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Toc And Lean Are Solutions For The Capacity Constrained Production Units

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Abstract :-In any manufacturing unit, meeting of the target in time is the primary objective, irrespective of the size of the manufacturing unit (small, medium, large). Most of the time, the firms fail in meeting the target due to 5M's (men, material, machine, method, means) are not controlled in time. In the engineering firm where study has undertaken, the demand is more than its capacity and the product calls for long lead time and also size of the product is very huge fabrication and quality requirement is most essential. The quantity of output is 50 Nos. /year and involves higher through put time and lesser productivity. The author in this study implemented "Theory of Constraints Principles" TOC and LEAN thinking to overcome the issue and achieved the considerable reduction in throughput time around 65 percent and higher productivity by the way of eliminating constraints and bottlenecks. Originally the process time for the product to come out in 32 days and achieved the same in 11 days.

I.INTRODUCTION

The objective/goal of any business is to make profit. From the many ways of running any business, TOC and LEAN are few among them. Here there is close correlation between TOC and LEAN. The TOC stresses for identifying the system constraints, where as LEAN focus on bubbling up of all problems during the operations and sort one by one as per priority. In short both are stressing about the same issue, but in a different. Theory of constraints (TOC) has enjoyed a place of prominence in the minds of entrepreneurs and managers, its application shows to improve cycle times, increase service levels, decrease inventory levels in the areas of manufacturing industry. TOC presented a revolutionary way of thinking about production scheduling whose implementation would prove beneficial to the organization. For thata company have to first define its objectives and then relentlessly focus on it.

II.BACKGROUND OF THE STUDY

The production unit involved in this study is the manufacturing unit of heavy engineering structure. Its core activity is fabrication of heavy structures and their machining. The structure made out of various thicknesses special alloyed steel plates. This structure will be used as moving / static platform for various applications. These steel plates were procured from national/international markets. The plates were prepared by means of machining prior to tack welding the structure. The steel plates were machined by using conventional/CNC machines depend up on the quality demands. The box making was done as per drawing by using a fixture through tack welding.

Six essential factors of organizational excellence are :

1. Right Customer focus which includes identifying customer need such as the products and services.
2. Consolidation of current business which includes restructuring, mergers, acquisitions and more.
3. Operational efficiency across the organization which includes systems like TQM, LEAN, TOC etc.
4. Exploring new markets such as opening of service centers etc., at field areas.
5. Human resource management which includes attracting, retaining, developing and carrier planning.

6. Corporate image building by developing the company's reputation in the minds of customers.

In this engineering firm the activity started for identifying the idle capacity if any exist to do the constrained task. When no capacity found internally the hunt started for locating the constrained capacity outside the firm.

After tack welding, the structure will be moved to a welding manipulator for full welding. This structure requires horizontal/vertical/overhead welding, when manipulator is employed more than 85% of welding were carried out in horizontal position by qualified welders. In this production unit the welding robots were not available, hence the entire welding were carried out manually.

As we know welding is such an activity, it has to be done with full care and dedication the welding is labour/heat/fume intensive work .Welders stressed out in very short duration of activity. At that time what is happening is work is stopped. Hence the remedy is to keep stand by welders and deploy as and when requires and ensure the work continuous by this way we can ensure the work is progressed round the clock. At the same time required cooling to be given to the job as per the process requirement. Because of the reasons mentioned above, the output /productivity is low. This happenings forced to think alternative ways to increase productivity hence this case study.

Since the concerned welders subjected to extreme heat fumes and also work in a confined area and the mancooler (Fans) also not permitted to focus that area because it will affect the quality of welding also the gases (co_2) used for welding to protect the welded area will be driven away. Hence, at the time of welding no external aircooler will be focused on the operator. In this kind of restrictions force the operator to weld only for few minutes, and then he will move out to nearby fan to cool himself. This kind of situation will lead to non-welding of the structure in most of the time. Moreover, in the manipulator only two welders can weld at a time since the job position is like that. This kind of situation will lead to delay in fabrication of the structure. This study is how we overcome the above situation and the productivity was improved.

The number of shifts we operate is 3 X 8 hr. = 24 hrs. , each shifts, 2 welders were employed since only two position can be welded at a time but in practice, the weld rate is very slow and intermittent in this way it has taken 32 working days to complete one structure. However, this is far less than the expected output rate of at least one structure per week.

III ORIGIN OF TOC, PRINCIPLE AND LITERATURE REVIEW

The Theory of Constraints had a humble beginning when, in the late 1970's, an neighbor of EliyahuGoldratt, an Israeli physicist, asked him for assistance in creating a scheduling program to increase the output of his chicken coop factory. The resulting software package known as Optimized Production Time tables (OPT) scheduling software was the first practical application of TOC. From this simple scheduling software TOC has evolved into a set of management tools encompassing production, logistics, and problem solving and thinking tools (Watson, Blackstone and Gardiner2007). This business philosophy captured the attention of practitioners with the publishing of "The Goal" in 1984.The success of the book prompted Goldratt to leave the software business and establish himself as a business educator. (Stanley C. Gardiner 2007) Nevertheless, in this seminal work Goldratt borrowed from previous operational wisdom and put forth many commonsense that have come to be lumped together and known collectively as the Theory of Constraints or TOC. The TOC's application has been documented to produce favorable results when applied to the manufacturing environment. (Mabin and Balderstone 2000).

