A Way Forward to Attain Lean Manufacturing Status through Transformational Leadership

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Abstract

Lean system is among the most extensively implemented business strategy, for quality and cost effectiveness. With roots in 1960's Toyota Production System (TPS) and Just-In-Time (JIT), Lean focuses on customer satisfaction. The goal is to produce exactly what customer wants, when and in what amount. For achieving the goal, principles like waste elimination, empowered employees and continuous improvement are employed.

Transformational leaders activate higher-order needs in followers. Research by Krishnan suggests that superior performance is possible only through stimulating and motivating followers to higher levels of performance through transformational leadership. Superior performance is possible only by transforming followers' values, attitudes, and motives from a lower to a higher plane of arousal and maturity.

The intention of this research is how to gain the lean status through transformational leaders. Results of this research shows that transformational leaders were more facilitating in achieving the lean status for an organization than non transformational leaders

This paper also highlights the strengths and weaknesses of the system by reviewing the research papers. Modern trends in the lean system are also mentioned for further research. Recommendations are given considering the common problems faced by organizations in lean transformation.

Keywords

Lean System, Transformational Leadership, Lean Implementation.

1. Introduction

In this fast moving technological world, the concepts of lean are again getting focus of the researchers, Moyano-Fuentes, et al (2012). It is adopted and implemented in a number of ways in the manufacturing organizations, a strategy for continuous improvement that ensures significant improvement in the manufacturing organization's stability, profitability and competitive advantage, Atkinson (2004). Lean manufacturing is a concept driven from the famous Toyota Production System (TPS) and emphasizes on understanding the customer and providing exactly what customer wants.

Lean manufacturing is usually preferred because it encompasses a unified and mutually reinforcing set of principles, linking management to shop floor for a holistic view of the enterprise operations, Taggart (2009).

Lean's main objective is to increase the profit and return on investment for the organization which is achieved by following the philosophy of eliminating Ohno's seven wastes, respecting the people of organization and continuously improving the process. A number of tools and techniques are used to

achieve the stated objective of being Lean. To help in gradually transforming into lean system a number of tools have been in practice like 5S, Kaizen, Pull system, Jidoka and others.

Lean system like other management systems has both strengths and weaknesses. Although its strengths overcome the weaknesses but still organizations must be well aware of what they are opting for and be ready to tackle any problems that might come their way.

With the passage of time original lean operations have been developed into a complete lean system with specific tools and techniques for attaining the status of being lean organization. Many new concepts have been introduced like lean thinking, lean audit, agile and leagile manufacturing, lean-six sigma (LSS) and lean value management (LVM).

The objective of this paper is to review the literature on lean operations and understand the philosophy behind its concepts and principles. A number of lean tools have also been studied in terms of their contribution towards becoming a lean organization and a relationship has been identified between lean system and transformational leadership in manufacturing organizations. Limitations on the lean implementation are discussed with strengths and weaknesses. Literature was reviewed for modern trends in lean operations. In the end recommendations are given for improvements in the lean implementation.

2. Background

2.1 Origin & Development of Lean System

American system of mass production was commonly in use after World War II. Mass production involved large amount of inventories, space requirements, over-standardization of products resulting in inflexibility to customer demand and changes in design. Materials were produced in large batches which resulted in sacrificing the quality. Henry Ford then introduced the concept of continuous moving assembly line for improving the production and workers performance. Fredrick Taylor, the founder of scientific management, supported mass production concept of manufacturing with high product volumes, low cost per unit and job standardization, Valentinova (2010).

The mass production system was not questioned till Japanese, Taiichi Ohno, introduced Toyota Production System (TPS) in 1960s. Due to lack of resources and poor demand for Toyota automobiles, at that time, TPS gained significant appreciation with smaller batches and fewer inventories. Just-In-Time (JIT) was also introduced to reduce inventory and improve throughput.

In reality, there is a little difference between TPS, JIT and Lean systems. Although

- TPS focuses on employee learning and employee empowerment on the shop floor
- JIT focuses on forced problem solving
- Lean systems focuses understanding the customer

Implementation of all these three system gives a competitive advantage and results in overall returns, Heizer (2011).

