

**MANUFACTURING INSIGHTS**

An Introduction to Lean Manufacturing

WARNING

federal law provides severe civil and  
criminal penalties for the unauthorized reproduction, distribution or  
exhibition  
of copyrighted videotapes.

© 2000 SME

**MUSIC UP AND UNDER**

**NARRATION (VO) :**

Manufacturing Insights, Manufacturing engineering magazine's video series for  
Process improvement.

This video is an introduction to lean manufacturing. It provides an  
understanding of how lean manufacturing can be used to achieve a substantial  
competitive advantage.

Lean manufacturing is of great interest to manufacturers throughout the  
world. companies of all sizes are applying lean principles and are realizing  
dramatic improvements in quality, productivity, customer service, and  
profitability. but What is lean manufacturing?

Lean manufacturing is a production philosophy--a way of mapping \* the overall  
manufacturing process from raw material,\* to finished goods, \* all the way to  
the customer.

It is called "lean" because these PRINCIPLES help a manufacturer to produce  
more with less: less time, less inventory, less capital, and fewer resources.  
lean accomplishes this by highlighting what needs to be changed to streamline  
the overall production process.

(Liker 14:04:28 - 14:04:43)

"The core philosophy is focusing on continuous flow of materials, from raw  
materials all the way to the customer, and eliminating anything that gets in  
the way of doing that, and anything that gets in the way of doing that is  
defined as waste. . . . Waste is anything that prevents value-added flow of  
material through the enterprise. . . ."

**NARRATION (VO) :**

There is a common misconception that lean manufacturing only works in large,  
high-volume, repetitive manufacturing companies. the truth is Lean  
manufacturing has been successful in many industries. The principles apply in  
both small and large manufacturing companies. This is welcome news since more  
than 96% of all manufacturing companies have fewer than 250 employees.

to better understand what is good about lean manufacturing it will help to  
know, what is so wrong with mass production?

(Liker 14:09:43 - 14:09:51)

"Mass production started with a number of principles, but two really prominent principles. One is economies of scale . . ."

(liker 14:10:56 - 14:11:00)

"the second principle in mass production was a tayloristic look at individual workstations and workers to make them most efficient."

**NARRATION (VO) :**

In contrast, lean manufacturing examines the whole operation. Lean focuses on total system efficiency rather than on isolated improvements.\* Ironically, improving overall success may require individual pieces of the system to operate less efficiently, \* but at the same pace as upstream and downstream processes. a guiding lean principle is streamlining production flow.\* Flow improves when you get rid of wasted time, wasted effort, and wasted processing.

lean challenges the principles of economy of scale that says the larger the production run, the lower the cost per unit. Lean Focuses on small batches, down to one-piece in some cases- to smooth production flow in the plant.

To further EXPLAIN this, Let's look at the total manufacturing effort required to produce an item. in most production cycles, only a small amount of time is spent adding value to a product-- something that is meaningful in the eyes of the customer.

Most manufacturing effort is spent on activities that DO not add value to the product and are not required by the process or by the customer. This is "non-value-added activity."

when a manufacturer wants to increase production output, it is common practice to simply plan more of everything. hire More employees. buy More equipment, or build Additional factory space. While this results in more value-added activity and higher output, it also results in more non-value-added activity.

Lean manufacturing takes a different approach. In lean manufacturing the production output (or value-added activity) expands as non-value-added activity is reduced. The operation is still the same size. Additional employees are not hired. New equipment is not purchased. People are not working harder or faster. The lean manufacturing approach is to redirect non-value-added activity into value-added activity.

This time line represents typical waiting time from the time a customer order is placed until the finished product is delivered and paid for.

the Value-added time is shown in red. This activity may include manufacturing processes such as machining, stamping, welding, finishing, and assembly: in short, any activity that transforms an item from raw material to a finished product.

Non-value-added time is shown in blue. This may include order entry,

scheduling, equipment setup, moving and staging material, inspection, repair, rework, and idle time.

in most cases, Actual value-added time is only a small fraction of the total cycle time. Yet, many companies focus on improving these value added processes.

A typical improvement initiative might be increasing "hits per minute" on a stamping press or increasing spindle speed in a machining operation. This may produce dramatic improvement in the individual value-added activity, However, it may not boost the overall system efficiency.

The power of lean manufacturing lies in its ability to identify actions you can eliminate or minimize so you can reduce cycle time. for this discussion "Cycle time" refers to the total amount of time production material is in the system.

Reducing cycle time requires reducing non-value-added activity as much as possible. This shortens the time line and the customer waiting time. Consequently, the factory receives revenue sooner.

the lean PRINCIPLE of "flow" or make-one, move-one, is an effective way to produce if you are trying to reduce cycle times. sometimes a more efficient layout may be successful at cutting cycle time. other times companies may form product cells to reduce cycle times.

what ever area you choose to improve, remember not all lean practices result in immediate and measurable performance improvement. some contribute to total system EFFICIENCIES that are subtle and less easily quantified.

