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A Feasible Study of *Lean Manufacturing*: An expert approach

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Abstract

James Womack, Daniel Jones, and Daniel Roos coined the term "***Lean Production***" in their 1990 book "***The Machine that Changed the World"*** to describe the manufacturing paradigm established by the Toyota Production System. In the 1950s, the Toyota Motor Company pioneered a collection of advanced manufacturing methods that aimed to minimize the resources it takes for a single product to flow through the entire production process. Inspired by the waste elimination concepts developed by Henry Ford in the early1900s, Toyota created an organizational culture focused on the systematic identification and elimination of all waste from the production process. ***Lean manufacturing*** refers to a manufacturing improvement process based on the fundamental goal of ***Toyota production system(TPS)*** in order to reduce or eliminate waste while improving production flow (Tapping, 2002). Many manufacturing organizations realize the importance of using lean methodology. However, few organizations implement lean concept with the necessary knowledge and proven tools to achieve it. The purpose of this study is to develop a value stream map (VSM) for a manufacturing plant in Manesar, Gurgaon to improve the productivity of line using Lean tool. This particular tool allows the manufacturing plant to document current lead time, inventory levels and cycle times to determine the ratio of value added work to total lead time of the product line being analysed. The first step will be to measure the current state to make a picture of the production flow and understand the

Company's current cycle times, process linkages, and machine equipment capacity. This provides the information needed to produce an improved future state map by creating an ideal value flow. The goal is to identify and eliminate the waste, which is any activity that does not add value to the final product, in the production process which will help to achieve the production capacity as per customer demand through Lean manufacturing techniques.

Keywords: Lean Way; Waste elimination; Value added work; Non-value added work; Productivity; Cycle time; TPS.

1. INTRODUCTION

Manufacturing operations are continually striving to increase productivity and output of their processes. Lean manufacturing or Lean technique is more than a cost reduction project or a problem solving approaches (Tapping, 2002). The main idea is that an efficient production can be achieved by a comprehensive approach to minimize wastes available in production processes. This means eliminating excess production and inventory, movement of material, waiting and delays in production process, over processing, excess worker movement, and the need for rework and corrections in product during or after production. We did the analysis on an assembly line in an automotive product manufacturing company in Manesar to improve assembly line production capacity by using lean manufacturing technique. During this activity we find detect area of improvement and took action to avoid/ reduce possible non value added work and improve current process of assembly line which will help us to meet increased customer demand through reduced working time.

2. WHY LEAN ??

In Manufacturing operations are continually striving to increase productivity and output of their processes. Lean manufacturing or Lean technique is more than a cost reduction project or a problem solving approaches (Tapping, 2002). The main idea is that an efficient production can be achieved by a comprehensive approach to minimize wastes available in production processes. This means eliminating excess production and inventory, movement of material, waiting and delays in production process, over processing, excess worker movement, and the need for rework and corrections in product during or after production. We did the analysis on an assembly line in an automotive product manufacturing company in Manesar to improve assembly line production capacity by using lean manufacturing technique. During this activity we find /detect area of improvement and took action to avoid/ reduce possible non value added work and improve current process of assembly line which will help us to meet increased customer demand through reduced working time.

In Lean, you pursue understanding the source and rooting out the causes of waste. The practice of Lean as the root-cause eliminator of wastefulness is based on a core set of fundamental assumptions. Follow this logic:

>You're in business to sell products and services to customers. The customer has the need and defines the purpose. Everything begins and ends with what the customer requires. Everything else is fluff.
>The customer is the only true arbiter of value. The customer is willing to give you their money for your product or service only when they believe it's a fair exchange of value. It has to be the right combination of quality products and services, in the right place, at the right time and at the right price.

>Value-creation is a process. A combination of steps — such as marketing, design, production, processing, delivery and support — rightly performed, will result in the creation of products and services that the customer will properly value.
>Waste diminishes the process of value creation. Things that naturally creep in and prevent the steps in a process from flowing quickly and effectively will inhibit the creation of customer value.

>A perfect process has no waste. If every step in the process is fully capable, acts only when necessary, flows perfectly, and adapts to perform exactly as needed, the process will develop and deliver products and services without waste.

