



PDHonline Course G300 (1 PDH)

Lean Series - Basics of Lean

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2020

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Lean Series—Basic of Lean

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Introduction

The term 'lean' was first used by Jim Womack and Daniel T. Jones in their book '*Lean Thinking*' to describe the improvement activities pioneered by the Toyota Motor Company. The authors created this term because this new way does more and more with less and less.¹ For many people, lean represents tools that eliminate waste in manufacturing operations. However, lean is really a business philosophy for pursuing business excellence based on continuous improvement and respect for people.^{2,3} The lean philosophy applies throughout an organization's entire value stream and beyond – spanning from their supplier's supplier to their customer's customer. An organization's ability to reach beyond the boundaries of their own enterprise will depend upon their ability to master the continuous improvement tools and to establish a lean culture.

Lean differentiates itself from other business philosophies by focusing on the elimination of waste vs. process improvement. Furthermore, lean uses cross-functional teams of workers to identify the wastes and to develop improvement plans. This approach leverages the fact that most processes contain 95 % wasted activities and that the people working in those processes are best suited to identifying and eliminating these wasteful activities. Implied in this philosophy is that the manager's role is to provide these workers support in the form of tools, training, assistance in removing obstacles, mentoring and coaching. (Hence the two pronged focus on continuous improvement tools and People.)

History

The history of the Toyota Production System (TPS) starts with Toyota's founder—Sakichi Toyoda. His invention of an automatic loom that would automatically stop if a thread broke and a non-stop changeover feature on the shuttle part of the loom started Toyota on its path. (In total, Sakichi Toyoda patented 24 improvements for automatic looms.)

In 1933, Toyota created an automobile department within the Toyota Auto loom Company using seed money from the sale of patent rights for the G-Type Auto Loom to Platt Brothers of England. Kiichiro Toyoda, son of Sakichi Toyoda, was placed in charge of the effort. In 1937, Toyota Motor Corporation is officially created with Kiichiro Toyoda as President. It was Kiichiro Toyoda who created the concept of “Just in Time” (JIT) in 1937 to avoid wasting material.

In 1937, Eiji Toyoda (Kiichiro's Cousin) joins the Toyota Motor Corporation after graduation from College. He later (in 1945) recruits Taiichi Ohno to begin making improvements in Toyota's machine shops. Their efforts created the Toyota Production Process over the next 3 decades. If you actually follow Taiichi Ohno's career, you see it parallels the expansion and development of lean tools within Toyota.

It was Ohno who brought Shigeo Shingo to work as a consultant with Toyota in 1955. Shingo's work with Toyota leads to the creation of the Single Minute Exchange of Dies (SMED) and Poka Yoke tools.⁴

It is interesting to note, that the tools were not developed in a lab environment but by *‘Toyota's line manager experimenters trying to solve pressing business problems, in particular a lack of financial resources, to grow rapidly without accumulation of large*

inventories'.⁵ This quote from Taiichi Ohno in 1988 sheds further light on their thought process and their motivation to eliminate waste: "*All we were doing is looking at the time line from the moment the customer gives us an order to the point when we collect cash. And we are reducing that time by removing the non-value-added wastes.*"⁶

Toyota continued to evolve their philosophies of waste elimination and flow unnoticed until the Oil Crisis of 1973 when Toyota became the only automobile manufacturer to make a profit. Since that time, Toyota has been extensively studied, numerous books have been written on Toyota and the tools it developed, and finally many organizations have tried to emulate Toyota's success.

The 5 Principles of Lean

For people who are new to lean and have not participated in a lean transformation the tools (flow events, 5S, SMED, Kanbans, etc.) are often confused with being the underlying philosophies of lean. As implied, these are just tools to help identify and eliminate waste (which is the goal of lean). Instead, the elements of lean can be summarized by five principles that were identified by Jim Womack and Daniel T. Jones in their book '*Lean Thinking*':

1. Precisely specify *value* by specific product.
2. Identify the *Value Stream* for each product.
3. Make value *flow* without interruption.
4. Let the customer *pull* value from the producer.
5. Pursue *perfection*.⁷

While not explicitly stated, respect for people is implied in every principle. Anyone undertaking a lean transformation must understand that it is the people who are closest to

the process that can best improve it when they have the tools and training. The role of managers and technical experts then becomes ensuring adequate resources and removing obstacles.

