Theory of Constraints

Part I: Introduction

Theory of Constraints (or TOC)

- Relatively recent development
- Looks at the practical aspect of making organizational decisions in situations in which constraints exist.
- Theory was first described by Dr Eliyahu Goldratt in his novel *The goal*.
- Represents the practical research on his work on “how to think”.

Theory of Constraints (or TOC)

- It is a verifiable philosophy.
- If we know how to think…
  - We can understand the world around us;
  - And we can therefore improve.
- Cause and effect: central to TOC
  - Combine cause-and-effect and intuition to gain knowledge.
  - With knowledge, we can improve.

Theory of Constraints

- Has been used at three different levels:
  - Production Management
  - Scheduling
  - Inventory reduction.
What is a Constraint?

- Anything that limits the company from moving toward achieving its Goal; a limit imposed on the organization.
- A Goal must exist first!
  - Usually, the goal is to make $\$$. 

Types of Constraints

- Physical
  - Examples:
    - The physical capacity of a machine
    - Time availability of specific skilled employees.
    - Raw Material
- Non-Physical
  - Examples:
    - Demand for a product
    - A Corporate Procedure
    - An employee’s perceptions of how things should be.

Steps in Applying TOC

1. Identify

- ToC says there’s always a constraint.
  - How do you find it?
  - Look for these clues:
    - The constraint resource is overloaded
    - Work piles up in front of the constraint
    - Resources downstream from the constraint are idle some of the time

Steps in Applying TOC

1. Identify
2. Decide
3. Subordinate
4. Elevate
5. Constraint Broken?

Constraint Broken?

- Yes
- New Constraint

Constraint Broken?

- No

Constraint Broken?

- Yes

Constraint Broken?
Steps in Applying TOC

1. Identify
   - Identify the system’s constraints.
   - Prioritize them.
   - Work on only the ones that really impact progress to reaching the GOAL.

Steps in Applying TOC

1. Identify
   - Manager’s first impulse: remove the constraint as soon as it is identified.
   - If possible to remove it immediately and if no large investment is needed, proceed.
   - So, move on to the next constraint.
   - More on this later…

Steps in Applying TOC

1. Identify
   - Decide how to manage the system’s constraints you identified - i.e. how to exploit them.

Steps in Applying TOC

2. Decide
   - Q: What about other resources that are not constraints?
     Ans.: Manage them so they provide just enough to MATCH the output of the constrained resources.
     - NEVER let them supply MORE output than is needed. They do nothing to help us move closer to goal.
Steps in Applying TOC
1. Identify
   ↓
2. Decide
   ↓
3. Subordinate
   - Subordinate everything else to exploit the constraint.
   - Exploiting means dealing with the constraint and squeezing everything possible from it.

Steps in Applying TOC
1. Identify
   ↓
2. Decide
   ↓
3. Subordinate
   - This means changing the objectives of any non-constraints to support the exploitation of the constraint.
   - It implies applying all our resources to BREAKING or ELEVATING the constraint.

Steps in Applying TOC
1. Identify
   ↓
2. Decide
   ↓
3. Subordinate
   - Means increasing the limit of the constraint to a higher level.

Steps in Applying TOC
1. Identify
   ↓
2. Decide
   ↓
3. Subordinate
   - How can we exploit a constraint?
     - Make sure there is always work for the constraint to do, never let them fall idle because of lack of resources.
     - Make sure that the constraint works only on tasks that improve throughput.
     - Cut all unnecessary, non-productive work from the constraint.
Steps in Applying TOC

4. Elevate

- Examples of Elevation
  
  If the constraint is the current level of demand:
  
  - Find ways to increase demand, like increasing product variety to attract new customers.

- Examples of Elevation
  
  If the constraint is a machine:
  
  - Obvious step: purchasing another machine.
  - Increase the number of shifts also elevates the capacity of the constrained resource.

- Should the limit imposed by the constraint be very high, we are achieving more of our goal!
- If global performance of the organization improves when the constraint is elevated:
  
  - The process is definitely a genuine constraint.
  - If elevated high enough, it may cease to be a constraint!
Steps in Applying TOC
5. Closing the Loop

- How to know if constraint has been broken?
  - When the limit has been elevated high enough so it no longer stops you from your goal.

Steps in Applying TOC
5. Closing the Loop

- This step is a warning.
  - Elevation of a constraint may shift the system constraint somewhere else!
  - Example:
    - Old machine is replaced by a more efficient one (25% more capacity).
    - Limit could still be dictated by this machine.

Steps in Applying TOC

Example: Closing the Loop

- But suppose that there is no market demand for the entire 25% added capacity.
- Or maybe the bottleneck is now at another work center.
- Elevation of machine increased performance level, but constraint MAY HAVE SHIFTED.

Steps in Applying TOC
5. Closing the Loop

- This is where this step helps.
- We know the constraint moved but...
  ....you still have all procedures set up to exploit the machine and everything else subordinated to it!
- REAL PROBLEMS can occur. Why?
Steps in Applying TOC

5. Closing the Loop

- You will probably generate and accumulate excess inventory with the new machine.
- You may say: “let’s produce more anyway and see if the market picks up” … doubtful.
- You have outgrown demand. Policies have to change. A new constraint needs to be identified…closing the loop.

Theory of Constraints: An Introduction

End of Part I

Adapted from: