



An air conditioner ODU assembly line

Eliminating Shortages in Manufacturing without Increasing Inventory

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Introduction

Do you face any one or more of the following challenges?

- Perennial shortage of input materials
- Daily change of production plans
- Inability to meet sales or production targets
- Poor on-time delivery performance
- High overall inventory and working capital
- A lot of expediting required towards the end of a project

Several organizations face disruptions in production due to shortage of raw materials and components for the planned schedule. In fact, there is rarely any day during the year when companies do not have shortage of any component or raw material required for that day's planned production. Shortage list has been a standard document in most Indian organizations for many decades. Only the formats have changed.

About the Authors

Ravi Gilani, a mechanical engineer from IIT Delhi, is the Founder and Managing Consultant of Goldratt India. He introduced the Theory of Constraints (TOC) to Indian organizations in 1998. Goldratt India is a management consulting firm that collaborates with clients to increase their sales, profit and cash by an order of magnitude. Ravi is the first Indian to receive the Lifetime Achievement Award from TOC International Certification Organization (TOCICO), USA for his contribution to the industry.

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Shortage List

This issue of shortage list needs attention, particularly in an assembly environment. The final product cannot be completed even if just one component is missing. Often, there are situations where we do not have all the parts even for one product though the overall inventory is very high. Since senior management does not want to waste any production capacity, the unwritten rule for the plant is to produce whatever possible from the available material. This leads to several incomplete orders in work-in-progress (WIP) and consequently, money gets blocked into working capital. This, in turn, leads to poor delivery performance, penalties and high receivables. This severely stresses the cash flow of the company and if it is not addressed effectively, it can also lead the company into a cash constraint situation.

Let us talk about make to order products first. Ask any plant head if they are able to

adhere to their planned production schedule even for a day. Most plant heads will tell you that even though they did not have all the required parts for the day's planned production, they still met their production targets. How come? They produced the models for which they had the material – irrespective of whether it was required immediately or not. These models were produced with the assumption that eventually they will be sold in the future.

As a result, the required products are not produced and delivered. And, on the other hand, the finished goods inventory goes up.

How to Eliminate Shortages without Increasing Inventory?

Reliable rapid replenishment is the solution for eliminating all the above pains without increasing inventory. Reliable rapid replenishment is based on the maximum expected consumption within the replenishment time, taking into account the variability (or reliability) of the supply from the vendors. This involves a few simple steps of determining the target levels for each product, increasing the order frequency, and monitoring stocks daily to adjust inventory levels. Before we discuss the details of the solution, I would like to share some observations.

During my more than 40 years of working with Indian organizations, be it small or medium enterprises or large industrial houses, I have observed that not enough emphasis is paid on starting production with full kit. Full kit is defined as the process of staging or ensuring availability of all inputs (raw materials, tooling, design and specifications) for an upcoming manufacturing order prior to release of the order to the shop floor. This also includes any customer approvals or confirmation required before the start of the order. Once you start production with full kit, you will be amazed at the flow and synchronization with which assembly takes place. This reduces the lead time to complete an order dramatically.

Achieving full kit requires a simple prioritization process that I will be sharing in the next few paragraphs. However, there are two important factors for this to take place successfully:

1. The key decision makers must agree that production will not start before full kit is available. Initially, it may happen that inability to achieve full kit will mean production will not take place, but we must not deviate from our stand. Adherence to full kit is essentially about bringing discipline and meticulous planning. In case of several sub-assemblies, we can ensure that full kit planning and order release is done for each sub-assembly, so we are not blocking a significant amount of cash at one point of time.

2. The order priority must not be changed at any cost. Once we have agreed to a priority list we have to adhere to it, and not keep changing it every morning – and then revise it every evening; that will defeat the purpose of the entire exercise.

Steps for Achieving Full Kit

For Raw Materials/Components that are kept in Stock

The starting point is to review the past consumption data and check the average daily consumption of each SKU over the last few, say 6, months. The target stock level is determined on the basis of maximum consumption within the reliable replenishment time.

Determine the Target Level

If the reliable replenishment frequency is a week, we determine the target based on maximum consumption in a week, taking into account past trends and minimum order quantities (MOQ). In case it is too difficult to determine this, we suggest starting with the average weekly consumption figure (x), and taking thrice that figure (3x) as the target. If the average weekly consumption of an SKU is 10 units, we set 30 units as the target stock level. Do not worry about taking a high target initially. The system will automatically adjust the target level in the subsequent replenishment cycles.

Order Daily, Replenish Frequently

The next step is simple but something that purchasers find difficult to adhere to. The essence of reliable rapid replenishment lies in increasing the order frequency and replenishing frequently as per the actual consumption. In a perfect world, this means ordering and replenishing daily just what was consumed today. Using the simple analogy of a household, this is similar to the supply of milk or bread at our homes.