Specify Value

The critical starting point for lean thinking is specifying Value. Value can only be defined by the ultimate Customer. To be meaningful, value must be specified in terms of a specific product which meets the customer's needs at a specific price and at a specific time. However, value is created by the producer. Here in lies the paradox—the customer and the producer do not usually share the same definition of value.

Ultimately, the customer defines value so producers must make a conscious attempt to define value in terms of the specific products with the specific capabilities offered at the specific price in terms of the customer's needs and desires. This approach challenges current paradigms and forces organizations to rethink: creation of product-lines with dedicated product teams, where in the world value creation occurs, and the role of the firm's technical experts.⁸

Value Streams

The value stream is the set of all actions required to transform raw material into a finished product that has been delivered to and accepted by the customer. The critical actions that occur in this transformation are: problem solving, information management, and transformation tasks.

Value stream analysis (VSA) is used to understand the value stream's value creating process. The Value stream analysis pictorially documents the flow of information and material in the transformation process. The VSA will help identify and

prioritize the waste in the value stream so that an action plan can be created. The VSA also prevents ‘islands of improvement’ from occurring and helps to create a process that produces products (be it material, service, or information) at the takt (or rate of demand) of the customer.

We typically think of value streams as existing within the confines of a plant or manufacturing process, but in reality the value stream exist from the point that basic raw materials are mined or created to the point that the product reaches the hands of the end customer. This definition implies that the value stream will cross different processes, plants and companies in the value creation process. The challenge therefore becomes trying to link these various entities and create transparency to create the least waste value creating process (which admittedly may be an idealistic and potentially unachievable challenge).⁹

Flow

Continuous flow is defined as producing and moving one item at a time (or a small and consistent batch of items) through a series of processing steps as continuously as possible, with each step making just what is requested by the next step.¹⁰ The objective of flow is to drastically reduce throughput time (or lead-time) and human effort by eliminating waste in the process.¹¹ All of the lean tools that we are familiar with are intended to help us to identify and to eliminate waste.

Waste can be defined as any process that consumes resources but does not create value for the customer. There are two types of waste:

1. **Type 1**—activity that creates no value, but is unavoidable with current technologies and production assets (such as inspecting for defects).

2. **Type 2**—activity that creates no value and can be eliminated immediately (such as disconnected process steps that cause additional product moves).¹²

To help in identifying waste, Taiichi Ohno further categorized waste into seven forms:

1. **Overproduction:** Producing ahead of what's actually needed by the next process or customer. (Ohno considered this the worst form of waste because it contributes to the other six.)
2. **Waiting:** Operators standing idle as machines cycle, equipment fails, without having needed parts, etc.
3. **Conveyance (or Transportation):** Moving parts and products unnecessarily.
4. **Processing (or Over-Processing):** Performing unnecessary or incorrect processing.
5. **Inventory:** Having more material than the minimum stock necessary for a precisely controlled pull system.
6. **Motion:** Operators making movements that are straining or unnecessary.
7. **Correction (or Defects):** Inspection, rework, scrap.¹³
8. Added by later practitioners--**Underutilized People:** Not fully utilizing people's abilities (not accepting suggestions, limited decision making authority, etc.).

While these definitions lend themselves more readily to manufacturing process, the same categories of waste exist in administrative and service processes—the multi-tasking and

computerization (inherent in most administrative and service processes) simply makes waste identification harder.

Pull

Pulling products through the value stream is the key to just-in-time (JIT) manufacturing. Pull occurs when downstream activities signal their needs to upstream activities.¹⁴ The upstream activity then produces just what the downstream (or customer) activity requires and delivers it when needed in a form ready for use.

Implementing pull eliminates (or minimizes) the waste of overproduction. It also reduces the issues of obsolescence and damage which can occur when you build inventory to forecast and schedules (i.e. batch manufacturing).