2.2 Lean Definitions

Edwards described Lean manufacturing as an innovative techniques keeping in view of the philosophy of craftsmen period, in line with modern era of work standardization, an assembly line technique and glued with teamwork for better measure, Deming (2000).

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Todd explains lean production to be an initiative with the goal of minimization of waste through human work, inventory management, time management and layout of shop floor, to enable the organization to gain the status of world class quality products with high efficiency and low cost, Todd 2000 as cited by Valentinova (2010).

Deming argued that lean manufacturing involved changing and improving processes as the prime principle, which in turn bring change in terms of waste minimization, it also requires “re-engineering of the whole process, which makes the system more stable with less variation on account of common causes” Valentinova (2010).

2.3 Lean Principles

Liker (2004) in his book "The Toyota Way" has given fourteen principles to become a lean organization. It is believed that to achieve a lean status an organization has to focus on a particular philosophy and management style like the concept of "4P" model i.e., Philosophy, Process, People, Partner and Problem solving Valentinova (2010). Another concept is that lean production consists of eight principles, i.e., waste elimination, continuous improvement, zero defects, multifunctional teams, delayering, pull scheduling, team leaders, and vertical information systems**.** However the five principles by Womack and Jones (1996) are known to be the most important in successful implementation of Lean system as follows:

a. Define Value
   First principle is to specify the value from the standpoint of customer not from your assets and organization. Value flow should be ensured across all the departments of organization to avoid wrong product or service resulting in loss to organization.
b. Map Value Stream
   Second principle is to identify the value stream through product definition, information management and physical transformation to create and deliver each product and eliminate wastes Valentinova (2010). Challenge all non-value adding steps and add nothing than value.
c. Create Flow
   Third principle is to control the flow of value creation process. In general, flow should be smooth and quick.
d. Pursuit Perfection
   Fourth principle is to pursue perfection through continuous improvement in product, process and value stream.
e. Establish Pull
   Fifth principle is to establish pull system among all the processes wherever continuous flow is running**.** Flow should be directed by the pull of customer.

All these principles support each other by influencing the outcome, so they should be performed together.

2.4 Lean Philosophy

Lean system has its roots in Japanese environment. Lean philosophy was developed considering the Japanese working standards and culture. But now many companies use lean as their preferred approach as there is nothing culturally inherent in the system. Following four philosophies are the main building blocks of lean operation, Heizer (2011).

1. Waste Elimination - Due to lack of space and lack of natural resources, leanness was focused on reduction of waste in all processes. In a lean system, anything that does not contribute value addition in the final product with respect to customer perspective is assume to be wasteful activity and should be eliminated, and value added activities should be incorporated. Taiichi Ohno list down seven most common types of wastes that contribute for the loss of resources, i.e., Overproduction, Queues, Transportation, Inventory Motion, over processing, and Defects.
2. Respect for People – Lean system believes in utilizing the full capacity, mental as well as physical, of the workers and suppliers to improve the operations. They are recruited, trained and treated as knowledge workers. Lean system introduced the idea of employee empowerment to make improvements and stop the process in case of quality problems. Lean operations ensure employee participation through quality teams, suggestion systems and others form.
3. Continuous Improvement – Third philosophy of lean systems is to work on continuous improvement of all processes. Lean systems strive for perfection in all processes. There is always some room for improvement in the process no matter how good it is Mefford (2009).
4. Improving Profits and Return on Investment – Previous three philosophies, waste elimination, utilization of workers and continuous improvement, are only means of achieving the real objective of lean system which

is improving profits and return on investment. The theme of lean production is to manufacture the right quality and quantity of products at the right time and the right place that satisfy customers' requirement as shown in figure-1.

