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# Organization planning using theory of constraints

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***ABSTRACT*****:** *In today's economic climate, many organizations struggle with declining sales and increasing costs. Some choose to hunker down and weather the storm, hoping for better results in the future. However, layoffs and workforce reductions jeopardize future competitiveness. However, organizations that have implemented the Theory of Constraints (TOC) continue to thrive and grow in difficult times, continuing to achieve real bottom line growth, whether by improving productivity or increased revenues. In this paper, the organization dealing with the furniture manufacturing has been studied and the main constraints for the maximum throughput are identified by applying a thinking process tool called as "Theory of Constraints" (TOC). The Drum Buffer Rope (DBR) has been applied for capacity planning and the time for each identified processes is calculated and workload for each work center is calculated. Then the capacity constraint machine is identified. The proper solution has been provided to overcome the constraint*

***Keywords***: *TOC; DBR; Primary Resource Constraint; Capacity Constraint Resource*

## I. INTRODUCTION

The organizational planning has become a vibrant field due to the growing demand of variety of products in the markets. In order to fulfill the requirements exploding population in the world and to cope up the uncertainties and opportunities in developing economies of the world, planning has become the most important part of the organizations strategies. For any organization, its utmost important to identify the organizations immediate and long term objectives and formulate the strategies to achieve them in order to sustain in the highly competitive environment. Organizational planning also entails the staffing, resource allocation and responsibilities of management team.

There are different decision making tools for organization planning. In this work, "Theory of Constraints" (TOC) has been applied for the planning at modular furniture manufacturing organization. Three important approaches have evolved for companies to achieve competitive advantages, each challenging old assumptions and ways of doing things. These are Materials Requirements Planning (MRP I and MRP II), Just-in-Time (JIT), and TOC. Developed by Eli Goldratt in the mid-1980s, TOC evolved from the OPT (Optimized Production Timetable) system and was later known under the commercial name of Optimized Production Technology (OPT). As part of a marketing tool for the OPT system, Goldratt illustrated the concepts of OPT in the form of a novel in which the theory is gradually unraveled through the context of an everyday production situation. It presented a logistical system for the material flow called the drum-buffer-rope (DBR) and, gradually, the focus of the concept has moved from the production floor to encompass all aspects of business. By 1987, the overall concept became known as the theory of constraints (TOC) which Goldratt viewed as "an overall theory for running an organization". This refinement recognized that the main constraint in most organizations may not be physical but managerial-policy related. To address the policy constraints and effectively implement the process of on-going improvement, Goldratt proposed a generic approach called the "thinking process" (TP). This is the current paradigm of TOC. Experts believe that it is the TP of TOC which will ultimately have the most lasting impact on business. The scheduling system of TOC is often referred as drum-buffer-rope (DBR) system. DBR systems operate by developing a schedule for the system's primary resource constraint. The aim of this work is to identify the constraints in the organization and apply TOC to solve it

## II. LITERATURE REVIEW

TOC views organizations as systems consisting of resources, which are linked by the Processes they perform. The goal of the organization serves as the primary judge of Success. Within that system, a constraint is defined as anything that limits the system from achieving higher performance relative to its purpose. The pervasiveness of Interdependencies within the organization makes the analogy of a chain, or network of Chains, very descriptive of a system's processes. Just as the strength of a chain is governed by its single weakest link, the TOC perspective is that the ability of any Organization to achieve its goal is governed by a single, or at most very few, constraints.

While the concept of constraints limiting system performance is simple, it is far from simplistic. To a large degree, the constraint/non-constraint distinction is almost totally ignored by most managerial techniques and practices. Ignoring this distinction inevitably leads to mistakes in the decision process. The implications of viewing organizations from the perspective of constraints and non-constraints are significant. Most organizations simultaneously have limited resources and many things that need to be accomplished. If, due to misplaced focus, the constraint is not positively affected by an action, then it is highly unlikely that real progress will be made toward the goal. Given this perspective, TOC's 5-step process offers a systematic and focused process which organizations use to successfully pursue ongoing improvement.

## III. PROBLEM DEFINITION

A manufacturing organization considered in this article is based nearby the capital of India. Due to sudden increase in the demand of products, management had to decide on action plan. As demand was uncertain to sustain management was not interested in strategic investment for resource acquisition. After considering all the related factors, management was not interested on providing overtime.