Pull is often used synonymously with Kanban scheduling. However, kanban should be considered as the implementation of the pull philosophy. Kanban (which means signboard in Japanese) is the visual scheduling process controlled by operators to produce products based on the demands of the customer (or customer process). Typical signals can be the famous 'kanban card', product bins, the product itself, faxes, emails, etc.. Ideally, the product being produced should dictate the signal as long as the chosen signal is visual and allows the process operator to make good decisions.¹⁵

Perfection

As organizations begin implementing the first 4 principles, they begin to recognize that there is no end to the process of reducing effort, time, space, cost, and mistakes while offering a product which is ever more nearly what the customer actually wants. Suddenly, the fifth principle of lean, perfection, doesn't seem like a crazy idea. As we do successive improvements on processes we see dramatic improvements in

performance and also new impediments and hidden wastes that are obstacles to further improvements to flow . These impediments and hidden wastes then become the value streams next opportunities to improve.¹⁶ The pursuit of perfection essentially becomes a never ending journey that we will discuss below.

By applying these principles, Womack proposes that value streams will evolve and expand to create the **lean enterprise**: which represents the creation of value from the original raw material to the delivery of the final product to the end customer.¹⁷

Journey vs. Tools

Although many books exist to help people gain knowledge about lean strategies and tools, no ‘cookbook’ exists for an organization to implement lean. Each organization must determine their own path in the lean journey if they are to be successful. This path will be determined by the specifics of the organization’s business model, industry and product. Examples of these specifics include: shelf life limitations on raw material or finished goods, customer lead-time or delivery requirements, product cure times, pricing levels or government regulatory requirements. Successful organizations in the lean journey will look at these specifics as specifications (or boundaries) that need to be met or challenged. Unsuccessful organizations will look upon these specifics as obstacles that prevent the start or continuation of the Lean journey.

Additionally, the organization must start to think in a longer timeframe and recognize that lean is a journey. Improvement paradigms need to change from: ‘Doing it perfectly the first time and getting the full result’ to ‘It will take multiple passes through the value stream to really recognize and eliminate waste’. Typically it takes 5 passes to start becoming lean (with the good news being that each pass will take the value

stream to a new level of performance and profitability). The successive passes also teach the organization (or value streams) to believe in continuous improvement.¹⁸ Jeffrey Liker and David Meier, in *The Toyota Way Fieldbook*, liken these successive passes to a spiral of deepening flow where every ‘cycle’ results in ever smaller quantities of waste and in ‘tighter’ more efficient work.¹⁹

Adopting this new paradigm also requires a change in thought process to sustaining the gains achieved and to recognizing problems as opportunities for improvement. These mindsets help to foster the continuous improvement culture needed to continue the journey. It also leads to a culture that is not afraid to raise issues so they can be fixed—vs. hiding them to avoid being blamed. They lead to the creation of aggressive, but simple, focused goals (usually referred to as ‘True North Goals’) that force sustainment and further improvement to achieve. Without these simple, focused, aggressive goals, organizations tend to fall back into ‘old habits’.²⁰

Summary

The term ‘lean’ describes the improvement activities pioneered by the Toyota Motor Company. Lean refers to the ability to do more and more with less and less. Lean should be considered as a business philosophy for pursuing business excellence based on continuous improvement and respect for people. The lean philosophy applies throughout an organization’s entire value stream and beyond—spanning from their supplier’s supplier to their customer’s customer.

Lean differentiates itself from other business philosophies by focusing on the elimination of waste vs. process improvement. This approach leverages the fact that most processes contain 95 % wasted activities and that the people working in those

processes are best suited to identifying and eliminating these wasteful activities. Implied in this philosophy is that the manager's role is to provide these workers support in the form of tools, training, assistance in removing obstacles, mentoring and coaching.

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For people who are new to lean and have not participated in a lean transformation the tools (flow events, 5S, SMED, Kanbans, etc.) are often confused with being the underlying philosophies of lean. The elements of lean can be summarized by five principles that were identified by Jim Womack and Daniel T. Jones in their book '*Lean Thinking*':

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Although many books exist to help people gain knowledge about lean strategies and tools, no 'cookbook' exists for an organization to implement lean. Each organization must determine their own path in the lean journey if they are to be successful. To that end, successful organizations in the lean journey will look at these specifics as specifications (or boundaries) that need to be met or challenged.