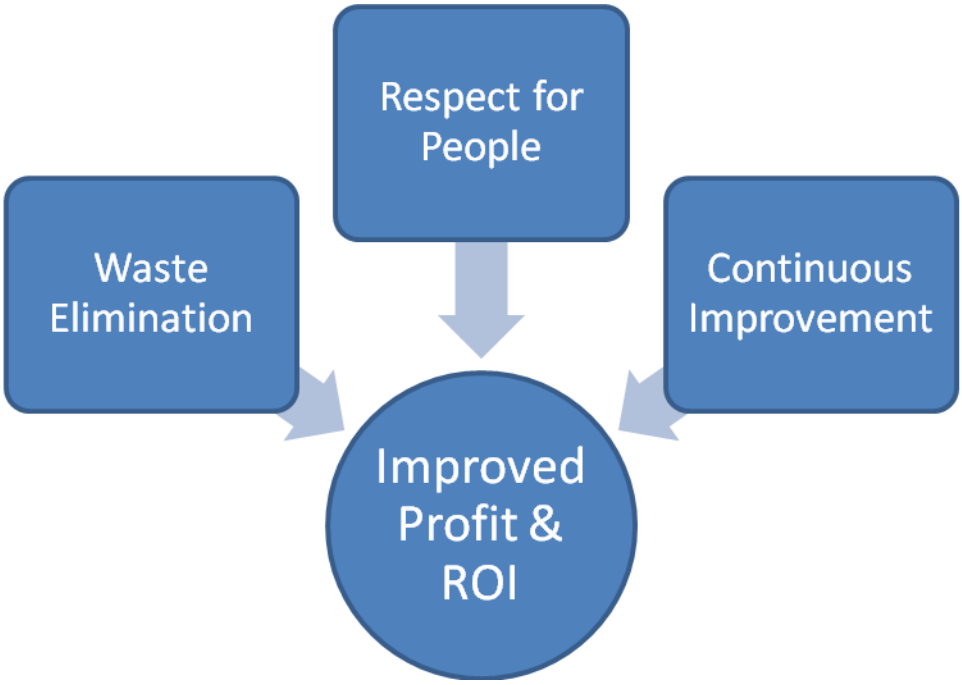

Figure 1: Philosophy behind Lean Objective

2.5 Elements of lean Production

There are six elements of lean production. Integrating them together is necessary for overall success of the organization (Schroeder).

- Small Size Lot Production
- Reduced Setup
- Pull System Production
- Standardized Operations
- Proper Equipment Maintenance
- Implementation of Group technology

It is established that lean operations provide an organization with competitive advantage in terms of winning orders because of quick response to customer at lower cost as well as high quality. Just-In-Time techniques help in overcoming almost all the problems in overall process from supplier to customer integration. Lean implementation, involving TPS and JIT, results in rapid throughput, waste reduction through quality improvement, pricing flexibility through cost reduction, variability reduction and rework reduction, Heizer (2011).

2.6 Lean Suppliers

Establishing a supportive partnership with the supplier with open communication aimed towards removing waste and cost reduction. Suppliers should be educated to satisfy end customer needs. Mutual understanding and trust are two main pre-requisites to partnership. Following are the characteristics of lean suppliers:

- Removal of unnecessary activities like inspection and paperwork.
- Reduction in in-plant inventory by delivering directly to concerned department
- Reduction of in-transit inventory

- Improvement of quality and reliability (on time deliveries)

2.7 Lean Layout

Better layout reduces the waste of movement on factory floor which adds no value to the product. Layouts should be flexible to reduce movement of people and material. Following are the characteristics of a flexible layout:

- Distance reduction through work cells for families of products, Group technology, U-shaped assembly line and multi-operation machines.
- Increased flexibility in machines to adjust for changes in volume, product improvement and new designs. Moveable and modular equipment is used for increased flexibility. Workers are cross-trained to add flexibility.
- Improved employee communication results in efficiency and opportunities for improvement.
- Reduced space and inventory due to distance reduction.

2.8 Lean Inventory

Inventory is a waste which adds to cost of the process. In lean system inventories are required to be at minimal level. Inventory can be reduced by using a pull system, ordering small lots and JIT delivery methods. Lean inventory has following characteristics:

- Reduced variability in production by uncovering problems
- Reduced setup cost and time

2.9 Lean Scheduling

Lean system requires effective schedules be communicated within the organization and to the suppliers. Better schedules can be achieved by level scheduling, Kanban's, freezing part of schedule and seeking one-piece-make and one-piece-move. Scheduling characteristics are:

- Improved ability to meet customer demand
- Inventory reduction through smaller lot sizes
- Reduced work-in-process

