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LEAN MANUFACTURING IMPLEMENTATION IN PLANT LAYOUT DOMAIN

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Abstract: Lean manufacturing was first introduced by Eijy Toyota and Taiji Ohno of Toyota motors from Japan in the form of Toyota Production system. They were forced to do this so due to the financial And manpower crisis after world war II. Toyota Production system was about efficient use of manpower with proper utilization of economy, which was nothing but related to make use of available resources at optimum level. In Toyota production system which modified by Ford in the form of lean manufacturing, the focus was on elimination of waste, like operations, manpower, transportation, activities, and plant layout. This paper is regarding the implementation of lean manufacturing in a Wood cutting tool manufacturing industry in improvement in plant lay Out, so that there will be minimization in the lead time of the product And minimization in the required man power. In this paper the focus is on elimination of waste during the transportation of product during the production due to improper plant layout or traditional old plant layout. Due to which the required lead time and man power required were more.

Keywords: Lean manufacturing, plant lay out domain, elimination of waste.

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INTRODUCTION

Lean Manufacturing is a systematic elimination of waste by focusing on production cost, product quality, and delivery and worker involvement [1]. Mainly waste is that thing for which customer don't' want to pay, waste may be of seven types Transporting, Overproducing, waiting, defects, In today's competitive world of manufacturing industries, Indian industries should focus on maximum production with optimum investment including world class quality. For this Indian manufacturing industries should adopt Lean manufacturing system, so that the challenge of maximum production with optimum investment including quality can be achieved. Nearly 125 manufacturing industries in India have been started working on Lean Manufacturing system, but it will take a long time to achieve final goal of lean Manufacturing system as it involves the contribution of whole organization along with its top level management, subordinates, managers, workers and labors. It is a team effort to eliminate waste or non profiting things from the organization. This non profiting thing or waste may be a single movement of the worker which consumes some seconds to a machine or equipment which may cost some lacks of rupees.

III. LITERATURE REVIEW:

It is defined, in its modern form, by Toyota Production system (TPS) invented by Shigeo Shingo and Taiichi Ohno in 1950s (Daniel [2]). After World War II Toyota motors adopted this lean manufacturing system due to oil crisis in 1973 to keep their assembly line moving. The main purpose of the system is to reduce cost; the system also helps increase in turnover ratio of capital (Jones [3]). TPS was developed and promoted by Toyota Motors Corporation and being adopted by many Japanese companies in the aftermath of 1973 oil shock. This system focuses on elimination of waste that means elimination of unnecessary things which contributes nothing but requires investment like man, machine, or money [4]. The Toyota family actually owned a big textile company in Japan. After World War II, the Toyota family decided to start new venture from Toyota Automatic Loom Company to Toyota Motor Company. According to Wren and Greenwood, "The Toyota Automatic Loom works was the product of the inventive and entrepreneurial genius of Sakichi, who perfected Japan's first power- driven loom and held numerous patent for automatic power looms and textile production. Sakichi sold his automatic loom patents to finance a research of automobile manufacturing system with his son Kiichiro. In the mean time, General Motors (GM) and Ford assembly plants had located in Japan. Therefore challenging new venture for the Toyota Group was considered a risky business [5]. The main key behind Lean Manufacturing System was to eliminate waste. Waste may be one which doesn't contribute in fulfilling customer's need. The goal of Lean manufacturing is to reduce

human effort, inventory, time to develop products and space to overcome the customer's demand by giving them a quality product in the most efficient and economical manner (Nakajima [6]). Lean manufacturing affects cost of production reviewed by many research scholars as, Iraqi manufacturing companies while establishing the basics of Lean manufacturing are different on the basis of availability of capital thinking. means there is strong relationship in capital thinking and Lean basics (Saleh [7]) In Brazil the Agricultural machines manufacturers shown interest in adopting Lean Manufacturing as they found rise in production with same investment as earlier (Badran[8]). According to Bhasin & Burcher Lean should not be seen as combination of Tools & Techniques but it should be seen as," a way of thinking"(Bhasin[9]). Rajgopal in a case focuses on a steel mill which has adopted Lean Principals and got the growth of 30% in productivity (Rajgopal [10]).El-Kourd shown that by adopting Lean construction in Gaza Strip reduced the number of steps in the whole project by 57%, the non- valued decreased from 81%to 14%in the project duration, and the total cycle time of the project was reduced by 75% (El-Kourd [11]). Rathi concluded that unnecessary processing, transportation of materials and WIP inventory wastes are significant in job type PI and raw material inventory was the most prevalent waste for the process industry sector (Rathi[12]). Abdullah remarks that the driving force behind implementing lean in the US was the reduction in cost of the steel companies among others (Abdullah[13]). Joing focuses that on-time delivery and customer satisfaction improved while lead times and inventory dropped significantly (Joing).

