International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869 (O) 2454-4698 (P), Volume-3, Issue-10, October 2015

Development of Dashboard for Production Management Using Theory of Constraints

Saloni Parekh, Janhavi Parulekar, Sayali Saswadkar, Sayali Jagtap, Prof. Shweta Guja

***Abstract*— We have witnessed many changes in the production management these days. By implementing the concept of 'Theory of Constraints' the production inventory can be effectively managed. Many applications can be developed that can use various parameters on which decisions need to be taken. The main motive is to provide solutions for the problems caused by bottlenecks. Thus in improving the process flow, production management and for managing bottleneck theory of constraints plays an important role. Theory of Constraints works around every single constraint that comes in the way by identifying it and then restructures the inventory. In this project we will make use of colour coding in combination with database. With the help of graphs and other pictorial representations we will be developing a dashboard for general use. The databases can be abundant in size so we make use of SAP for our database. This will then be connected to the dashboard using JCO. The dashboard will be connected to a warehouse holding the data and will make use of cloud for its interaction. The dashboard will also feature many abilities like reminders and auto updates in order to reduce human efforts and make the inventory flawless. This dashboard will make it more visual and so the managers can take the productions decisions easily the tedious jobs like analysing the database and then presenting the verdicts can be made easy and user friendly with the help of this dashboard. The user interface will include graphical representation of data in form of pie charts and bar graphs.**

***Index Terms*—Bottleneck, Downstream, Theory of constraints(TOC), Throughput, Upstream.**

I. INTRODUCTION

Highlight A constraint can be defined as a limiting factor or any sort of restriction that comes in the way of achieving a goal. So Theory of Constraints can be considered as an important methodology in achieving a goal where constraint is systematically processed until it is no longer a limiting factor. For this the constraint must be identified successfully and a solution must be sought in order to successfully process the production. In case of manufacturing and production systems constraint is often referred to as bottleneck.

Saloni Parekh, Computer department, NBNSSOE, Pune, India, 7507710624
Janhavi Parulekar, Computer department, NBNSSOE, Pune, India, 9822371551
Sayali Saswadkar, Computer department, NBNSSOE, Pune, India, 9765978889
Sayali Jagtap, Computer department, NBNSSOE, Pune, India, 7507710624

For improvement of any system a specific approach is required. This means that every system, even the manufacturing industry, has linked activities which are multiple in numbers, of which any one can act as a limitation on the whole working of the system. However, the ultimate goal of any production company being to gain profit in production for short as well as long term –these small limitations can be overcome easily with the help of TOC.
To achieve this goal Theory of Constraints can be considered as a powerful set of tools which includes:

- The Five Focusing Steps are the methodology for identifying constraints and eliminating them.
- The Thinking Processes are tools for analyzing and resolving problems.
- Throughput accounting is a method for measuring performance and guiding management decisions.

Dr. Eliyahu Goldratt has coined the concept 'Theory of Constraints' (TOC), After that, Theory of constraints has improved and developed to a great extent, and in today's date for management and production practices it is a significant and important factor.
Theory of Constraint concentrates on prioritizing the improvement activities which proves to be one of the key characteristics of Theory of Constraints. The first priority is always given to current constraint. In situations where there is an immense need of change, TOC has more concentrated methods for implementing fast and focused changes or improvements.

Advantages of a successful Theory of Constraints methodology are as follows:

- Primary goal of TOC of acquiring more profit can be achieved for almost all the companies.
- Fast improvement is observed since focus is on the important constraint.
- More products can be manufactured at a time thus increasing the capacity.
- Faster and smoother results can be achieved thus reducing the time.
- When bottlenecks will be reduced there will be less work to be processed and this will reduce the inventory.

II. IMPLEMENTATION

A. Identifying the constraints.

This is the first and the most important fundamental step in the implementation of TOC. In this step whole manufacturing process is reviewed in order to identify the constraint.

