



Optimization of Working Processes by Using Takt Time and Assignment Model

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ABSTRACT: Takt Time is an important lean tool used to set the pace of manufacturing process which leads to the customer satisfaction. Takt time is mainly used to standardize the time for the completion of an operation. The case study was carried out in an auto parts industry. The spring pin section of the industry was facing the problem of on time delivery problem of the product which leads to the customer dissatisfaction. Takt time tool and assignment model were implemented to overcome this problem. Takt time was calculated. One operation's cycle time was above the takt time. To keep the cycle time of operation under the takt time, some improvements were suggested in order to product to be completed within required time. Before state and after state were compared and also suggest for the assignment model resulted into, 9.88% reduction in the total processing time, 15.38% reduction in total number of workforce.

KEYWORDS: Spring pin, Takt time, Assignment Model.

I. INTRODUCTION

Many manufacturers are applying lean principles to reduce wastes and increase efficiencies. Lean manufacturing is a Japanese approach that focuses on eliminating waste and ensuring quality. The aim of lean manufacturing is to cut unnecessary costs by making the business more efficient and responsive to market needs. The primary idea of this system is to maximizing value while minimizing waste, thereby achieving manufacturing excellence through the creation of more value with fewer resources.

Lean manufacturing may be defined as a set of techniques which are used to reduce and eliminate the wastes. This will make the company more flexible and more responsive by reducing waste.

Linear programming (LP) has been successfully applied to a wide range of problems, such as capital budgeting, maintenance, production scheduling and traveling salesman problems. LP has in the last decade been shown to be a flexible, efficient and commercially successful technique for scheduling, planning and allocation. A wrong decision may result in significant loss of value due to understaffing, under-qualification or over-qualification of assigned personnel, and high turnover of poorly matched workers. In this machining operations as an assignment problem. The solution developed could be adopted for any problem that can be modelled as an assignment problem.

II. METHODOLOGY

For solving the problems arising in different departments and during machining, the company followed a system of work by applying manufacturing tools for enhancing productivity of the company. Here we solve current problem by using two methods. Starting with first that is Takt Time method.

Sr. No.	Operation	Avg. Time Taken(Sec)	Operators required
1	Hacksaw cutting	90	3
2	Raw grinding	20	1
3	Cross hole drilling	40	1
4	Counter sinking	16	1
5	Reaming	35	1
6	Case hardening	55	1
7	Tempering	21	1
8	Reaming	25	1

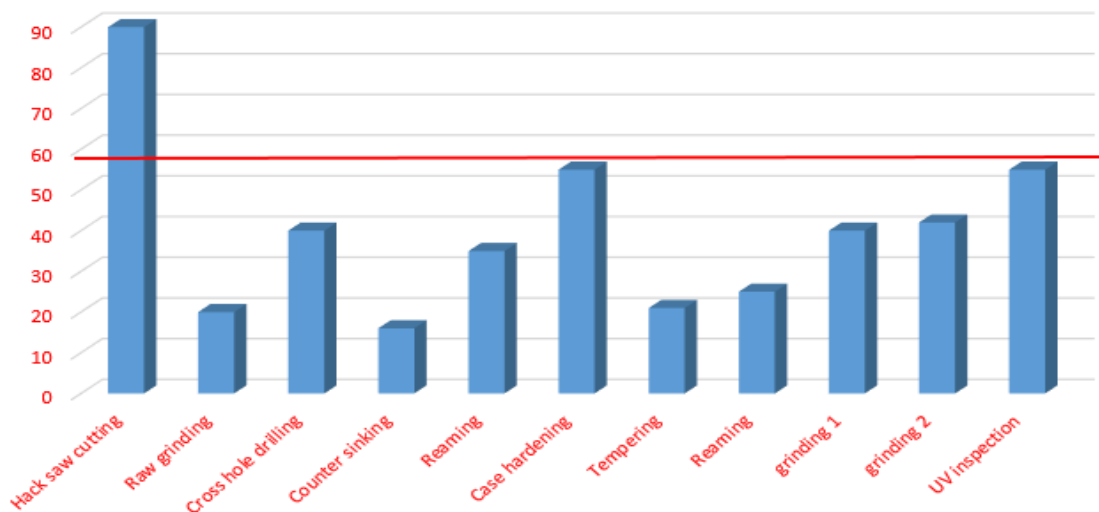
9	grinding 1	40	1
10	grinding 2	42	1
11	UV inspection	55	1
Total		435	13

Above table shows the average time required to perform particular operation. And after that calculated takt time as follows:

1. Demand = 450 pieces.
2. Available working time = 480 – 60 = 420mins.
3. Takt Time= 420/450= 0.93min= 56sec.

After calculation for Takt time, graph was plotted and from that we realized which process is going above takt time. There was one operation having cycle time above the takt time. The operation with cycle time above takt time was hack saw cutting. Rests of operations were well covered within the takt time.

