

LEAN MANUFACTURING

SECRETS FOR YOUR  
BUSINESS

“The secret of all power is - save your force.  
If you want high pressure you must choke off waste.”

Joseph Farrell

## TABLE OF CONTENTS

Introduction	3
What is Lean Manufacturing (LM) ?	5
How can LM help business processes, results and success – a quick overview	6
Different types of waste (MUDA)	7
What does Lean manufacturing bring to business? What is the value propositions really? Why do it?	11
Benefits of LM	12
Lean Tools to use in your business specifically	13
Steps In The LM Process	14
Lean Manufacturing Tools	18
▪ 5S	
▪ Cellular Manufacturing	
▪ Mistake Proofing	
▪ Set-Up Reduction	
Two Key Rewards For Business Using LM	20
Questions, Diagnostics and Assessments	21
Operational And Economic Benefits Or Metrics	27
Golden Rule of Lean and Lean Deployment in Business	28
Areas in Business where lean can help	29
The key lean manufacturing principles	37
Kaizen, CANDO and other LM tools	40
LM contingencies and TEN STEPS to enable LM deployment in your business	45
LM Toolkit overview	55
Conclusion and closing remarks	57
Books, Online Resources and Useful Links	59-62

# Introduction

Why is Lean Manufacturing or thinking so prevalent in the modern current economies of scale? To remain competitive, agile and the lowest cost producers, providers and streamlined business, getting rid of waste and being highly, consistently and sustainable is key for survival and thriving in this new economy.

Lean manufacturing or thinking is exactly what the name sounds like – it is about 'cut to the bone', fat-trimmed, streamlining operation and organizations.

Authors Womack and Jones define lean thinking as a set or collection of 'efficiency tools' that you can unleash in your business to save money, reduce cost and waste and deliver consistent and effective service that is affordable and pleasing to your customers. It is about vision and tools for reducing variability and cutting down on waste, being efficient and running a smooth and competitive, even profitable operation, well.

The thinking was initially championed by pioneers like Toyota and it was eventually adopted by the Japanese automakers as the principle upon which they wanted to build, run and grow their businesses. Only a little later, will the Western world catch onto the value and potential of this approach to their respective organizations and operations.

Some have referred to lean manufacturing as the TOYOTA PRODUCTION SYSTEM, or JIT (just-in-time) manufacturing, paying attention to things like flow productions, line operations, value streams, Kaizen (which we will get to later). In any lean manufacturing process and approach there are a couple of things to pay attention to. There is discipline, planning, rigor, scientific approach and statistically-based tools required and applied to make this business paradigm fit, work and last.

Lean manufacturing will help you in your business take a serious look at visible causes and effects in your business. Aspects that could get some attention could include things like:

- (i) inventory
- (ii) movement/motion
- (iii) waiting or queues
- (iv) broken machines or tools (missing)
- (v) dirt and clutter
- (vi) noise

... and many others.

Things that we can see that is obvious waste or inefficiencies attract attention and demand action. This is where lean manufacturing steps in and makes the

difference. It deals with the problems that we can actually SEE and do something about.

True to its Japanese origin there are lots of 'legacy' terminology here, one of which is MOST appropriate as we start this discussion on lean tools and the implications for your business:

It is referred to as MUDA, essentially meaning WASTE. In any process and business there are EIGHT forms of MUDA/WASTE present:

- (i) Making products, delivering service that no-one wants OR NOT MEETING USER NEEDS (useless)
- (ii) DEFECTIVE products or flawed services (mistakes)
- (iii) Making too much of something (overproduction)
- (iv) Inventory
- (v) Unnecessary processing (non-value added steps)
- (vi) Unnecessary movement of people
- (vii) Unnecessary movement of things

(viii) Waiting or queuing

There are many reasons people would want to use lean manufacturing in their organization or business

- (i) breakthrough performance
- (ii) increased quality
- (iii) shorter cycle times
- (iv) creating shareholder value
- (v) applying the principles throughout every level of the organization

When you focus on any improvements for production and profit you will have to pay attention to the saying 'time is money' and 'quality matters'. These two principles and fundamental pillars for lean manufacturing will reward you greatly if considered in all aspects and areas of your business.

- Achieve cost reductions on your terms
- Cut lead/wait times within a short period of time, in a planned fashion using lean tools to get you there!
- Cut down on processing time from start to finish, from the moment and order is placed to when it is shipped and delivered, (also called cycle time).

Through using lean manufacturing, you can in effect combine business improvement with business strategy.

YOU WILL NEED BOTH TO BE SUCCESSFUL and GET RESULTS THAT LAST.

There are ways that you can decide which specific approach or major projects can have the MOST impact on your bottom line, strategy and overall financial priorities.

Get rid of delays, waiting times, obstacles, bottlenecks and unnecessary waste hindering expedient, reliable, efficient and affordable products and services.

Cutting costs and saving money is at the very heart of lean manufacturing and thinking. It is a philosophy and practical business strategy that will reward greatly and even increase shareholder value significantly.

The tools and approaches we will be discussing and highlighting as part of this process, will be enlightening and inspiration. They are effective and they work. They complement and reinforce efficiency and streamlined operations, with measurable returns to your pocket and bottom line!

The reason we are all in modern-day business at all, is to earn return! It has to pay to do business, otherwise why do it at all?

In a time when businesses have to keep up with all the constant changing and evolving world or exciting, global business, agility and adaptability is key. Everyone is talking about the 'organic', collaborative workplace where we all work together well towards mutual goals.

Business, transactional and production efficiencies are an essential part of success, processes and outcomes that will serve and enable all of the above.

- There is the definite potential to significantly cut costs, waste, be more efficient, increase shareholder value and profits.
- Tools, utility and processes are needed to effect these outcomes.
- These approaches and tools can help you leverage and position your business, above mediocre and stand out from the crowd, in that quality matters.

Lean manufacturing has helped the big guns like GE and Toyota lower cost, cut waste and improve how they utilize their resources, quality and time. What are you leveraging to keep your company competitive?

If you are paying close attention to time and quality in your business, then lean manufacturing is for you.



Reducing waiting times, bottlenecks, cycle and lead times all matter to both the business and the customer

Variation in the time it does take to complete any given process (or steps within a process) causes variation and has to be dealt with to ensure customer satisfaction.

The favorite example is delivery 'windows' and managing expectations around that. Lean manufacturing is about MORE than identifying and dealing with defects. It goes beyond cause and effect and gets rid of the little jackals in the vineyard, with the potential for causing the most damage.

To make your operation and business reliable to your customers is a top priority and lean manufacturing, thinking, approaches and tools can help.

