

An Introduction to Lean Principles for Ergonomists and Engineers for the Healthcare Industry

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Introduction

Practicing ergonomists in many companies in the healthcare industry could benefit greatly by implementing the concepts of lean manufacturing. More importantly it shows how leaning a company's facility can also reduce ergonomic, safety and health issues as well as provide methods and standards, method improvements and cost/benefit analysis. Nursing homes for example were identified by the Occupational Safety & Health Administration (OSHA) as having the most dangerous jobs in America.

This paper offers an introduction to the entire system commonly called lean manufacturing and how it can be utilized in the Healthcare Industry. Understood as a system rather than individual tools and techniques, it can be seen that lean and ergonomics can be used in service and administrative functions to increase process effectiveness. Participants will learn how lean concepts can enhance their ergonomics and safety/health programs while setting standards, recommending method improvements and establishing cost/benefit analysis or metrics to measure your success.

Lean Manufacturing and Lean Principles

Lean Manufacturing can be defined as the principles and processes that reduce cost through the elimination of waste and the simplification of process. In other words lean manufacturing is an operational strategy oriented toward achieving the shortest possible cycle time by eliminating waste. The benefits generally are lower costs, higher quality, and shorter lead times. "Lean manufacturing" represents half the human effort in the company, half the manufacturing space, half the investment in tools, and half the engineering hours to develop a new product in half the time.

Lean is about being able to do more with less and getting more with less. Lean is about eliminating waste and producing what your customers want when they want it. Everywhere you look represents an opportunity, a place to increase output, improve quality, eliminate non-value

added steps, reduce inventory, improve on time delivery, and become more efficient and productive. The characteristics of lean processes are:

- One-Piece Flow Production (First In First Out)
- Standard Work
- Just-In-Time / Pull System
- Short Cycle Times (Lead Time Reduction)
- Quick Changeover (Set-Up time Reduction)
- Continuous Flow Work Cells (Cellular Manufacturing)
- Collocated Machines, Equipment, Tools and People (Process Flow)
- Multi-skilled Employees
- Empowered Employees
- High first-pass yields with major reductions in defects

Lean Manufacturing incorporates the use of level sequential flow (Heijunka), the heartbeat or pace of the production system (Takt Time), continuous one-piece flow manufacturing, cellular manufacturing at a glance, and Just-In-Time/pull production scheduling techniques such as Kanban.

	Traditional Manufacturing	Lean Manufacturing
Scheduling	Forecast – Push	Customer Order – Pull
Production	Stock	Customer Order
Lead Time	Long	Short
Batch Size	Large – Batch & Queue	Small – Continuous Flow
Inspection	Sampling – By Inspectors	100% - At Source by Workers
Layout	Functional	Product Flow
Empowerment	Low	High
Inventory	High	Low
Flexibility	Low	High

Exhibit 1. Comparison of traditional manufacturing to lean manufacturing.

Key Principles of Lean Manufacturing

1. **Value** is what the customer is willing to pay. When applying the lean principle, value, one must determine if the activity is value-added, non-value added, or non-value added but necessary. Value-added activities are those activities performed to a product that the customer perceives as actually adding value to the product while non-value added activities are all other activities associated with the production process that is not necessary to be performed and the customer perceives as not adding value to the product. Non-value added activities are activities such as searching for equipment or charts, sorting, stacking, transporting, and checking. Include in non-value added but necessary activities are those activities associated with the production process that may be necessary to be performed, but are perceived by the customer as not adding value to the product. Non-value added but necessary activities include paperwork, inspection, and training.

2. **Value Stream** is the steps that create and deliver value. There are five steps to use when conducting a value stream analysis. These steps include the analysis of current processes, the determination of whether the current activities are value-added, non-value added, or non-value added but necessary, the creation of a future state, the implementation of a plan to get the company to the future state and the creation of an ideal state. The analysis of current processes should include the identification of the product or service provided, all steps and activities required to complete the product or service from start to finish and the time required to complete each. When the activities have been identified by their value, a future state should be created where non-value added activities are eliminated and the time involved in value-added and non-value added but necessary activities are minimized. A plan should be developed and implemented to help the company achieve their future state as identified through this process. Finally, an ideal state that the company strives to reach should be created. An ideal state should eliminate all non-value added and non-value added but necessary activities and minimize the time of value-added activities. A graphic tool such as the one below shows the process of conducting a value stream analysis.

