Theory of Constraints

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Theory of Constraints
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- The Theory of constraints was developed and popularized by manufacturing guru Eliyahu M. Goldratt in 1984. Most people are first exposed to the concepts through his book *The Goal.*

- In 1986 Eliyahu Goldratt formed the Avraham Y. Goldratt Institute. This institute was formed to inform people about TOC (The Theory of Constraints).

Dictionary Definition of a Constraint

1 the act of constraining

2 the state of being checked, restricted, or compelled to avoid or perform some action
<the *constraint* and monotony of a monastic life -- Matthew Arnold>

3 a constraining condition, agency, or force : CHECK
<put legal *constraints* on the board's activities>

TOC's Definition of a Constraint

The most common question about the Theory of Constraints (TOC) is, "Huh?"

Eli Goldratt defines a Constraint as, 'Anything that limits a system from achieving higher performance verses its goal.'

One definition used by Eli Goldratt for TOC (edited) is:

'***A Thinking Process that enables people to invent simple solutions to seemingly complex problems.***'

Here's another definition (from Larry Leach): http://www.srv.net/~lleach/TOC/defined.htm

The Theory of Constraints states that every system must have at least one constraint limiting its output.

Consequences of the Theory:

1. The more complex the system, the less independent process paths exist, so the lower the number of constraints. (Usually, complex systems have only one constraint at a given time.)

2. A system of optimum processes can not be an optimum system.

3. An optimum system runs the constraint (or bottleneck) at optimum capacity (focused on the goal of the system), and all other process steps must have excess capacity.

TOC's Definition of a Constraint

- A process or process step that limits throughput.
- Anything that limits a system from achieving higher performance versus its goal.
- A constraint is a factor that limits the system from getting more of whatever it strives.

What is TOC?

- The core idea of the Theory of Constraints is that every real system such as a profit-making enterprise must have at least one constraint.
- The TOC is a thinking process that enables people to invent simple solutions to seemingly complex problems.
- The Theory of Constraint states that every system must have at least one constraint limiting output.
- There is no choice in the matter; either you manage the constraints or they mange you. The constraint will determine the output of the system whether they are acknowledged and managed, or not.

How does TOC help companies?

- Focuses improvement efforts where they will have the greatest immediate impact on the bottom line.
- Provides a reliable process that insists on follow through.

Finding the focal point

- Before a company can properly focus, one necessary condition is that they answer the following question:

What is the goal of a for-profit enterprise?

The Goal

To make money now and in the future.

The Goal (more)

- Some would say that the goal of a company is:

1) To satisfy customers.
2) To provide satisfying jobs for employees.

The Goal (more)

- TOC Recognizes that only the owner can choose the goal, however, once chosen, the other two ‘goals’ become conditions to achieving the goal.

Measuring Progress

- Once the goal is identified, a necessary condition to success in achieving the goal is to identify which measurement(s) will be used to judge progress.

What measurements should we use?
(Conventional Wisdom)

- Net Profit?
- Efficiency?
- Utilization?
- ROI (Return On Investment)?
- Cash Flow?

What measurements should we use?
(TOC Wisdom)

Throughput

Inventory

Operating Expense

What is: Throughput

- The rate at which the system generates money through sales minus raw materials and and purchased parts.
- All the money received from customers minus raw materials cost.
- The rate at which the system makes money(sales minus totally variable costs). Direct labor should not be deducted in calculating Throughput. Sales are only recognized when money is available to the firm. That is, production for inventory is not a part of throughput

What is: Inventory

- All the money the system has invested in purchasing things which it intends to sell.
  Some insights:
  - Inventory is a liability, not an asset.
  - Raw materials and finished goods are inventory.
  - Machines and fixtures (if owned) are inventory.
  - Scrap material that is to be sold is inventory until sold.

What is: Operating Expense

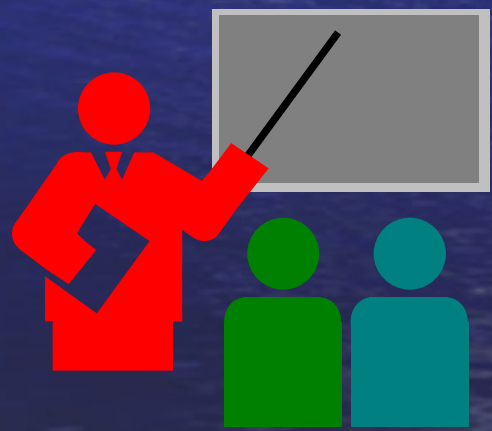
- All the money the system spends in order to turn inventory into throughput.
  - All employee time is operating expense.
  - Depreciation of a machine is a operating expense.
  - Scrap material thrown away.
  - All expenses not deducted in arriving at throughput. This includes direct labor and all operating and maintenance expenses.