Principle in TOC state the following identify the system constraint

- Identify the system constraints
- Decide how to exploit the above constraint ?
- Subordinate everything else to the above decision
- Elevate the system constraint,
- Once that particular constraint is eliminated is to go back to first step .

IV EXISTING CONSTRAINT IN THE PRODUCTION UNIT

- Present output only one number in a month against requirement of 3 to 4 Nos. per month.
- Availability of manipulator and fixer for fabrication is restricted to quantity one number only due to limitation space and huge investment. Providing additional unit is not feasible and economical being batch production (15 Nos./Quarter year)

- Engagement of welders in operation is restricted to only two welders due to process / space constraints.
- Involves higher throughput time and less productivity.
- Delivery is delay almost three to four months as against one month's requirement.

V METHODOLOGY AND APPROACH TO PRESENT PROBLEM

Throughput Time Reduction

A. Perform activities in parallel. By adopting parallel approach 80% reduction is possible in throughput time.

B. Change the sequence of activities.

C. Reduce interruptions.
Often 90% of time in a process line is waiting time; hence by merely eliminating waiting time the throughput can be increased greatly, in other words the process should be always manned.

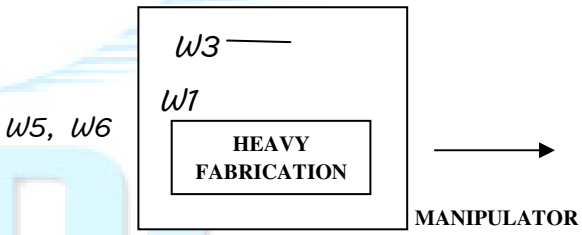
D. The slowest process in the system determine the throughput time.

Check lists for productivity improvement.

- Concentration should be made on controlling the controllable.
- Improved productivity comes from better methods and better equipment.
- There is no single means of perfecting productivity.
- Involve as many as possible for improve productivity.

To improve productivity TOC is followed, the bottlenecks were identified in the fabrication area and efforts were made to overcome the bottleneck hour lost in the bottle neck is an hour lost in the entire system. Bottleneck governs the throughput of the system(productivity of heavy structure).The weakest link determines the strength of the chain. So if we want to improve the strength of the chain, the first step is to identify the weak link and improve its strength. Here the weak links are **not manning the work station continuously, and to identify the suitable welding positions** so as to deploy more than two welders in the manipulators, to identify the optimum size of welding wire/electrode. By applying the TOC we can find solutions for this to some extent, however we further firm it up by developing a new productivity improvement model. If everyone is made to do his share of work together it can be achieved. Many small improvements will lead overall improvement in productivity of heavy structure fabrication. Method followed here can be universally followed for any fabrication activities. By synchronizing the efforts of each activity in a planned manner the productivity improvement will be achieved. In many organizations excess capacities available are hidden, if everything is utilized, the improvement in productivity will be achieved.

As per **Goldratt do not balance the capacity but balance the flow an hour lost at the bottle neck is an hour lost for the entire system bottleneck governs both through put and inventory in the system**. If each and every person work in the synchronized way the output can be delivered in time. In the current production method, two welders were employed in each shift but the actual welding is not taking place even to 50% of the shift timings. Hence, to improve the weld metal deposition rate, total six welders were employed in each shift ie. Minimum 18 welders/day were deployed in a single day instead of 6 welders/day, since there is threefold increase of manpower, it is expected 1/3 reduction of cycle time of fabrication ie. instead of 32 days, it should be brought down to 32/3 = 10.4 days. However, on reality we could achieve 12 days. This we could achieve by continuously doing the welding. The method of deployment welders are ensured in such a manner that the welding is carried out on the structure without any undue delay.



Weldersw_1&$w_2$are in the job, welders w_3&$w_4$are waiting on manipulator. w_5&w_6 were waiting outside the manipulator to replacew_1, w_2, w_3 &$w_4$as and when needed.

VI IMPLEMENTATION

To introduce new working arrangement, we just understand and apply correct principle the secret of good manager lies in simply looks at reality and think logically and precisely about what we see and arrive to the correct solution. After through study of the working environment the following arrangements were introduced.

Deploy 6 welders/shift (Total 18 welders/day) Keep the maintenance team ready always to attend any breakdown to welding machines

or manipulator etc. Keep the welding consumables in adequate quantity/quality. When this was introduced there was resistance from workers, they were educated and made to understand to meet the deadlines, within one week, the working condition became very normal. The shop could deliver one welded structure by 12 days. This was a great saving in throughput, the cycle time has reduced from 32 days to 12 days ie. 20 working days we could able to reduce.

VII RECOMMENDATION

- Deploy six welders per shift and 18 welders a day for a 3 shift system provided continuous maintenance team to attend the breakdown of welding machine and manipulators.
- Maintain adequate consumables with right quality
- Motivate welders to follow the modified model.

VIII CONCLUSION

Companies who have moved into TOC have significant improvement within a period of three months. This is because of the effective steps approach which forces a team to work on the right area aiming for the right bottom-line results. From my involvement and experience by using TOC the following results have been seen.

"Theory of Constraint is the Evolution of a Revolution". It brings quantum benefits to those who practice it within a very short period of time.

TOC is not something a company has to spend millions of dollars to embark on. It starts with the steps approach. Once the constraints have been identified, several tools are at the disposal of the Organization to improve itself. This case study is the classic case of TOC implementation and its results are seen by the management and others in the shop floor.

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