Establishing Lean Management in a Manufacturing Organization as a System’s Approach for Effective Implementation & Results

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Abstract—It is well accepted by now that “lean thinking and practice” is more than just a kit of process improvement tools. The practice of thinking on lean management have gone tremendous change during the last few decades, specific lean methods include just-in-time inventory management, kanban scheduling systems, 5s workplace organization, scrum and other “agile” software development methodologies. This study provides strong approaches on how to manage a manufacturing organization with clear implications on systems that is user friendly to all stakeholders by producing exactly what the customer wants, at the minimum cost with minimum or zero defects. The major idea behind this study is to maintain sustainability by improving the profitability of the organization, at the lowest cost and with the shortest lead time in low or stagnant markets through the systematic elimination of waste. This experimental approach with ideas associated with lean in line with “Toyota Production System” of TPS taken up to ensure implementation with productive outcome on major key result area for corporate excellence.

Index Terms: Lean Manufacturing, Lean Management, Lean System, Lean Implementation, Lean Tools, Lean Culture.

I. INTRODUCTION

It is well accepted by now that “Lean thinking and practice” is more than just a tool-kit. The practice of lean thinking is clearly different from the existing process improvement models, such as total quality management, six sigma, business process reengineering. These were indeed considered as tickets for results enhancement with profitability, but were actually tool-kits to improve processes.

A. UNDERSTANDING IMPLICATIONS OF LEAN ADOPTION

The most successful lean adaptations occur when manufacturing organizations seek to manage the series of steps in the process that produce value as a whole, rather than by bits or silos. This “systems” approach has holy implications across the organization, not just through measurement of productivity at the system level by unit, but also assures management effort effective. The culture that supports continuous improvement is required for a lean system to practical work to achieve concrete reduction of cost and head count from systems.

II. LEAN AS A SYSTEM APPROACH

Propose of lean framework that considers high-level manufacturing system performance objectives (i.e. Quality, cost, delivery, and flexibility) and tactical initiatives that contribute to the achievement of each performance objective.
III. BASIC STRATEGY ADOPTED BY LEAN MANUFACTURING

Lean manufacturing includes a set of principles that lean thinkers use to achieve improvements in productivity, quality, and lead-time by eliminating waste through Kaizen. Kaizen is a Japanese word that essentially means "change for the better" or "good change." The goal is to provide the customer with a defect free product or service when it is needed and in the quantity it is needed.

A. SEVEN WASTES OF MANUFACTURING

Lean principles aim to minimize all forms of waste, from sources as varied as material defects to worker ergonomics. Many sources of waste are easy to identify and correct, such as a machine that is out of adjustment, producing a high volume of defects. Other forms of waste include environmental conditions that impede worker efficiency. Better lighting may help a worker read production instructions; moving a file cabinet might eliminate wasted time for a clerk.

Taichi Ohno, former Toyota Chief Engineer, identified 7 wastes of manufacturing

- Overproduction
- Transportation
- Unnecessary Inventory
- Inappropriate Processing
- Waiting
- Excess Motion
- Defects

These wastes should not be considered separate categories; instead, we should use these wastes as a teaching/learning tool to help identify opportunities to improve our work environment and focus on adding value for the customer. Wastes are non-value-added activities for which the customer would not be willing to pay.

B. PRINCIPLES OF LEAN THINKING

The 5 principles of lean thinking that lean manufacturers employ are, according Jim Womack and Daniel Jones in Lean Thinking:

- Specify Value.
- Identify the Value Stream.
- Make Value Flow.
- Let the customer Pull.
- Seek Perfection (Continuous Improvement of Quality and Productivity).
IV. LEAN CONCEPTS AND TOOLS

There are many tools and concepts that lean companies employ to support the above principles and eliminate waste. Here are 12 of the most critical ones for you to know.

A: CELLULAR MANUFACTURING
Cellular manufacturing is an approach in which all equipment and workstations are arranged based on a group of different processes located in close proximity to manufacture a group of similar products. The primary purpose of cellular manufacturing is to reduce cycle time and inventories to meet market response times.

B: TAKT TIME
This is the "heartbeat" of the customer. Takt time is the average rate at which a company must produce a product or execute transactions based on the customer's requirements and available working time.

Takt = \frac{T}{D}

Where \( T \) is Time available for product/service. \( D \) is a demand for the number of units. \( T \) gives information on production pace or units per hours.

C: STANDARDIZED WORK
A process of documented description of methods, materials, tools, and processing times required to meet takt time for any given job. This aids in standardizing the tasks throughout the value stream.

D: ONE PIECE FLOW OR CONTINUOUS FLOW
This concept emphasis's reducing the batch size in order to eliminate system constraints. A methodology by which a product or information is produced by moving at a consistent pace from one value-added processing step to the next with no delays in between.

