

# Impact of Lean Manufacturing in Business Excellence

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## Abstract

*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. The objective of this research was to identify the problems associated with the manufacturing processes in different industries using Lean Manufacturing and to prepare guidelines for Indian managers in manufacturing industry. The main impacts found are unwanted wastage of raw materials, increased cycle times and decreased labour productivity.*

*Key words : Lean manufacturing, TPS, Just-in-Time, Kanban, Cycle time, Continuous improvement, labour productivity*

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## INTRODUCTION :

### History and evolution of lean manufacturing :

Japanese structure their development programs tightly and use targets and prototype to keep suppliers in line. Japanese set clear, and understandable goals and communicate them consistently to suppliers, and use schedules and targets as major coordinating mechanism. Toyota and others treat suppliers based on their capability and mutual alignment, not blind trust, is what binds important suppliers to customers. Interestingly, many of lean tools and practices are actually similar to those that US companies employed during their manufacturing prime and, in fact, Toyota imported these ideas from US only and put them into practice. The idea is to link breakthroughs of individual companies, in terms of lean techniques, up and down the value chain to form a continuous value stream.

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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. (Monden Y., 1983).

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.

The inability of US manufacturers to imitate lean manufacturing approach and failure to match Toyota's performance, prompted new generation of researchers to do in-depth study of TPS in order to decode and uncover the secrets of success.

Some researchers made attempts studying various aspects of TPS in order to identify and uncover basic truths of lean manufacturing. It can be inferred that the innovative aspects of TPS are not merely the use of Kanban , JIT, inventory reduction, setup reduction, or any other individual tool. Rather, the backbone of TPS is the processes by which Toyota designs its production system-that is development by cross-functional product development teams; integration of all ideas in the early design stages, thus reducing time and cost, and optimizing the overall manufacturing process.

This project consists chiefly of the models, methods and techniques, tools, skills and other forms of knowledge that go into making up any practice.

### **LITERATURE REVIEW :**

Shah R., Ward P .T., (2003) studied the impact of three factors plant size, plant age and unionization status which are key elements of lean manufacturing systems. They formed four inter connected and consistent practices; just-in-time (JIT), total quality management (TQM), total preventive maintenance (TPM), and human resource management (HRM). This study collected data from *IndustryWeek's* Census of Manufacturers. They found that there is strong impact of plant size on lean implementation, but the impact of unionization and plant age are not so effective than the existing propositions. Their results showed that the three factors have major contribution to the operating performance of plants.

This paper brings out the relationships between lean manufacturing practices, environmental management and business performance outcomes. The findings suggest that prior lean manufacturing experiences are positively related to environmental management practices. Environmental management practices alone are disproportionally related to market and financial performance. However, improved environmental performance substantially reduces the negative impact of environmental management practices on market and financial performance. They found that environmental management practices became an important factor to resolve the conflicts between lean manufacturing and environmental performance. They also found that gaps existed in terms of the strengths and statistical significance of some of the proposed relationships (Ma Ga (Mark) Yang et all., 2011).

Factor analysis followed by regression analysis carried out by Shahram Taj, Cristian Morosan, (2011) showed that three lean performance factors flow, flexibility, and quality had high relation to operations practice and production system design and the performances of all industries in China was good in quality.

Over the last two decades, many researchers have studied Toyota Production System (TPS) and have documented various principles and practices used by Toyota. 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 because of its ability to attain and realize 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 . 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. 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 (Monden Y., 1983).

### **Lean manufacturing**

Lean manufacturing is not a collection of best practices from which manufacturers can pick and choose. It is a production philosophy, a way of conceptualizing the manufacturing process from raw material to finished goods and from design concept to customer satisfaction. Lean is truly a different way of thinking about manufacturing

### **Key principles behind lean manufacturing**

According to Conner G. (2001) the key principles of lean manufacturing are

- **Recognition of waste** – The first step is to recognize what does and does not create value from the customer's perspective. Any material, process or feature which is not required for creating value from the customer's perspective is waste and should be eliminated. For

example, transporting materials between workstations is waste because it can potentially be eliminated.

- **Standard processes** – Lean requires an the implementation of very detailed production guidelines, called Standard Work, which clearly state the content, sequence, timing and outcome of all actions by workers. This eliminates variation in the way that workers perform their tasks.
- **Continuous flow** – Lean usually aims for the implementation of a continuous production flow free of bottlenecks, interruption, detours, backflows or waiting. When this is successfully implemented, the production cycle time can be reduced by as much as 90%.
- **Pull-production** – Also called Just-in-Time (JIT), Pull-production aims to produce only what is needed, when it is needed. Production is pulled by the downstream workstation so that each workstation should only produce what is requested by the next workstation.
- **Quality at the Source** – Lean aims for defects to be eliminated at the source and for quality inspection to be done by the workers as part of the in-line production process.
- **Continuous improvement** – Lean requires striving for perfection by continually removing layers of waste as they are uncovered. This in turn requires a high level of worker involvement in the continuous improvement process.