In our modern economy BOTH speed and reliability makes the difference. What was the gold standard yesterday, quickly becomes the entry-level requirement and prerequisite, in a highly competitive market. To stay on top, you need to be able to adjust and deliver consistently.

Reducing overhead cost and inventory is at the heart of lean manufacturing.

Some business metrics that are oftentimes used to gage a business' performance is on time delivery and reduction in

lead time. Scrap and rework, other forms of waste are good indicators too. Speed and quality often suffer in our fast-paced business, yet the consumer of the present and the future will be increasingly demanding and insisting on both as BASIC service!

Companies typically improve at a slow pace. Change takes time. Lean turbo-charges these improvement efforts and underpins with some muscle, the processes and outcomes undertaken.

High quality, high speed and low cost is what you are after with lean tools, thinking and manufacturing.

If you are after sustained value creation in your business then lean manufacturing is the answer and solution for you. Oftentimes combined with process and business improvement tools like Six Sigma.

You will find as you start out on this path, that lean thinking is sometimes really quite counterintuitive and brilliant, yielding great results, applying simplistic method and wisdom to process and outcome.

Lean manufacturing requires a strong sense of leadership and leading by example will be required. If you are in fact looking for a niche and competitive edge in your business, THIS IS IT!

Optimizing opportunity is the name of the game with lean. Moving faster and with quality in mind, lowering cost and waste in the process, will have you reaping rewards in no time. Make the most of the fact that some of your competitors are rather 'slow pokes'

- You might be having all sorts of questions at this point, like: What does Lean manufacturing bring to business? What is the value propositions really? Why do it?

Many have defines lean manufacturing as the streamlining of manufacturing processes to get the most out of equipment, inventory, and people.

To keep things really simple, lean manufacturing (or LM), has a base premise and overall goal 'to get more done with less' This is effectively done, by

- (i) minimizing inventory
- (ii) at and through all stages of production
- (iii) eliminating waste,
- (iv) reducing wait times, queues
- (v) shortening product cycle times from raw materials to finished goods.

LM processes involves some real positive, productive changes in businesses that will have a measurable impact on the bottom line.

- Benefits of LM could include
  - Reduced lead time, wait time and cycle time
  - Liberated capital
  - Increased profit margins
  - Increased productivity
  - Improved product quality
  - Just-in-time, affordable, streamlined, cost-efficient processes, products and services
  - Improved on-time shipments
  - Customer satisfaction and loyalty
  - Employee retention

As a business, regardless of the scope, range, condition, small, large, start-up, growing or expanding, improvement, quality and time, cost and waste all matter. LM affords you the opportunity to ensure your business grows stronger, quicker, consistently, getting higher value and improving competitiveness. Effectively positioning yourself above the masses and mediocrity.

- What is lean manufacturing and which tools can I use in my business?

LM is an on-going process. This approach and paradigm focusing on time and quality, cost and waste reduction, streamlining operations can assist you in reducing inventories, work-in-process (often referred to as WIP), required floor space, cycle times and lead times.

LM (even when combined with business improvement efforts such as Six Sigma methods and discipline), can lead to meaningful and measurable improvements, quality. Most of the tools focus on really simple concepts and are easy to use and implement. It focuses on the visible, what you can see, change and control. It does connect steps, processes and people. It spots waste, problems and allows us all to identify, spot and deal with errors quicker and more effectively, saving more money in the process!

There is nothing really complex or mysterious about it. Everyone can apply it to your business, no matter what industry you are in. It does not have to be intricate and only set aside for a chosen few. It can be a great tool to mobilize your organization.

The basic toolkit of LM has basic tools (which we will get to), that will consistently and constantly enable you to change ineffective processes to smoothly operating and flowing production lines. It provides everyone the opportunity to 'take control' and pride in the work that

they do. It is a hands-on enabler. When people understand how and what affects process and outcome and take a cause-effect, analytical approach to things around them, like work-processes for example, a whole new world of understanding, accountability and change erupts! It reenergizes your business and when the rewards start trickling in, everyone partakes and shares in the success and results.

One myth that needs dispelling right off the bat is that LM is ONLY for high-volume or standardized processes. This is simply misleading and far from the truth. LM is versatile and robust enough to be applied in any context on any process in numerous forms. Batch operations, mixed model production systems, shift-by-shift changes, switching of dyes etc. all qualify! Whether you are making appliances, light bulbs, providing a service or niche product, LM can help you in all aspects of your business, even financial, transactional, ordering, inventory and HR processes (payroll, hiring etc.)

You pick your priority, streamlining operations, improving productivity, eliminating waste, LM has a tool for that!

Here are some steps in the LM process to consider for your business if you are contemplating taking a hard, real look at how you operate, function and plan to get better using Lean tools:

### Step 1: Leadership and Commitment

Buy-in, championing and supporting the effort from the top is essential. Decision-makers have to back up what is being planned and visibly support the improvement efforts and projects. Without this support, companies will often, quickly and soon revert back to old habits and sustained change will not be possible or feasible. Vision and direction has to come from senior management as well.

### Step 2: Educate and Empower: Gather Knowledge, know how and practice Lean Manufacturing

Training, fundamentals and even books, consulting and advice from other businesses that are implementing and experimenting with Lean can all help you get on your way. Both public domain courses and formal training, certification are available.

There are training programs offered by MEP's (Manufacturing Extension Partnerships) around the US such as 'Lean 101'

It is a priority to educate and empower, giving people the tools they need, raising awareness of lean, introducing and using a couple of the tools at a time, over a period of

a couple of weeks or months, or a whole coordinated deployment or roll-out effort with resources and project plans. These are all feasible, depending on the needs of your organization and the depth you want to or feel like you have to get into.

### Step 3: Making Things Visible To All and Accountability

Understanding processes, cause and effect, root-cause analysis and even being aware of waste, goes a long way to get to low-hanging fruit, win and reward right away. Any improvement for your business, saved dollar and lower costs are good right? Why not use lean to help you and your employees SEE and DO something about it. Try to see if you can trace the source of waste. Just walk around your operation and try to spot where 'waste' is occurring (recycle bins), discarded, defective product, things on the floor, cluttered areas etc. This can be A great first step. Tracing and mapping out how it got there, how severe the problem is (pages per day, waste removed or scrapped, defective unit # versus yield). Any metrics and active tracking heightens awareness of potential problems and sources, creative solutions and harnessed resources working to save money. All wonderful, without necessarily even having implemented any formal LEAN TOOLS as yet! See the promise and potential here?



This can very easily then form a quite powerful technique and general base or platform for identifying bottlenecks, excess inventory and even discontinuous flow, more advanced Lean tools to cope with and address these issues are at hand. Getting all the staff involved in these processes give you the great opportunity to motivate and mobilize your entire workforce. Imagine everyone working to saving and making money, which is why we all work and got hired in the first place ... or started our own business, right?

