Lean Thoughts

Inspired People | *Robust Processes* | *Lean Operations*

April 13, 2004

For all Consortium events – Contact Richard for more information.. For other events – contact directly

Important Consortium Dates to add to your calendar

The Team Time schedule has been established for the coming year. Team Time will start at 1:00pm at the host company. This will allow for folks to work with peers in the host site to collaborate, facilitate and implement ideas to advance the implementation of manufacturing excellence. *Participants should be prepared to work on the shop floor and come equipped with proper PPE.* The host site will advise 1 week in advance Team Time Projects. Part of the Team Time activity will include a plant tour.

- ☐ **May 13, Team Time,Stackpole AGD,** contact Cindy Grolleman, cindyg@stackpole.ca
- ☐ **May 18 - 21, AME Pacific Rim Conf.,Melbourne Australia, info at www.x2xconference.com** contact ame@pams.org.au for dialogue
- ☐ **June 10, Team Time,Stackpole CSD,** contact Gerry Ward, gerryw@stackpole.ca
- ☐ **July 08, Team Time,Eaton Cutler-Hammer** contact Joe Fisher, JoeRFisher@eaton.com
- ☐ **August 12, Team Time,Messier-Dowty.** contact Richard Evans, Richard.Evans@Messier-Dowty.on.ca
- ☐ **September 09, Team Time,CGL Manufacturing** contact Dave Desker, daved@cglmfg.com
- ☐ **October 14, Team Time, CTS Corp.** contact Bob Garces,. Bob.Garces@ac.ctscorp.com
- ☐ **October 18-22, AME Annual Conference, Cincinnati.** contact www.ame.org for details
- ☐ **November 06, Consortium ShareShowcase,Eaton Cutler-Hammer** contact Joe Fisher, JoeRFisher@eaton.com
- ☐ **November 11, Team Time,Morrison Lamthe.** contact Tony Vita, tvita@morrisonlamthe.com
- ☐ **December 09, Team Time,Inscape.** contact Joe Cyr, jcyr@inscapesolutions.com
- ☐ **January 06, Team Time,Alumabrite Inc.,** contact Richard Kunst, Richard.Kunst@Kromet.com
- ☐ **February 10, Team Time,Kromet International.** contact Richard Kunst, Richard.Kunst@Kromet.com

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Create a Lean, Mean Machine

by **George Alukal**

Within the last 10 years or so, a new term—lean—has entered manufacturing's vocabulary. Decision makers working as senior leaders, especially in executive management, quality, human resources, operations and engineering, have been hearing a lot about lean recently in a context other than dieting.

Lean is a manufacturing philosophy that shortens the lead time between a customer order and the shipment of the products or parts through the elimination of all forms of waste. Lean helps firms reduce costs, cycle times and unnecessary, nonvalue added activities, resulting in a more competitive, agile and market responsive company. The National Institute of Standards and Technology Manufacturing Extension Partnership (NIST/MEP), a part of the U.S. Department of Commerce, says lean is a systematic approach to identifying and eliminating waste (nonvalue added activities) through continuous improvement by flowing the product only when the customer needs it (called "pull") in pursuit of perfection.

Lean focuses on value added expenditure of resources from the customers' viewpoint. Another description would be to give customers:

- What they want.
- When they want it.
- Where they want it.
- At a competitive price.
- In the quantities and varieties they want.
- Always of expected quality.

Many of the concepts in total quality management (TQM) and team based continuous improvement are also common to the implementation of lean strategies.

Why the Emphasis Now?

The reasons lean is a particularly important winning strategy today include the following:

- The need to compete effectively in the global economy.
- Pressure from customers for price reductions.
- Fast paced technological changes.
- Continued marketplace focus on quality, cost and on-time delivery.
- Original equipment manufacturers' (OEMs) holding on to their core competencies and outsourcing the rest.
- OEM requirements that suppliers conform to quality standards such as ISO 9000:2000 or QS-9000 in the automotive industry (being replaced by the international ISO/TS 16949).
- Ever increasing customer expectations.

In 50 Words Or Less

- **Today's competitive, rapidly changing and**

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customer focused global economy has led to renewed interest in lean.

- **Lean's elimination of waste and variation makes organizations more competitive, agile and responsive to markets.**
- **Planning and implementation management are keys to getting the most bang for lean's buck.**

• The need to standardize processes to consistently get expected results.

To compete successfully in today's economy, you need to be at least as good as any of your global competitors, if not better. This is true not only regarding quality, but also for costs and for lead, processing, delivery, setup, response and other cycle times.

Lean emphasizes such things as teamwork, continuous training and learning, producing to demand (pull), mass customization and batch size reduction, cellular production, quick changeover and total productive maintenance. Not surprisingly, lean implementation uses both incremental and breakthrough improvement approaches.