Time study



(a)

Fig. 1 shows the graph for Takt time(a)

1. Hack saw cutting operation involved 90sec.
2. Loading time = 58sec / single rod.
3. Value added time = 28sec.
4. Unloading time = 4sec.

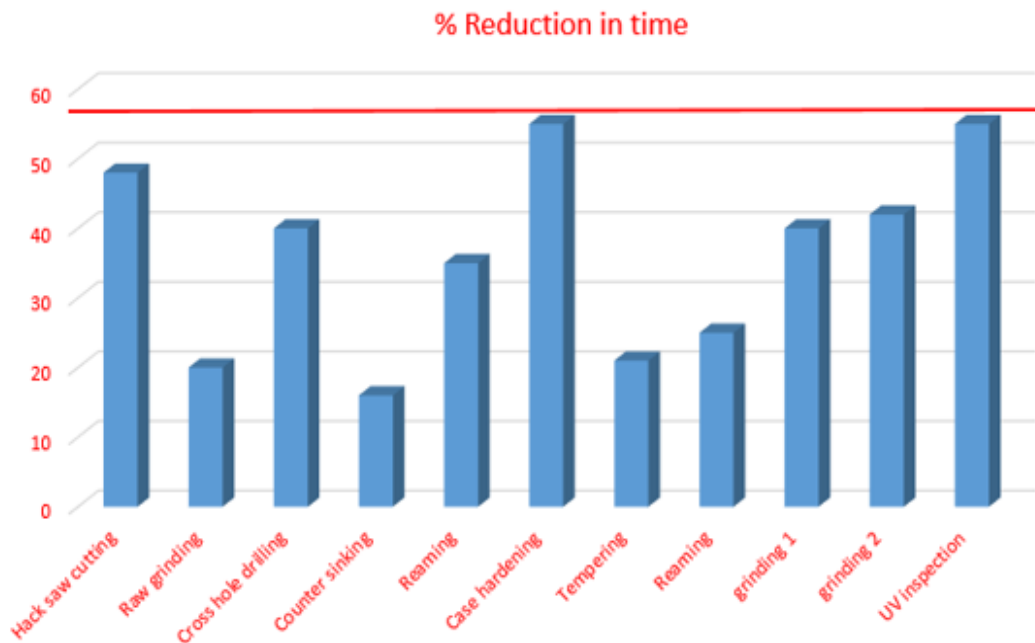
For second method that is by using Assignment Model. To solve their particular problem collected the data of each worker performing each operation and for every operation how much time he needs to do that job.

	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
Op.1	90	86	87	91	96	100	107	108	81	87	90	85	87
Op.2	20	22	24	21	19	17	20	26	35	35	24	21	23
Op.3	45	42	40	41	38	40	42	45	35	37	36	40	42
Op.4	19	20	18	16	14	19	20	16	18	14	13	17	16
Op.5	35	40	38	37	40	27	30	32	28	35	40	42	32
Op.6	55	50	52	58	54	57	55	65	55	60	52	55	60
Op.7	20	22	18	30	25	28	21	19	32	20	20	24	26
Op.8	25	23	35	30	31	20	30	25	24	28	29	29	21
Op.9	40	42	38	45	50	38	48	40	35	32	42	35	40
Op.10	50	48	42	39	40	40	40	42	38	35	38	42	46

III.RESULTS

Problem is solved by using two methods therefore first the result of Takt time was as follows:

By incorporating ‘Electric Overhead Travelling Wire Rope Crane’, this non-value added activity could be reduced to a great extent. Only one worker was required for whole operation after the implementation of Crane which led to profit to the company due to elimination of two workers.



