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# A Brief Overview on Toyota Production System (TPS)

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**Abstract:** *This article provides a comprehensive introduction about the Lean Manufacturing Systems or also known as Toyota Production System in Japan. First, the paper gives an introduction to TPS, followed by a brief Literatures Review on all the papers referred for the conception of this paper. The two fundamental pillars of TPS are discussed later on with a description of each pillars in depth. The next section deals with the 7 wastes of lean followed by the benefits of implementing TPS and the barriers to successful TPS implementation. The literature review framework in this paper provides a clear overview of the Toyota Production System, which can be used as a starting point for further research work.*

**Keywords:** *Toyota Production System, Mudas, TPS Pillars*

## I. INTRODUCTION

The Toyota Production System has been sought after by many companies, but none have been able to achieve the same success as that of Toyota itself. Toyota Production System has been interchangeably called lean manufacturing system [1] because, in the end the process can run:

- A. Using less investment
- B. Using less material
- C. Using less space
- D. Using less manpower
- E. Using less inventory

But what makes it truly unique is that, not only does it make the facility financially and physically leaner, it makes it *expressively leaner* as well [1]. What that means is that employees work with much confidence, greater ease and greater peace of mind as contrast to other non-lean facilities. Originally called the “Just in time” production, it works on the very foundation built upon by the founder of Toyota, Sakichi Toyoda, and the industrial engineer Taiichi Ohno. According to Taiichi Ohno, there are three statements that must be fulfilled, which together can define Toyota Production System. They are:

- 1) Soul of TPS must be cost reduction
- 2) The very basics of TPS is the complete elimination of the mudas(wastes)
- 3) Objective is how to produce the exact quantity needed

Together taken, Ohno defines TPS as “A production system which has quantity control at the centre, working on the foundation of quality, with the sole purpose of cost reductions, and the means to reduce cost is through the elimination of the mudas (wastes)”. The underlying principles of TPS is encompassed by the Toyota Way.

This paper mainly focuses on the Toyota Production System, the underlying principles and the also a description on the benefits of implementation of TPS and the challenges involved in successful implementation of TPS. The paper is a review paper on Toyota production System.

## II. LITERATURE REVIEW

In LM, waste is outlined as something associated with the method that adds price however doesn't add worth to the ultimate product made [2]. Waste elimination is one amongst the LM's goals and it's believed to be one amongst the foremost effective ways in which to scale back the assembly price and increase the profit of the many firms. a number of the samples of wastes elimination activities area unit elimination of defects, needless transportation, waiting time, rejects and non-value-added activities like work, recheck and marking method [3], To eliminate waste, it's vital to know what waste is and supply of the wastes [4].

The seven wastes were at the start known nearly fifty years ago by Toyota's Chief Engineer, Taiichi Ohno throughout the event of the TPS [5]. They were classified as: i) transportation; ii) inventory; iii) motion; iv) waiting; v) over processing; vi) over production; and vii) defect. Ohno believed that these wastes account for up to ninety fifth of all prices in non-Lean producing environments [6].

This statement was bolstered by the Lean Enterprise centre, Cardiff, UK, through their analysis that all over that, for a typical physical product setting, five-hitter of the entire activities were value-adding activities (VAA), hr were non-value-adding activities, and therefore the remaining thirty fifth area unit necessary however non-value adding activities (NNVAA) [7]. Since non-value-added activity (NVAA) could be a waste, several makers United Nations agency area unit aware of this matter strived to eliminate the maximum amount waste as potential in their system.

The effectiveness of luminous flux unit is supported by a group of lean tools like Kanban system, Standardized Work (SW), MIFC/VSM, Total Productive Maintenance (TPM), Single Minute Exchange of Dies (SMED), Continuous Flow producing System, Kaizen, 5S, Heijunka system et al.

### III. THE TWO PILLARS OF TPS

According to Taiichi Ohno, the process of elimination of mudas (wastes) is done through a system which is built upon the fundamental principles of TPS. They are:

#### A. *Just in Time (JIT)*

After the world war 2, Toyota was more focused on how to produce exact quantity of goods. This was because of Japan did not possess the financial strength to succeed in high batch, high inventory type of manufacturing which was prevalent outside of Japan. Another factor was the lack of space needed to set up huge factories with high inventories. To tackle this, Toyota incorporated JIT into their manufacturing methods. JIT, the first pillar of TPS, is a method of supplying the right type, right quantity, at the right time and to the right place. In this way, Toyota leaned out their process. They only kept the materials in their factories which would be needed for that day's work process. In this way inventory levels and investment needed to manufacture can be kept low.