- Look for any large accumulations of work-in-progress on the plant floor. Inventory is often accumulated immediately before the constraint.
- Look for the areas in the process where process expeditors are frequently involved. Special attention and handholding are often needed when considering the constraints to ensure that critical orders are completed on time.
- Review equipment's performance data in order to determine which equipment has the longest average cycle time. Adjust out time where the equipment is not operating due to the external factors, such as being starved by any upstream process or blocked by a downstream process. Although this time affects the throughput, the time loss is usually not caused or controlled by the starved or blocked equipments.
- Ask the operators where they think equipment is not keeping up with the demand. In order to improve pay close attention to these areas, but also look for other supporting indicators.
  The deliverable entity for this step is the identification of the single piece of equipment that is constraining the process throughput.

B. Exploit the constraints.

In this step, the objective is to make the most of what we have by maximising the throughput of the constraint using any currently available resources. The line between exploiting the constraint (step B) and lifting the constraint (step D) is not always clear. This step initially focuses on quick wins and rapid relief and leaves more complex and substantive changes for later.

- Create a suitable sized inventory buffer immediately in front of the constraint to make sure it can keep on operating even if an upstream process stops.
- Check the quality immediately before the constraint so that only known good parts are processed by the constraint.
- Make sure that the constraint is continuously scheduled for operation such as operating the constraint during breaks, approve overtime, schedule fewer changeovers or cross-train employees to ensure there are always skilled employees available for operating the constraint when required.
- The routine maintenance activities must be outside of constraint production time .For example during changeovers.
- Unload some constraint work to other machines. The improved system throughput is likely to improve overall profitability even if they are less efficient.
- Also unload some work to other companies. This should be a last resort and must be done only if other techniques are not sufficient to relieve the constraint.

The end result for this step is better utilization of the constraint, which in turn will result in enhanced throughput for the process. If the actions are taken in this step they "break" the constraint moves, jump ahead to Step E. Otherwise, continue to Step C.

C. Subordinate and synchronize the constraints

Here, the focus is on non-constraint equipment. The primary objective of this step is to support the needs of the constraint that are subordinate to the constraint. Efficiency of non-constraint equipment is a secondary concern as long as constraint operation is not adversely affected.

By definition, all non-constraint equipment are said to have some degree of excess capacity. This deductible capacity is a virtue, as it enables smoother operation of the constraint. The manufacturing process is intentionally unbalanced:

- Upstream equipment has excess throughput which ensures that the constraint buffer is continuously filled but it is not overfilled so that the constraint is never "starved" by the upstream process.
- Downstream equipment has excess throughput which ensures that material from the constraint is continuously processed so the constraint is never "blocked" by downstream processess.

Some useful techniques for the above include:

- Implement Drum-Buffer-Rope (DBR) on the constraint for synchronizing the manufacturing process to the needs of the constraints.
- Ensure that the constraint will always be the highest priority for maintenance calls which will subordinate the maintenance to the constraint .
- Add sprint capacity to non-constraint equipment in order to ensure the interruptions to their operation which are the breakdowns or the material changes that can quickly be offset by speedy operation and additional output.
- Operate non-constraint equipment at a steady pace in order to minimize the stops. Often inertial changes like stops and speed changes can increase wear and result in breakdowns.

The output for this step is fewer instances of constraint operation that are paused by the upstream or the downstream equipment, which in turn results in enhanced throughput for the process. If the actions are taken in this step they "break" the constraint moves and jump ahead to Step E. Otherwise, continue to Step D.

D. *Elevate performance of the constraints.*

Here, more substantive changes are implemented in order to “break” the constraint. These changes may also necessitate a significant investment of time and in many cases money too like adding equipment or hiring more staff. The key is to make sure that all such investments are evaluated for the effectiveness of the systems preferably by using Throughput Accounting metrics.

- Use performance data like overall equipment’s effectiveness metrics and down time analytics to recognize the largest sources of the lost productive time at the constraint.
- Target those largest sources of lost productive time, consecutively, with cross-functional teams.
- Implement working plant floor reviews within shifts by using a technique called Short Interval Control to identify tactical actions that will improve constraint performance.
- Implement a setup reduction program in order to reduce the amount of productive time lost to changeovers.
- Evaluate the constraint for potential design updates and sometimes component upgrades too.
- Purchase additional equipment that will supplement the constraint that is a last resort.

