Practice of Lean

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Book Summary

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"The Practice of Lean" is a book written by JMA Consultants that presents the foundational principles of the Lean approach from product design to production. This book is aimed at engineers, equipment managers, production directors, or continuous improvement managers who are eager to ensure a sustainable competitive advantage for their production.

This summary covers four main topics:
- Lean Manufacturing,
- Lean in product design
- Lean principles in industrialization activities
- Reduction of losses in production

1. Lean Manufacturing

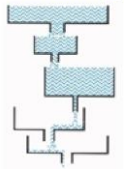
1.1. Principles of Lean Manufacturing

Lean Manufacturing is a term coined by MIT in the United States, based on the Toyota Production System (TPS). A Lean system strives to retain only value-added actions. That is why it advocates for the systematic reduction of production losses. Eliminating waste requires, first and foremost, understanding the functioning of the target factory to determine the root causes.

In Lean Manufacturing, the losses or wastes of production are detailed as follows :
- Causes of increased Lead Time: **the 7 Muda** (*Overproduction, Defects, Transportation, Motion, Overprocessing, Inventory and Waiting*),
- Overburden phenomena: **Muri**,
- Irregularity phenomena: **Mura**.

Before implementing any methodology, the success of implementing a Lean system relies on two important prerequisites :
- Personal commitment from each individual in the factory (especially from managers),
- Participation of all teams in a continuous improvement approach, (meaning constantly striving to be better).

The Toyota system is based on four fundamental methodological elements :
- **5S:** The first phase of the Lean Manufacturing program, which involves implementing rules for organization and cleanliness in a defined area,
- **Visual Management:** Building an on-site information system based on visual solutions,
- **Standardization of tasks:** Creating a detailed and visual documentation reference for each workstation, defining the tasks of each operator,



- **Heijunka:** The levelling of workload by reference to ensure a consistent work pace over a given period of time.

The production flows are managed with the philosophy of “Just-in-Time” (or how to “deliver the right part to the right place at the right time in the right quantity).
To achieve this, the flow must be “pulled” :

- Produce at each workstation only what has been consumed by the downstream workstation.
- Produce only what is necessary for the customer.

One of the most well-known tools for implementing pull flows in production is the Kanban system ("card" in Japanese) :

- A device that enables the control of production at an upstream workstation based on the needs of a downstream workstation.
- Simplifies information flows by representing them through labels or cards.

1.2. Two approaches to implementing a Lean initiative

Depending on the objectives that the company wants to achieve, there are two different approaches that, however, have a common goal: **reducing Lead Times**.

1.2.1. Project-based approach

This approach can be applied if:

- The objectives are related to improving productivity,
- The objectives are related to improving the flow of revenue-generating products.

This approach involves a rapid implementation guided by short-term result needs. The process will rely on narrow scopes that are identified as significant sources of improvement. The variety of skills required necessitates functioning through multifunctional workgroups, where operators are immediately involved.

1.2.2. System approach

This approach can be applied if:

- The objectives are related to a desire for cultural change,
- The objectives are related to the long-term evolution of the company.

This mode of implementation requires defining the strategic axes of the company and thus a strong commitment from the management (throughout the process). The management is done at the plant level, and the deployment of Lean tools is done one by one to allow time for the production teams to adapt and adopt them.

2. Applying Lean from the Design Stage

"The best way to solve a problem is to attack it at its source." This is the philosophy that Toyota followed by applying the good practices established in production to the design offices. The objective remains unchanged: to reduce losses (non-value-added actions) as early as possible, that is, from the design stage.

Within a design office, losses may be less visible due to its project-based organization. Losses in this context can be categorized into two types:

- Delays un the project team,
- Errors in product development.

2.1. Reducing Losses in Design

In order to reduce losses in a development project, Japanese design offices now use a short-term team animation schedule called **Visible Planning**, characterized by:

- A rolling six-week schedule,
- A visible planning, meaning it is displayed so that all stakeholders can be informed,
- Project breakdown into phases and milestones,
- Repositionable papers to designate tasks needed to reach the next milestone (with colour-coded labels for each department),
- Project planning managed by the project leader based on the critical path (the sequence of tasks that determines the overall project timeline),
- Analysis of planning performance to identify project waste (Muda).

Furthermore, continuous improvement in development projects will gradually allow the establishment of standards, similar to those in production).

2.2. Variety Reduction Program (VRP)

The VRP (Variety Reduction Program) is a method used to control and reduce the variety of products, components (and implicitly, manufacturing processes) within an organization. The method is implemented as follows:

1. Analyze marketing studies to anticipate product range developments,
2. Measure the variety index, which is the product of the number of components and the number of component applications,
3. Calculate the associated costs,
4. Apply VRP techniques to reduce product variety,
5. Derive rules to be integrated into development projects based on the findings.