The "Wastes" of Lean

Waste of resources has direct impact on cost, quality and delivery. Excess inventory, unnecessary movement, untapped human potential, unplanned downtime and suboptimal changeover time are all symptoms of waste. Conversely, the elimination of wastes results in higher customer satisfaction, profitability, throughput and efficiency.

Eight types of waste (called *muda* in Japanese) are associated with lean:

1. Overproduction: making more, earlier or faster than required by the next process.

2. Inventory waste: any supply in excess of a one-piece flow (make one batch and move one batch) through the manufacturing process, whether it is raw materials, work in process or finished goods.

3. Defective product: product requiring inspection, sorting, scrapping, downgrading, replacement or repair.

4. Overprocessing: extra effort that adds no value to the product (or service) from the customer's point of view.

5. Waiting: idle time waiting for such things as manpower, materials, machinery, measurement or information.

6. People: not fully using people's mental and creative skills and experience.

7. Motion: any movement of people, tooling and equipment that does not add value to the product or service.

8. Transportation waste: transporting parts or materials around the plant.

Cutting out these eight types of waste is the major objective of lean implementation. The continuous reduction or elimination of them results in surprisingly large reductions in costs and cycle times. A root cause analysis of each of the eight wastes allows you to come up with the appropriate lean tool to tackle the causes identified.

If, for instance, long lead times and missed delivery dates are major bottlenecks, identifying the underlying reasons might lead you to focus on such things as setup times, machine downtime, absenteeism, missed supplier shipments, quality problems or overproduction resulting in excess inventory.

Many examples of waste may be associated with variations in processes. Statistical tools, including the Six Sigma DMAIC (define, measure, analyze, improve, control) methodology might be appropriate to attack such wastes. Table 1 provides a look at other examples of root causes of variation and waste.

Lean and Six Sigma, thus, are not mutually exclusive—rather they are complementary. Some firms use an appropriate combination of lean, Six Sigma, theory of constraints and TQM in their constant

- Poor layout.
- Long setup time.
- Poor workplace organization.
- Poor equipment maintenance.
- Inadequate training.
- Use of improper methods.
- Statistically incapable processes.
- Not following procedures.
- Instructions or information unclear.
- Poor planning.
- Supplier quality problems.
- Inaccurate gages.
- Poor work environment (for example, light, heat, humidity, cleanliness and clutter).

Causes of Variation and Waste

striving for continuous improvement and competitive advantage.

Starting the Journey

The starting point of lean initiatives could be any one of the following:

- Value stream mapping.
- Lean baseline assessment.
- Mass training.
- The basic building blocks of lean.
- A pilot project.
- Change management.
- Analysis of internal overall equipment effectiveness and losses.

Value stream mapping (VSM). VSM studies the set of specific actions required to bring a product

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family from raw material to finished goods per customer demand, concentrating on information management and physical transformation tasks.
The outputs of VSM are a current state map, future state map and implementation plan for getting from the current to the future state. Using VSM, you can drastically bring the lead time closer and closer to the actual value added processing time by attacking the identified bottlenecks and constraints. The implementation plan serves as the guide. Bottlenecks addressed could include long setup times, unreliable equipment, unacceptable first pass yield, or high work or process inventories.
Lean baseline assessment. Using interviews, informal flowcharting, process observations and analysis of reliable data, an "as is" situational report can be generated from which the lean improvement plan flows, based on the identified gaps.
Mass training. After training in lean is provided to a critical mass of employees in teach-do cycles, lean should be immediately implemented.
The basic building blocks of lean. These include 5S (see section under Building Blocks), visual controls, streamlined layout, point of use storage and standardized work. You then build on the implementation of the building blocks with higher level tools and techniques, finally achieving flow production based on customer pull.
A pilot project. Choose a bottleneck or constraint area for breakthrough lean improvement using the Association for Manufacturing Excellence's *Kaizen* Blitz approach for breakthrough improvements. Then, using the lessons learned, migrate lean implementation to other areas.
Change management. Align the company's strategies and employee goals; then change the culture from the traditional push production to lean pull. This should eventually result in a philosophical change in how daily work life is viewed.
Analysis of internal overall equipment effectiveness and losses. A Pareto chart of these losses will identify the biggest bang for the buck and indicate where to start the lean journey.

