

LEAN PRODUCTION, LEAN VS. MASS PRODUCTION, TPM AS A TOOL OF LEAN PRODUCTION

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Summary: Article discusses the key feature of lean production, its basic objectives, advantages. Next article describes the differences between mass production and lean production. It focuses on one of the tools of Lean Production – Total Productivity Maintenance.

Key words: lean production, waste, TPM, mass production.

INTRODUCTION

The core idea of lean manufacturing is relentlessly work on eliminating waste from the manufacturing process. Another way to look at lean manufacturing is as a collection of tips, tools, and techniques (i.e. best practices) that have been proven effective for driving waste out of the manufacturing process.

1. WHAT IS LEAN PRODUCTION

Lean is about doing more with less: less time, inventory, space, labor, and money. "Lean manufacturing", a shorthand for a commitment to eliminating waste, simplifying procedures and speeding up production.

Lean Manufacturing (also known as the Toyota Production System) is, in its most basic form, the systematic elimination of waste.

Five areas drive lean manufacturing/production:

1. cost
2. quality
3. delivery
4. safety, and
5. morale.

Just as mass production is recognized as the production system of the 20th century, lean production is viewed as the production system of the 21st century.

1.1 Benefits of Lean Production

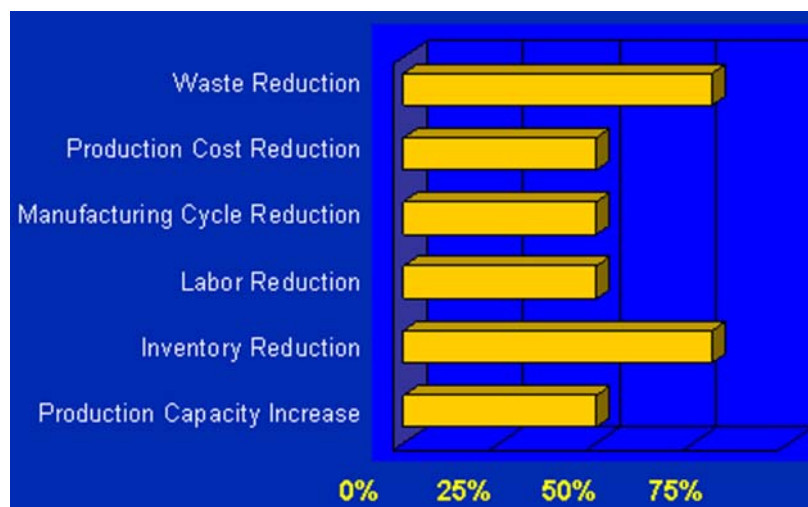
Establishment and mastering of a lean production system would allow you to achieve the following benefits:

- Waste reduction by 80%
- Production cost reduction by 50%

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- Manufacturing cycle times decreased by 50%
- Labor reduction by 50% while maintaining or increasing throughput
- Inventory reduction by 80% while increasing customer service levels
- Capacity in current facilities increase by 50%
- Higher quality
- Higher profits
- Higher system flexibility in reacting to changes in requirements improved
- More strategic focus
- Improved cash flow through increasing shipping and billing frequencies

However, by continually focusing on waste reduction, there are truly no end to the benefits that can be achieved. (3)

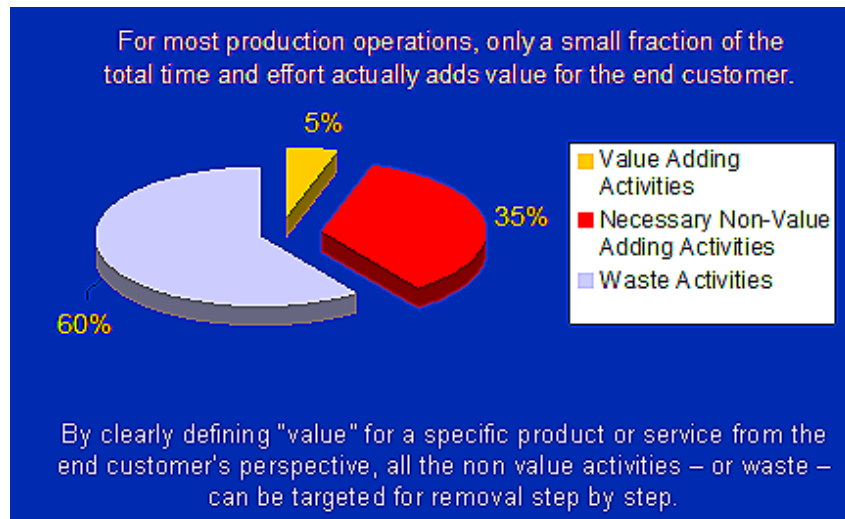


Source: www.1000ventures.com

Fig. 1 - Benefits of Lean Production

1.2 Removal of waste activities

In Lean Manufacturing, waste is any activity that consumes time, resources, or space but does not add any value to the product or service. Lean manufacturing is, in its most basic form, the systematic elimination of 7 wastes – overproduction, waiting, transportation, inventory, motion, over-processing, defective units – and the implementation of the concepts of continuous flow and customer pull.