>Perfect processes maximize customer value. The closer to perfection a process becomes, the more effective the creation of value, the more satisfied the customers and the more successful the endeavour.

No one has ever experienced the perfect process, but Lean continually strives for perfection. Lean is the strategy and approach, and it provides the methods and tools for pursuing the perfect process.
To accomplish this, companies employ a variety of advanced manufacturing tools to lower the time intensity, material intensity, and capital intensity of production. When companies implement several or all of these lean methods, several outcomes consistently result:

- ***Reduced inventory levels*** (raw material available in store, work-in-progress stock at assembly line, finished product available at Finished Goods store) along with associated carrying costs and loss due to damage, spoilage, off-specification, etc.
- ***Decreased material usage*** (product inputs, including energy, water, chemicals, etc. by reducing material requirements and creating less material waste during manufacturing.
- ***Optimized equipment*** as per production process helps to reduced capital cost.
- ***Reduced*** need for ***factory facilities*** by driving down the space required for product production.
- ***Increased production velocity*** (the time required to process a product from initial raw material to delivery to a customer) ***by eliminating*** / reducing process steps, extra movement, **wait times**, and downtime available in production process.

- ***Enhanced production flexibility*** (the ability to alter or reconfigure products and processes rapidly to adjust to customer needs and changing market circumstances) enable the implementation of a pull production, just-in-time(JIT) oriented system which lowers inventory and capital requirements; and
- ***Reduced complexity*** of product (complicated products and processes that increase opportunities for variation and error) by reducing the number of parts/ components and material types in products, and by eliminating unnecessary process steps, movement and equipment with unneeded features.

With the help of all above methods we can achieve the increased profit on product without increase in cost of product as we can understand by Figure 1 & 2. Lean Way not only helps us to gain profit rather than we will achieve customer satisfaction with on time product delivery with right quantity and quality.