E: PULL SYSTEMS AND KANBAN
A methodology by which a customer process signals a supplying process to produce a product or information or deliver product/information when it is needed. Kanban is the signals used within a pull system through scheduling combined with travelling instruction by simple visual devices like cards or containers.

F: FIVE WHY'S
A thought process by which the question "why" is asked repeatedly to get to the root cause of a problem.

G: QUICK CHANGEOVER / SMED
A 3-stage methodology developed by Shigeo Shingo that reduces the time to changeover a machine by externalizing and streamlining steps. Shorter changeover times are used to reduce batch sizes and produce just-in-time. This concept aids in reducing the setup time to improve flexibility and responsiveness to customer changes.

H: MISTAKE PROOFING / POKA YOKE
A methodology that prevents an operator from making an error by incorporating preventive inbuilt responsiveness within the design of product or production process.

I: HEIJUNKA / LEVELING THE WORKLOAD
We know that customer order patterns may be quite variable and all of our processes should build consistent quantities of work over time (day to day, hour to hour). This strategy is adopted by intelligently planning different product mix and its volumes over period of times.

J: TOTAL PRODUCTIVE MAINTENANCE (TPM)
A team-based system for improving Overall Equipment Effectiveness (OEE), which includes availability, performance, and quality. This aids in establishing a strategy for creating employee ownership autonomously for maintenance of equipment. The goal of the TPM program is to markedly increase production while at the same time increasing employee morale and job satisfaction.

OEE (Overall Equipment Efficiency)
K: HOUSE KEEPING 5S SYSTEM
5S is a five step methodology aimed at creating and maintaining an organized visual workplace. This system aids in organizing, cleaning, developing, and sustaining a productive work environment.

L: PROBLEM SOLVING / PDCA / PDSA
The PDCA cycle is a graphical and logical representation of how most individuals have already solved problems. It helps to think that every activity and job is part of a process, that each stage has a customer and that the improvement cycle will send a superior product or service to the final customer.

- PLAN: Establish a plan to achieve a goal
- DO: Enact the plan
- CHECK: Measure and Analyze the results
- ACT: Implement necessary reforms if results are not as expected

A system established for identifying and solving problems to their root cause and then implementing counter measures with monitoring.

V. IMPLEMENTATION OF LEAN SYSTEM

A. IDENTIFY KEY ORIENTED AREA’S
It is very difficult to say where you must start implementing lean manufacturing techniques. Some say it should be with a simple technique like 5S. Some say starting point should be rearranging workflow into work cells. For me the starting point must be able convince people in the organization about the oncoming results. So start becoming a lean thinker. Understand the concepts, which lean manufacturing works on. Then start teaching others in your organization the importance of lean manufacturing in becoming a more productive workplace. When you do your groundwork, you can build the lean empire on it, without major difficulties.

B. CULTURE IMPLICATION
Implementing lean principles in your workplace requires input and participation from your production staff. They are often in the best place to see where waste and inefficiency occurs. Not only do they serve as a resource for you, employees usually respond in a positive way to sincere efforts to involve them in improvement processes. When they see suggestions and ideas incorporated a sense of ownership and satisfaction about their contribution is more likely to follow.

C. WELL PLANNED APPROACH
The lean manufacturing implementation process must be well planned, step by step process. Importantly it should have contingency plans. Everything will not go as you intend or planned. It is also very important to remember that there is no one way to achieve success in lean manufacturing. Lean manufacturing techniques and tools must be used to overcome your problems. But you must always stick to the lean manufacturing concepts and principles. This is why many lean manufacturers say “lean thinking is universal not the processes at Toyota”.

Fig 2: Main Lean Production Target Approach
D. CLARIFY PRIORITY WITH TIME LINE

The value stream manager should periodically clarify priorities for the value stream, and identify the performance gap between what the customer needs and what the value stream is provided. The manager should then engage everyone touching the value stream in carefully figuring out whatever is causing the gap.

Management PDCA means applying the art & craft of science - PDCA - to the practice of management itself, to the task of aligning people and process to achieve purpose.

"The next step is to envision a better value stream," Womack says, "and then determine who will need to do what by when to bring it into being. Finally, the value-stream leader needs to determine what will constitute evidence that the performance gap has been closed and collect the data to demonstrate this. This exercise is, of course, nothing but Dr. Deming's Plan-Do-Check-Act cycle conducted repetitively by the responsible person."

E. SUSTAIN IMPLEMENTATION APPROACH

The basic system once generated the only approach is planned, do check and act for sustaining the system as well as provide a base for continues improvement over a period of time.

Fig 3: Aligning people and process is both an art and a science and requires constant dialogue at all levels of the organization

For most production operations, only a small fraction of the total time and effort actually adds value for the end customer.

