Introduction to the Theory Of Constraints “TOC”
Who is Tim Sullivan?
Work experience…
TQM experience…
TOC experience…
Lean experience…
Before I start…

Who is my Audience?

How many have…

• Some knowledge of TOC?
• Read the book “The Goal”?
• Experience with TOC?
• Experience with Lean?
Before I start…

Let me hear from you…
What questions are you hoping I will address today?
What is the Leadership "puzzle"?

The dictionary says a puzzle is a "perplexing problem."

Your business is a complex, interdependent web of people, equipment, methods, materials, environments, and measures.

Add to that the dynamics of changing customers, suppliers, regulations, etc.
Leadership's perplexing problem, then, is how to manage this combination of complex details and changing dynamics!
Is There a Holy Grail?

Theory of Constraints (TOC)?
Lean?
Six Sigma?
Or, are they pieces of same puzzle?
Objectives today…

• Challenge your way of thinking
• Introduce tools and tenets of TOC
• Discuss how TOC can work with Lean, and Six Sigma

In the next 40 minutes…

Que the music to Mission Impossible!
‘People start to appreciate a very different world view when they realize the things that happen to us in our world, whether they are in … a business organization, or in our families, … may not occur *despite* our best efforts – they may occur *because* of our best efforts.”

*The Fifth Discipline* by Peter Senge, 1994
“Once people start to consider that, then this little thought that I offered a bit earlier – that the fundamental changes needed in our organizations lie in how we think – has a whole new credibility.”

“They also discover a bit of timeless wisdom delivered years ago by Walt Kelly in his famous line from Pogo:

‘We have met the enemy and he is us’.”

The Fifth Discipline by Peter Senge, 1994
Challenging the way you think…

“The significant problems we face today can not be resolved at the same level of thinking we were at when we created them.”

Albert Einstein
“The core idea in the Theory of Constraints is that every real system such as a profit-making enterprise must have at least one constraint. If it were not true, then the system would produce an infinite amount of whatever it strives for. In the case of a profit-making enterprise, it would be infinite profits.”
“Because a constraint is a factor that limits the system from getting more of whatever it strives for, then a business manager who wants more profits must manage the constraints.”
“There really is no choice in the matter. Either you manage constraints or they manage you. The constraints will determine the output of the system whether they are acknowledged and managed or not.”

The Theory of Constraints and its Implications for Management Accounting by Eric Noreen
Intro to TOC: a Throughput$ Operating Strategy

WHICH BOX DO YOU WANT TO BUY?

Box “A” sells for $250,000.

Box “A” produces 5/hr.

Box “B” sells for $200,000.

Box “B” produces 3/hr.
Box “B” sells for $200,000.

@$150 Contrib / hr
$6000 Contrib / wk
+50% Contrib$ / wk

Box “A” sells for $250,000.

@$100 Contrib / hr
$4000 Contrib / wk

Choose the box that generates contribution $ faster!!!
Manufacturing can be compared to a chain.

The activities that constitute business are really a “chain” of dependent events. That is to say that we don’t ship parts until they are packaged, and we don’t package items until they are manufactured, etc.
Conventional Wisdom

• Improvement of any link is an improvement to the entire chain.
• Global improvement is the sum of the local improvements.
• Primary Measurement: Link Strength

As a result there is a natural pressure to improve or strengthen every link of the chain.
Traditionally, management has divided the organization into smaller, more manageable pieces. The objective, then, is to maximize the performance of each part. After all, global improvement is the sum of the local improvements. Right?

Every link wants/needs more resources all the time!
Focus on Chain strength rather than link strength.

• Most improvement of most links do not improve the chain.
• Global improvement is NOT the sum of the local improvements.
• Primary Measurement: Chain Strength
Focus **scarce** resources on the constraint.

Think Globally. “Take local actions that will strengthen the chain.” (i.e. Focus scarce resources on the constraint.)