(Liker 15:08:33 - 15:09:00)

". . .Individual lean manufacturing practices often don't really make much of an impact, and then sometimes companies get frustrated and decide lean doesn't work for them. The only way you really get the benefits is through lean as a system, as a total system. If you do that, i've yet to see a company that has seriously implemented lean as a system and has a philosophy of continuous improvement that hasn't become very efficient—dramatically more efficient than they used to be."

**NARRATION (VO) :**

there are several common TRAITS found in lean companies. Most lean factories use "visual management" techniques to help employees spot problems quickly. These visual management techniques may take the form of status Boards, right-sized storage space for inventory control, andon lights, and colored bins for easy product identification. visual management techniques take many forms but they all have the same goal, To help highlight problems in the production system so they can be quickly fixed.

STANDARDIZED work is also practiced in most lean organizations. standardized work procedures are provided in most cases by simple documentation at each work station for just what is to be accomplished at each step in the process. employees can then move from job to job and still be ASSURED they are doing the job right.

another common practice in lean manufacturing is keeping the WORKPLACE flexible. depending on your industry, this may entail adjustable workbenches, overhead power grids, movable machines and other portable devices that will allow easy layout changes. a flexible layout will allow for quick changes if customer orders FLUCTUATE.

One of the most essential principles of lean manufacturing is the concept of "pull." "Pull" refers to a production control system based on replenishment. A pull system reacts to needs, it doesn't anticipate them. material is produced or transported only to replenish material consumed by a downstream process or a customer.

a simple and effective way to control production and manage inventory, A pull system can be implemented in a variety of ways. Some common trigger mechanisms include kanban cards, bins, marked floor space, or a computerized system. which ever pull method you select, the system must be convenient and easy to use.

Another essential principle of lean manufacturing is quality at the source. If a defective part is discovered immediately, the cost and disruption are minimal.\* Only one defective item is made, and the cause of the defect is easy to identify. If the part is found DEFECTIVE at final inspection, there will be significant REWORK and the need to reschedule the job. If the defective product reaches the customer, there are added costs due to recall and replacement, warranty, and perhaps liability issues.

Lean manufacturing philosophy teaches that production costs decline as quality improves. While this may seem to contradict experience, current research demonstrates that production costs really are lower as quality approaches perfection.

From the viewpoints of traditional mass production and today's lean manufacturing, the same situation in a factory is seen differently. Lean manufacturing recognizes that performance measures are more than tracking devices;\* they are decision-making tools. performance measures reinforce desired behaviors and support policies that are consistent with the company's business goals.

For example, if a processing station produces parts at a rate higher than expected, the mass production managers sees higher individual efficiency and greater economies of scale.\* In contrast, the lean manufacturing manager sees a DISRUPTED flow of production material along the value stream.

Performance measures and appraisal criteria that are appropriate in mass production may not be valid in lean manufacturing.

(liker 15:10:33 - 15:10:46)

"One measure that reflects good flow is what some companies are calling dock-to-dock time - the time the product spends in the plant from the time it enters 'til the time it leaves. That's probably the single best indicator of lean manufacturing."

to make lean work, There must be company-wide awareness of the business goals \* and an understanding of how lean principles will help the factory reach those goals. \* This builds confidence in lean manufacturing as a management

strategy.

Osvaldo (10:17:? - 10:18:? - end of interview)

"the key thing about lean manufacturing is that it requires a commitment from all the management. It will not work if we all do not think the same way. To me lean manufacturing means lower inventories. But maybe for production it means highest productivity. But if the orders are not there, production cannot build them. Production would want to build them. So we all need to understand what our goal is as a company, and then we all follow the same rules. That is the first one. To implement lean manufacturing, you have to be on the floor. It cannot be done in an office. You have to be involved out there, and you have to have clear visual controls. If you can do all those, then lean manufacturing will be easy."

**NARRATION (VO) :**

What factors contribute to the acceptance of lean manufacturing by managers and shop floor workers?

By far the most important factor is the Genuine commitment of all employees to the success of the company. Other factors are an acceptable work pace, and training in continuous improvement and waste elimination.

The benefits of Lean are shorter cycle time, higher quality, excellent customer service, and lower production cost.

many companies have APPLIED Lean manufacturing PRINCIPLES to provide a significant and sustainable competitive advantage. to see examples of how 2 different types of companies have applied the PRINCIPLES of lean manufacturing, view the companions to this tape "lean manufacturing at miller SQA", or "lean manufacturing at TAC manufacturing"

Manufacturing Insights wishes to thank the following organizations for there assistance in the production of this program:

TAC Manufacturing

Miller SQA

University of Michigan

Produced By:  
The Society Of Manufacturing Engineers

Executive Producer: Karen Wilhelm

Producer/Director/Cameraman: Steven Bollinger

Written By: Dale Davis and Charles Standard