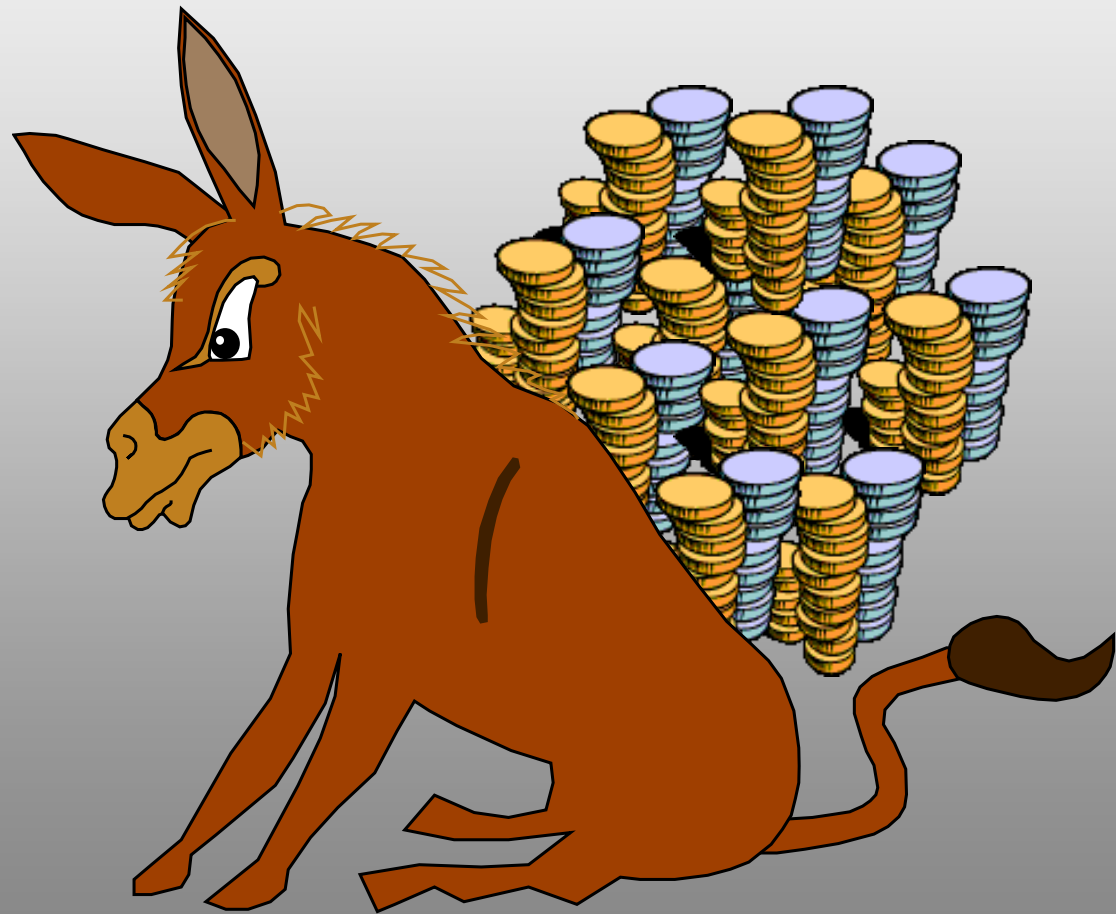
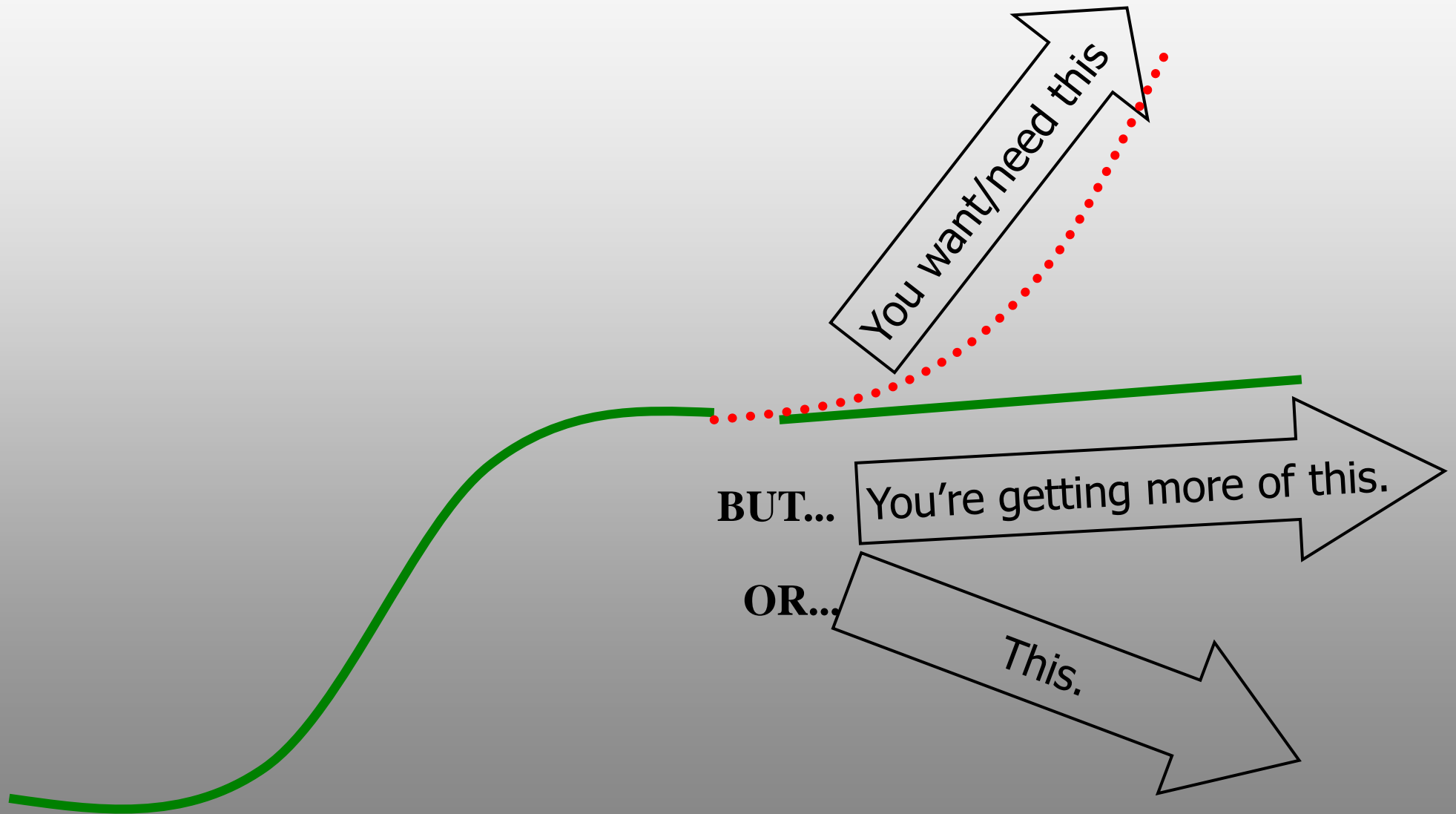