Dynamic Buffer Management

The target inventory level is divided into three equal zones – green, yellow and red – for each 33% band. They are monitored

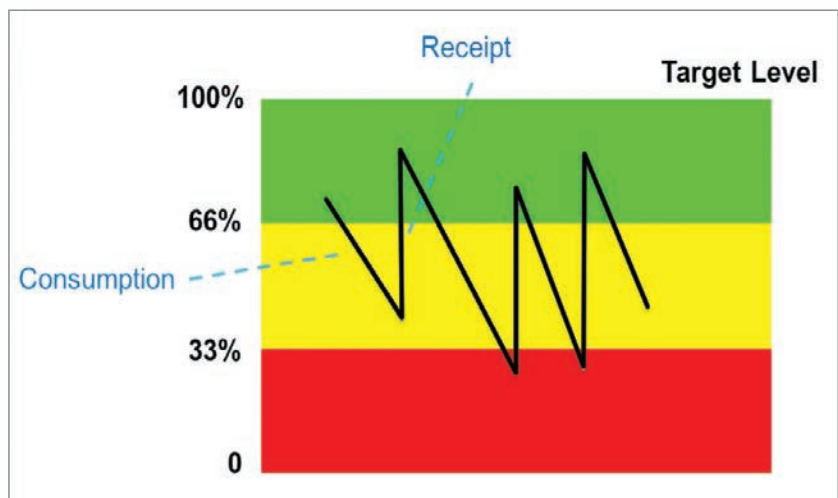


Figure 1: Typical stock level movement

constantly and if the inventory falls into the red zone, it is a signal to expedite replenishment to ensure that there are no stock-outs. Ideally, the actual inventory levels should be within the green and yellow zones (Figure 1).

If the stock remains in the green or red zone (too little stocks) frequently, the target level can be adjusted. In case of green, it is recommended that the target level be reduced by 33% and in case of red, it can be increased by 33%. Wait for a couple of replenishment cycles before adjusting target levels again.

- Check stock level for each SKU daily.
- If stock level gets in the red zone, increase target level by 1/3, and order as per the system immediately.
- Wait for one or two replenishments to take effect before further adjusting target level.
- If stock level stays for long in the green zone (5-6 replenishment periods), reduce target level by about 1/3 to 1/5.
- Target levels can be adjusted for seasonality.

For 'Make-to-Order' Raw Materials/Components

As mentioned earlier, it is of utmost importance to finalize a priority list and make sure it is communicated across the organization, and ensure 100% adherence to this schedule.

- List all orders in hand along with delivery schedule.
- Out of the above, list all orders in various stages of work-in-progress.
- Detail for each order the additional material required.
- Determine funds required for making full kit.
- Prioritize all the above keeping in view the funds required for full kit, customer delivery date, ease of manufacturing, etc.

All resources, i.e. money, management time, design capacity, in-house manufacturing capacity, vendor capacity, etc. must be provided to make full kit as per the priority agreed. Purchase orders (POs) must be issued for completing full kit for the highest priority order for all components at the same time with confirmed delivery schedules before placing POs for other orders. Funds must also be allocated in the above manner. Resources (time and cash) must be allocated to the next level only when the requirements of higher priority level order have been met completely.

Theory of Constraints

The approach shared above is based on the Theory of Constraints (TOC) and its application to supply chain. TOC provides simple, effective solutions and a reliable process that ensures follow-through. Teams focus rigorously on the selected metrics that have the maximum impact on the system goal. Dr. Eli Goldratt, the creator of TOC and the author of *The Goal*, observed that just as the strength of a chain is dictated by its weakest link, the overall performance of any company is dictated by its constraint.

In current management practice, the common belief is that system performance is the sum total of performance of its parts.

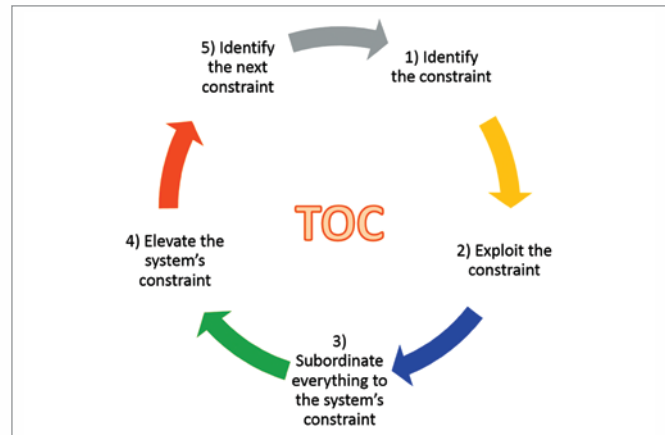
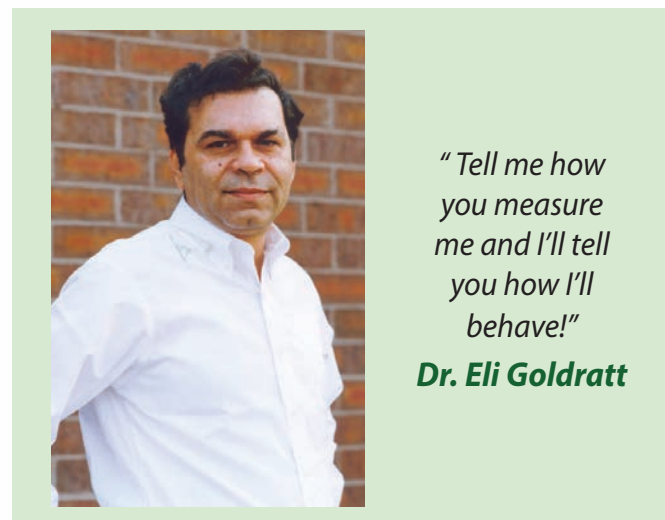