The Five Focusing Steps

- Identify a system's constraints
- Decide to exploit the system’s constraints
- Subordinate everything else to the above decision
- Evaluate / Elevate the system’s constraints
- If in the previous steps a constraint has been broken, go back to step 1. That is, find a new constraint.
- Warning: Do not allow inertia to cause a system constraint.

Step 1:
Identify the System's Constraint(s)

- In order to manage a constraint you must first identify it. In Eli Goldratt's book *The Goal,* a machine known as the 'NCX10' was identified as the constraint.



Step 2:
Exploit the Constraint

- Once the constraint is Identified, the next step is to focus on how to get more production within the existing capacity limitations. Goldratt refers to this as exploiting the constraint.

  An example of this from *The Goal* was when the company and the labor union agreed to stagger lunches, breaks, and shift changes so a machine could run during times it previously sat idle.

Step 3:

Subordinate Everything to the Constraint

- Exploiting the constraint does not insure that the materials needed next by the constraint will always show up on time.

  This is often because these materials are waiting in order at a non-constraint resource that is running a job that the constraint does not need yet. Subordination is necessary to prevent this from happening.

Step 4:
Evaluate / Elevate the Constraint

- After the constraint is identified, the available capacity is exploited, and the non-constraint resource have been subordinated, the next step is to determine if the output of the constraint is enough to supply market demand.

  If so, there is no need to elevate because this process is no longer the constraint of the system. If not, elevate by adding resources.

Step 5:

Go Back to Step 1

- Step 5 is to go back and repeat step 1 and identify a new constraint, because there is always one in every system. The five-step process is then repeated for the next constraint.

The Process of Change

- Simply stated, the thinking process involves the rigorous application of effect-cause-effect logic to answer the following three questions:

What to Change?

What to Change to?

How to Cause the Change?

What to Change?

- Pinpoint the core problems.

  The first question is equivalent to asking, “Where is the constraint?” Since this process is generally used when the constraint is not a physical resource, there is usually not physical evidence (such as work in process inventory) to point you to the constraint. Instead, you have to map what is currently going on in your system.

  This leads to the “Current Reality Tree”.

the Current Reality Tree

- Instead of using physical evidence, you have to start with the evidence that is available; the negative events that are apparent in the system.

  Examples include:

  - Frequently shipping orders late
  - excessive amounts of inventory
  - lead times that are increasing
  - poor human relations within the organization.

- Goldratt calls these Undesirable Effects, or UDEs. The challenge is to map out the interrelated web of cause-and-effect that links the undesirable effects together. Once completed, one is is generally able to identify a “core problem” at the bottom of the map.

What to Change to?

- The first step in determining the answer to this question is to understand why the core problem exists.

  It is assumed that managers are not dumb. If there is an easy solution to this core problem it would have been solved a long time ago. There must be some conflict that underlies the core problem. Once this is identified, the thinking process is used to develop a breakthrough idea that will resolve a conflict. This is done by using a tool known as evaporating clouds.

What to change to? (more)

- In order to do this you must use simple and practical solutions.

How to cause the change?

- In order to cause the change you must induce the appropriate people to invent such solutions. Using methods like the Socratic method can have this effect.

Conclusion

- The Theory of Constraints is about two things:
  - Focus
  - Follow through

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  - and of course, making money!

Resources

- Levinson, William A., P.E., MBA. *Goldratt's Theory of Constraints: Online Simulation*, at http://www.ganesha.org/leading/toc.html
- Leach, Larry. http://www.srv.net/~lleach/TOC/defined.htm

References

- Goldratt, Eli, ***It's Not Luck.*** The North River Press, Great Barrington, MA, 1994
- Goldratt, Eli, ***What Is This Thing Called The Theory Of Constraints?***, The North River Press, Great Barrrington, MA, 1990
- Dettmer, William, ***Eli M. Goldratt's The Theory of Constraints, A Systems Approach to Continuous Improvement*****,** 1996, ASQC press**.**