Lean Manufacturing Tool for Productivity Enhancement-Case Study

Vijayshri Mahobiya
Department of Industrial Engineering
G.H.raisoni college of engg, nagpur

Abstract—Today worlds lean manufacturing is very common term for waste elimination in manufacturing industry. This paper focused on lean manufacturing concept in XYZ Pvt. Ltd Pithampur. The concept of lean manufacturing is based on the waste elimination. Lean tool are helpful to indentify the waste and non value added thing in system and provide the tool for removing the wastes. Waste is reduced by the lean technique in XYZ manufacturing company; there is manufacturing work, the loder backhoe, vibratory compactor. The loader backhoe completes in several operation. In the XYZ plant there are two basic productions line one is conveyor line another is sub assembly line. The company manufactures 4 to 5 loader backhoes in a day, i.e. in 16 hours. The company has observed increase in demand of loader backhoes. The company has established a target of manufacturing 10 loader backhoes in a day. In order to reach the set target the company has to increase its productivity. This paper is based on data based analysis In XYZ company. Although the process and discrete industry share several common characteristics, there are areas where they are very different. Both manufacturing settings have overlap, but at the extreme, each has its unique characteristics. Using this concept try to enhancement of productivity, by using the concepts of lean manufacturing and single piece flow system in particular format.

Key words: Lean Manufacturing, Takt Time, And Single Piece Flow System

I. INTRODUCTION

Lean Manufacturing is a philosophy, based on the Toyota Production System, and other Japanese management practices that strive to shorten the time line between the customer order and the shipment of the final product, by consistent elimination of waste. In other words, producing more with less. Lean manufacturing will be defined as a systematic approach to identifying and eliminating waste (nonvalue-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection (Manufacturing Extension Partnership, 2000[3] and One-piece flow is a concept that really requires systemic change to a traditional batch processing setup. Some management improvement concepts can be tried without too many changes to the system required. One-piece flow does not offer such opportunities. Some process that can be completely redesigned from start to finish can be tried it on a small scale. This allows learning on a small scale before adopting it for large processes.

The company manufactures the loader backhoe, vibratory compactor. The company has observed increase in demand of loader backhoes. The company intends to increase production rate. At present the plant produces 8 loader backhoe machines per day in 2-shifts, which is the company intends to double without increase in the workforce.

This paper described how lean manufacturing and single piece flow system helps to improvement productivity at XYZ Pvt. Ltd.

The company manufactures 4 to 5 loader backhoes in a day, i.e. in 16 hours. The company has established a target of manufacturing 10 loader backhoes in a day. In order to reach the set target the company has to increase its productivity.

II. METHODOLOGY

The loader backhoe completes in several operation. In the XYZ plant there are two basic productions line one is conveyor line another is sub assembly line. The Material movement and man machine activities have shown in the outline process chart shown in fig 1

The table1 describe the elemental study of man machine with material movement activities. In front of each element the start time finish time and total time, types of weight, numbers of employees involved in the operations.

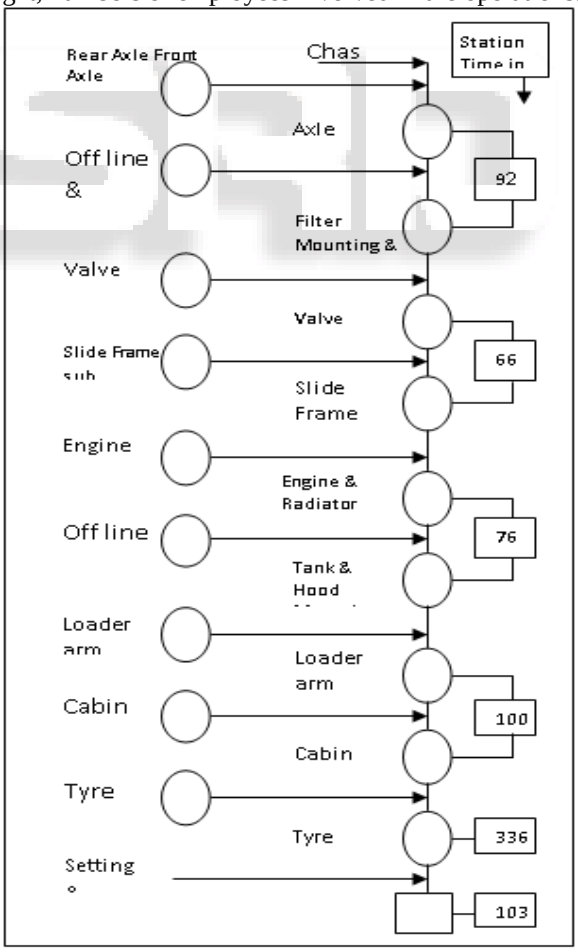


Fig. 1: Outline Process Chart

S.N	Element	○	□	⇨	D	△	ST	FT	TT	TOW	No of persons
1	Operators move to take trolley						0	60	60	LW	3