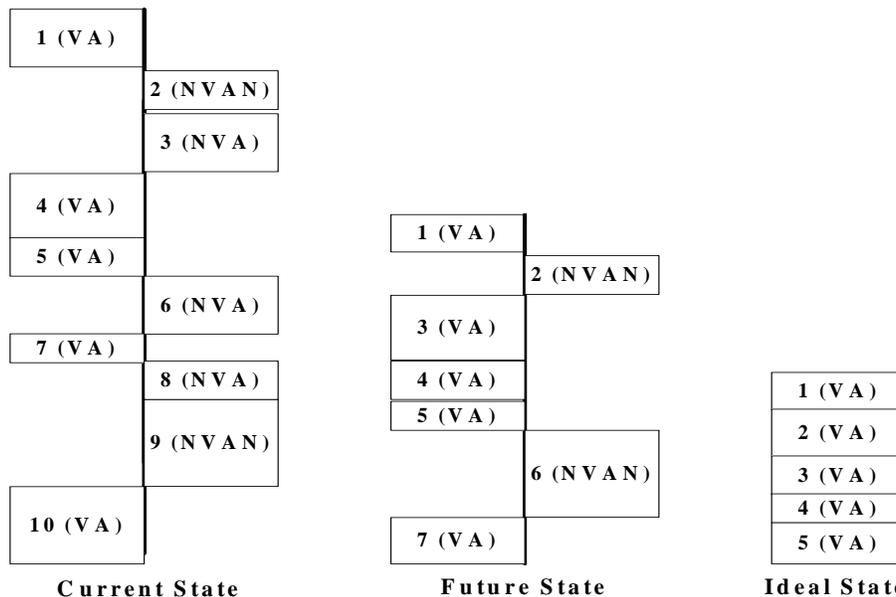


Exhibit 2. A graphic tool represents the process of conducting a value stream analysis. Each step is identified by a number and whether the step is value-added (VA), non-value added (NVA), or non-value added but necessary. The length of time it takes for each step is identified by the size of the box. The longer the time the larger the box, thus the shorter the time for each step the smaller the box.

3. **Flow** is the continuous Internal patient flow within and between departments without delays, bottlenecks and long waiting periods. Flow is one by one and non-stop or First In First Out (FIFO).
4. **Pull** is a system that controls the work in progress level by authorizing work releases based on system status. The pull system is triggered on demand. The advantages of Pull System are the low unit costs because of low inventory, reduced space, and little repair work,

flexibility that encourages the capacity for employees to float, good customer service as a result of short cycle times and steady, predictable output streams and higher external quality.

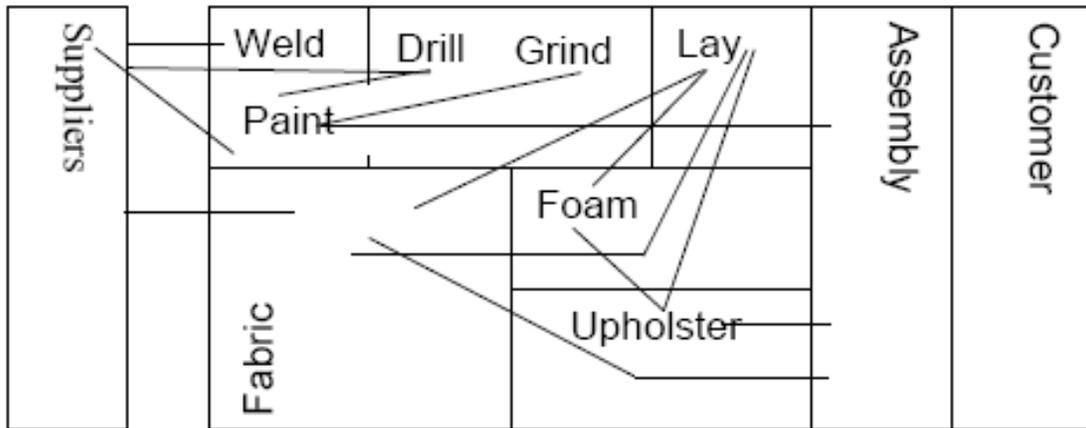


Exhibit 3. Traditional Manufacturing without Lean Implemented Pull System.