There are five techniques, three of which can be applied during the design phase:

- Distinguish between the fixed and variable parts of different products to identify a common core among the products,
- Optimize the number of modules to achieve the desired variety in the final product,
- Create multifunctional parts (based on a profitability study),
- Group references based on their area of application (the notion of performance ranges),
- Simplify design and adjustments by establishing laws representing specification levels (the notion of series).

3. Ideal Factory

3.1. Principes

Prior to product industrialization or workshop construction, the principle of the Ideal Approach is to involve future users, company management, and designers in a reflection on the future operation in order to enrich the specifications.
This collaborative work aims to determine the level of industrial excellence to be achieved in terms of:

- customer response time,
- flexibility,
- total productivity (productivity, quality control, cost reduction, etc.)
- equipment
- management and structure

3.2. Approach

The approach of the Ideal Factory consists of 5 steps :

1. **Preparation and launch**: he preparation phase involves forming a "permanent" working group that will be trained in the method. The launch phase allows the management to reiterate the objectives of the project and its major milestones.

2. **Establish the function/criteria matrix**: This step involves describing the project based on two axes: performance criteria (listed previously) and the expectations expressed by the various functions of the company.

3. **Identify and prioritize topics**: Once the function/criteria matrix is obtained, the permanent working group is responsible for prioritizing expectations and functions to obtain a reduced and prioritized matrix.

4. **Establish and schedule working groups**: Based on the selected topics (using the reduced matrix), the group sets up a project plan with a breakdown into stages, an overview of the workload, and the selection of the necessary actors for successful implementation.

5. **Monitor and set milestones**: The group defines the operational project management rules and establishes steering committees for project monitoring.

4. Reduce losses in the factory

The implementation of Lean Manufacturing is only possible through a revision of the management methods within the company. Without a genuine awareness and commitment from managers regarding the evolution of their roles, any Lean project will fail.

To achieve this, several elements need to be modified.

4.1. Revision of indicators and operational meetings

The implementation of Lean requires numerous modifications on each project that need to be monitored, which calls for new indicators. Therefore, it is essential to be highly selective when constructing a new tracking dashboard.

The activity tracking dashboard should be designed to monitor progress in achieving performance mastery along three axes:

- **Visual management**: Displaying performance indicators directly in work areas where operators are responsible for updating the figures. This allows for real-time visibility of performance and promotes operator engagement and ownership in achieving targets.
- **Elimination of waste (Muda)**: A reflection on the implementation of new indicators (e.g., First-Time Right Rate, Work-in-Progress (WIP) cycle time, WIP compliance, Line Service Rate, etc.)
- **Measurement frequencies**: A reflection on the update frequencies of indicators, distinguishing between those intended for immediate decision-making and those intended for analysis (this reflection also structures the schedule of team leaders).

4.2. Quality management

Reducing losses related to quality requires first and foremost the ability to identify them. Indeed, most losses are considered "hidden" within the manufacturing process.

In addition, another phenomenon leads to non-quality losses: process variability. Any products that fall outside the tolerance range of an operation will require rework or, worse, be scrapped.

Thus, several techniques related to quality control can be used :

- **First Time Right**: This is a more ambitious objective than simply ensuring the product's quality level. It aims to achieve consistent success on the first attempt, eliminating sorting, verification, rework, and so on…?
- **Self-inspection**: This involves a deep cultural shift where production is halted when a problem is detected to prevent deliberate losses. The operator themselves initiates this stoppage, which is why it is called self-inspection.
- **Use of standards**: Creating references and standards that enable trained operators to distinguish between good and defective products.
- **Autonomation**: Automating quality checks and halting the production line in case of detected defects.
- **Poka-Yoké** Implementing error-proofing devices that prevent the creation of defective parts.
- **Andon**: A visual alert system used by operators to notify support functions when a defect is detected.
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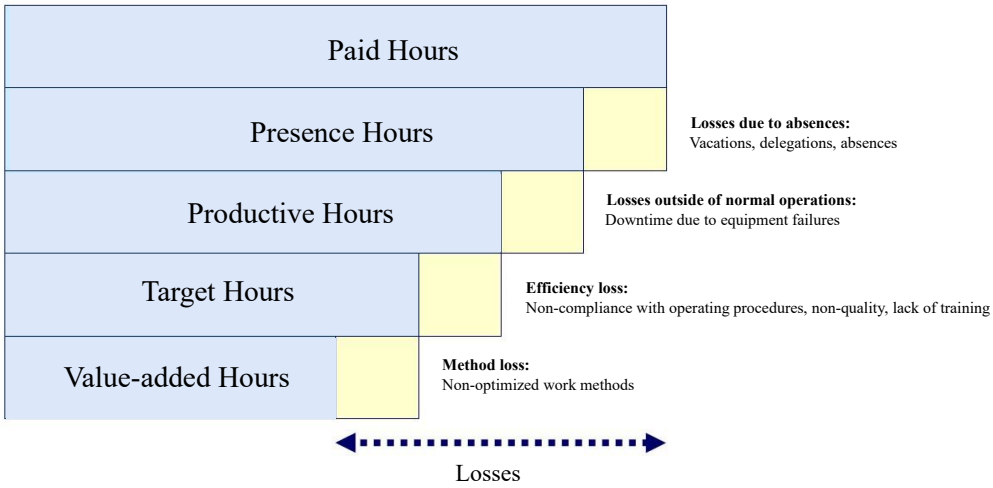
4.3. Improving Labor Productivity

