty available in storage. As you build excess inventory to accommodate problems in processes, the costs escalate. Safety stock levels are driven by downtime, quality problems, supplier delivery problems, and job imbalances. Lowering the amount of in-process inventory forces you to improve your processes.

Waste of Motion –

Any movement of people or equipment that does not contribute value to the product is waste of motion. Waste of motion can be found both in the machine and the method of the production system, including production systems for services. Programming errors that lead to excessive "air cut" and travel time in machining equipment will sometimes go unnoticed if the machine is not the bottleneck in the process; failure to identify the waste can lead to missed line-balancing opportunities. When you are trying to identify waste in the

method or in human motion, it is important to recognize the difference between value-added and non-value-added motion. There are many times when non-value-added motion can be combined with another part of the process to reduce the overall cycle time, thereby minimizing the non-value-added motion. Walking to get files, documents, supplies, and make copies is also waste of motion. In most cases, simply recognizing the opportunity is the most difficult part of reducing this type of waste (see Figure 1).



Waste of Waiting –

Idle time between operations is waste of waiting. It can occur in many places in the system of production for a product or service. Because of batch processing, the customer lead-time can be 30 days while the value-added time is only 18 hours. The use of multi-process employees goes a long way toward eliminating this waste; however, there is always room for improvement. We cannot wait in line anywhere without growing impatient. Why else would cash point machines, E-tickets, fast food, and high-speed lines exist?.Waiting for "batch produced" work from a previous process, waiting for a document from a previous department, waiting for supplies to be delivered are all examples of waste. Waiting is 100 percent waste, and whenever it is eliminated the cost is reduced by the entire amount of the wait time.

Applying Lean Principles

Initiating, establishing, and maintaining a Lean operation entails these interrelated steps:

Identify customer value: Define value from the perspective of the customer. Understand clearly and exactly what product or service the customer desires, when it is to be delivered, and at what price. No matter how valuable a particular aspect of a product or service may appear to you, it's irrelevant if it's not similarly valued by the customer.

Document the value stream: Precisely map the set and sequence of all specific actions, communications, and material movement required to bring a product or service, valued by the customer, from conception to final delivery.

Recognize the waste: Mapping the value stream enables you to identify valued-adding and non-value-adding activities from the customer's perspective. Any activity that doesn't add value for the customer is waste and offers an opportunity for improvement.

Standardize processes: Determine the one best way to perform a step or a process and then follow that prescribed best way. Until you consistently follow the process steps to provide your customers with what they need, you can't be sure of sustained improvement. To eliminate variation in processes, you must clearly and in detail define the sequence, timing, and outputs of each activity. Standardized processes also enable you to expand production with minimal disruption.

Establish continuous flow: Ensure the uninterrupted movement of material through a process without backflow or scrap, one piece at a time. Continuous flow yields shorter cycle times and, shorter lead times; and it allows production flexibility, higher throughput, and increased revenue. Remember, it's a value stream – make it flow smoothly.

Enforce quality at the source: Make sure that things are done right the first time, eliminating after-the-fact quality inspections that catch errors often after the mistake has been duplicated over and over. First, the processes should be designed to keep defects from occurring, the strategy referred to as Poka-yoke. Second, when defects do occur they should be detected and corrected where they occur by workers in the in-line process. Personnel at each stage in the process need to know the quality specification limits, operate within those constrains, and build in controls to avoid poor quality from advancing in the process.

Strive for continuous improvement: As Lean uncovers waste, often new layers appear that offer additional opportunities for continuous improvement or Kaizen. Every employee in a process should be encouraged to be on the lookout for ways to continuously improve the process and to eliminate non-value-adding waste.

Key Tools of Lean

Lean employs a variety of tools to put those principles into practice. Some representative examples include:

Process mapping, which may be thought of as a subset of value stream mapping, visually displays precisely how a particular process is carried out. The map reflects what actually happens rather than what you believe should happen so that opportunities for improvement can be uncovered and standardized processes developed.

Standard work provides detailed and complete operating procedures for a process or activity and communicates those procedures clearly to the personnel who must perform them. In the absence of detailed, standard

work specifications, workers are likely to make assumptions about how to perform work and, as a result, generate waste.

Work cells, often laid out in a U-shape, bring together several stages of a process in order to eliminate transport waste and waiting, to facilitate one-piece or small-batch flow of products through the process, and to take advantage of multi-purpose workers who can perform any process handled by the cell.

5S (sift, sort, shine, straighten, sustain) specifies rules for cleaning and organizing the workplace so that each worker's work area is laid out and maintained for maximum efficiency.

Production levelling smoothes production by distributing volumes and product mix as evenly as possible over time in order to avoid disruptive peaks and valleys.

Poka-yoke enables the enforcement of quality at the source by providing methods of mistake-proofing through in-line quality testing of 100 percent of the units in the process.

Kaizen circles and Kaizen events increase worker involvement and effectiveness by bringing together small groups of workers to generate ideas for solving problems and improving processes, thus helping fulfil the ongoing goal of continuous improvement.

Lean and Six Sigma

Lean and Six Sigma are complementary methodologies. Often, Lean and Six Sigma are implemented concurrently in what is referred to as "Lean Six Sigma". Lean streamlines processes and eliminates waste, reduces overall complexity, and helps to uncover the value-adding activities of a process. But because Lean does not recognize the impact of internal process variation and provides no tools for bringing a process under statistical control, Six Sigma can provide the data-driven, rigorously statistical methodology that Lean lacks. Moreover, Six Sigma's methods are ideal for solving complex, cross-functional problems where the root causes of a problem are unknown. Both methods focus on processes and their improvement, but Lean addresses variation external to processes, such as sales quantity changes, product mix changes, and the like, in order to enable the business to continue to make money in spite of the variation. Six Sigma addresses variation within processes to remove the impact of that variation on the ability of the business to make money. For maximum operational effectiveness Lean can be used to create a foundation that allows the advanced tools of Six Sigma to yield greater benefits, faster.

Getting Started

As with any major improvement initiative, a Lean project requires the visible support and commitment of senior management. Such support is crucial for overcoming resistance and for preventing a backslide into the old and wasteful ways of working. Here, again, Six Sigma can help. With its structure of Champions and Belts, it provides a framework for mobilizing personnel, ensuring accountability, and creating leaders.

The ideal time to begin utilizing Lean principles is after your key business processes have been defined. If you are embarking on Lean Six Sigma this should take place before a Six Sigma project pool has been developed. Value Stream Mapping identifies which method of improvement will immediately achieve the greatest results. Some business processes need to be leaned before applying Six Sigma to eliminate variation. Others require a complete re-design or a development of a new process using Design for Six Sigma.

It is also advisable to begin with manageable projects rather than global transformation. Most companies rarely implement Lean throughout their operations all at once. Partial implementation enables you and your organization to gain experience and confidence, and then in the later stages roll Lean out more quickly to other parts of the organization.

Moreover, as you begin to achieve lower production costs, increased output, and shorter production lead times in your pilot projects, you will build momentum for wider transformation and help fund those future changes through such improvement. After all, eliminating defects and waste, shortening cycle times, reducing inventory, raising productivity, and increasing output aren't just operational goals – they are essential ingredients in better financial performance.