	from S/Assly.										
2	Moved the trolley from S/Assly to main line.						60	180	120	LW	3
3	Delay. (Crane not available						180	240	60	LW	3
4	Moved the crane to hold R/A.						240	300	60	LW	1
5	Hold rear axle.						300	360	60	LW	1
6	Moved rear axle from trolley						360	480	120	LW	1

Table 1: describe the elemental study of man machine with material movement activities

In the Station M1- M2 the assembled rear axle sits on the conveyor trolley. After this the chassis line up on rear axle. Here the other assemblies are performed on the chassis. When the front axle is assembled the chassis moved to station M3-M4. In this station the two spool valve and six spool valve mount on chassis. The harness and hose routing also part of station M3-M4. The engine, radiator and tank assemble on station nunber M5-M6. The Loader arm and Cabin assemble in station M7-M8. The backhoe assembles at station number M9. The tyres mounting, battery connection powering of machines testing and setting in station number M10.

The quality department checks all machines again and gives approval. Now the machine ready for go to the Finishing Shop.

The company has established a target of manufacturing 16 loader backhoes in a day. In order to reach the set target the company has to increase its productivity. To increase the productivity certain steps Can be taken.

They can be:-

- Increase the number of employees.
- Increase the facilities given to the employees.
- Give the assembly work to the vendors and have assembled parts from them.
- We can alleviate the mechanical work and boost the hi-tech work.
- develop a new production system or improve the existing production system for resolving all this problem and for achieving the set target lean manufacturing is suitable tool

Fig 2 show the present layout, in this layout there is lots of wastes regarding time, movement and transportation

Fig. 2: Layout

A. Wastage of Time & Movement

To take a nut, distance cover by the workers is different for FIX A its less for FIX B more & for C need more time to reach .it's totally wastage of time and work, convert it in single piece flow pattern for reducing the wastage of time,

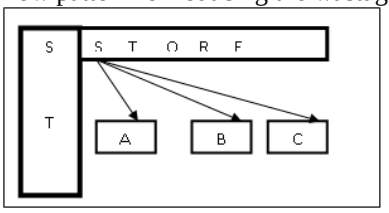


Fig 3: Flow Pattern

B. Transportation

Transportation time is another source of waste. Moving parts from one end of the facility to another end does not add value to the product. Thus, it is important to decrease transportation times within the manufacturing process.

- Lot of crossing point present, it increases the accident
- Not present the smooth flow material
- Plant layout
  Company use FILO system
- increases the chances of SCRP of the material, due to moisture
- Not proper storage of material

Other problem which is related to transportations and consuming time they are:

- Worker has no tray to pick up more nut bolt and tool which is use for assembly.
- No proper sequence to perform work.
- They use FILO system for using material
- No proper line for subassembly
- No proper arrangements of the tools
- Noises level is high
- Underutilization of human resources
- No proper assessment of the worker and work
- Absences of the multi skilled operators
- There are no schedule for maintenance of storage system
- For transporting not sufficient cranes are available
- No any training program is organizes for workers or operators

C. Takt Time:

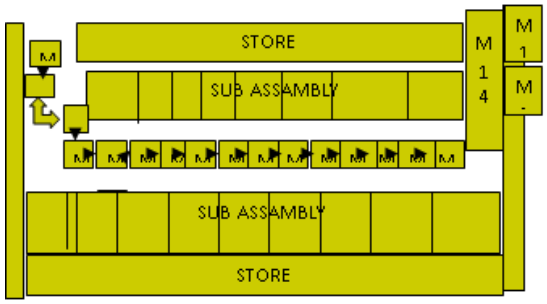
TAKT time = Net Time Available for production / Customer Demand
The daily available hrs = 8 hrs or 480 minutes
And daily production required 16 machines
Takt time = 480/16
= 30 minutes

D. Minimum Number of Stations:

Minimum number of stations= Production/Time
= 480/30
= 16 stations

E. Plant Layout

Fig 4 show suggested layout. In suggest plant layout it has 16 station which is start from M0 to M16 and it has both side sub assembly are present and try to arrange the subassembly and both side it has store system.