Source: www.1000ventures.com

Fig. 2 - Target of lean production

The seven wastes to be eliminated:

1. **Overproduction** and early production – producing over customer requirements, producing unnecessary materials / products
2. **Waiting** – time delays, idle time (time during which value is not added to the product)
3. **Transportation** – multiple handling, delay in materials handling, unnecessary handling
4. **Inventory** – holding or purchasing unnecessary raw materials, work in process, and finished goods
5. **Motion** – actions of people or equipment that do not add value to the product
6. **Over-processing** – unnecessary steps or work elements / procedures (non added value work)
7. **Defective units** – production of a part that is scrapped or requires rework.

1.3 Difference between Lean Production and Mass Production

Mass production refers to a manufacturing process in which products are manufactured on a mass scale. Lean production refers to a manufacturing process in which items are produced based on current demand trends.

Here is how lean and mass production differ (4):

1. A **mass production** process focuses on manufacturing in large-sized lots. The idea is to manufacture the maximum number of products in one lot. A **lean production** process focuses on producing as per the latest market demand. For example, a high-end car that is priced at several millions may be produced on an order basis.
2. The **mass production** process requires the company to stock the manufactured products in a warehouse. These products are dispatched to market intermediaries (distributors). These distributors then supply these products to retailers. A **lean production** process generally supplies direct to the customer. Stocking of products is not required – however,

a market intermediary may be required (for example, a car dealer in the case of a custom-built car).

3. Planning for **mass production** is based on a variety of complex factors like market price, competition, inventory levels, time taken for distribution, extra production that is required because an advertisement is released, etc. Such planning is complex and requires enterprise-level tools. **Lean production** is easy to plan because it is based on market demand. Figures and statistics are known and the production schedules are easy to plan.
4. The manufacturing cycle and the sales cycle are separate issues in the **mass production** process. In a **lean production** process, these two are closely intertwined because the products are manufactured based on the latest demand numbers.
5. **Mass production** is a “push” type of process – push the products to the market. **Lean production** is a “pull” process – let the customer pull the product based on its demand.
6. It logically follows the **mass production** is supply-oriented, while **lean production** is demand-oriented.
7. Huge volume of waste is generated in a **mass production** facility; a **lean production** facility produces minimal waste.
8. **Mass production** facilities are equipped with heavy machinery. These facilities typically work in 3 shifts. **Lean production** facilities may not be equipped with bulky machinery. The machinery used in lean production is compact and movable, and can be easily set up.
- 9.

	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 Turns	Low - <7 turns	High - 10+
Flexibility	Low	High
COGS	High and Rising	Lower and Decreasing

Source: www.1000ventures.com

Fig. 3 - Comparing Lean and Traditional manufacturing

2. TOTAL PRODUCTIVE MAINTENANCE AS A ONE OF TOOLS OF LEAN PRODUCTION

TPM (Total Productive Maintenance) is a holistic approach to equipment maintenance that strives to achieve perfect production:

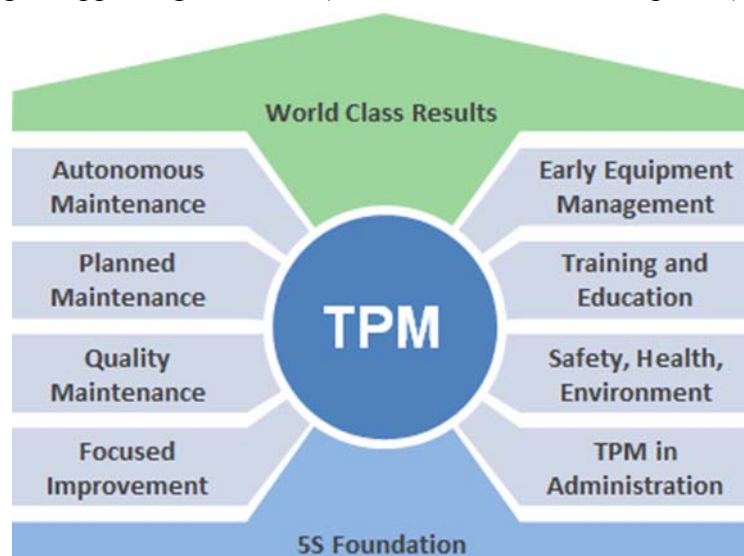
- No Breakdowns
- No Small Stops or Slow Running
- No Defects
- No Accidents

TPM emphasizes proactive and preventative maintenance to maximize the operational efficiency of equipment. It blurs the distinction between the roles of production and maintenance by placing a strong emphasis on empowering operators to help maintain their equipment.