  The result for this step is a significant performance improvement that breaks the constraint and moves the constraint elsewhere.

E. *Repeat the process.*

In this step, the objective is to make sure that the Five Focusing Steps are not implemented in a way of one-off improvement project. They should instead be implemented as a continuous improvement process.

- If the constraint has been broken to the normal case, recognize if there is a new constraint. The new priority is to find and eliminate the new constraint .Now restart at Step One.
- If the constraint has not been broken, recognize if more work is required, and a fresh look needs to be implemented, including verification of the constraint has been correctly identified, now restart at Step One.

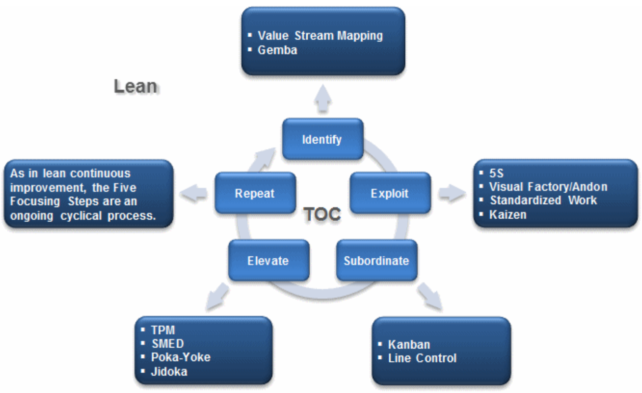

Figure 1-Implementation of TOC

III. Conclusion

Theory of Constraints has laser-like focus on improving the constraint it is one of the most powerful aspects of TOC. While Lean Manufacturing can be focused, typically it is implemented as a broad-spectrum tool.

In the real world, we always need to compromise, since all companies have finite resources. Not every aspect of every process is worth optimizing, and not all waste is worth eliminating. In this light, the Theory of Constraints can serve as a highly effective mechanism for prioritizing in improvement of projects and Lean Manufacturing can provide a rich toolbox of improvement techniques. As a result – manufacturing effectiveness is significantly increased by eliminating excess of material from those parts of the systems that are supposedly the largest constraints on opportunity and profitability. While Lean Manufacturing tools and techniques are firstly applied to the constraint, they can be applied to equipment that is subordinated to the constraint as well (e.g. to equipment that starves or blocks the constraint; to post-constraint equipment that causes quality losses).

Acknowledgment

We would like to thank out project guide Prof. Shweta Guja for her guidance and help in this project. We also thank our HOD Dr. Rajesh Prasad Sir for his support and also our project coordinator Prof. Swati Shirke for her co-ordination. We must also thank Onama groups for sponsoring our project and guiding us through it. Our special thanks to the director of Onama groups Mr. Anand Godse and our external project guide Mr. Praful Mankar for their generous and immaculate support.

References

[1] Eliyahu M. Goldratt. 2004. The Goal: A Process of Ongoing Improvement.
[2] Theory of Constraints Handbook.
[3] A. Clark and H. Scarf, “Optimal policies for a multi-echelon inventory
[4] “Using the theory of constraints’ production application in a semiconductor fab with a reentrant bottleneck,” IEEE/CPMT Int.
[5] “A Multi-Objective Decision Making on Reliability Growth Planning for In-Service Systems” , IEEE paper.
[6] Eliyahu M. Goldratt. 2004. The Goal II: Living the dream.
[7] “Study on integrated algorithm of complex multi-product flexible scheduling” , IEEE paper.
[8] “Theory of Constraints”. Vector Consulting.
[9] “Decision support system for inventory management by TOC demand-pull approach”.
[10] Mukherjee, S.M. and Chatterjee, A.K. (2007). The concept of bottleneck. Working Paper No. 2006-05-01, IIM Ahmedabad Brown, L. D., Hua, H., and Gao, C. 2003. A widget framework for augmented interaction in SCAPE.