III. RESULTS AND CONCLUSION

A. *Plant Layout*

Improved plant layout =increased profitability

Lean Manufacturing focuses direct and non-direct labour costs as well as material flow and inventory turns. This results in savings in all three key areas:

- Materials
- Overhead
- Direct Labour

	Present	**Proposed**
Material	Cross link	smooth
No of station	8	16
Sub assembly line	1	2
Storage system	FILO	FIFO
Production	Based on forecast	Based on forecast
manufacturing	Traditional	Lean
Work condition	Complex	simple
Processing	Some time batch (M!-M2,M3-M4)	Continues flow
Quality	Not assured during processing	Assured during processing
Takt time	160	40

Table 2: Comparison the advantage of present and proposed system

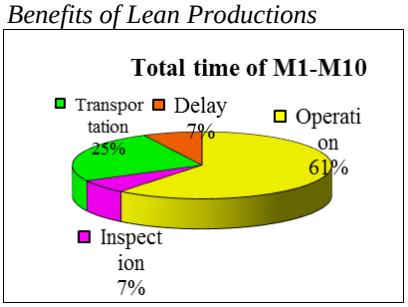
B. *Advantage of Storage system*

For plant and storage of the material, three types of system are planed

Firstly all parts which is use in main assembly line or sub assembly are divided in three category they are kit item, table bin item and trolley item (delicate trolley) in table bin item include the material which is very small in size and less in weight an bulky used. Second type category include the material or parts which is middle bulky in used and more in weight, in third type of category include the assembly par which is heavier in weight need to transform to assembly line.

- Suggest storage system, chances of the scarp is very less
- Safe material
- Lees chances of the factices
- Reduce inventory management cost

1) Typical Benefits of Lean Productions



After Appling lean manufacturing

- Reduction in waste is more than 75%
- Reduction in production cost 50%
- Reduction in manufacturing cycle50 %
- Reduction in labour is 50%
- Reduction in inventory is more than 75%
- Increase production capacity 50%

The impact of new plant layout

- Reduces Takt time 160 to 25 mint in a sift
- Reduce costs and risks
- Reduce distance traveled and space consumed
- Maintain distances for transfer of materials between plant/storage units to a minimum to reduce costs and risks;
- Reduce distance travelled and space consumed
- Use proper spaces of the side
- Interaction with existing or planned facilities on site such as existing roadways, drainage and utilities routings
- Interaction with other plants on site
- Plant operability and maintainability;
- Locate hazardous materials facilities as far as possible from site boundaries and people living in the local neighbourhoods.
- Prevent confinement where release of flammable substances may occur
- Provide access for emergency services;
- Provide acceptable working conditions for operators.

Stations	Operation	Inspection	Transposrtation	Delay	Total
M1-M2	3390	90	1679	250	5409
M3-M4	4301	391	1750	180	6622
M5-M6	4674	390	1567	134	6765
M7-M8	4628	80	2181	96	6985
M9	1801	182	711	854	3548
M10	2768	1219	1093	1112	6192
Total	21562	2352	8981	2626	35521

The most important factors of plant layout far as safety aspects are concerned are those to:

- Ensure safety within on-site occupied buildings;
- Control access of unauthorized personnel;
- Facilitate access for emergency services.

2) The Impact of New Takt Time

After the applying the modified Takt time the line efficiency will increase from 55.25 % to 89.13 % and the balance delay will reduce from 60.56 to 11. 51 %.