### 3.1 The Manufacturing Environment

The company where the work is conducted is involved in the manufacturing of various types of modular furniture, and the kitchen, bedroom furniture. The various key business processes in the company are discussed below:

The customer sends the inquiry to the sales department.

After receiving the inquiry, the sales department sends a quotation to the customer.

If the offer is acceptable to the customer, he sends the purchase order for the same.

The order is then forwarded to the design department for the detailed drawings. One copy of the order is also sent to the planning department to prepare a detailed plan for the project.

At the same time process, the plan and the detailed drawings are sent to manufacturing.

After completing the manufacturing of ordered furniture inspection is conducted and dispatched to the customer.

The plywood serves as raw material for making furniture. The plywood sheets cuts in different sizes and then send for routing process, for this process there are four CNCs. After routing panels, plywood proceeds for shaving and cleaning section. In this section, panels are treated with sand paper and then cleaning is to be done. Then, panels are transferred to glue room where the gluing operation is to be done, so that the foil can be stick on panels, for this foliar, m/c is to be used. Then quality inspection is done. Then panels proceed for their last stage i.e. the assembly of panels is done in order to achieve the final product.

## IV. IMPLEMENTATION DBR MERHODOLOGY

A company manufactures furniture. The environment is that of a job shop environment and there are an eight work centers on the shop floor. There are three shifts per day. Per day working hours are 24 and working days per week are six. It produces five main products P1, P2, P3, P4, and P5 the description and demand of each product is mentioned in Table: 1

Table: 1. Product Descriptions

| PRODUCT | NAME | DEMAND |
|---|---|---|
| P1 | ARESA | 120 |
| P2 | FIRA | 90 |
| P3 | NENO | 82 |
| P4 | DUATE | 70 |
| P5 | AVITA | 110 |

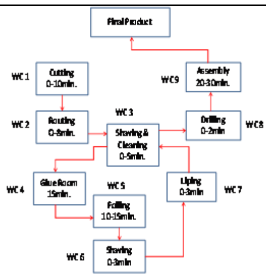


Figure: 1 Logical Product Process Structure

The flow chart represents a specific operation for a specific product to be performed on a specific raw material for a specific amount of time on a specific machine. Material passes through total nine types of work centers (WC).Work centers for certain operations. For all the products basically there were one routes for components ultimately assembled at work centre 9 (WC 9). Another component passes through Work Centers 1, 2, 3, 4, 5, 6, 7, 8 and assembled at work centre 9.

## V. METHODOLOGY

It is a technique for developing smooth achievable schedules from the capacity constraint resources so that maximum output is obtained from the plant. It is different from the other production scheduling technique.DBR also provides an improved method to focus on the capacity constraint resource. So that the impact of the variability in the output of other resources does not causes more distributed in the manufacturing of finished products. DBR was basically developed to implement the five step methodology of on the ongoing improvement described by Dr. Goldratt in his business novel, The Goal.

### 4.1 Drum –Buffer-Rope and Buffer Management

The logistics paradigm of the TOC has evolved from the scheduling software called Optimized Production Technology (OPT) which in turn, is based on the following nine rules:

(1) Balance flow, not capacity.
(2) The level of utilization of a non-bottleneck is not determined by its own potential but by some other constraint in the system.
(3) Utilization and activation of a resource are not synonymous.
(4) An hour lost at a bottleneck is an hour lost for the total system.
(5) An hour saved at a non-bottleneck is just a mirage.
(6) Bottlenecks govern both throughput and inventories.
(7) The transfer batch may not, and many times should not, be equal to the process batch.
(8) The process batch should be variable, not fixed.
(9) Schedules should be established by looking at all the constraints simultaneously. Lead times are the result of a schedule and cannot be predetermined.

The implementation of the logistical system of TOC is governed by the drum-buffer-rope (DBR) methodology and managed through the use of time buffers (T-Bs). The *drum* is the system schedule or the pace at which the constraint works. *Rope* provides communications between critical control points to ensure their synchronization. *Buffer* is strategically placed inventory to protect the system's output from the variations that occur in the system.