TOC / Constraint Management (Theory of Constraints)

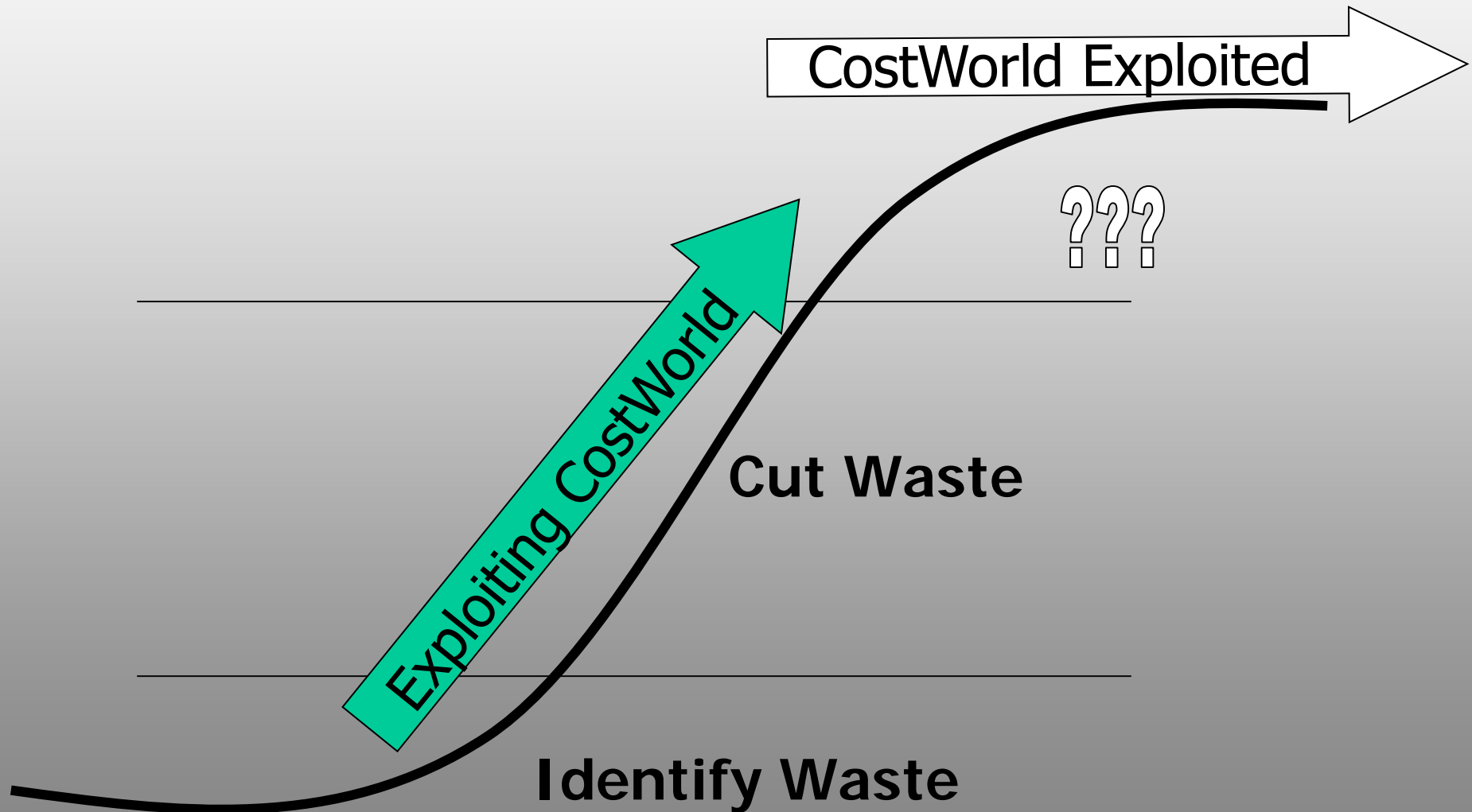
**What is
blocking you
from getting
more of
your Goal?**