3) Impact of Storage System

- Reduction in maintenance cost
- Reduction in scarp
- Reduction of the wastage

REFERENCES

[1] Harbour Report, Harbour Consulting, Troy, MI, 2004 Ward, Allen, Jeffrey K. Liker, John J. Cristiano, and Durward K. Sobek, II. "The Second Toyota Paradox: How Delaying Decisions Can Make Better Cars Faster." Sloan Management Review. Vol. 36, No. 3, Spring 1995. pp. 43-61.
[2] Wixson J.R. university of Idaho Fallls,ID,i[ndustrial technology program
[3] Harbour Report, Harbour Consulting, Troy, MI, 2004.
[4] S.Rajinder, Lean Manufacturing: Changing Paradigms in Product Manufacturing,Design & Supply, The Third International Conference on Quality Management, Quantum Leap Strategies Pvt. Ltd.N.Delhi, INDIA
[5] K.Yamada and M.W. Tracey, "The Creation, Development and Implementation of a Lean Systems Course at Oakland University, Rochester, MI," Proc. of the SAE 2005 World Congress, (to appear).
[6] 14Haggerty, Al, "Lean Engineering Has Come of Age," 30th Minta Martin Lecture, MIT Department of Aeronautics and Astronautics, April 10, 2002.
[7] Ohno, T., The Toyota Production System: Beyond Large-Scal Production, Productivity Press, 1988.
[8] Wysocki, B., "To Fix Health Care, Hospitals Take Tips from Factor Floor Adopting Toyota Techniques Can Cut Costs, Wait Times Ferreting Out an Infection," Wall Street Journal, April 2004.
[9] Drickhamer, D., "Lean Manufacturing: The 3rd Generation," Industr Week, March 2004.
[10] Standard, C. and Davis, D., Running Today's Factory: A Provens Strategy for Lean Manufacturing, SME, Dearborn, MI, 1999.
[11] Landgrave, T., "The True Cost of Training Staff," Tec Republic, July 2004.
[12] Maynard, M., The End of Detroit: How the Big Three Lost Their Grip on the American Car Market, Doubleday, New York, 2003.
[13] K. Yamada and M.W. Tracey, "The Creation, Development andImplementation of a Lean Systems Course at Oakland University,Rochester, MI," Proc. of the SAE 2005 World Congress, (to appear).
[14] Slack, Robert A., "The Lean Value Principle in Military Aerospace Product Development", LAI RP99-01-16, Jul 1999.web.mit.edu/lean, and "Application of Lean Principles to the Military Aerospace Product Development Process," Masters thesisin Engineering and Management, Massachusetts Institute of Technology, December 1998.
[15] McGraw-Hill Irwin, 2005. Nadler, Gerald, and Shozo Hibino. Breakthrough Thinking: The Seven Principles of Creative Problem Solving. 2nd ed. Rocklin: Prima Publishing, 1994
[16] Hoffherr, Glen D., John W. Moran, and Gerald Nadler. Breakthrough Thinking in Total Quality Ohno, T., The Toyota Production System: Beyond Large-ScaleProduction, Productivity Press, 1988.
[17] White,R.E.,"An empirical Assessment of U.S.manufacturing,"production Inventory management journal,second quarter 1993,pp.38-42
[18] Zenger, John H., and Joseph Folkman. The Extraordinary Leader: Turning Good Managers into Great Leaders. 1st ed. New York: McGraw-Hill, 2002
[19] Maynard, M., The End of Detroit: How the Big Three Lost Their Grip on the American Car Market, Doubleday, New York, 2003
[20] McManus, H. L., and Warmkessel, J. M., "Creating Advanced Architectures for Space Systems: Emergent Lessons from New Processes," Journal of Spacecraft and Rockets, Vol. 41, No. 1, Jan.-Feb. 2004, pp. 69-74.
[21] Wysocki, B., "To Fix Health Care, Hospitals Take Tips From Factory Floor Adopting Toyota Techniques Can Cut Costs, Wait Times: Ferreting Out an Infection," Wall Street Journal, April 2004. Drickhamer, D., "Lean Manufacturing: The 3rd Generation," Industry Week, March 2004.
[22] Supplier Integration," R & D Management, Vol. 28, 1998, 163-173
[23] http://lean.mit.edu/public/index.html.
[24] Johnson w.lean principles in EMS

Books

[25] William M. Feld "Lean Manufacturing Tool, Techniques & How to use them", CRC press (2000)
[26] Carreira B. Bill Trudell "Lean Six Sigma", AMACOM div American mgmt Assn(2006)
[27] Maynard H. kjell B Zandin "Maynards industrial engineering Handbook" , McGraw- Hill Professional(2001)
[28] Khanna O. P. "Industrial Engineering and Management", Dhanpat Rai Publication (P) Ltd, (2002).
[29] ILO (International Labour Office) "Introduction to Work Study" Universal Publication Corpn 3rd revise edition
[30] Shingo, Shigeo, "a study of the Toyota production system" From an industrial engineering viewpoint (Andrew Dillon, Trans.). (1989)
[31] Ohio, Taiichi. & Mito, Setsuo. "Just-in-time: For today and tomorrow" (Joseph P. Schmelzeis, Jr., Trans). (1988)
[32] Mahajan M. "Industrial Engineering and Production Management" First Edition Dhanpat Rai and sons, (2000-2001).