#### Step 4: NOW THE TIME HAS COME! Focused Improvement Activities and Advanced Lean Tools

Map out the major processes in your business. Identify all the sources of waste, prioritize the areas you want to focus on first, where the maximum gain is with minimum effort. Always a good place to start. Take the area, process or problem apart, analyze it and see how you can make it better. Put the improvements in place and ensure that it does not happen again and stays in control should be a priority as well. Plan for the sustainability, by having a project or process champion and getting employees to take the lead and responsibility as well.

Some of the most wonderful stories, opportunities and promise lies in the fact that LM effectively brings together a motivated group of individuals/people involved in work

and/or a typical process, maybe even also from other areas of an operation, combines their talents and focus on a particular issue or topic, area or problem. Next, defines and maps the current situation, cost and waste, (baseline and diagnose), set some clear objectives to change and make things better. These can be metrics or stated smart goals, measured in terms of wait or lead-time, process steps, cycle time, floor-space, inventory, and other metrics) Time-frame for improvements are set and the group celebrates the successes, outcomes and results together.

#### Step 4: Looking Further Ahead and Beyond

LM enables you individually, collectively and as an organization/business to get renewed momentum, continued effort and on-going improvement (what lean often refers to as Kaizen – the pursuit of continual improvement and perfection, a standard of sorts).

- Lean and speedy processes and how they affect business

Some of the lean manufacturing tools that might be able to help you in your processes are:

- 5S
- Cellular Manufacturing

- Mistake Proofing
- Set-Up Reduction

A basic, fundamental tool in Lean manufacturing that can help any business the '5S' approach is an organizing, structuring technique to get rid of clutter and waste. Cleanliness and having a set place for everything is key.

The name stems from the Japanese meanings and equivalent words for...

- Sorting things (seiri)
- Setting things in a particular order (Seiton)
- Shining, daily maintenance (Seiso)
- Standardization (Seiketsu)
- Sustainability (shitsuke)

Cut costs and reduce waste by applying these simple techniques to your business today.

Cellular manufacturing has to do with organizing not the workplace only but the work as well. Work-cells and designated work- areas, certain spaces for certain activities, minimizes movement of people and things, therefore costing less. In an operational sense this means no batching, no waiting, no delays, no queuing, just smooth operation and easy flow.

### Mistake-proofing (Poka-Yoke)

Built-in safeguards, reducing defects to zero is at the center of this approach. Highlighting problems as they occur, not letting mistakes, oversights and errors slip through is key. Processes are designed around this principle to be more efficient and will help you business cut down on cost, scrap and waste.

(SMED or single minute exchange of dies ) Quick and speedy change-over in business processes, manufacturing and operations are essential. Remember time and quality matters, means money! Process thinking is the key here. Getting rid of unnecessary steps, actions or movement are key. Reducing time on any line, saves money.

There is more to lean manufacturing than just these couple of tools. They just serve as an introduction to some of the major business enablers that LM can bring to your business and organization.

**TWO KEY REWARDS FOR YOUR BUSINESS TO CAPITALIZE ON: Breakthrough profit and competitive advantage**

Improving quality and speedy delivery rates are any company's priority. Making and keeping customers happy is what it is all about. LM offer you the tools to do that practically, quickly, easily and consistently.

You can not change what you do not acknowledge or know about. Lean Manufacturing brings with the appeal and awareness to 'take note' and notice things around you (cost, waste, movement, clutter, scrap etc.) and then DO something real, meaningful and constructive about it!

What improvements should and could be made are both important questions to ask, prioritize and act upon. Customer priorities, things that affect your incoming revenue should get attention quickly and first. Things like quality, lead and waiting, cycle time, cost, inventory and other internal processes that affect the customer and are 'internal' and controllable, should be dealt with expediently.

In order to get you started asking the right type of questions could provide you with hints as to a strategy and starting point/priority:

- Which process or step should get the bulk of our immediate attention –where is the biggest WIN-WIN for both the customer and the company?
- What are all the priorities that we need to pay attention to in this organization/business and operation, map the processes and make the list. Then ask in what order you should tackle the priorities?

- How do we get the BEST improvements the quickest way? How do/can we tap into the benefits of LM right away?

If reducing overhead, quality costs and inventory to save money, reduce weight and be a smooth operating, streamlined and cost-efficient provider are keys to your business success, LM can help your business in all aspects and areas.

Taking the theory of LM to the practical implementation will take planning, patience and persistence.

Determination, detail orientation and discipline. We often refer to these as the THREE p's and the THREE d's to make them easy to remember. Gradual, planned, focused effort is what it is all about. Step-by-step instructions and actions to get to improvements over time, that can be sustained, stable and predictable are essential.

If any of the following scenarios are important to your business, LM can help you reach targets and goals in this area that you set for you, your team and your business:

- Increasing operating margin and revenue
- Reduce manufacturing lead, wait and cycle times
- Lessen WIP or work-in-progress inventory (half-completed product), time and space costs money!  
Reduce costs

- Reducing manufacturing overhead and quality costs
- Increase gross profit margin
- Get customers what they want, when they want it, anytime, every time and all the time, quickly and correctly, affordably and on-demand.
- Achieve consistent quality and low defect rate (scrap/waste)

Make the most of your shareholder value and you can not go wrong. Achieve high levels of improvement rates and customer satisfaction, quality products, low costs and do so quickly and you remain competitive and profitable.

Get and keep your processes under control and improve getting better all the time, setting and positioning yourself head-and-shoulders above the masses and mediocrity. Help define and execute your competitive edge with a well-thought out, supported, gradual deployment, throughout or LM in your business and you are set for desired outcomes, success and results!

Having a very real measurable impact and resulting dramatic improvements in your business listening to your customer complaints can give you great hints as to where some of the problems might lie. DO NOT hesitate to ASK them! They will tell you. It is a wonderful opportunity and channel to let your customers know that what they want, say and need, REALLY MATTERS. If you provide this level

of responsive personalized business, you will have success, not only now, but also, in the future. Slow and inefficient processes, finished goods just sitting around or waiting for things to happen all cost money. Finding ways to cut down on these is the challenge and opportunity that LM brings to your business. This is oftentimes referred to as the so-called 'hidden factory' or unseen cost of 'doing business'. Once you put a number on it and are aware of it, you will benefit from ways to reducing it or eliminating it, adding to your bottom line and cutting down on cost and waste. That is the heart and purpose of LM.