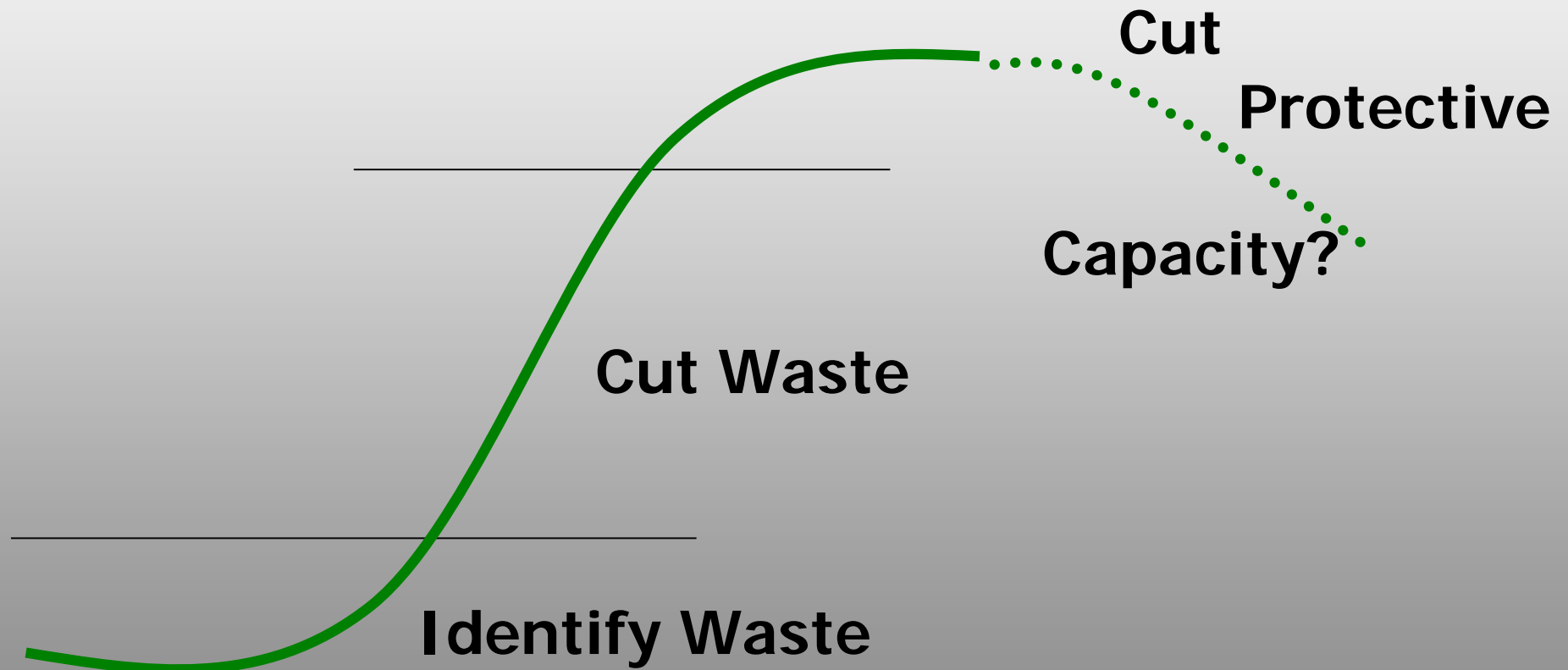
The Current State of Affairs



Cost World Thinking Has Paid Off for Many...Until Now...



