Chapter

Application of Lean in a Small and Medium Enterprise

Venkataramanaiah Saddikuti, Saketh Saddikuti Venkat and Ganesh Babu Shanmugam

Abstract

Application of lean principles in manufacturing as well as services has been revolutionizing the operations for more than five decades. Many large as well as small enterprises have implemented lean and reported benefits in both direct and indirect activities of business. Due to advent of digital technologies and better understanding of process improvement approaches made lean much more effective across many sectors. In this chapter, we highlight various elements of lean and its application to a small enterprise in food processing sector in India. We draw some useful insights based on the implementation of lean and challenges faced by SMEs.

Keywords: lean, Toyota Production System, customer value, value chain, food processing, SMEs, Total Quality Management

1. Introduction

> *"One of the most noteworthy accomplishments in keeping the price of Ford products low is the gradual shortening of the production cycle. The longer an article is in the process of manufacture and the more it is moved about, the greater is its ultimate cost" [1].*
>
> *Henry Ford 1926*

Lean was identified at Toyota Production System (TPS) to eliminate or reduce waste or non-value added activities in the manufacturing system. It is also believed that application of Lean was implemented by Henry Ford at Ford Motors in 1920s. Lean is defined as by the National Institute of Standards and Technology Manufacturing (NISTM) Extension Partnership's Lean Network [1]: "A systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection." It is a systematic approach for reducing different types of wastes which are constituting around 95% of the total waste. Important elements of TPS is given in **Figure 1**. TPS/Lean system was built on two major aspects (i) Elimination of Waste and (ii) Respect for people. TPS has three pillars (JIT, Continuous improvement and Jidoka) with fundamental blocks of standardized and stable process and level production. Some of the wastes in manufacturing environment are given in **Figure 2**. **Table 1** gives the brief description of eight wastes in TPS [2, 3].

The main objective of this chapter is to highlight various elements TPS and wastes in a typical manufacturing organisation and demonstration of application of

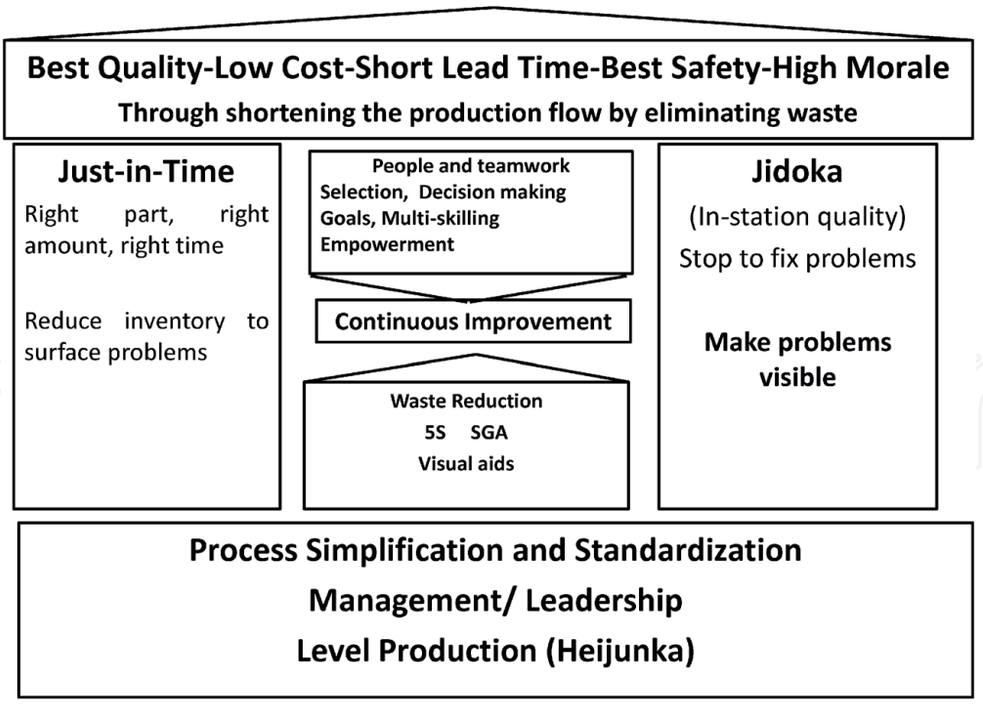

Figure 1.
Elements of Toyota Production System.