Getting rid of things (even internal process steps, time and inventory) that add NO VALUE TO YOUR CUSTOMERS is a TOP PRIORITY TOO! The costs of poor quality products, services and waste add up over time and could cause you the loss of loyalty and potential repeat/new business. Really taking issues with these aspects can save you money, time, ensure quality and customer retention, satisfaction and more business!

Customer want to do MORE business with a provider that is reliable, quick and affordable, stable and predictable. If you set certain targets in certain areas of your business and work diligently towards them, the results will be evident quickly and these changes will 'stick' and be sustainable over time, which is what you are really after.



Ask yourself how long it takes you to get your product and service out the door and in the customer's hand. Seconds, minutes, hours, days, weeks. Asking the question is important, raising awareness. Putting a number to it, makes it visible, measurable and enables you to do something about it! For example cutting it down or in half!

Any and all processes within your business are fair game! No exceptions. It does not only have to be manufacturing processes. Other examples could easily include: product development, order entries, design, customer service, HR and financial processes as well.

By taking this 'overall' holistic approach to improving your business in all areas and aspects, means you are in effect adding value to your business, growing your profits and bottom line, while streamlining and becoming a smooth, low-cost, predictable partner and provider of choice!

Taking an analytical approach to business in this fashion opens your eyes to new channels and ways to grow and expand, strengthen and position your business for success and results.

Ask the following questions to ascertain if LM is right and holds potential for you and your business:

- Where is the real 'time' in our business spent? How much of this adds value to our customers? Is it worth it? Where can we make some changes?
- Is there any benefit in our business trying to establish a competitive edge getting goods and services to customers quicker?
- What kind of payback can we expect from these LM efforts? What are the financial gains and potential here?
- If we cut operating expenses, manufacturing cost, overhead, inventory, lead, wait and cycle times, how would it affect the bottom line? What would the \$\$ impact be weekly, monthly, quarterly, annually? Again these metrics will help you gage your progress, raise awareness and give you a whole new outlook on what your business is doing well and where the areas for improvement would/could be!
- If we reduce our goods in waiting (WIP) and finished goods inventory what will that mean in \$\$ and cents to our business? What would be able to do with the cash at hand (investment, debt reduction, new machinery,

marketing etc.) How can these changes and dollars save BEST benefit and grow the business?

In any LM deployment and change management, improvement initiative in your organization/business, there are enabling aspects to pay attention to:

Some of the operational and economic benefits or metrics to look out for to help you answer some/any of the above are:

- Operating margin
- ROIC (return on investment capital)
- EBITDA
- Capital Turnover
- WIP
- On-time delivery rates and ratios
- Cost of poor quality
- Quality performance, customer satisfaction data

If you have your eyes set on the top-spot in your industry, expanding your markets and horizons and increasing your market share, this is the way to go about it quickly, reliably and with sustainable gains.

There is a simple rule of thumb here, central to all LM as well - any improvements made within your business should benefit the customer and add value.

LM succeeds in making the time, quality and cost issues within and between processes, start to finish, steps etc. visible and tangible. It gives eyes and ears to these processes, outcomes and allows you to do something meaningful and intervene to make things better, to the benefit for company and customer! It provides, ,purpose, direction, baseline and practical means to get your results and effect changes for good.

Seamless operation ,less bureaucratic, 'lean' , streamlines and effective processes make business successful. This overall business methodology and thinking will help you re-make, energize and shape your business better. You are now pro-active and hands-on in your operation, NOT LEAVING SUCCESS UP TO RANDOM CHANCE, BUT RATHER PLANNING AND EXECUTING FOR IT.

REMEMBER A GOLDEN RULE OF LEAN: SLOW PROCESSES ARE EXPENSIVE! LM HELPS YOU SPEED THINGS UP, WITHOUT HAVING TO SACRIFICE QUALITY!

Agility, adaptability, low cost and responsiveness are all qualities that business should have and desperately need almost as prerequisites and entry-requirements for doing business in the new economy.

One of the great contribution that LM can/does make to your business is what we will call 'shared purpose,

direction and goals'. This individual and mutual 'orientation' and 'coordinated effort, gives common direction to all, fosters commitment and camaraderie. It strengthens and builds the organization, links the leaders to the shop-floor employees and engages everyone at all levels to achieve better performance consistently. It is a unifying and motivational principle that will underpin and build your efforts, getting you results quicker and maintaining it over time. Making success stick, so to speak.

So, ask yourself first and foremost how you think LM can help you in your business, consider your options, pros and cons or doing/not doing it and then make your decision.

Enable and strengthen your business by using LM tools to drive improvements, cost reduction and implement it across the levels and aspects of your business that matters most and reaps the highest rewards quickly.

Other aspects of lean to consider for LM deployment in your business are as follows:

- Leadership

Initiative and leading by example from the top is key. The main flag-bearer and champion of this LM process and initiative starts with the business leader

(CEO/President) and the senior management team. Buy-in and support can make or break the efforts of LM.

Personal, hands-on, practical engagement, commitment, practice and even reward for full participation in these initiatives, being the drivers of performance per se is critical to and for LM success. Inspire and mobilize others.

Corporate, business culture and infrastructure, support and championing of the LM efforts contribute to the momentum and success of it throughout the organization.

Include and engage EVERYONE! LM provides you the opportunity to harness and leverage the talents of the entire workforce and collective, not merely a hand-full of individuals or some employees. MAKE EVERYONE COUNT AND CONTRIBUTE!

If lasting results and sustained top performance matters to you and your business here are the means to that end in the LM toolkit!

Metrics and goals make things easier to achieve and practically act upon, effect, change, impact, reshape etc. MAKE EVERY ASPECT OF YOUR BUSINESS COUNT!

- Infrastructure, support and deployment

Share the commitment, discipline and persistent toil to get to where you need to be. It starts with everyone, not just some! Have your customers front-of-mind at every step, process and corner of what you are doing, planning, improving, know what they value, why and how to get it to them quickly, effectively, consistently and affordably, anytime, every time! SHIFT YOUR FOCUS.

Shareholder value and \$\$ impact is a good guideline for priorities and activity within LM. IMPROVEMENTS CAN/SHOULD BE MEASURABLE AND ACTUALLY TRACKED!

Engage everyone in the process, assign roles and responsibilities and tap into the full potential everyone has to bring to the table. Committed resources, time and training (initial investment) will pay off quickly. Mobilize your workforce and enable, empower and energize them.

- Vision

Making it all about our customers is another key. They are your incoming revenue streams, what keeps the

wheels of your business churning. For once, make it count! Quality, time, what they want, when they want it can make you fail or success. Reducing variability is essential. Be consistent, predictable and reliable as a provider and/or supplier, business partner and make what they want a priority. Never merely focus on reducing defects, also know why you are doing it and how it adds value to your customer(s).