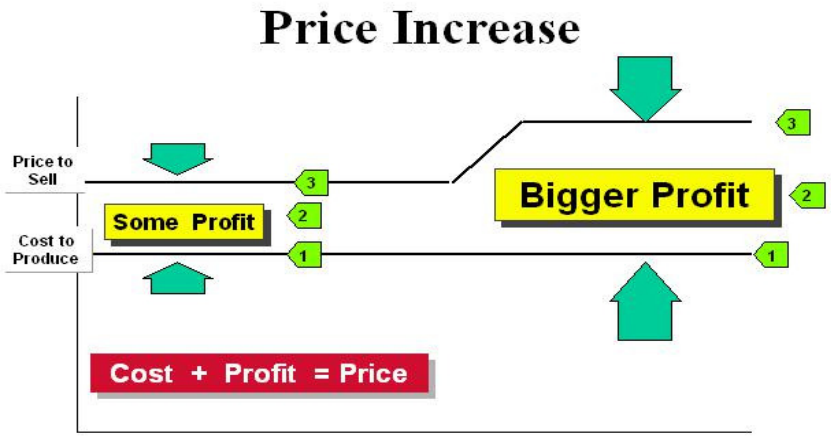


Figure 1. Traditional Way

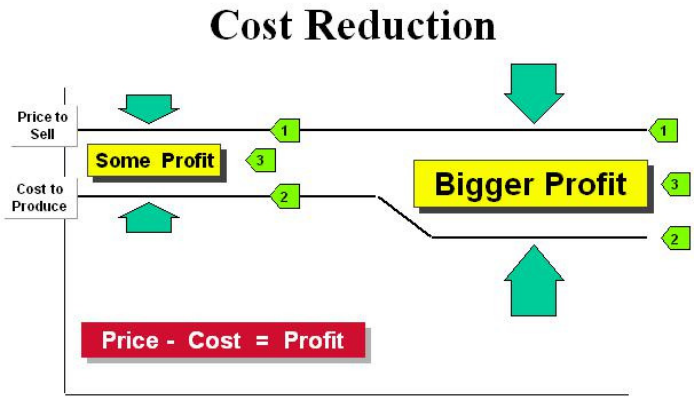


Figure 2. Lean Way

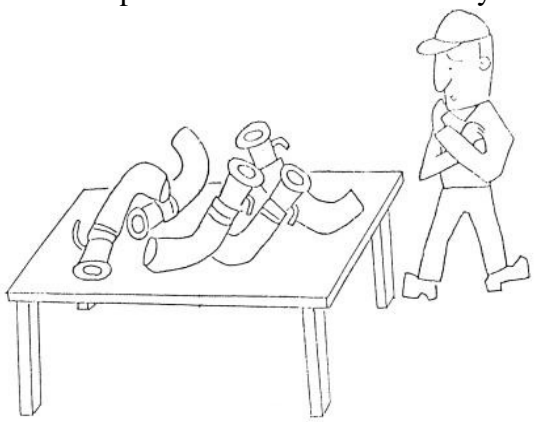
3. WASTE ELIMINATION

To improve the line capacity and its product quality we visited through the assembly line to find out the possible area of improvement through waste elimination.

According to Tapping (2002) "the ultimate lean target is the total elimination of waste. Waste, or Muda, is anything that adds cost to the product without adding value of product" (p. 41).

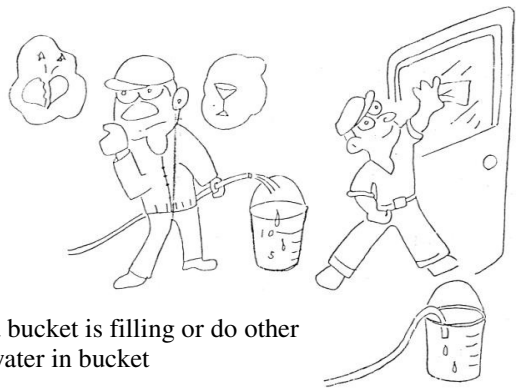
Sources of waste are available everywhere, we need to focus on production process to find out the available waste in whole Value Stream Mapping. Wastes can be classified into seven categories (Tapping, 2002):

1. ***Waste of overproducing***: Producing components or child parts that are neither intended for stock nor planned for sale immediately will increase only waste.



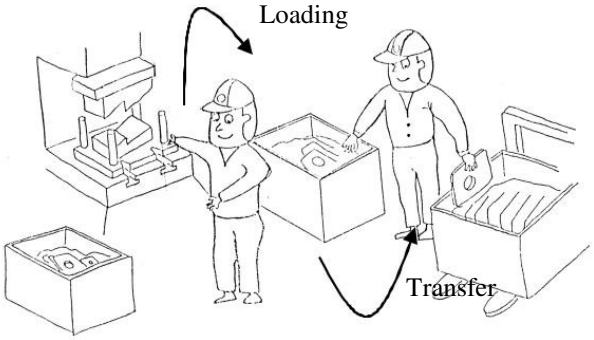
Only one is necessary at one time

2. ***Waste of waiting:*** Refers to the idle time between two operations. We should utilize it.



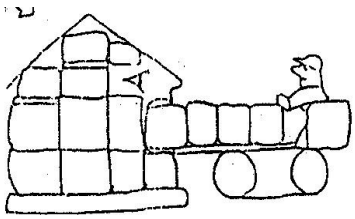
Waiting until a bucket is filling or do other job while fill water in bucket

3. ***Waste of transport:*** Moving material more than necessary will not add any value just un-necessary increase time, cost and fatigue of operator.



4. ***Waste of processing:*** Doing more to the product than required necessary and the customer is willing to pay. We should focus on all process to eliminate un-necessary work.

5. ***Waste of inventory:*** Excess of stock / more than required stock from raw materials to finished goods always loss for any company.



Unnecessary material storage

6. ***Waste of motion:*** Any motion that is not necessary for the completion of a work.

1st Worker go to take a tool repeatedly and 2nd used small bag

7. ***Waste of defects and spoilage:*** Defective parts that are produced and need to be reworked after completion of work.

Based upon the above Waste or Muda's we observed at our assembly line and improve the assembly line to improve the line productivity, to reduce cycle time, to reduce operator fatigue, to improve operator safety and to reduce cost.
During this site visit we found some area of improvement, which we improved at automotive Switch manufacturing assembly line in a company at Manesar, Gurgaon are as follows:

Before: Location of rivet tray at rivet assembly station is left side of fixture.