Building Blocks

The tools and techniques used to introduce, sustain and improve a lean system are sometimes referred to as the lean building blocks.
The building blocks are:
• **5S.** The five steps that go into this system for workplace organization and standardization all start with the letter S in Japanese (*seiri*, *seiton*, *seison*, *seiketsu* and *shitsuke*). These five terms are loosely translated into English as sort, set in order, shine, standardize and sustain.
• **Visual controls.** All tooling, parts, production activities and indicators are in view so everyone involved can understand the status of the system at a glance.
• **Streamlined layout**. Plant layout is designed according to optimum operational sequence.
• **Standardized work.** Performance of a task is consistent according to prescribed methods, without waste and focused on human movement (ergonomics).
• **Batch size reduction**. The best batch size is onepiece flow. If one-piece flow is not appropriate, reduce the batch to the smallest size possible.
• **Teams.** In the lean environment, the emphasis

Lean and Six Sigma, thus, are not mutually exclusive rather they are complementary.

is on working in teams, whether improvement teams or daily work teams.
• **Quality at the source.** Inspection and process control is carried out by the operators so they are certain the product passed on to the next process is of acceptable quality.
• **Point of use storage**. Raw materials, parts, information, tooling, work standards and procedures are stored where they are needed.
• **Quick changeover.** The ability to change tooling and fixtures rapidly (usually in minutes) allows for multiple products in smaller batches that can be run on the same equipment.
• **Pull and *kanban*.** Under this system of cascading production and delivery instructions from downstream to upstream activities, the upstream supplier does not produce until the downstream customer signals a need, using a *kanban* system.
• **Cellular or flow.** The aim of one-piece flow is to physically link and arrange manual and machine process steps into the most efficient combination, thus maximizing value added content while minimizing waste.
• **Total productive maintenance.** This lean equipment maintenance strategy maximizes overall equipment effectiveness.
Many of these building blocks are interconnected and can be implemented in tandem. For example, 5S, visual controls, point of use storage, standardized work, streamlined layout, working in teams and autonomous maintenance (part of total productive maintenance) can all be components of a planned implementation effort.
Besides the building blocks, other important lean

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concepts or techniques include just-in-time (JIT) methods, error proofing (*poka-yoke*), autonomation (*jidoka*) and continuous improvement (*kaizen*).

Example

Let's look at one example in detail. If the primary reason for overproduction and excess inventory is long process changeover times, the correct tool or lean building block to use will most likely be single minute exchange of dies (SMED) or quick changeover techniques.

Changeover time is the time between the last good piece off the current run and the first good piece off the next run. The traditional changeover assumption is that long runs are necessary to offset the cost of lengthy changeovers. This is not valid if the changeover time can be made as short as possible (under 10 minutes if the SMED technique is applicable) and standardized at that level so there is confidence the first good piece from the next run can be made in a certain period.

The changeover improvement process typically includes the following steps:

• Identify and form the changeover improvement team (such as operators, manufacturing and quality engineers, setup specialists, material handlers, tool and jig fixture makers, maintenance technicians, and supervisors and team leaders).
• Document the current changeover (videotape where possible).
• Through brainstorming, analyze the changeover and identify ways to reduce, eliminate, consolidate or mistake proof steps and convert from internal to external time and tasks. (Internal time is when the machine is stopped, whereas external time is when the machine is running and producing the previous part).
• Implement improvements and monitor results.
• Streamline all aspects of setup operations.
• Standardize the improved changeover.

Besides attacking overproduction and inventory wastes, quick changeover can reduce lead time, defective product and space requirements while improving productivity and flexibility and allowing smaller batches with more variety (mass customization).

Lean Enterprise

Enterprisewide lean implementation has slightly different challenges compared to deploying lean in manufacturing.

On the shop floor, a tangible product is being transformed. The utility of the tools and techniques for cost and cycle time reduction in the processing of raw materials into usable finished goods is fairly evident. In the office functions of a manufacturing firm or in a strictly service organization, many of the same tools and techniques are applicable but in a slightly modified form. Instead of hardware, you look at value adding processing and use of information or software.

For example, you can visualize the usefulness of lean in a hospital setting where many processes could be improved with cycle time reduction through methods such as proceduralization, team training, standardized work, point of use storage, visual systems and quality at the source.

The concept of streamlining and purging nonvalue added steps from the time an order (or request for quotation) is placed until payment is received is currently in vogue. Bottlenecks are attacked using the plan-do-check-act model and the appropriate lean building blocks.

Eliminating Barriers

Managers know you cannot stand still in the face of global competition because your rivals are not standing pat but are improving their processes and systems to catch up with you. If you do not also improve, they will overtake you sooner or later. You lose market share, margins deteriorate, and sales revenue and profitability suffer. So, if you know you need to improve, the question then becomes, why don't you?