2.10 Lean Maintenance

Equipment maintenance is another important part of lean system. It requires daily scheduled maintenance. It is operator's responsibility to maintain its workstation and equipment. Operator should follow the instructions from manual, keep the equipment clean and report performance. Equipment maintenance results in:

- Empowered employees and involvement in the process
- Equipment ownership
- Standards for measuring equipment effectiveness

2.11 Lean Quality

Unlike mass production, lean ensure quality within all processes and products through process control, fail-safe methods like poka-yoke and employee empowerment. Lean quality characteristics are:

- Reduction in cost of good quality by reduction in inventory, as inventory hides bad quality and lean exposes it.
- Improved quality because of early warning system for quality problems

2.12 Lean Empowerment

Employee empowerment is vital for the continuous improvement process in lean system. As employees know more about their job than anyone else so they should be given power to make changes for the improvement of process and product quality. Job should be made challenging through constantly improving job design and increasing responsibility. Employee empowerment gives:

- Flexibility in the system

- Ideas for quality improvement, process improvement and reduction in setup time

2.13 Lean Commitment

Commitment of all stakeholders is necessary for the implementation of a lean system. Lean system requires support of management, employees and suppliers. They all should be integrated in a system for better process. Success requires full commitment and complete involvement of all the team member.

2.14 Lean Tools

Lean tools help organizations to transform from mass producers to lean exemplars. Lean has a very extensive collection of tools and concepts. Any organization can start with implementing a tool that best resonates with the culture. The attraction of these tools is that they can be implemented in isolation without changing the whole organization and management approach. They can be implemented by staff improvement teams or outside consultants at many points within an organization (Jim Womack).
Some of the most widely tools used for lean implementation are:

2.14.1 5S

Its purpose is to quickly see if anything is abnormal at workplace. It eliminates waste resulting from poorly organized work area.
Elements of 5S are:

a. SEIRI- Sort (eliminate which is not needed)
b. SEITON- Straighten (organize remaining items)
c. SEISO – Shine (clean and inspect work area)
d. SEIKETSU – Standardize (make standards for above)
e. SHITSUKE – Sustain (regularly apply these standards)

All benefits of 5S fall within lean methods as they eliminate wastes in one form or another.

- Improves efficiency & productivity
- Better quality and shorter lead times
- Responsible workers
- Positive impression on customers

2.14.2 Just In Time

Just-In-Time (JIT) is a tool for forced problem solving. JIT supports lean production through pull system and provides/produce necessary amount of product at the right place and at the right time. Goal of JIT is to reduce waste and variability, continuous improvement and provide flexibility. JIT ensures minimum inventory, deliveries in small quantities, small lot sizes, short setup runs and long term partnership with few vendors. Advantages of JIT include:

2.14.3 Kanban

Kanban is a Japanese word meaning “signal” or “visual card”. It is a scheduling system for determining what, when and how much to produce. Kanban orders small lot sizes through pull system. A card is the authorization of nest container of material to be produced. There are many types for kanban e.g. P-Kanban for production authorization, T-Kanban for transportation similarly material and supplier kanbans.
A card is normally used when both producer and customer are not is direct contact. When there is a visual contact a light, flag or an empty floor is enough.

2.14.4 Kaizen

Kaizen is referred as continual improvement process involving all employees to work together for achieving continuous improvements on regular basis in the processes. The idea is to combine all talents to build a system for eliminating all wastages.

2.14.5 PDCA

It is an iterative methodology for implementing improvements. It was proposed by Deming as PDCA cycle.

- Plan (establish plan and expected results)
- Do (implement plan)
- Check (verify expected results achieved)
- Act (review and assess; do it again)

2.14.6 Poka-Yoke

Poka-Yoke is an automated device for the detection of errors/rejected items. It is very time consuming and tedious job to find the defects through inspection, Poke-yoke error detection and prevention method are designed for the production process to achieve the goal of zero defects.

2.14.7 SMED

Single Minute Exchange of Die (SMED) is a setup time reduction tool. It reduced setup time (change over) to less than 10 minutes by following three steps:

a. Identify the external and internal changeover activities (where internal activities require production to stop)
b. Shift activities, as many as possible, from internal to external activities
c. Streamline the remaining internal activities.