Figure 2: Theory of Constraints

This is absolutely wrong. System performance is controlled by the performance of its weakest link – the constraint. And in 100% cases the constraint is a policy of the top management as reflected in its metrics.



Today, most companies are so focused on local KRAs such as lower unit price, low freight cost, etc. that employees are unable to get a big picture view. We suggest the following global metrics for the supply chain:

1. Sale value of full kit material available.
2. Inventory of full kit material as a % of total inventory.

Delivery Reliability

How many business owners and decision-makers are aware of the impact on their bottom lines of not being able to deliver on-time-in-full (OTIF)? Whenever I pose this question to senior industry leaders, the response varies from 10% to 30%. In my 20 years' experience of TOC consulting, I have observed that increasing OTIF significantly has always resulted in a Profit Before Tax (PBT) increase of minimum 100%. In some cases it even shot up to 400%. Even a conservative assessment of profit

Case Study: Paharpur Cooling Towers



Gaurav Swarup

MD, Paharpur Cooling Towers

“We had introduced TOC in our Flexi Packaging business in 2006 where we had losses for quite a few years. We had not only turned around within a few months, but have also been increasing our profits year after year for the last 11 years. We introduced TOC in our cooling tower business in 2013. I am pleased to share the gains we have achieved here in the last 3 years.

Measurement Changes: Concept and measurement of On Time In Full (OTIF) has immensely helped in increasing timely despatches.

Weekly Review: The whole weekly review concept as against monthly review is a game-changer.

Inventory: Introduction of TOC supply chain solution DBM has led to improvement in the quality of inventory while reducing the money blocked. Focus on surplus/non-moving inventory has also increased.

Team-work: Co-ordination between factories, marketing, and HO functions has improved significantly. This has not only helped in better communication but also in cleaning up/ updating data in ERP system.”

increase of 10-30% should be sufficient for further exploration to overcome obstacles for achieving high delivery reliability.

The main reasons often quoted for not being able to deliver reliably on consistent basis are inadequate manpower and skill. I will take the analogy of a car. A car requires only 4 wheels to drive. Yet most cars carry a spare tyre called the stepney. Though the requirement of the stepney is not frequent, yet we always carry it because we know that the consequence of not carrying this could be extremely undesirable. Now, let us examine various manpower related issues. Most organizations face labor shortage both on an ongoing basis and during festive seasons. Almost all organizations employ temporary or casual workers. We know for sure that employing these temporary workers creates a high level of uncertainty in availability apart from skill issues. Yet we continue this practice. Why? Primarily to reduce labor cost or some other



Figure 3: On-time-in-full delivery

parameter such as labor cost as a percentage of total cost, or labor cost as a percentage of sales or some other similar and irrelevant measure. An organization’s goal is to make more and more money rather than achieving any other surrogate measure. At best, these parameters may be the means of making more money but they are definitely not substitutes for the goal itself. I am not suggesting that we must have only permanent employees. We must ensure that we have sufficient number of workers with the right skills at all times – temporary or permanent. If we cannot control high absenteeism during festive seasons, we must make sure that we add sufficient buffer of workers beforehand so that even with heavy absenteeism we will still have adequate numbers.

Frankly speaking, this issue of manpower shortage due to absenteeism is blown out of proportion. What about the loss in output due to wrong selection, inadequate skill development, etc.? Why is that even our regular workers do not have adequate skills even after years and years of working?

I strongly believe that improving delivery reliability could be the next significant competitive edge for India particularly for exports, and also for domestic sales. In the last two decades, Indian manufacturing may have gained due to its price competitiveness. However, if low price is the only criterion, any one can take away your orders by lowering prices. Committing high delivery reliability with significant penalties for delays is something that your competitors cannot achieve in a short period of time. This provides your organization the ability to significantly increase both volumes with existing customers and prices with new customers.

Conclusion

I know for sure that adding buffer manpower, training, worker skill up-gradation, etc. will cost the organization a fair amount of money. However, if improving OTIF could increase sales by 30-50%, I believe the benefits of over 100% increase in profits would compensate more than adequately the corresponding cost increase.