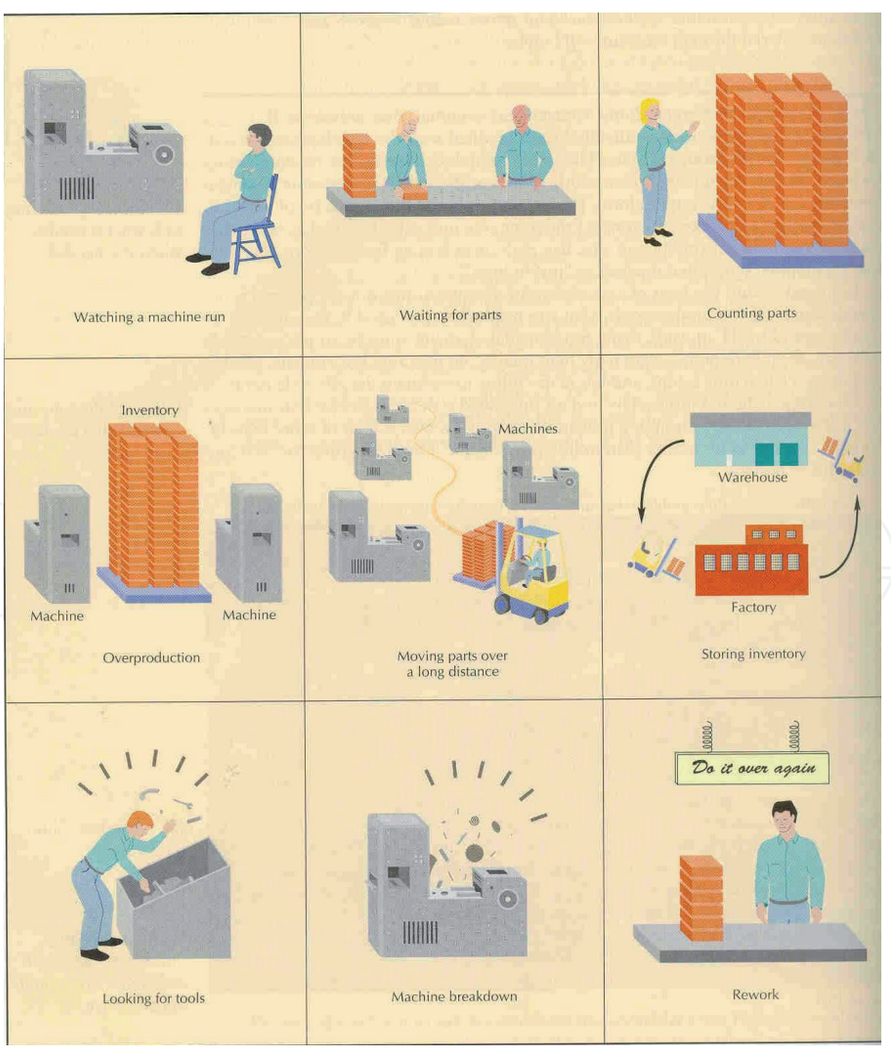

Figure 2.
Different types of wastes in manufacturing.

Sl No	Waste Type	Brief description and Examples
1	Overproduction	Producing more than required. It includes safety stocks, work-in-process, Finished goods etc
2	Waiting	Waiting for authorization, information, tools and equipment or operator. Example, waiting for machine, operator or handling equipment before or after completion of an operation at particular stage of the process.
3	Transportation	Distance travelled by various resources including parts, operators, handling equipment from point of availability to point of use. Example, an item travelling from storage to assembly or from vendor to manufacturer.
4	Over Processing	Processing more than required. Example, finishing more than specifications
5	Inventory	Any resource kept in reserve for future use due to uncertainties. This would include raw materials, WIP or finished goods.
6	Defects/Errors	Not meeting the customer specifications. Under size or over size dimensions of an item.
7	Excess Motion	Unnecessary motion or movement of products/resources due to poor layout or lack of coordination.
8	Underutilized People	Underutilization of highly skilled manpower. Example, high skilled person doing low skill job.