Result: Resources are channeled to the weakest link (aka: Herbie, the constraint, “CCR”).
Simple measures are used to calculate impact

• Throughput – the rate at which the system generates contribution $ through sales
• Inventory/Investment – all the money tied up inside the systems (materials; equip + buildings, etc)
• Operating Expense – all the money spent to turn inventory into throughput
The Theory of Constraints (TOC) Philosophy

Based on “The Goal” by Goldratt and Cox, 1984

1. The **goal** of a for profit system is to make money now **and** in the future.

2. A **constraint** limits the system’s ability to achieve more of its goal day after day. A **bottleneck** is any resource whose capacity is less than demand. A **capacity constrained resource** (CCR) is the resource that becomes a constraint when demand exceeds system capacity. CCRs are typically the drum/pacesetter.

3. A system has at least one **constraint**, and never more than a few.

4. Constraints can be **internal** (capacity is less than market demand) or **external**. The market should **always** be treated as a constraint.

5. All non constraint resources must have **protective capacity**. If you intend to offer your market rapid response, you will also need protective capacity on the constraint.
1. People are good

- Assume that the core problem is NOT the person
- Assume that the person who disagrees with you does so to protect something that is necessary for them to successfully complete their job, i.e. *meet their measure*, without leaving their comfort zone.
2. Any conflict can be removed

• The path to breakthrough solutions is THROUGH conflict, not around it
• Seek first to understand what need the other person is trying to satisfy – this will clarify why the proposed actions are in conflict
3. Reality is simple
   • Complex solutions do not address the root cause

4. Never say "I know".
   • Doing so blocks you from seeing opportunities for improvement.
1. **Identify** the system‘s constraint(s).
   (Focus on customer delivery/service.)

2. Decide how to **Exploit** the system‘s constraint(s).
   (Focus on how to increase the flow of T$ by increasing flow through the constraint.)
   (Put in place a focusing process for improving flow: buffer mgmt + pereto analysis.)
   (Utilization and efficiency are crucial at the constraint.)
   (This step is often treated as indistinguishable from step 4, but it is generally important to Exploit before elevating.)
3. **Subordinate** everything else to the above decision.
   - Have a practical means to guide workers when NOT to produce.
   - Abolish local efficiencies at non constraints.

4. **Elevate** the system’s constraint.
   - Only if Exploit and Subordinate have not created enough flow to satisfy customer demand. (Most of the time this is unnecessary.)

5. **Warning:** if in the previous steps a constraint has been broken, **Go Back** to Step 1
   - Do not allow inertia to cause a system constraint!
Is a constraint good or bad?

A constraint is neither bad nor good. It is simply a fact of life. Every system has one.
The objective, then, is not to cycle repeatedly through the 5 steps with the intent of finally removing the system’s constraint. Rather, the objective is to strategically choose the system’s constraint and manage everything (marketing, HR, investment, etc) accordingly. This will stabilize the system, allowing managers to reliably predict outcomes!
LAYERs OF RESISTANCE

1. “I / we don’t have a problem.” Or, “You don’t understand my / our problem.”

2. “I / we don’t agree with the direction of the solution you propose.”

3. “The proposed solution can’t possibly produce results you claim.”

4. “Yes, but we can’t do that because of…”
   [Obstacles exist]

5. “Yes, but if we do that bad thing will happen.”
   [Potential Unintended Negative Consequences exist]

6. Unverbalized fear.
There are 7 logical thinking processes used to overcome the layers of resistance.

- Current Reality Tree
- Evaporating Cloud
- Future Reality Tree
- Negative Branch Reservation
- Prerequisite Tree
- Intermediate Objective Map
- Transition Tree

Graphic Tools make it easier to:
- Get agreement on our reality
- Scrutinize and improve the accuracy of the diagram
- Identify the thinking behind our reality
- See possible counter measures
The Evaporating Cloud (EC) seeks win/win solutions.