Proper planning and implementation management are the keys to obtaining enduring success with lean deployment. Lean is not a quick fix. You are kidding yourself if you think lean implementation is easy. Success requires not only good change management practices, but also the integration of lean into the overall business strategy. The flavor of the week syndrome should be avoided. Complete implementation of lean might not be for everybody, so a well thought out master plan based on cost-benefit analysis is a useful preliminary step. Great benefits from lean implementation are derived by first focusing on what processes you have, the product families you make, the environment you operate in, the competitive situation you face and the need to use the right technique at the right time. For example, a firm producing parts to customer orders will face different challenges from one producing parts to stock. For lean implementation to be successful, senior managers must take an active role in many areas. Examples include:

• Undertaking a planned approach to lean implementation, rather than single point solutions.
• Providing needed resources.
• Appointing lean champions.
• Empowering and involving employees and emphasizing teamwork and cooperation.
• Having good communication channels—both top down and bottom up.
• Managing expectations, such as fear of loss of jobs.
• Making sure everyone understands the need for change, as well as new roles as change is implemented.
• Creating an atmosphere of experimentation, a

Core Concepts Of Lean

Here are some useful concepts to keep in mind while

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preparing for a lean transformation:
• Creativity before capital: In lean, team brainstorming of ideas and solutions is emphasized instead of spending large sums of money on capital expenditures. People working in the process are brought together to tap into their experiences, skills and brainpower to generate a plan for waste reduction and process improvements.
• A not so perfect solution implemented today is better than a perfect solution that is late. Just do it now!
• Inventory is not an asset, but a cost or waste.
• Use the proven plan-do-check-act methodology for deploying improvements—both incremental and breakthrough.
• Once started, lean is a never ending journey. Typically, 95% of lead time is not value added. Collapsing the lead time closer to the actual processing time by squeezing out nonvalue added time and tasks results in both cost and cycle time reductions. Henry Ford knew this in 1926, when he said, "One of the most noteworthy accomplishments in keeping the price of Ford products low is the gradual shortening of the production cycle. The longer an article is in the process of manufacture and the more it is moved about, the greater is its ultimate cost." risk taking environment and a safety net for trial and error.
• Offering good rewards and recognition programs, suggestion systems and gain sharing.
• Making everybody understand the competitive reasons for and benefits of lean for the organization as well as for themselves personally.
• Creating a vision of the future after the change.
• Introducing a performance measurement system based on meeting company goals.
• Analyzing and sharing of cost vs. benefit information.
• Emphasizing everyone's accountability.

In many cases, implementing pilot projects first, perhaps in a *Kaizen* Blitz mode, gets immediate buy-in from skeptics. The success achieved from these quick hitters can then be migrated to other areas in a planned approach. Ultimately, lean has to become the daily work habit or operating philosophy of the whole firm to be sustainable. Starting the lean process is comparatively easy; but sustaining it over the long haul takes robust planning, discipline, commitment, patience, an environment that tolerates some risk or mistakes, a good reward and recognition program and peoples' receptivity to change and growth. Many managers have found the three essential ingredients for successful lean implementation are:
• Sustained, hands-on, long-term commitment from senior management.
• Training for all employees in the lean building blocks.
• Good cultural change management during the transformation from the traditional push to the lean pull mentality.

Never Ending Journey

Many firms have appointed and empowered lean champions for successfully implementing their lean transformation. These champions help others as mentors, trainers, group facilitators, communicators, planners, evaluators, drivers of continuous improvements and cheerleaders celebrating each success. Champions also help in permanently capturing the gains by standardizing at the higher levels of performance as lean is implemented, so as not to slip back. Lean will not work if it is viewed as merely a project, point solution or vehicle for downsizing.

Because lean is a never ending journey, there is always room for continuous improvement—a necessary component of any effective quality management system and the key to success in today's highly competitive, rapidly changing and customer focused global economy.

A Brief History Of Lean

Most lean concepts are not new. Many were being practiced at Ford during the 1920s and are familiar to most industrial engineers.

A few years after World War II ended, Eiji Toyoda of Japan's Toyota Motor Co. visited American car manufacturers to learn from them and transplant U.S. automobile production practices to Toyota's plants. With the eventual assistance of Toyota's Taiichi Ohno and Shigeo Shingo, Toyoda introduced and continuously refined a system of manufacturing that had a goal of reducing or eliminating nonvalue added tasks—those for which the customer was not willing to pay. The concepts and techniques that go into this system are now known as the Toyota Production System, and they were recently reintroduced and popularized in America under the umbrella of lean manufacturing. Lean concepts became applicable beyond just the shop floor. Lean manufacturing in this context is known as "lean enterprise." ASQ has seen a steady increase in member demand for information about lean, as evidenced by the attendance and interest in lean presentations at recent Annual Quality Conferences, the new two-day seminars on lean being offered by ASQ as part of its career based training programs and the creation of a new Advanced Manufacturing Interest Group (AMIG). Other organizations, such as the Society of Manufacturing Engineers and Association for Manufacturing Excellence, report similar interest.

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