Lean Manufacturing Initiatives to Ensure TQM

Binod Kumar Singh, Research Scholar ,
Indian School of Mines University, Dhanbad-826004, India
Email: singh_binod_kumar@yahoo.com

Dr Chandan Bhar, Professor and Head,
Department of Management Studies
Indian School of Mines University, Dhanbad-826004, India
Email: chandanbhar@hotmail.com

Dr Visvesvaran Pandurangan Professor,
Department of Mechanical Engineering,
Galgotias College of Engineering and Technology
Greater Noida 201306, India
Email: visupan@yahoo.com

ABSTRACT

This paper addresses a framework for studying lean thinking, as well as principles of TQM. We focus on the 5 principles of lean production and the 8 types of waste, in order to find out the applications of lean principles to ensure the Total Quality Management (TQM). We conclude that waste exists in any organization and lean thinking seems to be a useful tool for reducing the different types of waste and in this way improving quality in order to achieve TQM objectives. The results of this research reveal that Total Quality Management and Lean Manufacturing have much in common. Based on Lean strategies, Total Quality Management, similar to numerous improvement approaches, can be a tool to support and create synergy for inducing a more competitive market among companies.

KEYWORDS: ***Lean Production, TQM, Waste.***

1.) INTRODUCTION

After World War II Japanese manufactures were faced with the dilemma of vast shortages of material, financial, and human resources. The problems that Japanese manufacturers were faced with differed from those of their Western counterparts. These conditions resulted in the birth of the "lean" manufacturing concept. Toyota Motor Company, led by its president Toyoda recognized that American automakers of that era were out-producing their Japanese Counterparts; in the mid-1940s American companies were outperforming their Japanese Counterparts by a factor of ten. In order to make a move towards improvement, early Japanese leaders such as Toyoda Kiichiro, Shigeo Shingo, and Taiichi Ohno devised a new, discipline, Process-oriented system, which is known today as the "Toyota Production System," or "Lean Manufacturing." Taiichi Ohno, who was given the task of developing a system that would enhance productivity at Toyota, is generally considered to be the primary force behind this system. Ohno drew upon some ideas from the West and particularly from Henry Ford‟s book "Today and tomorrow". Ford‟s moving assembly line of continuously flowing material formed the basis for the Toyota Production System. After some experimentation, the Toyota Production System was developed and refined between 1945 and 1970, and is still growing today all over the world. The basic underlying idea of this system is to minimize the consumption of resources that add no value to a product. In order to complete in today's fiercely competitive market; US manufacturers have come to realize that the traditional mass production concept has to be adapted to the new ideas of lean manufacturing. A study that was done at the Massachusetts Institute of Technology of the movement from mass production toward lean manufacturing, as explained in the book "The Machine That Changed the World" [Womach et. Al., (1990)], awoke the US manufacturers from their sleep. The study underscored the great success of Toyota at NUMMI (New United Motor Manufacturing Inc.) and brought out the huge gap that existed between the Japanese and Western automotive industry. The ideas came to be adopted in the US because the Japanese companies developed, produced and distributed products with half or less human effort, Capital investment, floor space, tools, materials, time, and overall expense (Womack et al., 1990).

Lean manufacturing has been increasingly adopted as a potential solution for many organizations, particularly within the automotive [Jone] and aerospace manufacturing industries. Lean manufacturing derives its name from the manufacturing systems and processes of the Toyota production system that are so effective at producing at low cost and short cycle time. These systems are highly flexible and responsive to customer requirements. Lean manufacturing is a

multi-dimensional approach that encompasses a wide variety of /management practices, including just-in-time, quality systems, work teams, cellular manufacturing, supplier management etc. in an integrated system. The core thrust of lean production is that these practices can work synergistically to create a streamlined, high quality system that produces finished products at the pace of customer demand with little or no waste [Shan & Ward, (2003)].Lean manufacturing also called lean Production is a set of tools and methodologies that aims for continuous elimination of all waste in the Production process. The main benefits of this are lower production costs; increased output and shorter production lead times. More specifically, some of the goals include defects and wastage, cycle times, inventory levels, standard processes, continuous flow, pull production, quality at the source, continuous improvement.

It is well known that lean manufacturing had been influenced by many techniques and school of thoughts. One such management thinking is TQM or Total Quality Management influence of TQM on lean manufacturing is very large therefore many techniques are common to both lean manufacturing and TQM .In lean manufacturing, we can discuss TQM as one of its prime tools used to achieve its objective. Many of TQM gurus like Deming and Juran played a major role in shaping Toyota Production System (TPS). SO, it is worth learning, some of the total quality management techniques and tools which are commonly used in lean manufacturing. It is said that lean manufacturing can bring all the results TQM alone can bring quickly. A baseline technical definition of what TQM is all about has been given by the American Federal Office of Management Budget circular (cited in Milakovich, 1990, p.209) TQM is a total organizational approach for meeting customer needs and expectations that involves all managers and employees in using quantitative methods to improve continuously the organization's processes, products and services.TQM is an attempt to improve the whole organization's competitiveness, effectiveness and structure.

