

Implementation of Lean Manufacturing Principles in Auto Industry

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Abstract

Lean manufacturing is defined as a systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection. This paper describes some learning from the literature and actual practices in USA, UK, and India. Attempts are made to present the gaps between the principles and practices. Some pertinent propositions are put forth to enrich the knowledge base of professionals to make the implementation process more pragmatic and robust in the long run and for furtherance of empirical research by academics.

1. Review of implementation of lean principles in auto industry

Lean manufacturing is a performance-based process used in manufacturing organizations to increase competitive advantage. The basics of lean manufacturing employ continuous improvement processes to focus on the elimination of waste or non value added steps within an organization. The challenge to organizations utilizing lean manufacturing is to create a culture that will create and sustain long-term commitment from top management through the entire workforce. Lean manufacturing techniques are based on the application of five principles to guide management's actions toward success:

1. **Value:** The foundation for the value stream that defines what the customer is willing to pay for.
2. **The Value Stream:** The mapping and identifying of all the specific actions required to eliminate the non-value activities from design concept to customer usage.
3. **Flow:** The elimination of all process stoppages to make the value stream "flow" without interruptions.
4. **Pull:** The ability to streamline products and processes from concept through customer usage.
5. **Perfection:** The ability to advocate doing things right the first time through the application of continuous improvement efforts.

2. The Four Thrusts of Lean Manufacturing: Lean manufacturing organizations focus on four thrusts to support their lean manufacturing designs:

I. Solid leadership that:

- Communicates the vision.
- Facilitates and models the behaviors of lean manufacturing.
- Sets the standards for the organization.

- Assists the workforce in adapting to the change.
- Builds trust and inspires commitment.
- Coaches and develops the workforce.
- Constantly challenges the system.

II. Team-based cultures that:

- Use project-oriented, team-based structures that focus on empowerment concepts.
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- Leverage knowledge by using highly skilled workers.
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- Promote employee accountability and responsibility for work.
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- Advocate the continual development of the workforce.
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- Value diversity.
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- Believe that employee ownership of the final product is shared throughout the process.

III Communication systems that:

- Advocate and develop processes to identify critical design issues as early in the process as possible.
- Encourage “on-the-spot” decision-making processes that use the fewest resources to resolve critical design issues.
- Promote knowledge sharing between hourly workers, management, and design personnel.
- Drive the behaviors of internal operations, as well as focus on the behaviors of suppliers and customers.
- Accept formal and informal communication behaviors.

IV. Simultaneous development and continuous Improvement processes that:

- Design the product right the first time.
- Use continuous improvement processes to identify the non-value-added problems.
- Drive commitment to eliminating problems (controlling them is not enough).
- Advocate just-in-time material control systems.
- Promote constant improvement throughout the supply chain.
- Leverage the knowledge of the organization with the knowledge bases of suppliers and customers.
- Continually train and develop highly skilled workers.
- Use scoreboards or measurement systems to monitor progress.

Lean manufacturing processes are being used predominantly in the automotive industry. Toyota Motor Company, considered the leader in lean manufacturing techniques, started using the techniques during the 1950s and 1960s. They have since built their reputation as quality leaders and boast one of the fastest growing market shares in the automotive industry.

Manufacturers using lean manufacturing include:

Automotive Industry:

- Toyota Motor Company Toyota Production System
- Ford Motor Company The Ford Production System
- Chrysler Chrysler Operating System
- Porsche The Porsche Improvement Process
- General Motors NUMMI joint venture with Toyota

Other Industries:

- Pratt & Whitney, United Technologies Jet engine manufacturers
- Showa Manufacturing Radiator and boiler manufacturers
- Lifescan, Inc. a subsidiary of Johnson & Johnson Electronic Products
- Lantech Corporation Packaging Machines (stretch wrapping products)
- Wiremold Company Wire management systems (electronic transfer)

Results of Lean Manufacturing

Lantech Corporation

- New product development time reduced from 3 to 4 years to 1 year
- Employee hours per machine reduced by 50 percent
- Defects per machine reduced from 8.0 to 0.8
- In-process and finished goods inventory values reduced from \$2.6 million to \$1.9 million
- Product delivery lead time reduced from 4 to 20 weeks to 1 to 4 weeks