3. Analysis of Lean Manufacturing System

Like most management systems lean manufacturing has both: advantages and disadvantages. It is important to analyze the system by its strengths and weaknesses. The idea is to give a clear picture of the system and help organizations to choose the system or any tool carefully. Let first look at the strengths of lean system:

3.1 Strengths

Implementing Lean manufacturing has immense benefits to the business and these benefits are sustainable if it is integrated into the culture and slowly shifted towards lean thinking. By implementing lean system, an organization may gain following benefits:

1. Its efficiency increases more rapidly, competitive cost and quick customer response.
2. Its inventory level will be minimize because it allows a firm to work on just-in-time basis that ultimately reduces inventory and holding costs.
3. Useful approach to operational, administrative and strategic improvement
4. Provides a major competitive advantage over traditional processes
5. Improves morale and participation of employees
6. Encourages innovation
7. Reduces the cash tied up in stock and borrowing from bank by reducing the amount of WIP and finished goods
8. Reduced waste and defects reduces cost and adds to profits

3.2 Weaknesses

Lean, although most appreciated by experts and widely used, has some weaknesses too. It is not necessary that all organizations will face problems while implementing lean but it is vital for an organization to predict when problems may occur with the lean system and do detailed planning. Some of the weaknesses that became problems for the organizations are:

1. Interdependent processes make the supply chain very costly and less responsive.

2. There may be risks associated in situation like worker strikes, stock outs, market fluctuations, interrupted production and supply lines, and communication gap in supply chain system.
3. There may be not enough buffer inventories to make the system running.
4. Does not work in unstable and unpredictable customer demands
5. Communication breakdown at any level disrupts the whole process
6. Health and safety issues due to repetitive tasks
7. High cost of implementation due to expensive machinery and training sessions
8. Difficult to measure the extent of implementation within the organization

4. Transformational leadership and lean status

Bass (1985) has defined transformational leadership as those leaders who have a good vision, metaphoric, and excellent impression management talents, and they use these expertise's to build strong emotional relationships with their followers. Burns (1978) also defined transformational leadership as a process through which 'leaders and followers raise one another to higher levels of morality and motivation'. Transformational leaders look for raising the perception of followers to better ideals and good moral values like freedom, justice, fairness, peace, and caring, and not to negative emotions like fear, greed, resentment, or hatred. Krishnan (2001) research found that extra ordinary performance by followers is achievable only by motivating and inspiring followers through transformational leaders. Extra ordinary performance by followers is achievable only by transforming followers' ideals, feelings, and motives from a lower to higher levels of encouragement and development.

5. Research Context

For exploring the link between transformational leadership and lean system, a survey was conducted in five different manufacturing organizations. Leaders were indentified in terms of transformational leadership characteristics using Podsakoff et al. (1990), questionnaire to measure transformational leadership characteristics, which was composed of 23 questions to be answered by followers about their leaders. Eighty nine followers from five manufacturing organizations were requested to respond to the transformational leadership questionnaire and it was analyzed to identify transformational leaders. A total of thirty eight leaders were identified as transformational leaders using Podsakoff et al., questionnaire who have high transformational leadership qualities. Twenty nine leaders were termed as non-transformational leaders and rest of them were on the border line between transformational and non-transformational leaders. The objective for doing this is to explore successful implementation of lean system in manufacturing organizations, although in most of the manufacturing organization in spite of doing/completing all the pre-requite of lean philosophy, most of the manufacturing organization are not able to achieve lean status.

6. Results and conclusion

It has been observed that organizations where transformational leaders were working, lean system was successful and implemented. Followers were more responsive to lean concept by making minimum wastages in their work, reduced rejection, rework and transportation. It was observed that organizations where transformational leaders were employed at the shop floor were facing little or no hurdle in implementing lean concept and their productivity and profitability was better than non-transformational leaders were employed. In the lights of the results, it can be concluded that to achieve the lean status, transformational leaders are one of the key to successfully implement the lean concept in manufacturing organizations to minimize waste and improve productivity. It was also found by Natasa Vujica (2014) that one of the key factor of success of lean system lies in the human resources of a company. From the results of this research, a lean implementation model is developed as depicted in figure-2.

Figure-2: Lean Implementation Model

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Biography

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