2. LITERATURE REVIEW

In recent times due to increase in global competition, scarce resources, and fluctuating economics it is not surprising that lean production has become critical to the long term survival of today's manufacturing organizations. Lean is a management philosophy focused on identifying and eliminating waste throughout a product's entire value stream, extending not only within the organization but also along the organization supply chain network. Lean is achieved through a set of mutually reinforcing practices, including Just-In-Time (JIT),Total quality management (TQM),Total productive maintenance (TPM),Continuous Improvement ,Design For Manufacturing and Assembly (DFMA),Supply Management, and Effective Human resource management. After having gone through the literature available on the present topic it has been concluded that major manufacturing industries in the developed countries have been trying to adopt new manufacturing initiatives in order to stay alive in the new competitive market place. Lean manufacturing is one of these initiatives that focus on cost reduction by identifying and eliminating non value added activities. In developed countries work is being carried out on successful implementation of lean manufacturing in totality but such studies have not evidenced in Indian context. In Indian industry a lot of scope is there to improve inventory control, reduce lead time, reduce set up time and improve the availability of machines etc which will lead to competitiveness of Indian industry. In present study an attempt will be made to correlate lean manufacturing and TQM. In a 2004 survey by Industry Week Magazine, U.S. companies implementing lean manufacturing reported a savings of 7% of Cost of Goods sold (COGS) as a result of implementing lean. Another way of looking at Lean Manufacturing is that it aims to achieve the same output with less input, less time, less space, less human effort, less machinery, less material, less cost. When a U.S. equipment manufacturing company, ManTech, completed the implementation of lean in 1995, they reported the following improvements compared to their batch-based system in 1991. [Womack et. Al., (1996)].

Manufacturing space per machine was reduced by 45%

Defects were reduced by 90%

Production cycle time was reduced from 16 weeks to 5 weeks -14 hours; and

Product delivery lead-time was reduced from 4-20 weeks to 1-4 weeks.

Many lean manufacturers intentionally maintain certain inventories of raw materials, semi-finished products and finished products in order to: Protect against variations in customer demand; Protect against unexpected late shipments from suppliers or production slowdowns; Smooth production flow by producing some items on a continuous basis even if not required by the customer; Accommodate the fact that raw materials must be delivered in batches and that finished products must be shipped in batches; Accommodate the fact that some processing must be done in batches due to the nature of the equipment or the process. Replenishment pull is more common when a company has a large number of small volume customers who order standardized products. In a replenishment pull system, production schedules are more predicable so low inventories of raw materials are required.

3. LEAN MANUFACTURING CONCEPTS

Lean manufacturing concepts are fundamentally different from the conventional manufacturing concepts. These are proven to be correct for past six decades.

3.1 VALUE CREATION AND WASTE

In Lean Manufacturing, the value of a product is defined solely based on what the customer actually requires and is

willing to pay for. Production operations can be grouped into following three types of activities:

Value-added activities are those activities, which transform the materials into the exact product that the customer requires.

Non value-added activities are activities, which aren't required for transforming the materials into the product that the customer wants. Anything, which is non-value-added, may be defined as waste. Anything that adds unnecessary time, effort or cost is considered non value-added. Another way of looking at waste is that it is any material or activity for which the customer is not willing to pay. Testing or inspecting materials is also considered waste since this can be eliminated insofar as the production process can be improved to eliminate defects from occurring.

Research at Lean Enterprise Research Centre (LERC) in the United Kingdom indicated that for a typical manufacturing company the ratio of activities could be broken down as follows [Hines P. et al, (2000)].

Activities	Breakdown (%)
Value-added activities	05
Non value-added activities	60
Necessary non value-added activities	35
Total Activities	100

Table 1 (Breakdown of activities)