- **Purpose**: Get agreement on the direction of the solution by resolve conflicts in a win/win manner.
- **Allows us to work through conflict together rather than to compromise our way around it in a lose/lose manner.**
- **Based on the TOC Pillar that all people are good and the maxim to seek first to understand.**
To evaporate a cloud it is necessary to challenge the assumptions behind the arrows.

Every arrow has at least one assumption that is implicit. Identifying and challenging these assumptions is the key to successfully “evaporating” a cloud so you can then have a clear view of a win/win solution.

In this case the one assumption in the conflict arrow is that it is **impossible** to run large batches and small batches at the same time.
Challange the assumptions

It is **impossible** to run large batches and small batches at the same time.

*Impossible, unless....????*

*...**Unless** we run large process batches on the capacity constrained resource small transfer batches at the non constrained resources.*

[For an interesting article Google: Alan Barnard + impossible unless]
What is the essence of the Socratic Method?

The essence of the Socratic method is: **Cultivating Moments of Insight**

“The Neuroscience of Leadership”  
by Rock and Schwartz
What is your definition of “Lean”?

What is good about Lean?

What is bad about Lean?
Lean Definition
Source: “Lean Thinking” by Womack

- Define value from the customer’s perspective
- Value stream mapping
- Flow continuously
- Pull
- Shoot for perfection
What is waste, aka, Muda?

Muda – activity that doesn’t add value

• Waiting
• Over processing
• Errors
• Transportation
• Inventory
• Motion
• Excess production
Mura – unevenness in operations
Muri – over burdening

“In short, mura and muri are now the root causes of muda in many organizations.”
Womack, LEI

(www.lean.org 7/6/2006)
The Perfect Process

One that creates the desired value
In which every process step is:
- Valuable = Ratio of VA to NVA is relatively high
- Capable = Consistently meet customer requirements
- Available = Equipment has high up-time
- Adequate = Can produce immediately when needed
- Flexible = Can change between products rapidly
Toyota Production System (TPS)

Toyota nearly went bankrupt around 1950 and laid off a third of its employees.

Toyota’s current way of thinking is committed to never experiencing that painful situation again.
Toyota leadership agreed on 4 “Aims” for their company.

1. Deliver the highest possible quality and service to customers.

2. Develop employee potential based on mutual respect and cooperation.

3. Reduce cost through the elimination of waste in every process.

4. Build flexible production capability that can respond to changes in the market.
Toyota leadership also agreed on 2 “Pillars” for their company’s production systems.

1. **Just In Time**: Material is processed and moved in order to arrive "Just In Time" for the next operation.

2. **Jidoka**: Do not allow defective parts to go from one work station to the next.
All we are doing is looking at the time line from the moment the customer gives us an order to the point when we collect the cash. And we are reducing that time line…

Taiichi Ohno, Toyota
21 mfg plants, 101 projects over 2 yrs

• 11 applied 6 Sigma
• 4 applied Lean
• 6 applied “TLS” (TOC + Lean + 6 Sigma)
Results: of the total savings reported

- Lean…… 4%
- 6 Sigma… 7%
- TLS…… 89%
Parts of the Same Puzzle?

TOC… to establish a Throughput$ Operating Strategy so as to decide where to focus

Lean… to map the value stream, identify waste, etc.

Six Sigma… to reduce variation in the pursuit of perfection
Recommended Starting Resources: Books

- “The Goal” by Goldratt
- “Managing to Learn” by Shook
- “The Gold Mine” by Balle
- “The Machine that Changed the World” by Womack, Jones, and Roos
Recommended Starting Resources: Web Sites

• http://www.tocico.org/?page=toc_portal
• http://public.wsu.edu/~engrmgmt/holt/em526/ConstraintsOverview/TOCICO-FundamentalsReview.htm
• http://www.scoop.it/t/theory-of-constraints-by-philip-marris
• https://www.tocinstitute.org/theory-of-constraints.html
• https://www.lean.org/
• http://www.leanproduction.com/
• https://www.6sigma.us/
Questions?

Thank You!

Tim Sullivan  sullyttg@gmail.com