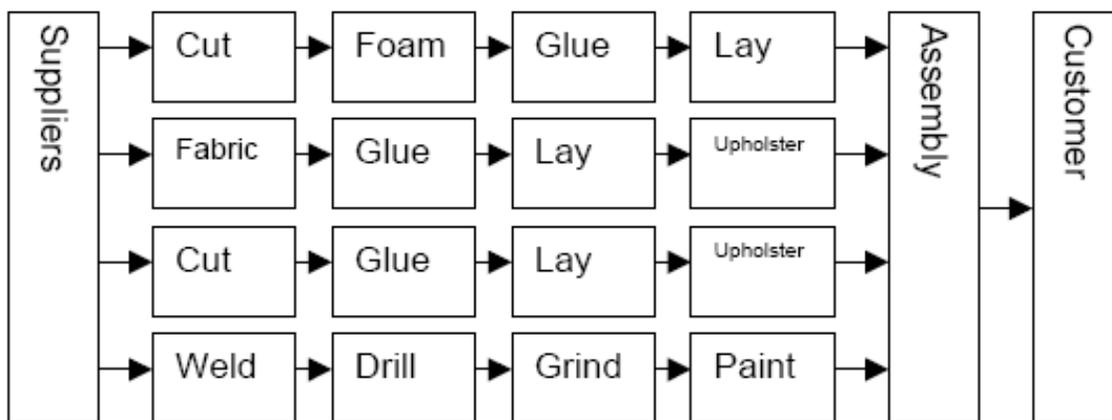


Exhibit 4. Lean Manufacturing with Pull System Implemented

5. **Perfection** can be defined as relentless continuous improvement. Kaizen means ‘change for the better’ in Japanese. The English equivalent is ‘improvement’. Kaizen events are set to build a company culture of continuous improvement, ‘If is not broken, don’t fix it, but improve it.’ Kaizen event benefits include:

- The utilization of what exists to implement new processes quickly with rapid improvement (1 week event).
- Changes in people’s mindsets about the organization.
- Changes in people’s mindsets of how they view their job.
- Employee Empowerment.

- Team-based activities, great involvement of people, buy-in and ownership of the improvements.

Lean Manufacturing and Waste

Lean Manufacturing methodologies are based on maximizing value and minimizing waste in the manufacturing process. Waste (Muda) elimination and reduction is a key factor in lean production. Waste is everything that does not add value to the process. There are eight types of waste tied to lean manufacturing. They include:

- Inventory (Finished Goods, Work in Progress, and Raw Materials)
- Over Processing (Doing more than required in a process, doing what the customer doesn't ask for)
- Knowledge Disconnection (Communication problems in and out of a company)
- Overproduction (Making more than required, large lot sizes)
- Correction (Rework, fix malfunctioning tools and equipment from human error and supplier defects)
- Conveyance (Inefficient workstation layout, large equipment and batch production.
- Delay (Waiting for materials, inspection, machines, broken equipment, process delays)
- Motion: Transportation, non-efficient flow (Long travel distances, and excessive travel trips)

Lean manufacturing is used as a tool to focus resources and energies on producing the value-added features while identifying and eliminating non-value added activities, and minimizing non-value added but necessary activities. By knowing who the customer is and how they define value, lean manufacturing allows for focusing sources on adding value by manufacturing to customer demand, driving out waste and continuously improving.

Lean manufacturing is customer focused. Since the success of your business as a whole is due in large part on satisfying customer demands, lean allows your manufacturing activities to become more closely aligned with other company goals.