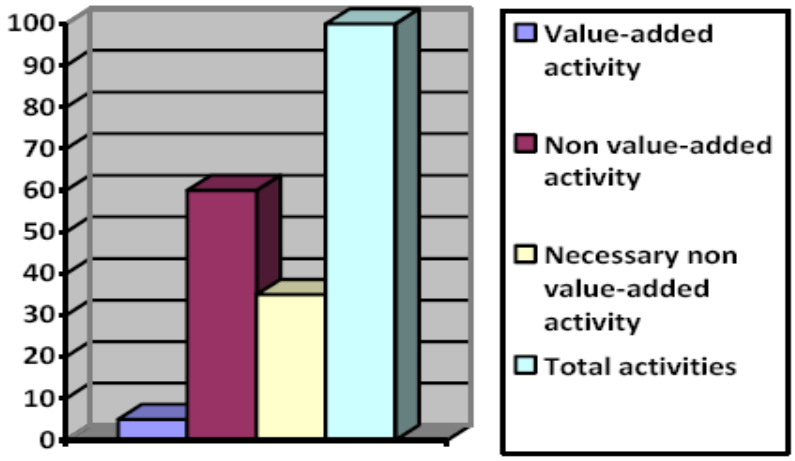

Figure 1 (Breakdown of activities)

3.2 FIVE PRINCIPLES OF LEAN (Womack and Rrse, 1996):

Value– The traditional definition of value is the end product that the customer purchases. In the Lean model, value is not just the end product, but the chain of activities that are required to perform in order to produce and end product/end services to be delivered to the customer.

Value Stream – Value is identified through value stream mapping (VSM).This stream is comprised of each step that is performed from raw materials to end product and every step is designed ,in order to fulfill customer expectations at minimum price. Every role, functions, and responsibilities are designed to make the delivery mechanism more responsive with, minimum resources.

Flow – Flow is the efficiency of the process that transforms raw material into an end product. This involves analyzing every step in the process that touches and does not touch the end product and goal is to provide a continuous flow without any bottlenecks.

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.

Perfection – The improvements in the identification of value, the analysis and flow of the value stream, and the pulled product/service can be felt and seen at the all levels of the organization.

3.3 WASTAGES IN LEAN MANUFACTURING (MUDA)

In the book „Lean Thinking" (Womack and Jones, 1996) the very first word is interestingly the Japanese word for waste ('muda') and it is concluded that muda is everywhere. Generally manufacturers agree that there exist 8 types of 'muda', which are waste absorbing resources that create cost but no value. In any organization it is believed that the 8 types of waste exist. Taiichi Ohno (1912-1990), a Toyota executive identified seven types of waste found in any process:

Transportation: - Unnecessary transport of parts under production

Inventory: - Stacks of parts waiting to be completed or finished products waiting to be shipped.

Motion: - Unnecessary movement of people working on product

Waiting: - Unnecessary waiting by people to begin the next step

Over-processing: - Over-processing the products with extra steps

Over-production: - Over-production of products not needed

Defects:-Defects in any products.

Some authors have added an eighth waste as goods and services do not meet the customer's need and someone has added underutilization of people.

3.4. OBJECTIVES OF LEAN MANUFACTURING

Lean manufacturing, also called Lean Production, is a set of tools and methodologies that aims for the continuous elimination of all waste in the production process. The main benefits of this are lower production costs; increased output and shorter production lead times. More specifically, some of the goals include.

Defects and wastage - Reduce defects and unnecessary physical wastage, including excess use of raw material inputs, preventable defects, and 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 work-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 productivity 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 though 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, increase labor productivity and elimination of bottlenecks and machine downtime can be achieved, companies can, generally increase output from their existing facilities.

4. TOTAL QUALITY MANAGEMENT

Definitions and Concept of TQM: A variety of definitions of TQM have been offered over the years. Reviewing previous contributions a dominant insight among experts seems to define TQM as an approach to management characterized by some guiding principles of core concepts that embody the way the organization is expected to operate, which, when effectively linked together, will lead to high performance. Although there are some differences of opinion, there is a general agreement regarding the assumptions included in the TQM concept that can be summarized in three main points.

Firstly, the core concepts of TQM can be classified into two broad categories or dimensions: social or soft TQM and technical or hard TQM. The social issues are centered on human resource management and emphasize leadership, team work, training and employee involvement. The technical issues reflect an orientation toward improving production methods and operations and seek to establish a working method through the establishment of well-defined processes and procedures to make possible the constant improvement of goods and services to customers.

Secondly, the management of social or technical TQM issues cannot be performed in isolation. Social and technical dimensions (and the core concepts that form them) should be interrelated and mutually support one other, reflecting the holistic character of TQM initiatives. This holistic character is also extended to the expected results of a TQM initiative because a balance of the stakeholders' interests should be considered when the firm defines TQM practices.

Thirdly, the literature suggests that the optimal management of TQM core concepts will lead to better organizational performances, as studies such as Kaynak (2003) have verified. The basic theoretical foundation for this relationship is based on the assumption that TQM provides superior value to the customer by identifying customers' expressed and latent needs, responsiveness to changing markets, as well as through improving the efficiency of the processes that produce the product or service.