IV Case Study: For implementation of lean manufacturing in plant layout.

For the case study we have considered the parameters coming under the lean manufacturing techniques

During implementation we have to consider the following factors.

1. Elimination of waste
2. Continuous improvement
3. Continuous flow and pull driven systems
4. Multifunctional teams
5. Information systems.

Out of these if we concentrate on the elimination of waste, under this we can find different parameters on which the implementation of lean manufacturing is based.

Elimination of waste: everything that does not add value to the product, like inventories, machine setups, machine downtime, movement of parts and scrap. Therefore, the metrics should reflect those

Categories of waste:

*. *WIP:* Value of WIP in the line.

*. *Setup time:* Time spent in setups/ total productive time (percentage).

*. *Machine downtime:* Hours-machine lost due to malfunction/Total machine hours scheduled (percentage).

*. *Transportation:* Number of parts (trips) transported * Distance.

*. ***Space Utilization:*** **How much area does the line need, including its WIP and tools?**

In this paper the concentration is made on the case study on a woodcutting tool manufacturing industry for implementation of lean manufacturing. During this we have considered the plant layout of the industry. This was traditional and not based on any parameter to reduce the lead time of the product.

There was not proper distribution of transportation time.

During the study of the industry, the operations for TCT (Tungsten carbide tipped tool) wood cutting blades section were as follows.

1. Teething, 2A. Drilling 2B.Slotting 3.Surface Grinding, 4A.Seating, 4B .O.D. Grinding 5.Brazing operation 6A. Boring 6B. Sand blasting, 7. Straightening 8. Side grinding, 9. Top grinding, 10.Inside grinding, 11.Final inspection, 12. Polishing

13. Packing. Out of these 2A: Drilling operation is at 80 m distance from the existing shade, for this one labor is required to take and bring the WIP. 6B: Sand blasting operation is 40 m long from existing shade, due to which again one labor is required.12&13 operations respectively polishing and packing are again 40m far from the shade so again one person is required to carry the finished products. All the remaining operations are done in the two compartments of one shade as shown in fig. As four operations are out of shade. Due to this the required travel time is increased. These unnecessary delays result in increase in lead time [avg. lead

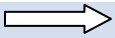
time=13120 Sec.] of the product. Due to the presence of four operations out of the shade the required man power [20 operators] is more. These four operations increase the delay time. These all results in reduction in production rate of the industry. Production rate is 2.05 Cutting tools / Hour, then, 2.05*8=16.4 Cutting tools per shift. As 20 Operators required per hour to As 20 Operators required per hour to produce 2.05 cutting tools the labor productivity can be given as,