Lean Manufacturing Concept – 6 S's

The 6 S's of lean manufacturing are can be utilized to create and maintain an organized, clean, high performance workplace. The 6 S's of lean are:

1. Sort - get rid of what is not needed
2. Straighten - organize what belongs by rationalizing locations, organizing and applying colors, and implementing a visual system
3. Scrub – clean-up, identify and solve problems
4. Safety – identify and fix unsafe conditions
5. Standardize – Identify who does what to maintain and keep-up through the use of shadow boards, production boards, Kanban cards and/or process control boards
6. Sustain – Maintain discipline and keep workplace orderly

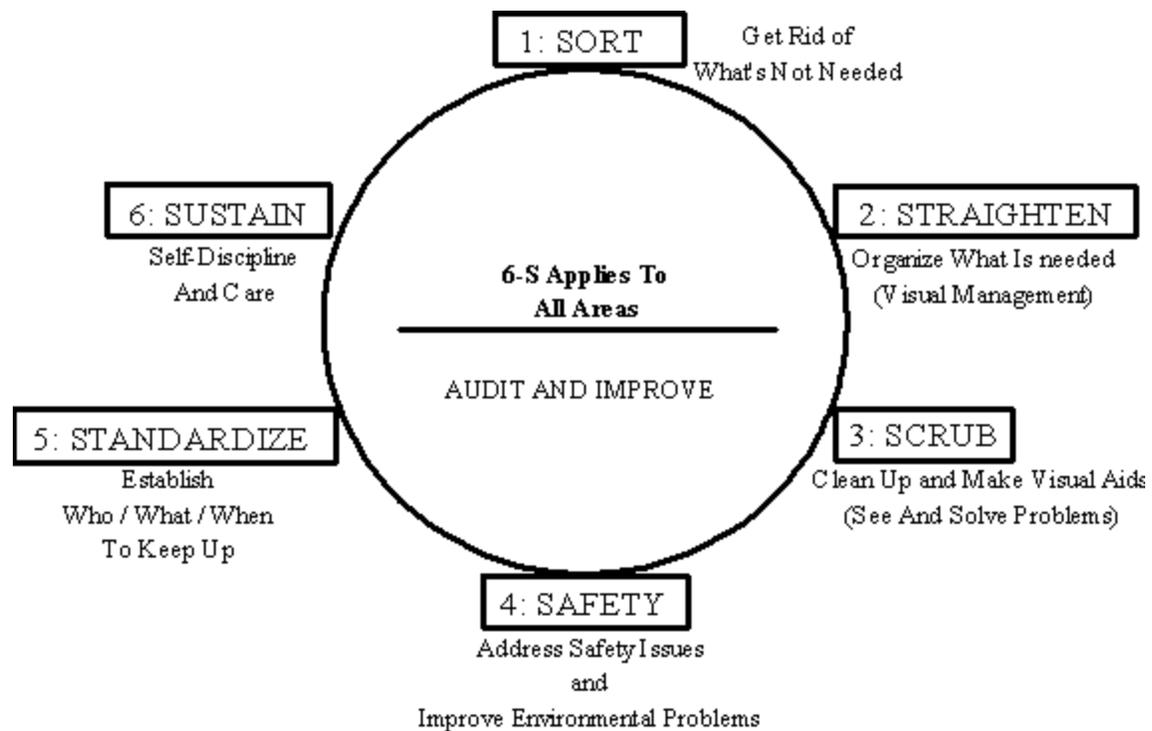


Exhibit 5. Elements of 6 S

When done properly, lean eliminates non-value added activities and allows companies to focus on more customer value added activities. The result is doing more with less. Less cost, less labor, less space, inventory, less lead-time will result in more profits, better quality, on-time production, and greater productivity.

A CD will be available to session attendees containing the PowerPoint presentation for reference purposes to assist attendees in enhancing their ergonomics and safety/health programs.

Documentation

Dennis, P. *Lean Production Simplified*. New York: Productivity Press. 2002.

<http://www.lean.org>

<http://www.simpler.com>