The implementation of a TPM program creates a shared responsibility for equipment that encourages greater involvement by plant floor workers. In the right environment this can be very effective in improving productivity (increasing up time, reducing cycle times, and eliminating defects).

2.1 The Traditional TPM Model

The traditional approach to TPM was developed in the 1960s and consists of 5S as a foundation and eight supporting activities (sometimes referred to as pillars).



Source: <http://www.leanproduction.com>

Fig. 4 - The traditional TPM model consisting of a 5S foundation and eight supporting activities

2.1.1 The 5S Foundation

The goal of 5S is to create a work environment that is clean and well-organized. It consists of five elements:

- Sort (eliminate anything that is not truly needed in the work area)
- Set in Order (organize the remaining items)
- Shine (clean and inspect the work area)
- Standardize (create standards for performing the above three activities)
- Sustain (ensure the standards are regularly applied)

It should be reasonably intuitive how 5S creates a foundation for well-running equipment. For example, in a clean and well-organized work environment, tools and parts are much easier to find, and it is much easier to spot emerging issues such as fluid leaks, material spills, metal shavings from unexpected wear, hairline cracks in mechanisms, etc. (1)

2.1.2 The eight pillars

The eight pillars of TPM are mostly focused on proactive and preventative techniques for improving equipment reliability. (1)

1. Autonomous Maintenance

Places responsibility for routine maintenance, such as cleaning, lubricating, and inspection, in the hands of operators.

- Gives operators greater “ownership” of their equipment.
- Increases operators’ knowledge of their equipment.
- Ensures equipment is well-cleaned and lubricated.
- Identifies emergent issues before they become failures.
- Frees maintenance personnel for higher-level tasks.

2. Planned Maintenance

Schedules maintenance tasks based on predicted and/or measured failure rates.

- Significantly reduces instances of unplanned down time.
- Enables most maintenance to be planned for times when equipment is not scheduled for production.
- Reduces inventory through better control of wear-prone and failure-prone parts.

3. Quality Maintenance

Design error detection and prevention into production processes. Apply root cause analysis to eliminate recurring sources of quality defects.

- Specifically targets quality issues with improvement projects focused on removing root sources of defects.
- Reduces number of defects.
- Reduces cost by catching defects early (it is expensive and unreliable to find defects through inspection).

4. Focused Improvement

Have small groups of employees work together proactively to achieve regular, incremental improvements in equipment operation.

- Recurring problems are identified and resolved by cross-functional teams.
- Combines the collective talents of a company to create an engine for continuous improvement.

5. Early Equipment Management

Directs practical knowledge and understanding of manufacturing equipment gained through TPM towards improving the design of new equipment.

- New equipment reaches planned performance levels much faster due to fewer startup issues.

- Maintenance is simpler and more robust due to practical review and employee involvement prior to installation.

6. Training and Education

Fill in knowledge gaps necessary to achieve TPM goals. Applies to operators, maintenance personnel and managers.

- Operators develop skills to routinely maintain equipment and identify emerging problems.
- Maintenance personnel learn techniques for proactive and preventative maintenance.
- Managers are trained on TPM principles as well as on employee coaching and development.

7. Safety, Health, Environment

Maintain a safe and healthy working environment.

- Eliminates potential health and safety risks, resulting in a safer workplace.
- Specifically targets the goal of an accident-free workplace.

8. TPM in Administration

Apply TPM techniques to administrative functions.

- Extends TPM benefits beyond the plant floor by addressing waste in administrative functions.
- Supports production through improved administrative operations (e.g. order processing, procurement, and scheduling).

CONCLUSION

An extremely important form of waste that is not represented within the Seven Deadly Wastes is unused human potential. This form of waste results in all sorts of lost opportunities (e.g. lost motivation, lost creativity, and lost ideas). One of the reasons that this form of waste is often underemphasized or even ignored at companies is that responsibility for it lies squarely on the shoulders of management. Unused human potential often results from management policies and management styles that diminish employee contributions. By way of contrast, developing strong coaching skills for managers can be very effective in strengthening employee contributions.

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