After: Location of rivet tray shifted at the right side of rivet assembly station which reduces the Waste of Motion.

Before: Location of Insulator at line is also on left side of machine and inside the deep bin.

After: Location of insulator shifted to right side of machine and reduced the depth of bin it reduces Waste of Motion and operator fatigue.

Before: one station uses 2 different type of rivet and always chances of mix up.

After: Location of rivet tray properly identified by colour coding and process defined to use one rivet by left hand other by right hand. It reduces waste of defect.

Before: at spring assembly station operator always faced problem of spring entangled.

After: Spring separator installed at station, now operator can pick one spring easily it reduces Waste of process.

Before: During illumination checking of switch operator have to bend more than normal which caused high operator fatigue and reduced productivity.

After: Illumination checking process improved as per operator height, it reduces operator fatigue and operator can achieve the production as per standard time. It reduces Waste of Motion and Water of Process.

Before: Manual assembly and remove coupler for testing Switch require more time and it became bottleneck process.

After: Automatic assembly and remove coupler machine installed to reduce operation time.

Before: Batch code marking and terminal straightness testing done on two different stations.

After: new modified fixture designed which can do both work at one station. It reduces Waste of Over process.

CONCLUSION

During research, team evaluated where waste occurs in the production process and analyse observations with team to improve the process and achieve customer demand with right quantity and quality, improve employee satisfaction. After all the improvement we achieved:

- ***Cycle time*** reduced from 56.9 seconds to 42.9 seconds. This is ***24.6 % reduction***.
- ***Productivity improved by 38.26%.***
- Able to achieve increased customer demand on time helps us to ***improve customer satisfaction.***
- Knowledge of team for Lean way improved which will be used at other assembly line to improve.
- Operator ***fatigue reduced*** helps to improve employee more adoptable towards changes.
- ***Safety*** of operator ***improved.***
- Team morale improved for new challenges.

REFERENCES

[1] James Womack, Daniel Jones, and Daniel Roos (1990) *The Machine that Changed the World.(Book)*

[2] Ohno, T. (1988). *Toyota production system: Beyond large-scale production.* Cambridge, MA: Productivity Press.(Book)

[3] Womack, J., & Jones, D. (1996). *Lean thinking: Banish waste and create wealth in your corporation.* New York, NY: Simon & Schuster.(Book)

[4] Rachna Shah, Peter T. Ward, "Lean Manufacturing: Context, practices, and performance", *Journal of Operation Management*, 21(2003)129-149 (Article)

[5] J. Ben Naylor, Mohamed M Naim, Danny Berry,"Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain",Int. *Journal of Production Economics*, 62(1999) 107-118 (Article)

[6] Leonardo Rivera, F. Frank Chen,"Measuring the impact of lean tool on the cost-time investment of a product using cost-time profile", Robotics and computer integrated manufacturing, 23(2007) 684-689 (Article)

[7] Tapping, D., Luyster, T., & Shuker, T. (2002). *Value stream management: Eight steps to planning, mapping, and sustaining lean improvements.* New York, NY: Productivity Press.(Book)

[8] Brandon G. Mabry(Delphi Chassis System), Kenneth R. Morrison : Transformation to Lean Manufacturing by an automotive component supplier.*Computer ind. Engag Vol.31.No.1/2 pp.95-98,1996(Article)*

[9] William G. Sullivan, Thomas N.McDonald, Eileen M. Van Aken : Equipment replacement decision and Lean Manufacturing, *Robotics and Computer Integrated Manufacturing 18 (2002) 255-265(Article)*

[10] *Hitoshi Kume:*A book on Problem Solving Techinique (Book)

[11] *V.* Jayakumar : A book on total Quality Management by Laxmi Publication (Book)

[12] *Jiju Antony and Ricardo Banuelas* : Journal of Key ingredients for the effective implementation of six sigma program Warwick Manufacturing Group, University of Warwick, and Coventry, UK.(Journal)

[13] The six sigma approach, Quality world volume3, march2006.(Book)

[14] Paschal Ugochukwu, Jon Engstrom, Jostein Langstrand: Lean in the Supply Chain: A Literature Review, Management and production engineering review, Volume 3, Number 4, December 2012,pp87-96