Table 1.
Different types of wastes in manufacturing.

lean at a small food processing enterprise. This chapter is organised in five sections. Section two highlights the methodology adopted in the chapter, section three describes building blocks and benefits of lean, section four application of lean at a small food processing organisation and finally conclusions in section five.

2. Methodology

In this study, we have adopted a generic method for literature search and industry practices in the area of lean manufacturing. Literature search has been carried out using key words like Lean, SMEs, Food processing, Toyota Production System, customer value, TQM from the databases like ABI, EBSCO, Google Scholar, etc. The search does not include other databases. Apart from these we have also used the case of an SME in food processing sector. The author's own research and consulting experience in the area of lean and transformation of SMEs in manufacturing and services.

3. Building blocks and benefits of lean

Lean/TPS uses various tools or building blocks which are proven and easy to implement in practice for minimizing or elimination of waste. Major building blocks of Lean include the following:

- Pull System
- Kanban

- Work Cells
- Total Quality Management
- Total Productive Maintenance
- Point-Of-Use-Storage
- Quick Changeover/SMED
- Batch Size Reduction
- 5S
- Visual Controls
- Concurrent Engineering

These are not only used in manufacturing organizations but also apply equally to service organisations. Summary of these are given in **Table 2**.

Many organisations around the world from manufacturing and service organisations have reported both operational and administrative benefits of successful implementation of Lean principles. According to NISM survey of firms implemented lean have reported operational and administrative benefits and are given below.

Operational benefits:

- 90% reduction in Lead Time (Cycle Time)
- 80% reduction in Work-In-Process Inventory
- 80% improvement in quality
- 75% improvement in space utilization
- 50% increase in productivity

Administrative Improvements includes the following:

- Reduction in order processing errors
- Streamlining of customer service functions
- Reduction of paperwork
- Reduction in staff required
- Improvement due to outsourcing of non-critical functions
- Reduction employee attrition
- Improved job standards

Sl No	Name	Brief Description
1	Pull System	Manufacturing based on customer demand/order, Make-to-order (MTO), in terms of exact requirement and time. This is against Push system. Capacity driven or Make-to-Stock (MTO).
2	Kanban	Producing based on accurate and timely information given in the form of a card where material is moved based on the timely information between stages. It can use single card Kanban or dual card Kanban system. Size and number of Kanbans are decided based on the volume of demand and production economics.
3	Work Cells	Lean or TPS focus on improved flow of material, manpower and other resources. The resources are organised around the requirements of the job done. Generally U-shaped layouts are more productive. It also helps better coordination and communication
4	Total Quality Management	Lean is built based on TQM fundamentals where every aspect of the organisation is very important. It recognizes the strength of the human resource and team work.
5	Total Productive Maintenance	It is based on proactive or preventive maintenance approach using knowledge and cooperation of people, vendors and other resources. It tries to identify and eliminate the breakdowns and improve the reliability of the system for improved throughput.
6	Point-Of-Use-Storage	This aspect of lean focus on keeping the required resources near the place of use. For example, the tools and equipment required at work center kept at the work center itself. Dedication of resources.
7	Quick Changeover/ SMED	It focuses on reduction of long changeovers which will be costly in terms of time and cost. It allows more frequent changes and smaller lot sizes.
8	Batch Size Reduction	Traditionally, manufacturing organisations used to manufacture to reduce the cost of set-up. In pull system, small batch size is more appropriate which will result in low WIP, low quality cost etc. Small batch size increased inventory turnover and better visibility, improved cash flow.
9	5S	5S is a systematic way of organizing the workplace.
10	Visual Controls	TPS heavily uses visual controls in almost every aspect of the business since it enhances the productivity, visibility and easy to understand at the executional level.
11	Concurrent Engineering	This approach helps in reducing the lead time drastically and utilizes cross-functional teams. This aspect particular helpful in reducing the time-to-market of new products/services. Some of the empirical results shows that around 50% decrease in the time-to-market.