### Key implications of lean manufacturing

As mentioned by Conner G. (2001) the key implications of lean manufacturing are :

	<b>TRADITIONAL BATCH MANUFACTURING</b>	<b>LEAN MANUFACTURING</b>
Orientation planning	Supply driven	Customer driven
Batch size	Large	Small
Quality inspection	Checking of samples by QC inspectors	Inline inspection by workers
Inventory	Buffer of WIP at each stage	Little or WIP at each stage
Hand-of works	Material after each stage accumulate	Materials handed off directly from one

## RESEARCH OBJECTIVES :

1. To identify the problems associated with the manufacturing processes indifferent industries using Lean Manufacturing.
2. To compare mass production with lean production
3. To prepare guidelines for Indian managers in manufacturing industry

## FINDINGS :

### Major impacts of lean manufacturing

- **Defects and wastage** - Reduce defects and unnecessary physical wastage, including excess use of raw material inputs, preventable defects, costs associated with reprocessing defective items, and unnecessary product characteristics which are not required by customers.
- **Cycle Times** - Reduce manufacturing lead times and production cycle times by reducing waiting times between processing stages, as well as process preparation times and product/model conversion times.
- **Inventory levels** - Minimize inventory levels at all stages of production, particularly works-in-progress between production stages. Lower inventories also mean lower working capital requirements.
- **Labor productivity** - Improve labor productivity, both by reducing the idle time of workers and ensuring that when workers are working, they are using their effort as productively as possible (including not doing unnecessary tasks or unnecessary motions).
- **Utilization of equipment and space** - Use equipment and manufacturing space more efficiently by eliminating bottlenecks and maximizing the rate of production through existing equipment, while minimizing machine downtime.
- **Flexibility** - Have the ability to produce a more flexible range of products with minimum changeover costs and changeover time.
- **Output** – Insofar as reduced cycle times, increased labor productivity and elimination of bottlenecks and machine downtime can be achieved, companies can generally significantly increased output from their existing facilities.

**Manufacturers using lean manufacturing include:**

**Automobile Industry:**

- Toyota Motor Company - Toyota Production System
- Ford Motor Company - The Ford Production System
- Chrysler - Chrysler Operating System
- 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)

**Mass Production Vs Lean Production**

According to Conner G. (2001) :

	<u>MASS PRODUCTION</u>	<u>LEAN PRODUCTION</u>
Basis	Henry Ford	Toyota
People design	Narrowly skilled professionals	Teams of multi-skilled workers at all levels in the organization
People doing production	Unskilled or semi-skilled workers	Teams of multi-skilled workers at all levels in the organization
Equipment	Expensive, single-purpose machines	Manual and automated systems which can produce large volumes with large product variety
Production methods	Make high volumes of standardized products	Make products which the customer has ordered
Philosophy	Aim for 'good enough'	Aim for 'perfection'

## CONCLUSION :

- Over 75 per cent of the companies claimed to have implemented lean manufacturing or similar approaches and around 15 per cent are actively engaged in implementation process.
- Most manufactures are still a long way to go to attain Toyota's level of performance, and literature survey also shows that there are very few companies who have successfully imitated Toyota's lean approach.
- Another interesting observation was that four important lean principles, i.e., teaching and learning, pursuit of perfection, functional expertise and stability, and cultivating organizational knowledge, which are generally considered as building blocks for organizational transformation are not on the high priority and only 60 per cent organizations have recognized their importance.
- To manage outside suppliers, Indians automakers are also trying their best to have very tight relationship.
- The in-depth study reveals that very few organizations claim to have ideal goal set for achieving excellence in world market. Majority of organization are struggling to stay in business by adopting drastic cost cutting measures and frequently changing their business focus rather than setting ideal goals to achieve.

## DISCUSSION

### Learning for Indian companies

In Indian companies, we could observe the following factors as the major impediments in promoting lean manufacturing-

- Power politics between various functional departments
- Low investment in human resource development
- Short term interests of business leaders
- Quick-fix expectations and shallow thinking of most managers

Some well established auto manufacturing companies have achieved the following:

- Reducing cycle time and customer reducing inventory
- Improving productivity



- Reducing material cost
- Improving performance of the employees
- Effective supplier and dealer networking
- Multi-skilled workforce

### **Changes after implementation 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

### **RECOMMENDATION**

- Managers and supervisors need to play role of facilitators, get involved in problem solving projects and work along with subordinates to enhance the learning of whole team rather than demonstrating her/his authority.
- Most companies seriously need to curtail the tendency of making changes for the sake of changing the existing procedures. Companies seriously need to rein in this tendency and

inculcate the scientific methods at all levels of the workforce by involvement of managers and supervisors in problem-solving projects.

- In order to excel in world market, any organization needs to transform itself into a learning organization. The answer is in the professional practice, which requires pragmatic acculturation and corporate discipline by making people capable of and responsible for learning by doing and improving their own work.

### **GUIDELINES FOR INDIAN MANAGERS**

- Establish a clear sense of direction for lean manufacturing
- Open communication and continuing education
- Reduce bureaucracy
- Instill a sense of ownership
- A tolerance for risk and failure

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