Wiremold Company

- Product development time-to-market reduced by 75 percent
-
- Receipt and fulfillment of order time reduced from more than one week to less than one day
-

- Amount of plant space needed reduced by 50 percent
-
- Time for raw material to shipping dock reduced from 4 to 6 weeks to 1 to 2 days
-
- Productivity up 160 percent over three years
-
- Sales per employee more than doubled from 1990 to 1995
-
- Number of suppliers reduced from 320 to 73
-
- Inventory turns increased from 3.4 to 15.0

The lean manufacturing as a set of principles is now fairly rooted in the literature. The principles behind lean manufacturing are not in themselves new; many of them can be traced back to the work of pioneers such as (Deming, 1986; Taylor, 1911; Skinner, 1969). Although the concept of lean as now understood could have modeled from this literature, it was not until the Japanese auto industry was studied, that the total concept became clear.

Indeed lean manufacture has been extended to encompass the whole spectrum of activities in the business such that world-class companies, in particular the automotive and electronic sectors are seeking to become lean enterprises. While there are some voices of discontent (Gordon, 1995; Berggren, 1992) to the adoption and ultimate effectiveness of lean production, nonetheless many case examples exist to demonstrate how companies are changing their production methods and management practices to become leaner.

In the mid-1980's, U.S. auto industry was in crisis. It was rapidly losing market share to Japanese competitors. The Japanese automakers were able to make better quality cars with fewer defects resulting in better customer satisfaction and thereby creating an image of excellence across the globe. Toyota Motor Company, which despite 1973 oil crisis increased its earnings, was able to continue increase its market share. Even today, Toyota is one of the world's most successful automakers that have perpetually outperformed their competitors in terms of quality, reliability, cost, delivery, after sales service etc. Japanese manufacturing systems have been rigorously researched by global academia.

The famous book "The Machine That Changed the World" written by Womack, Jones, and Ross (1990) awoke the US manufacturers. Over the last two decades, many researchers have studied Toyota Production System (TPS) and have documented various principles and practices used by Toyota (Womack and Jones, 1994; Liker, 1998; Adler, 1993, Spear and Bowen, 1999; Sobek et al. 1998). Researchers, who studied and documented TPS in the 1980's, termed the total approach as "lean manufacturing" although the principles behind lean are not in themselves new; which can be traced back to the work of pioneers such as (Deming, 1986; Taylor, 1911; Skinner, 1969); because of its ability to attain and realise so much more in terms of final outcomes with the deployment of fewer resources. The ideas were adopted because the Japanese companies developed, produced, and distributed products with less human effort, capital investment, floor space, tools, materials, time, and overall expenses (Womack et al., 1990).

Lean manufacturing was accepted as an innovative paradigm-that eliminates waste in any form, anywhere and at any time, relentlessly strives to maintain harmony in the flow of materials and information, and continually attempts to attain perfection. Ohno (1988), Shingo (1989), Womack et al. (1990), Monden (1997) and many other researchers made wide ranging contributions to popularize the lean approach. Stunned by the Japanese growth, many companies in the US and developed countries pursued ways to develop and make products more quickly and efficiently, tried very hard to imitate or implement TPS.

These manufactures started using various tools and shop-floor practices identified as key elements of lean approach such as Just-in-time, Kanban, setup time reduction, production leveling, production cells, quality circles etc. Strangely, despite their power and ability to greatly improve operational performance, these tools have not been very effective in lean implementation.

Many of the companies that report initial gains from lean implementation often find that improvements remain localized, and the companies are unable to have continuous improvements going on. One of the reasons, we believe, is that many companies or individual managers who adopted lean approach have incomplete understanding and, as a result, could not be able to gain all the benefits as Toyota enjoys. Frustrated by their inability to replicate Toyota's performance, these companies assume that secret of Toyota's success lies in its cultural roots.

But Toyota has successfully introduced its production system all around the world, including in USA, and New United Motor Manufacturing Inc. (NUMMI) is a well known example to narrate the success story (Adler 1993). The objective of this paper is to report some learning by way of understanding and evaluating the lean implementation practices in some major companies in India, USA, and UK.

Stemming from the view of lean manufacturing, as an area of professional practice, there is a need yet to define lean approach: the content or subject matter of implementation. This consists chiefly of the models, methods and techniques, tools, skills and other forms of knowledge that go into making up any practice.

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