Additionally, the organization must start to think in longer timeframes and recognize that lean is a journey. Improvement paradigms need to change from: 'Doing it perfectly the first time and getting the full result' to 'It will take multiple passes through the value stream to really recognize and eliminate waste'. Adopting this new

paradigm also requires a change in thought process to sustaining the gains achieved and to recognizing problems as opportunities for improvement. A successful lean transformation will require recognition that it is a never ending journey of improvement which pays off in breakthrough levels of safety, quality, delivery, cost and growth performance.

Acronym List:

C/O – Change Over

C/T – Cycle Time

JIT – Just in Time

SMED – Single Minute Exchange of Dies

TPS – Toyota Production System

VSA – Value Stream Analysis

VSM – Value Stream Map

VSL – Value Stream Leader

WIP – Work In Process (or Progress)

Suggested Reading

1. *Lean Thinking—Banish Waste and Create Wealth in Your Corporation*, James Womack and Daniel Jones, Free Press
2. *Learning to See*, Mike Rother and John Shook, The Lean Enterprise Institute
3. *The Complete Lean Enterprise—Value Stream Mapping for Administrative and Office Processes*, Beau Keyte and Drew Locher, Productivity Press.

4. *Seeing the Whole—Mapping the extended Value Stream*, James Womack and Daniel Jones, The Lean Enterprise Institute.
5. *The Toyota Way Fieldbook*, Jeffrey Liker and David Meier, McGraw-Hill.
6. *Leading the Lean Enterprise Transformation*, George Koenigsaecker, CRC Press
7. *Kanban Made Simple: Demystifying Toyota's Legendary Manufacturing Process*, John Gross and Kenneth McInnis, AMACON Books

Recommended Websites:

- www.ArtofLean.com
- www.Lean.org
- www.ShingoPrize.org

Footnotes:

1. James Womack and Daniel Jones, *Lean Thinking—Banish Waste and Create Wealth in Your Corporation*, (New York; Free Press, 2003), p. 9
2. Jerry Solomon (Author and Lean Accounting thought leader) in a 2 day training session, August, 2009.
3. Bob Emiliani, *Practical Lean Leadership: A Strategic Leadership Guide for Executives*, (Wethersfield, CT; The Center for Lean Business Management, LLC, 2008), p. vii.
4. www.ArtofLean.com , *Toyota and TPS Timeline of Selected Events*, (Art of Lean, Inc.), p. 1-5.
5. Koichi Shimokawa and Takahiro Fujimoto, Editors, *The Birth of Lean—Conversations with Taiichi Ohno, Eiji Toyoda, and other figures who shaped Toyota management*, (Cambridge, MA; The Lean Enterprise Institute, 2009), p. v.

6. Jeffrey K. Liker and David Meier, *The Toyota Way Fieldbook: A Practical Guide for Implementing Toyota's 4Ps*, (New York, McGraw Hill, 2006), p. 33
7. James Womack and Daniel Jones, *Lean Thinking—Banish Waste and Create Wealth in Your Corporation*, (New York; Free Press, 2003), p. 10.
8. Ibid, p. 15-26.
9. Ibid, p. 15-26.
10. Chet Marchwinski and John Shook, Editors, *Lean Lexicon: A graphical glossary for Lean Thinkers*, (Brookline, MA; The Lean Enterprise Institute, 2003), p. 9
11. Ibid, p. 22.
12. Ibid, p. 88.
13. Ibid p.71.
14. Ibid, p. 65.
15. John M. Gross and Kenneth McInnis, *Kanban Made Simple: Demystifying Toyota's Legendary Manufacturing Process*, (New York, AMACON, 2003), p. 1-2.
16. James Womack and Daniel Jones, *Lean Thinking—Banish Waste and Create Wealth in Your Corporation*, (New York; Free Press, 2003), p. 25.
17. Ibid, p. 12
18. George Koenigsaecker, *Leading the Lean Enterprise Transformation*, (Boca Raton, FL; CRC Press, 2009), p. 49.
19. Jeffrey K. Liker and David Meier, *The Toyota Way Fieldbook: A Practical Guide for Implementing Toyota's 4Ps*, (New York, McGraw Hill, 2006), p. 50-51.
20. Ibid, p. 59.