#### B. *Jidoka*

Jidoka, the second pillar, is the backbone of TPS which helps in stopping the process or machine safely. The stoppage can occur due to quality issues, process issues or material issues. Quality issues stoppage occurs when there is a defective component in the line. The line is stopped to prevent the defective component's processing. This saves additional time and money to the company if they need to rework the defect found after it is already processed and further down the line. Process issues can be for example, a machine emitting a lot of sound. In that case it needs to be stopped and examined even though the quality of processing by the machine is acceptable. If it is not stopped and examined, then it may later on break down, leading to quality issues and injuries to workers. Material issues can be when a particular station has run out of parts or components needed for the workflow of that station. In that case the line has to be stopped. In order for all this to work, Jidoka makes use of concepts such as poke-yoke and Andon boards.

The above two pillars are fundamental for ensuring quality products and the right amount of inventory. But sometimes there exists many non-value-added inputs which exist outside of a line. Those wastes are the seven mudas.

### IV. THE SEVEN MUDAS (WASTES)

Waste is anything that adds no value to a process or product. From the TPS point of view, identifying and reducing or eliminating them is critical in order for improvement in the overall process or system. Waste elimination is one direct way of increasing profitability of a company. According to Taiichi Ohno the seven forms of wastes are:

#### A. *Over Production*

Producing more than the customer demands. The corresponding Lean principle is to manufacture based upon a pull system, or producing products just as customers order them. Anything produced beyond this (buffer or safety stocks, work-in-process inventories, etc.) ties up valuable labour and material resources that might otherwise be used to respond to customer demand which may also camouflage other problems in the organisation.

#### *B. Inventory*

Related to Overproduction, inventory beyond that needed to meet customer demands negatively impacts cash flow and uses valuable floor space. One of the most important benefits for implementing Lean Principles in manufacturing organizations is the elimination or postponement of plans for expansion of warehouse space.

#### *C. Transportation*

Material should be delivered to its point of use. Instead of raw materials being shipped from the vendor to a receiving location, processed, moved into a warehouse, and then transported to the assembly line, Lean demands that the material be shipped directly from the vendor to the location in the assembly line where it will be used.

#### *D. Waiting*

If a product or a material is not being transported or processed the waste of waiting occurs. Waiting tends to disturb the flow of the processes, so must be dealt with severity.

#### *E. Over Processing*

Some of the more common examples of this are reworking (the product or service should have been done correctly the first time), deburring (parts should have been produced without burrs, with properly designed and maintained tooling), and inspecting (parts should have been produced using statistical process control techniques to eliminate or minimize the amount of inspection required). A technique called Value Stream Mapping is frequently used to help identify non-valued-added steps in the process (for both manufacturers and service organizations).

#### *F. Defects*

Production defects and service errors waste resources in four ways. First, materials are consumed. Second, the labour used to produce the part (or provide the service) the first time cannot be recovered. Third, labour is required to rework the product (or redo the service). Fourth, labour is required to address any forthcoming customer complaints.

#### *G. Motion*

This waste deals with ergonomics and health issues with respect to the workers and their job. All activities of walking, bending, reaching, lifting, etc. must be studied carefully as they cause stress to the workers and equipment, which leads to costing the company time and money. Jobs with such excessive activities must be analysed and carefully redesigned so as to decrease the strain on the workforce.

### **V. BENEFITS OF EXECUTING TPS**

The benefits of implementing Lean may be counteracted into 3 broad categories; Operational, Administrative, and Strategic benefits.

Even to the current day, most organizations that implement Lean do therefore for the operational benefits, primarily owing to the perception that Lean solely applies to the operations aspect of the business. However, from our experiences, Lean's body and strategic edges square measure equally impressive. a number of Lean's edges square measure summarized below.