Everyone has to understand this mutual undertaking, its value and potential and the role, contribution and recognition of their efforts and input.

- Right resources and projects

Having dedicated resources working tirelessly and exclusively on LM type processes and work, improvements and projects will have desired outcomes and effects. For meaningful performance improvement you need the right people and the right projects, working on the right value-added things within your business. Focused, deliberately targeted WORK is essential for results and success.

- Teamwork

IT IS ABOUT EVERYONE'S ROLE AND RESPONSIBILITIES. ALL MATTER. Leaders, shop-floor,



administrative, all staff can contribute and make a difference. Leaders often mount the charge and get the ball rolling, providing support and encouragement along the way. Direction and results matter here. Full-time sponsors, champions and process leaders encourages accountability and gets results quicker. Problem-solving leadership, training and coaching might be required to, grunt-work, data collection and analysis and support. Investment in time and resources is well worth the effort and cost. It will reap you rewards you can only imagine when starting out. It will exceed your expectation in as little as 1 year! YOU WILL START SEEING RESULTS EVEN QUICKER THAN THAT!

- Process and Tools

Tools and culture go hand in hand. You need both. So jumping right in and just focusing on implementing some key LM tools, might not be the most appropriate and/or effective way of unleashing the power of lean on your organization. Getting the support and infrastructure in place up front, planning for success, resources etc. might save you lots of time, money and headaches down the line, when it comes to actually doing the work and making the improvements! PUTTING LM IDEAS INTO ACTION TAKES TIME, DISCIPLINE AND PLANNING.

Planning for success in any LM deployment is essential. Having metrics to measure certain things (the right ones too!) have to be paid close attention to.

Infrastructure and support put in place and everyone prepared, trained in what the LM paradigm is, what the tools to use are and how to use the tools exactly have to be considered as well as part of your overall plan of action, if you do choose LM for your business.

- Making it the way you do business

LM is NOT only about PROJECTS! It is about so much more than that. It goes deeper and beyond. It is and will become the way that you do business. Everything we undertake in our businesses have to start with the customer, who they are, ,what they want and how we can get it to them quickly, correctly, in working order, what they asked for exactly and to specification, ,on demand, at an affordable price, delivered and guaranteed. Sound like a tall order? Well, increasingly research shows informed, empowered customers know and get what they want and to stay viable, let alone be profitable and thrive, we need to have our businesses in line with delivering to all of the above in a cost-effective and streamlined, efficient way. A good plan of action, the right culture and voila you are all set to start your deployment of LM and unleash its power and reward on your business, profits and customers!

Now that we have determined that LM can actually help you eliminate waste, time, effort and material, is customer oriented and just-in-time delivery of what they want, reducing costs while improving quality, we can briefly switch gear and look at areas of the business where LM can help you and your customers.

Areas where Lean can help:

Making the most of quality and time, speeding up processes actually matter. It does make a difference. Wait times, cycle times from start to finish all impact business success. LM is not just for manufacturing processes. It is for ALL PROCESSES.

Knowing where to focus your efforts are also important. The 80/20 rule of thumb in LM is a handy tool to help you prioritize and focus on what needs to get done right away, first, eventually, over time. 80% of the problems/potential is in 20% of the process, area or dynamic. It is up to us to find it and do something about it!

LM can apply to any and all processes.
--

BOTH manufacturing and transactional processes can benefit here

- Supply chain acceleration and management
- Logistics
- Manufacturing
- Design Processes
- Transactional
- Other

So far, we have discovered that LM is:

A business management philosophy and paradigm that asks for a shift in the way that we think about and do business

It clearly stems from a proud history and grounding in the quality movement (of more specifically Japanese automakers, before spreading to Europe and the west). TQM or total quality management initiatives and Toyota's early Production System put quality, time and cost, waste in the spotlight and clearer focus.

Getting rid of the main sources of waste in business, means paying attention to things like:

- Over-production
- Wait, lead or cycle times (start-to-finish)
- Transportation
- Processing
- Inventory

- Motion
- Scrap

There are some great tools in the LM toolkit of which we mentioned FOUR initially to get you off to a good start.

The logic and rationale behind the premise and argument for LM states clearly by reducing the waste, you are improving quality. As production time is lowered, costs are lowered.

Kaizen – a Japanese term, (constant process focus on getting better) is at the very heart of LM.

LM can be helpful in many processes throughout your business, including BOTH manufacturing and transactional processes. Some, any or all of the processes involved in your business can be included in your LM deployment and initiatives.

The key lean manufacturing principles can be identified as:

- GETTING IT RIGHT THE FIRST TIME WITH NO DEFECTS identifying and solving problems from the source, quickly and as they happen
- NON-VALUE ADDED ELIMINATION and OPTIMIZING ALL RESOURCES AT YOUR DISPOSAL
- KAIZEN or ON-GOING CI or Continuous improvement as it is also known, keeping on raising the bar of performance and excellence in your business. This can

- be done through LM focusing in on reducing costs, improving quality, increasing productivity and better information sharing, streamlined operations and great teamwork, focused, targeted process improvement.
- CUSTOMER-demand drives activity in a pull NOT push system and inventory, wait times etc., effectively trimmed and cut down (even eliminated where possible).
  - Adaptability, agility and flexibility efficient, quick without giving up on quality.
  - Extending these efficiencies and efforts to your supply chain and other business partnerships in a collaborative effort, building relationships that fit, work and last.

Lean is basically all about getting the right things, to the right place, at the right time, in the right quantity while minimizing waste and being flexible and open to change.

It is like having a recipe for success to succeed in the new global, fast-paced, technology enabled and driven, highly competitive marketplace and economy. Using the LM way and tools better enables and empowers you and your business to not only succeed in this environment, but flourish and thrive!

Its history and future is built on the premise that wasted, time, space, energy, effort, money and poor quality all cost money and should be made visible, dealt with and

eliminated. Working quicker with less effort and waste, being efficient, consistent and with the minimum amount of waste, unnecessary movement, cost and time, LM quickly sets you up for success and business improvement. It is about more than merely focusing on manufacturing processes. There is more to the philosophy and methodology than meets the eye.

Think of innovative ways to cut costs in your business and operation without risk to quality and customer. Eliminate trim and unnecessary process steps, cheaper alternatives or costly extras that are not really deemed necessary. Shared utility or tools are a great way to minimize expenses, set-up and overall costs. Make the most of the resources that you do have available.

Take a closer look at the materials and processes you and your team use everyday and try to spot the as is process. Do a reality check. See the costs and waste, put metrics to things, raise awareness of what could be done differently, more effectively and cheaper.