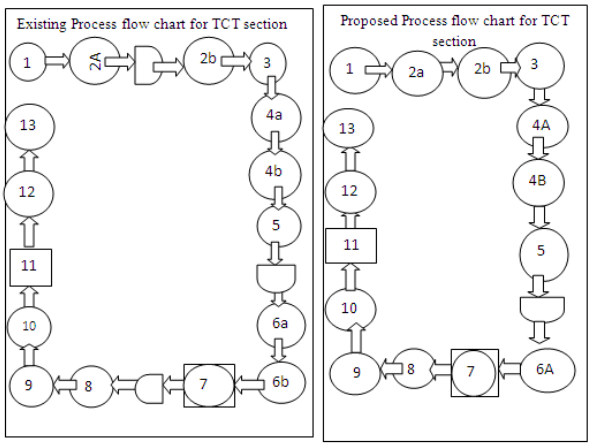
Labor productivity= 2.05/20

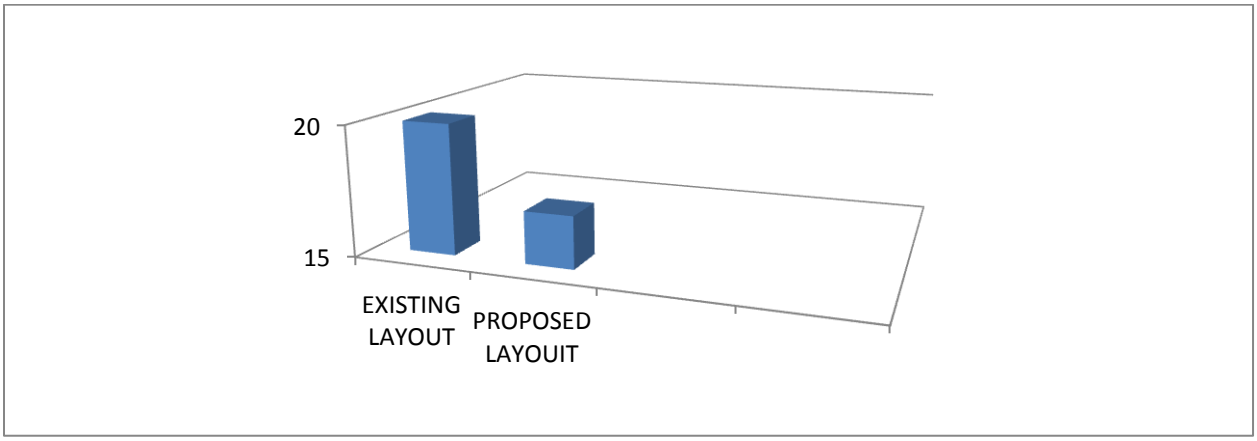
= 0.102 per man hour.

To eliminate these parameters, results in increase in delay time, lead time, manpower and rise in production cost, we can arrange the plant lay out in a better manner under the consideration of parameters of lean manufacturing. To reduce the waste in transportation we can locate the existing four operations in the existing shade as the space is available. By changing the positions of all these four machines in the main shade we can reduce the delay time which will result in reduction in lead time of the product. We can reduce the man power required which was 20 in the existing plant lay out to 17 in proposed plant lay out. We can reduce the lead time by reducing the delays in the operations 2B. Slotting =116 sec, 7.Straightening=48 sec, 12.Polishing and 13. Packing =328 sec. This total delay time of 492 sec. can be eliminated and lead time can be reduced to 12634 sec as shown in the table.

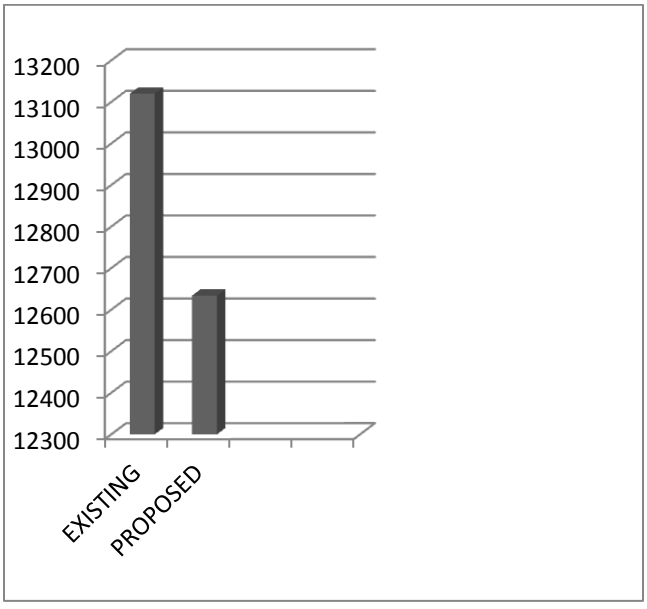
Proposed Process flow chart for TCT section

SYMBOL	MEANING
	OPERATION
	DELAY
	INSPECTION & OPERATION
	INSPECTION
	TRANSPORT





MANPOWER COMPARISON CHART



LEAD TIME COMPARISION CHART

OPERATION		PRESENT PLAN		PROPOSED PLAN		SAVINGS
OPRN NO	NAME	Operators Reqd.	Avg. time Reqd. (Sec.)	Operators Reqd.	Avg. time Reqd. (Sec.)	
1	Teething	01	437	01	437	
2A	Drilling	01	578	01	578	
	Delay	01	115	00	00	
2B	Slotting	01	572	01	572	
3	Surface Grinding	01	1151	01	1151	
4A	Seat	01	570	01	570	
4B	OD Grinding	01	570	01	570	
5	Brazing	01	2057	01	2057	
	Delay	01	1266	01	1266	
6A	Boring	01	787	01	787	
6B	Sand Blasting	01	959	01	959	
	Delay	01	45	00	00	
7	Straightening	01	958	01	958	
8	Side Grinding	01	696	01	696	
9	Top Grinding	01	699	01	699	
10	Inside Grinding	01	570	01	570	
11	Final Inspection	01	410	01	410	
	Delay	01	326	00	00	
12	Polishing	01	73	01	73	
13	Packing	01	290	01	290	
	TOTAL	20	13120	17	12624	
					Man Power	03 Operators
					Lead Time	496 Seconds

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