Therefore, TQM includes both an empirical component associated with a statistics and an explanatory component

that is associated with management, of both people and processes. The terms hard and soft are commonly used to represent these two components. TQM brought recognition to the fact that task can be categorized as value adding or not. The obvious corollary is that non value adding tasks would be eliminated and value adding ones improved. Many processes design an operation tools have been highlighted in TQM, such as a statistical process control, Kanban and flexible organization.

SIMILARITIES AND DIFFERENCES

Lean Approach: A five-step thinking process was proposed by Womack and Jones, authors of 'LT' manual, to guide managers in their attempts to introduce Lean principles into the production. The five principles are:

- Setting the value of each product family from final customer's point of view.
- Identifying all activities on the value stream of each product family, eliminating as much as possible those waste –generating activities.
- Ranking value-adding activities in a sequence (flow) of clearly identified steps, so that the product should reach the final customer through a process that should as continuous as possible.
- After value stream is established and introduced, each interval or external customer / beneficiary can apply the 'pull' system to the product from the production line.
- After the value is set, the value adding activity identified and those generating waste eliminated the value stream set and introduces, the process can be operationalized and repeated until it reaches the optimal level of maximum value and no waste.

In this section, some similarities and differences between the TQM, and Lean are presented. The overall similarities and differences between the concepts regarding origin, theory, process view, approach, methodologies, tools, effects and criticism, are also discussed.

5. A COMPARISON BETWEEN TQM AND LEAN

Concepts	TQM	Lean
Origin	The quality evolution in Japan	The quality evolution in Japan and Toyota.
Theory	Focus on customer	Remove waste
Process View	Improve and inform processes	Improve flow in processes
Approach	Let everybody be committed.	Project Management
Methodologies	Plan, do, study, act.	Understanding customer value, value stream, analysis flow, pull, perfection.
Tools	Analytical and statistical tools	Analytical tools
Primary Effects	Increase customer satisfaction	Reduce lead time.
Secondary Effects	Achieve customer loyalty and improves performance.	Reduce inventory, increase production and customer satisfaction
Criticism	No tangible improvements, resource demanding, unclear motion.	Supply chain, not applicable in all industries.

Table 2 (Comparison between TQM and Lean)

6. CONCLUSIONS

After reviewing the available literature and correlating lean manufacturing and TQM, it has been concluded that major manufacturing industries in the developed countries have been trying to achieve TQM objectives by implementing Lean by identifying and eliminating non-value added activities to satisfy customer needs and improve processes continuously. Lean manufacturing has become an initiative that focus on cost reduction, inventory control, and reduction of lead times, cycle times, continuous improvement and finally customer satisfaction. A focus is made on the 5 principles of lean production and the 8 types of waste, in order to find out the applications of lean principles to ensure the Total Quality Management (TQM). We conclude that waste exists in any organization and lean thinking seems to be a useful tool for

reducing the different types of waste and in this way improving quality in order to achieve TQM objectives.

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ABOUT THE AUTHORS:

Binod Kumar Singh is presently associated with Gopal Sharma Modern Vidya Niketan Institute of Engineering & Technology, Palwal Haryana, India, as an associate professor and head in Mechanical Engineering Department. He holds a B.Tech degree from Gulbarga University, and M.Tech from Maharishi Dayanand University Rohtak. He is presently pursuing PhD on Lean Manufacturing from ISM University, Dhanbad. He has more than fifteen years teaching experience in undergraduate and post-graduate classes. He has published paper in international journal and several National and International Conferences. He has guided many projects to undergraduate and post-graduate students.Binod Kumar Singh is the corresponding author and can be contacted at: singh_binod_kumar@yahoo.com

Dr. Chandan Bhar obtained his PhD from IIT Kharagpur India. He is presently associated with the Department of Management Studies, Indian School of Mines, Dhanbad, as Professor & Head, Department of Management Studies. He has more than 22 years of teaching experience and actively engaged in consultancy and research in the areas of Long-Range Planning, System Dynamics and Productivity Management. Prior to joining this institute, he served Coal India Limited for about seven years. He has been guiding several research scholars in the areas of Long-range planning for coal industry as well as for technical education sector, performance assessment of service sector industries, technology transfer in small scale industries etc. He is also guiding many research scholars for their PhD degree in his field.

Dr. Visvesvaran Pandurangan, eminent scholar he did him M.Tech from IIT Kanpur, India and PhD from IIT Delhi, India is currently a Professor in the Department of Mechanical Engineering at Galgotias College of Engineering and Technology, Greater Noida India. He guided many candidates in their dissertation for M.Tech degree. He is guiding many students for their PhD degree. He got young scientist award from government of India. He has published many papers in national and international journals of repute.