Sometimes process steps can be eliminated or combined to get to a result quicker and use resources, time, quality better. Standardization goes a long way to cut down on waste. Tweaking and adjusting machines for no apparent reason other than routine and habit should be stopped and taken a close look at. Reuse, reduce, recycle comes into

play. More effective materials and process steps that take less time will often help your business out too. How technology, automation, outsourcing etc. can save you and your customers some time and money.

Kai-Zen or 'change for the better' is the mantra for LM. It is on-going and not once-off! A process in itself!

Taking actions to correct certain aspects within your business, rid it of waste, expense and streamline processes for optimal function and ultimate success is what LM is all about.

Learning by doing and hands-on involvement is a great by-product and enabler of these processes and initiatives. It engages and energizes. It sparks interest and builds involvement and action. Make changes, review the results and adapt if necessary, celebrating your success, looking for new opportunity summarizes this ongoing cycle well.

Here is an easy way to remember some of the fundamental practical things you can do right away in your business, applying LM tools:



## "CANDO"

C – Cleanup

A – Arranging

N – Neatness

D – Discipline

O - Ongoing improvement

By effectively focusing on improving the efficiency of any underlying processes, improving performance, you will reap the financial rewards. It is like having measure and 'proof' of your success.

Bringing science, intuitive and creative problem-solving, analysis and scrutiny to business processes you increase the handle you have on the unfolding events, steps and outcome. It drives the performance excellence of your business to new heights. LM will get you there. Combining this approach with the discipline and rigor of process management and business process improvement tools like Six Sigma, increases the impact and effectiveness.

Three pillars of strength for both these business approaches are: (i) customer focus, -centric and directed activity, value-add process and outcome (ii) Effectiveness (iii) Efficiency.

Giving customers EXACTLY and MORE than they wanted, exceeding expectations are important. What is your niche and specialty that makes you stand out from the crowd?

Again some self-diagnostics from the LM toolkit to help you out here regarding assessing your own business and readiness:

- How can LM help you establish, identify and communicate that competitive edge to your business employees, partners and customers?
- How successful are your products and services in securing 'clients for life' and repeat business? How strong is your brand?
- How do you currently minimize costs, cut expenses and deal with waste?

Another important concept in LM to grasp, understand and utilize is KANBAN (another Japanese-inspired term). LM or just-in-time manufacturing, on-demand production, meaning sign or card. Signals or visual cues are used, when products, parts or services are required by customers. The system is reactive and takes advantage of the 'flow' concept. On-demand solutions for operations, production lines and manufacturing facilities are suggested and preferred, due to

the fact that having inventory pile up costs money, time and quality, better spent elsewhere. (Retrieved from "<http://en.wikipedia.org/wiki/Kanban>")

Yet another essential LM tool and utility to consider is something referred to as Total Productive Maintenance. This is different from routine or occasional maintenance that has to be performed. Having no downtime and scheduled maintenance, pro-active planning for and working with it, as opposed to a more passive-responsive approach is recommended in the LM philosophy and practical application. It is often depicted as "deterioration prevention" It is NOT FIXING MACHINES WHEN/IF THEY BREAK DOWN. There is more here than meets the eye.

Equipment must be ready at any and all time for operation. The equipment should be able to provide us with [efficiency](#) on demand while running and provide quality service and output that can be relied upon.

[Overall Equipment Effectiveness](#) or [OEE](#) Uptime and and throughput are the three key metrics we use to track and gauge how the maintenance tasks are going and what should be done, when and next to keep them all humming and working effortlessly, seamlessly individually and together. Mistake-proofing is important too, reducing the variability and increasing the process capability, the 'baseline' and means to and end (namely the machines and operation overall) have to be well taken care of.

So, we have provided numerous examples and reasoning for why LM will be good for your business, regardless of size, developmental phase, partners, customers, size or current level of performance. There tools can help you move your business forward.



(source: [www.beyondlean.com](http://www.beyondlean.com))

An underestimated factor in all LM deployments is the underutilized talents of our collective and collaborative potential. We oftentimes get so busy with what each of us are doing individually, that we lose sight of how much more powerful we could be, if we combined our efforts!

In our opinion, here-in lies the secret of LM ...

WE HAVE TO GIVE EVERYONE THE OPPORTUNITY TO  
PARTAKE AND PARTICIPATE, SHARE IN THE EXPERIENCE  
AND UNDERTAKING FOR MAXIMYM RESULTS!

Ask yourself how you can make the most of people's time and investment in CI or LM practices and how it will/call affect/benefit your business? Your resources, employees and customers are important assets – how are you using and utilizing them all in this process of becoming a more agile and cost-effective organization/business/operation ?

Always, start by asking what can I do? This personal hands-on approach can truly make a difference in any business.

Ways to avoid your LM initiatives to be stymied and frustrating, fail or come up short:

- Pay special and close attention to what the business culture really is! It could be totally out of alignment with the principles and fundamentals of LM and cause some stress, tensions, or even resistance within and throughout the organization.
- Ask and answer yourself/your team, your business, partners and customer honestly what the existing climate is that would support (hinder/help) Lean working methods and how it will benefit all stakeholders?
- Here is another useful question: Is our organization hierarchical, rigid and autocratic and not a people centered company?

- Learning what not to do from the mistakes and discoveries, shared learnings and insights from others is critical.
- Be aware that not everyone will necessarily share your enthusiasm for LM. Some might dread what it does to their work load and world. Some initial resistance to any change is normal. Showing the value or the WIIFM (what is in it for me) is a very important part of the whole LM initiative.

Here are TEN easy tips of how to enable LM in your organization:

#### 1. KEEP THE CHANNELS OF COMMUNICATION OPEN

- Talk and inform often
- Educate and empower, knowledge, skill, practice and competence, on-going mastery and teaching others
- Trust, honesty and information = transparency
- Give everyone a head start, a common language, goal and purpose and unleash the power of lean on your organization.

#### 2. GIVE OPPORTUNITY FOR EVERYONE FOR INPUT AND FEEDBACK

- Get everyone engaged, excited and hands-on, involved and aboard with your LM initiative and plans

- Introduce feedback and coaching, establishing communication channels where before they might have been none

### 3. CREATE AND CULTIVATE THE RIGHT WORKING CONTEXT AND ENVIRONEMENT WHERE HONESTY IS ALWAYS THE BEST POLICY!

- Set communication and information sharing, learning and openness (transparency) as an organizational priority
- Less people will feel threatened and insecure about speaking up, hiding errors for fear of embarrassment or consequences (like being held accountable or losing their jobs or face in front of others)
- Treat each other with respect and share ideas, issues openly, always keeping in mind the overall benefit (or detriment) for all if closer attention are paid to certain issues or challenges at hand.