Table 2.
Building blocks of Lean/TPS.

4. Application of lean at a small food processing organisation

This section highlights the implementation of Lean at a small food processing organisation in Southern part of India. The organisation was established in the year 2002 and gained a significant market share. The founder of the organisation is a first generation entrepreneur with high levels of enthusiasm and energy along with dedicated team of around 50 members including 10 members representing planning and execution [4].

4.1 The context

The organisation is a leading manufacturer and exporter of high-quality aquarium and pet food.

The organization was unable to increase the sales turnover and also struggling to maintain healthy profit margin despite that the organization catered to both Indian and export market. The founder of the organisation sought the help of one of the authors of this chapter for improving the market share and revenue. A five-member team consisting of internal members and external Lean transformation expert identified the following challenges.

- Sales Turnover is stagnant for the last three years
- Declining profitability
- Manufacturing cost is on an increasing trend
- No clarity on the losses in both manufacturing and sales function
- No management reviews and lack of data transparency among the team members
- No proper coordination among Team on deliverables
- Founder get involved in all day to day decision making

4.2 Solution methodology adopted

Internal team along with external Lean transformation expert identified various areas for improvement using brainstorming sessions and listed the following areas for improvement.

- Training of the core team on Quality Management and Lean project
- Awareness workshop for the senior executives
- Development of overall system with suitable metrics and fixing of responsibilities for each functional area of the business.
- Identified the waste in plant utilization,
- Efficiency, and quality issues
- Implemented Quick changeover techniques to reduce changeover losses between food products
- Identified the constraints that affecting the equipment efficiency
- Set the key performance metrics (KPI's) for customer deliveries, cost, and quality and reviewed every month along with Business Head
- Implemented sales and operational key performance reporting on a daily, weekly basis to avoid communication problems
- Analysed and implemented right inventory norms for raw material and finished goods to improve stock availability and reduce inventory

- Identified and implemented cost-saving projects in plant and administrative areas
- Identified the staffing levels and gaps and recruited suitable skilled personnel in the areas of shortage
- Improved the communication process among operations, sales, and finance team to take decisions on time
- Identified the utilization of floorspace in the plant and movement of the products inside and outside the organisation

4.3 Application of lean tools & process

The team has adopted and designed transformation process using well proven lean management tools and processes including the following:

- Performance Measurement and Management at business and operation level
- Application of Lean tools and techniques
- Designed suitable inventory management systems for raw material and finished goods
- System for Performance reporting on daily, weekly and monthly basis
- System for communication at all levels of the organisation
- Metrics for supply chain management at internal and external to the organisation.

4.4 Business result achieved

- 40% reduction in changeover times
- 40% reduction in inventory value without affecting deliveries
- 33% Reduction in number of shifts (from 3 shifts to 2 shifts)
- 30% Improvement in plant capacity utilization;
- 30% increase in production tonnage with reduced working hours
- 15% increase in sales turnover and increase in delivery performance by around 10%
- 15% (appr) increase in operating profit (from negative to positive)
- 5% reduction in overall manufacturing cost

4.5 Recommendation for sustainability and future growth

Based on the detailed study and implementation, the team has suggested the following for future growth.

- Training and development of workforce in all functional areas with right caliber of professionals
- Monitoring and evaluation system for financial performance and cash flows
- Expanding into new markets
- Structured review mechanism on business and functional performance on regular basis
- Accountability improvement through organizational structure/role clarity and management practices
- Streamlining New Product development process w.r.t new markets and sales plan

5. Insights and conclusions

Implementation of Lean has benefited both small and large business organisations in manufacturing and services. Lean systems/practices are built on the strong empirical evidence of both operational and administrative benefits. Lean focuses on elimination of waste by utilizing the dynamics of team work and strength of people and processes. Implementation of lean has proved in improving quality of products and services across all industries and organizational boundaries and revolutionizing the operations [5]. There are many other studies like [6–10] focused on various aspects of lean implementation. However, the implementation of lean requires certain level of certainty/stability in the system, discipline and culture at inter and intra organizational level. Further, studies can focus on the impact of socio, economic and technological determinants of lean in different sectors of business.

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