(a)

SR. NO.	ELEMENTS	BEFORE STATE	AFTER STATE	PERCENTAGE REDUCTION
1	Value adding time	28	28	0%
2	Non-value adding time (loading)	58	16	72.41%
3	Non-value adding time (unloading)	4	4	0%
Total		90	48	46.66%

SR. NO.	PARAMETERS	BEFORE	AFTER	PERCENTAGE REDUCTION
1	Total Processing time	435	392	9.88%
2	Workforce	13	11	15.38%

(b)

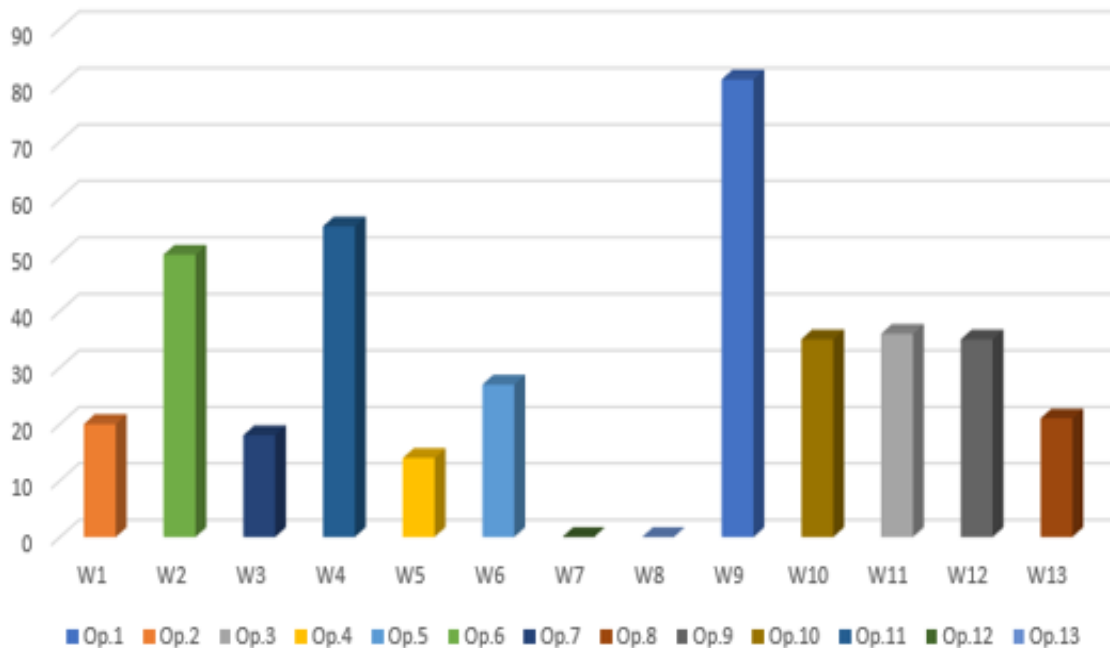
Fig. 2 Shows graph of % reduction in Takt time (a) and % reduction in time and workforce (b) Second result of Assignment Model:

1. After completion of assignment model the calculated total processing time is 392 secs.
2. Total number of workforce was reduced from 13 to 11.

	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
Op.1	6	3	3	7	13	20	24	24	0	7	8	2	3
Op.2	0	3	4	1	0	1	1	6	18	19	6	2	3
Op.3	7	5	2	3	1	6	5	7	0	3	0	3	4
Op.4	4	6	3	1	0	8	6	1	6	3	0	3	1
Op.5	1	0	11	6	8	0	0	1	0	8	11	12	1
Op.6	4	0	1	7	4	10	5	14	7	13	3	5	9
Op.7	2	5	0	12	8	14	4	1	17	6	4	7	8
Op.8	4	3	14	9	11	2	10	4	6	11	10	9	0
Op.9	4	7	2	9	15	6	13	4	2	0	8	0	4
Op.10	12	10	3	0	2	5	2	3	2	0	1	4	7
Op.11	0	3	1	0	0	4	2	3	7	3	2	3	1
Op.12	0	0	0	0	1	3	0	0	2	3	1	0	0
Op.13	0	1	0	0	1	4	1	0	3	3	2	1	0

(a)

Workers assigned to particular operation



(b)

Fig. 3 table shows the assignment model result (a) and graph (b)

IV. CONCLUSION

After case study and literature review on Takt time, concluded that before, the loading was done manually by three workers in the hacksaw operation. The primary motive was to reduce loading time. After the implementation of Electric Overhead Travelling Wire Rope Crane or Assignment Model Solution, time was reduced to a great extent as well as reduction in workforce too.

1. Processing time for the hacksaw cutting operation was reduced 46.66%.
2. Whole processing time for manufacturing the spring pin was reduced from 435sec to 392sec or 9.88% reduction.
3. Total number of workforce was reduced from 13 to 11 or 15.38% reduction.

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