Fig 4: Value Analysis in Lean System (http://www.1000ventures.com/business_guide/lean_production_main.html)

PLAN: The first thing one should concentrate its stakeholders, by doing research on what the customers, stakeholders and the organization itself expects of the service in terms of standards, costs, volumes, speed of delivery. Establish the key result area, and value flow diagram to monitor the expected measurement, as well as any bottlenecks for smooth flow during implementation.

DO: Implement the plan, after providing training, and awareness by maximizing the right information availability and involving all the responsible stakeholders.

CHECK: Monitor the key results and benchmark them against expected standard, and also if any bottle neck observed in plans to maintain the smooth implementation. (Also Fine tune the plan).
ACT: Remove the bottleneck and non-value added parts of the plan, by suggesting the corrective action and taking up tasks for modifying the plans by appropriate authorities. Emphasis on quality is supreme and any failure needs to be analyzed in depth to get the root cause. Maintain the history of lessons learned and improvement undertaken in documentation, systems and process.

VI. RESISTANCE MANAGEMENT DURING IMPLEMENTATION
Middle management resistance to change is now the No. 1 obstacle to implementing lean production, according to a survey conducted by the Lean Enterprise Institute, a nonprofit management research centre. Respondents were asked to select all applicable obstacles from a list of 12 possibilities. Members also were polled on industry trends and the implementation level of their lean transformations. The survey was distributed electronically to 77,200 businesspeople and had 2,444 respondents.

Middle management resistance was cited by 36.1 percent of respondents in Lei’s annual surveys about lean business system implementation in the United States. The top-three obstacles to implementation were middle management resistance (36 percent), lack of implementation know-how (31 percent), and employee resistance (27.7 percent).

This was in contrast to last year's survey, which found backsliding to the old ways of working as the primary obstacle to introducing lean management principles, followed by lack of implementation know-how and middle management resistance. Backsliding dropped to sixth place in this year's survey.

VII. PROBLEMS FACED DUE TO LEAN SYSTEM LIMITATION
"The application of lean management principles exposes problems by traditional business systems, which often is threatening to middle managers in the problem areas," says management expert James Womack, Ph.D., Chairman and founder of LEI. "To get middle managers on board with lean transformation, organizations must transform the matrix and behaviors’ for judging their performances.”

Suppose the manager of a value stream has a goal of reducing defects by 50 percent every year. If the trend line starts to diverge from the performance target, the manager leads team members in collectively searching for the root cause of the variance rather than maneuverings to ‘make the numbers.’ Some managers might find this threatening, because identifying and eliminating the root cause means making problems visible.”

Traditional financial metrics often need to be removed from day-to-day management decisions about key processes. "Instead," he said, "operating managers have to learn to help employees look for waste and remove it. The financial numbers will be positive. Most metrics are nothing more than an end-of-the-line quality inspection: At the end of the quarter or the end of the year everyone looks to see what happened, at a point long after the mistakes have been made.”

VIII. ORGANIZATIONAL CULTURE THROUGH LEAN TRANSFORMATION
- Positive, clear communications
- Ensure “no-blame” culture
- Work through cross-functional teams
- Staff involvement at every stage
- Process maps on display for comments
- Remove non-value added steps, hand-offs, rework loops
- Agree design principles with all
- Fix the root cause, not the symptom
- Ensure solution supports departmental interfaces
- Incorporate Continuous Improvement
IX. MAJOR GAINS DUE TO ADOPTION OF LEAN SYSTEM

A. WITHIN THE ORGANIZATION

Lean helps to add detail to a systems view of the world by encouraging managerial interest in the way work and information flows through the system, particularly where it flows freely and where there may be bottlenecks. This allows us to focus improvement efforts on those areas that will improve the whole system and avoid sub-optimal changes.

In lean organization, the wastage was brought down under seven specific types:

- Over-delivering - volume is reduced by over 36%
- Waiting for the work to be ready for the next process is reduced by 30%
- Conveyance or transportation is automated and 18% supported the manufacturing plan.
- Over processing – because of design and value engineering is reduced by 14%
- Inventory levels that are too high brought down by 32%
- Human motion reduced through motion study thus enhanced productivity by 21%
- Correction of defects through second factory almost to zero level.

B. COMPETITIVE ADVANTAGE

Beyond simply reducing costs and improving efficiency, lean production techniques introduce systems and develop skills with your staff that support changes in the workplace that new sales create. Space saved on warehousing may be used to add new product lines. The same is true of time savings. Your staff can absorb new work and react quickly to changes in client demand. Producing work quickly, in short iterations, without waste and delivered on time enhances your advantage over your competition.

X. CONCLUSION

Today, it is relevant that any organization that has set its goal to be a global player or a regional leader has to incorporate changes to be productive and competitive. Lean manufacturing shows the way to that goal.
Finally we say that Lean management isn’t just KPI (Key Process Indicator) managing. Neither is it just trying to make everyone feel engaged. So there is freedom to adopt his/her the best system to obtain the situational advantage and move beyond the traditional lean for operational excellence.

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