## VI. RESULTS AND DISCUSSIONS

### Calculate the available time of each recourses

For daily 24-h run total weekly time was (1440×6) =8660 min. Calculation of weekly setting time is, 15 min per set up, that is (15×3×6) = 270min.and other activities time like lunch time, etc is 830min in a week one WC requires one set up, Weekly capacity (total weekly time – time lost due to other activates) is equal to (8660–1100) = 7560 min. The available time of each WC is 7560 minutes per week.

### Calculation of load of each operation on work centers

The table 2 shows the total load on workstations of each operation requires for total five products listed in the first column. The required quantity of product P-1 is 120 units; it takes 88 min for routing operation on a single unit. Total 120 units require 10560 min to complete the routing operation for total 120 units of P-1. Similarly, the values have been calculated for rest of the operations for each product. The total processing time for all five products for routing is 30425 min i.e. the load of routing operation on WCs. But the available time for routing is 30240 as 4 WCs are available for it.

Table: 2 Work Centre Load (Min.)

| Product No. | Req. | Routing | Glue | Sanding | Foiling | Shaving | Liping | Drilling | Assembly |
|---|---|---|---|---|---|---|---|---|---|
| P-1 | 120 | 88 | 15 | 39.5 | 15 | 35.5 | 21 | 17 | 30 |
| | | 10560 | 1800 | 4740 | 1800 | 4260 | 2520 | 2040 | 3600 |
| P-2 | 90 | 60 | 15 | 30 | 15 | 33 | 13.5 | 13 | 25 |
| | | 5400 | 1350 | 2700 | 1350 | 2970 | 1215 | 1170 | 2250 |
| P-3 | 82 | 55 | 15 | 21.5 | 15 | 32 | 13.5 | 14 | 30 |
| | | 4510 | 1230 | 1763 | 1230 | 2624 | 1107 | 1148 | 2460 |
| P-4 | 70 | 38.5 | 15 | 22.5 | 15 | 24 | 10.5 | 9 | 30 |
| | | 2695 | 1050 | 1575 | 1050 | 1680 | 735 | 630 | 2100 |
| P-5 | 110 | 66 | 15 | 30.5 | 15 | 31 | 16 | 18 | 35 |
| | | 7260 | 1650 | 3355 | 1650 | 3410 | 1760 | 1980 | 3850 |
| total process time(min.) | | 30425 | 7080 | 14133 | 7080 | 14944 | 7337 | 6968 | 14260 |
| NO. of WCs | | 4 | 1 | 2 | 1 | 2 | 1 | 1 | 2 |
| TIME available(min.) | | 30240 | 7560 | 15120 | 7560 | 15120 | 7560 | 7560 | 15120 |

**Identified Capacity Constraint Resource**

Table 3 shows the gap between the required capacity in terms of minutes and the actual available time on the resource. The resource having this gap on the negative side will be the candidate for the capacity constraint resource. From the resources having negative gaps, the resource having the lowest negative value will be the capacity constraints resource. In this table shows that the routing section has the lowest negative gap i.e. -185. Hence, the routing section is the capacity constraint resource.

Table: 3 Capacities

| Total Available Time | Routing | Glue | Sanding | Foiling | Shaving | Liping | Drilling | Assembly |
|---|---|---|---|---|---|---|---|---|
| | 30240 | 7560 | 15120 | 7560 | 15120 | 7560 | 7560 | 15120 |
| Required Time | 30425 | 7080 | 14133 | 7080 | 14944 | 7337 | 6968 | 14260 |
| Gap Req. B/W Capacity And Actual Capacity | -185 | 480 | 987 | 480 | 176 | 223 | 592 | 860 |

The above table illustrates that there is a number on constraint on the shop floor. This means that the machine/ work center having the maximum utilization is considered as the capacity constraint resource. In a normal situation, the work center may not be a capacity constraint resource, but certain irregularities –power failure, machine failure, unavailability of worker-will make it so. Hence, to decide the priority, this resource should be considered as the capacity constraints resource. Using above priorities to develop a Gantt chart for the capacity constraint resource.

## VII. CONCLUSION

This paper is aimed to introduce in applying the DBR methodology of TOC in a manufacturing process based on the concept of the CCR, which is the corner stone of the TOC philosophy. Atypical TOC/DBR implementation is an extremely interesting experience given the fact that it has to involve the entire organization. In this work, the capacity constraints have been identified, further, the master production schedule can be developed to achieve the spectacular results for organization planning using the TOC approach. The approach does work and further enhancements to its tools and features will make it easier to implement.

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