### 4. TAKE NOTICE, REWARD, ENCOURAGE AND CELEBRATE!

- Select examples of great achievement with LM, samples, project studies, specifics, general, share and celebrate them all-round. Give credit and recognition to the team where it is due, even for accomplishments that made a great difference for the company, a specific area or problem that was solved. It is highly motivational and quite an incentive for many to keep trying and even do more!

5. Implement a system and metrics and monitor process  
BUT ALSO PROGRESS!!

- Formalized record and tracking is essential for these LM processes and initiative to WORK and LAST! Ensure they are streamlined and purposeful, organized and regularly occur.

6. STICK TO THE BASICS and KEEP IT SIMPLE STUPID!

- It sounds easy enough, but believe me, we get sidetracked so easily in the intricacies of calculations, metrics and spreadsheets, that we often forget the pleasantries and clarity that simplicity brings.
- Making things easy to follow and stick to, will help that they do exactly that!

7. STAY POSITIVE AND KEEP AT IT!

8. ACHIEVE and TAP INTO YOUR RESOURCES

- Be always focusing on needs, wants, desires and motivations, to mobilize and sustain momentum and change.
- Make the stake and reward personal for participating and applying the principles of LM.
- Make it the way that you do business – WITHOUT COMPROMISE!
- Set the bar and standards high, keeping on reaching higher.



## 9. DISCIPLINED PRACTICE

- consistent, persistent, determined, dedicated to make things work, better and last! Low cost, no waste, effective and efficient!

## 10. A CONTINUING JOURNEY (not only a destination)

- Ongoing Learning is essential and learning from our mistakes, oversights, challenges and achievements are important.
- Always ask what we learned, what went well, what did not work and how can we make it all better next time round, should be part of normal conversation and routine.

You will discover more secrets and revelations, unearth more truths about LM as you go along. Be sure to pass on the wisdom to others.

Always remember, despite what you read or hear from consultants, there is NO ONE-SIZE FITS ALL LM deployment that works and fits for everyone. It depends on the organization, leadership, dynamics etc.

MUCH has been written about lean manufacturing (see reference listing for an eclectic sampling of some recent books and classics on the topic). Practical information on how to implement lean, especially in small business is hard to come by. Tapping into the expertise of those who have

thread along this path is a great way to discover the secrets and pitfalls, mistakes to avoid when considering LM for your business/organization.

Start by asking yourself what the current readiness and knowledge levels regarding LEAN would be? Close to most of us (almost 100%) have heard about lean manufacturing at some point in time, we are just not sure even how much or little we really know until you start getting into it!

For some lean thinking comes naturally, for others a little more rigor and discipline is required to effect and impact business processes and ensuing success.

Are you doing something currently (like LM) to cut down on waste, scrap or unnecessary costs? Typically less than 50% of companies will still be in the running here.

Do you consider your lean manufacturing processes a roaring success? Less than 5-10% will respond with affirmation and agreement here!

There is always room for improvement in any business. LM provides us with the tools and means, channels and connections to plan, execute and sustain these changes to benefit our profit and bottom line.

Always remember that...

You can not do everything yourself or quickly necessarily. You need the combined efforts, buy-in, support and infrastructure to get things done and it may take longer than expected initially or overall, BUT STICK WITH IT!

LM is an on-going journey and NOT a 'quick-fix' for business woes! Although some of the tools and applications will start providing you with immediate reward and benefit that is measurably making a difference.

It is not successful as a project here and there or uncoordinated strategy, shooting from the hip, when we feel like it type of approach.

Dedicated time and resources, focused and targeted effort will benefit your LM initiative tremendously. SHIFT YOUR FOCUS MORE LONG-TERM and step out of the day-to-day fire-fighting and reduced focus we so typically have in our organizations, dealing with one problem at a time, as they come up and not following a very effective strategy overall or at all.

LM is about more than tools, counterintuitive thinking and application to manufacturing and transactional processes! It is about the people involved in, touched by, working with and through these processes and outcomes, to IMPROVE and SUSTAIN business success and growth.

Someone once quipped that LEAN IS NOT ABOUT WHAT YOU SEE, BUT COMES FROM WHAT YOU THINK. The impetus and motivation starts early and it starts with each of us. Engage and enable the minds and hearts of your people and mobilize your organization, taking it to new heights of performance excellence and increasing bottom line profit. Tap into the collective talents within your organization, more organic, lead by example and emphasize that this is NOT A PROGRAM (with a start and finish). This is an initiative that will continue, grow and expand FOREVER, from here on forward.

Things can not and will not stay the same with LM – that is the one guarantee.

Skill-building, training, knowledge-application, ,refinement and mastery will come over time. There will be learning curves (steep sometimes at the beginning), no recipe BUT a ROADMAP (general ideas and suggestions, like we mentioned in this book) to follow to great, proven success.

In the lean manufacturing toolbox it is NOT ABOUT how many tools or which ones you have, chosen or are/will be using BUT HOW YOU UNLEASH, UTILIZE AND LEVERAGE THEM!

We have covered a few key tools to get you started, there are myriads of LM tools available and it will take time to develop your competency and mastery over time of any, some or all of these as part of your overall strategy of getting BETTER as a business or organization:

Jidoka, kaizen, andon, kanban, SMED, visual management, 5S, 5 Whys are all examples of lean tools that you can use. It all starts with how we think about things and the shift that we have to make in our minds from conventional, traditional and current ways we are doing things, what works, what does not?

NO ADVANCED LM TOOL WILL HELP US DO THAT AND COME MAGICALLY TO THE RESCUE AS A 'SILVER BULLET'.
---

LM starts with each of us and a willingness to be open-minded, see, discover and harness the potential savings, cost and waste reduction opportunities within and across our organization and levels, business partners and even customers to all become MORE SUCCESSFUL and BETTER (even BEST) at what we do, at the lowest possible cost, without sacrificing quality.

Here is an example of what we mean. Mastering a tool like the 5S (reducing waste or MUDA), you could go around cleaning up basically, without a detailed understanding or internalizing the ability to immediately identify problems to

enable quick responses. What then would be the purpose?  
See the difference?

For those of us who would want to learn more about LM and the tools that can be leveraged, laws of lean that can be applied with great success in your business, consider the FOUR LAWS OF LEAN as laid out and adapted from Bowen and Spears' in "Decoding the DNA of the Toyota Production System" (Harvard Business Review, Nov. 1999). Space eludes us to elaborate too much on this.

In Kanban for example, it is not about the visual cue or tool as much, as understanding the logic and importance of upstream and downstream process, flow and the implications for operation and customer!

DAILY Decision-making, problem-solving and managing will be affected and enabled by this type of thinking and very soon it will be about so much more than mere application of tools on a couple of projects. It will change the way you think about and do business moving forward, FOREVER!