#### *A. Operational Benefits*

The National Institute of Standards and Technology producing Extension Partnership recently surveyed forty of their purchasers World Health Organization had implemented Lean producing. Typical benefits were reported as follows:

- 1) Interval (Cycle Time) reduced by ninetieth
- 2) Productivity exaggerated by five hundredth
- 3) Work-In-Process Inventory reduced by eightieth
- 4) Quality improved by eightieth
- 5) House Utilization reduced by seventy fifth

### *B. Administrative Benefits*

A small sample of specific benefits in body functions is (based upon personal experiences):

- 1) Reduction so as process errors
- 2) Streamlining of client service functions so customers aren't any longer placed on hold
- 3) Reduction of work in workplace areas
- 4) Reduced staffing demands, permitting an equivalent range of office to handle larger numbers of orders Documentation and streamlining of process steps allows the out-sourcing of non-critical functions, allowing the company to focus their efforts on customers' wants
- 5) Reduction of turnover and therefore ensuing attrition prices
- 6) The implementation of job standards and pre-employment identification ensures the hiring of solely "above average" performers

### *C. Strategic Benefits*

Many corporations UN agency implement Lean don't adequately profit of the benefits. Highly successful corporations can find out how to plug these new edges and switch them into enhanced market share. One specific example involves a western manufacturer of a typical health care product. Of approximately forty U.S. competitors, the third largest company within the trade determined to implement Lean producing principles. The trade average lead-time was fifteen days, and this company was no different. At the tip of the project, Company #3's average lead-time was four days, with no product shipped in but seven days. so as to capitalize upon these benefits, the corporate began a marketing campaign, advertising that customers would receive the merchandise in 10 days, or the order would be FREE. Sales volume enhanced by two hundredth presently. when creating the acceptable improvements to handle the new demand, the company initiated another promoting campaign; for under a 10% premium, they might ship at intervals seven days. Again, sales volume enhanced (by solely 5%) as a result of new customers wished the merchandise at intervals seven days, however over half-hour of existing customers additionally paid the premium, even they were already receiving the merchandise in but seven days. the tip result was that the corporate enhanced revenues by virtually four-hundredth with no increase aborning or overhead prices. Another key profit was that the corporate was able to invoice customers eleven days previous before, greatly improving income.

## **VI. BARRIERS TO SUCCESSFUL IMPLEMENTATION OF TPS**

Many of the businesses that plan to implement Lean expertise difficulties and/or don't seem to be able to attain the anticipated edges. a number of our own observations during this space include:

- A. The corporate fails to tie the development metrics to money statements. In different words, the corporate solely reports the % improvement and doesn't convert this to a financial live. By not expressing in the same language as management, the department or operate implementing Lean doesn't get the support needed to continue the efforts.
- B. The corporate implements the building blocks within the wrong sequence. for instance, if batch sizes are reduced before reducing conversion time, and conversion times are drawn-out, instrumentation utilization can drop, and therefore the ability to serve customers are reduced.
- C. Selecting a tough or low-impact project because the initial one. Lean isn't tough, however will be sophisticated because of all the variables and communication concerned. If the primary Lean project isn't flourishing or generates very little come on investment, cooperation and support for future comes can fade.
- D. Dominating body areas. Some producing environments, particularly continuous processes have solely tiny or insignificant opportunities within the production or operations areas. Implementing Lean there'll offer very little impact.
- E. The corporate spends an excessive amount of time on coaching and not "doing," or they begin at the incorrect place.
- F. Failing to expand lean implementation to the provision chain. as a result of the necessity for just-in-time delivery of materials, step-down of inventories and Lean's dependence upon prime quality product and services, companies have to be compelled to bring suppliers into the development efforts. If vital suppliers cannot deliver on time, and in smaller quantities, the advantages of Lean are greatly diminished or perhaps non-existent. The development of a lean offer chain is perhaps one in every of the foremost tough, however a lot of financially bounties, aspects of implementing Lean.

## VII. CONCLUSION

The Toyota Production System (TPS) may be an amount system engineered on a solid foundation of quality, and was the producing system perpetuated by the sturdy culture of Toyota. Herein are the 2 variations between Lean producing and therefore the TPS: the strong Toyota culture and therefore the solid quality foundation. each are sturdy producing philosophies designed to create your business safer and an improved money-making machine through the overall elimination of waste, thereby activity what the client wants: worth. It must be understood that Lean is primarily a producing philosophy and isn't a business philosophy. Finally, the tools of Lean were designed for—and work best in—what I decision the Lean Stereotype, though you're solely a bit exertion and imagination far from applying these tools terribly loosely.

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