Reducing productivity losses at the labour level requires proper measurement of a standard. The most commonly used techniques to achieve this are MTM (Methods-Time Measurement) and MOST (Maynard Operation Sequence Technique).
Once the standards are established, JMAC proposes the following breakdown to separate the types of labour productivity losses (for direct labour) :

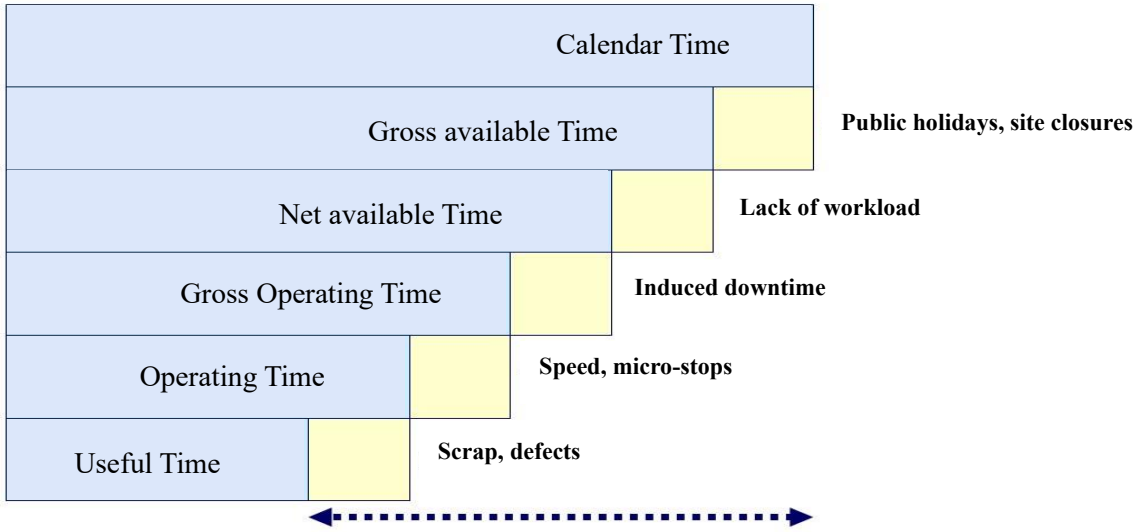


This breakdown allows for quantifying the potential for improvement within each area of responsibility (operational or support functions).

4.4. Improve machine productivity

Most factories have not yet accepted the importance of issues related to equipment maintenance and reliability and prefer to have significant work-in-progress to cope with breakdowns and uncertainties.
In order to reduce equipment performance losses, "The practice of Lean" presents three of the five pillars of TPM (or Total Productive Maintenance) :

- **OEE (Overall Equipment Efficiency):** Similar to the previous chapter, this technique allows for the breakdown of equipment losses into categories of analysis. It highlights improvement potentials for the equipment. OEE is the ratio of the actual **production time** to the **net available time** (see diagram below) :



- **Autonomous maintenance**: This involves giving increased responsibility to the operator for the production equipment, allowing them to perform maintenance and inspection tasks on their machine,
- **Preventive maintenance**.

4.5. Reducing Losses related to Flows

The flow improvement program involves the use of specific indicators related to production flows: lead time, service rate, etc. Lean Manufacturing provides many tools to improve the circulation of parts in a production process:

- **VSM (Value Stream Mapping)** : This tool allows a working group to formalize the entire flow (physical and information) within a specific scope. It is ideal for starting a Lean project and helps teams understand the encountered issues.
- **SMED (Single Minute Exchanged of Die)** This tool, arguably the most powerful in Lean practice, aims to reduce setup/changeover times. It allows for either increased machine flexibility (more frequent series changes) or increased production volume (improved OEE).
- **Heijunka (Load leveling)** : The use of SMED improves the flexibility of a machine. This flexibility, coordinated with customer demand, can be used to mix different products in order to create repetitive sequences (instead of using batch production).