Lean is not about what you see; lean is about how you think.
--

## A LM TOOLBOX OVERVIEW

A quick summary is provided here of some of the most basic LM 'tools' to get you off to a good start. They are:

## 5S

- sift, sweep, sort, sanitize and sustain
- helps organize what's needed and eliminate what's not,
- allowing the organization to identify problems quickly.

## 5 Whys

- Problem-solving by asking why the problem occurred,
- then why that cause occurred
- repeating the process five times until you get to the main or 'root' cause of a problem.

## Andon

- operator pulls a cord that triggers a horn and light, which tells the team leader or supervisor that he or she needs help or support.
- Keep production moving and catching problems early

## Jidoka

- Autonomation or people identifying problems
- either stopping for correction or self-correcting PRIOR to proceeding or moving on to the next step.

## Kaizen

- A structured ongoing process
- engage those closest to the process
- improve both the effectiveness and efficiency of the process
- remove waste and add standardization.

## Kanban

- A signal or card system that a downstream (customer) process can use
- Optimized to request a specific amount of a specific part from the upstream (supply) process.

## SMED--Single-minute exchange of die

## Visual management

- manage every aspect of the process
- at a glance, using visual data, signals and guides.

## Closing Remarks

Getting on board with LM is no easy task, but the initiative will soon deliver rewards to your business. Fostering its growth and filtering through all levels of the organization will definitely pay off in the long run.

Many of our organizations are so busy getting 'work' done, dealing with problems, fires and urgencies, meeting goals and objectives, and initiating business strategies, that they do not take or have the time to even consider 'looking' for waste.

WE all should pause and take a minute to consider how LM principles, rules, tools and thinking can help us eliminating waste. Getting to root-causes make problem-solving easier and more permanent! This process is on-going and will reveal things about your business you did not even know at all! You might be surprised by what you find, unearth and reveal when using LM thinking and tools.

Looking at processes to see how to BEST eliminate the different forms of MUDA or waste, requires new, counterintuitive thinking at times, a true non-traditionalist point of view.



HERE IS AN AMAZING TRUTH (and in our opinion another key to really understanding the power and potential of LM) for business, regardless of their size, industry, challenges and the like:

The ability to recognize and understand the systems that create results is not a natural ability.

We DO NOT HAVE THAT PROCESS-FOCUS AUTOMATICALLY. WE have to discover, hone, harness, develop and refine it as we go along!

See value through the eyes and requirements of your customers and take a real, long hard look at what and how you are doing things to get them what they need and want. Look for opportunities to improve it and cut down on cost, waste and expenses. and remember – keep it simple:

EVERYTHING THAT DOES NOT ADD VALUE = WASTE!

We wish you all the best on your LM journey. If you like to learn more see additional sources provided here.

For your reference, convenience and review there are some listings on good books on Lean Production, Manufacturing and Thinking in general for the avid learners amongst us, who want to know more:

1. Ohno, Taiichi (1988), Toyota Production System: Beyond Large-Scale Production, Productivity Press, ISBN 0915299143
2. Womack, James P., Jones, Daniel T., and Roos, Daniel (1991), The Machine That Changed the World: The Story of Lean Production, Harper Perennial, ISBN 0060974176
3. Womack, James P. and Jones, Daniel T. (1998), Lean Thinking Free Press, ISBN 0743249275.
4. Emiliani, M.L., with Stec, D., Grasso, L. and Stodder, J. (2003), Better Thinking, Better Results: Using the Power of
5. Lean as a Total Business Solution, The CLBM, LLC Kensington, Conn., ISBN 0972259104
6. Imai, Masaaki (1997), Gemba Kaizen, McGraw-Hill, ISBN 0070314462

7. Rother, Mike and Shook, John (2003), Learning to See, Lean Enterprise Institute, ISBN 0966784308
8. Schonberger, Richard J. (1986), World Class Manufacturing, Free Press, ISBN 0029292700
9. George, Michael L. (2003), Lean Six Sigma For Service, McGraw-Hill, ISBN 0071418210
10. Levinson, William A. (2002), Henry Ford's Lean Vision:  
Enduring Principles from the First Ford Motor Plant, Productivity Press, ISBN 1563272601
12. Levinson, William A. and Rerick, Raymond (2002), Lean Enterprise: A Synergistic Approach to Minimizing Waste,  
ASQ Quality Press, ISBN 0873895320
14. Liker, Jeffrey (2003), The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer, First edition, McGraw-Hill, ISBN 0071392319.
15. Ford, Henry and Crowther, Samuel (2003), My Life and Work, Kessinger Press, ISBN 0766127745
16. Ford, Henry and Crowther, Samuel (1988), Today and Tomorrow, Productivity Press, ISBN 0915299364

17. Ford, Henry and Crowther, Samuel (2003), Moving Forward, Kessinger Press, ISBN 0766143392
18. Norwood, Edwin P. (1931), Ford: Men and Methods, Doubleday, Doran, ASIN B000858158
19. Dinero, Donald (2005), Training Within Industry: The Foundation of Lean", Productivity Press, [ISBN 1-56327-307-1](#)
20. Emiliani, M.L., with Stec, D., Grasso, L. and Stodder, J. (2003), Better Thinking, Better Results: Using the Power of Lean as a Total Business Solution, The CLBM, Kensington, Conn., [ISBN 0972259104](#)
21. Imai, Masaaki (1986), Kaizen: The Key to Japan's Competitive Success, McGraw-Hill/Irwin, [ISBN 007554332X](#)
22. Hirano, Hiroyuki (1995), 5 Pillars of the Visual Workplace, Productivity Press, [ISBN 1563271230](#)

Online resources and links:

1. [www.wikipedia.com](http://www.wikipedia.com), [www.leanlearningcenter.com](http://www.leanlearningcenter.com) as accessed on 5/11/2006 9:54 AM
2. "NWLEAN: <http://www.nwlean.net/>" - The Northwest Lean Networks - A free knowledge-sharing website, with over 10,000 professionals discussing the various aspects of lean implementation.

3. "Formula for Success in New Product Development" A white paper on the benefits of Lean Manufacturing in New Product Development by Dr. Robert G. Cooper
4. "Maintaining the spirit of innovation" - The Manufacturer Magazine - An article about the importance of involving the whole workforce in lean implementations
5. "Lean Manufacturing Blog" A blog focused on lean manufacturing, Toyota Production System, and lean healthcare news and commentary
6. "Lean Manufacturing Efficiency Resources" A web site with free resources on Lean Manufacturing. The site also covers the main tools used in Lean Manufacturing. Six Sigma, OEE, Kanban, Kaizen, 5S and SMED