What Now? Continue to Cut?



A New Way of Thinking...

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

Einstein

What is the TOC/ Constraint Management?

Organizations are a complex web of people, equipment, methods, materials and measures. This detail complexity is bad enough, then add to it the dynamic complexity of changing customers, suppliers, workforce, regulations, etc. and you have a picture of the challenge faced by today's management team.

What is TOC? (continued)

Traditionally, management has divided the organization into smaller, more manageable pieces. The objective is to maximize the performance of each part. After all, global improvement is the sum of the local improvements.

Right?

What is TOC? (continued)

Wrong! TOC claims complex systems exhibit inherent **simplicity!**

There are very few points in a system, perhaps only one, where a significant improvement in local performance causes a significant improvement in global performance.

Such a factor is called a **constraint**.

How does TOC help companies?

If you want more of your *goal*,
you must *focus* on your constraint,
follow through,
and manage based on *feedback*.
That is the essence of TOC!

Finding the Focal Point

- Before a business 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 (continued)

Some would argue that the goal of their company is to...

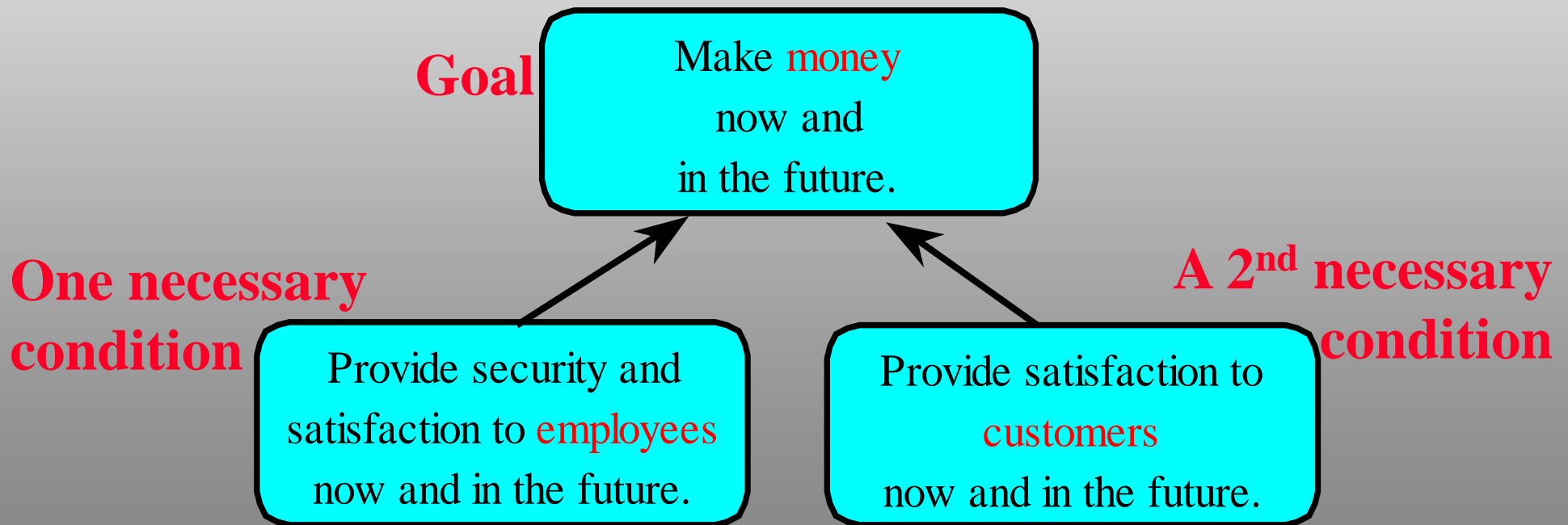
- To satisfy **customers** now *and in the future!*

Or to..

- Provide a secure and satisfying jobs for **employees** now *and in the future!*

The Goal (continued)

TOC recognizes that only the “owners” of a company can choose THE goal. However, once chosen, the other 2 become conditions necessary to achieving the goal.



The Goal (continued)

That is...

- If your goal is to satisfy customers, it is absolutely necessary that you make money and that you provide security and satisfaction to employees...
- Likewise, if your goal is to provide secure and satisfying jobs, you also have to make money and satisfy your customers...
...or you won't be in business in the future!

The Goal (continued)

The choice is yours, choose any of the three as the goal of your organization! You cannot escape the fact that a company must make money now and in the future!

For the duration of this presentation, we will assume that the goal is:

- To make money now *and in the future!*

Measuring Progress

Once the Goal is identified, the next crucial need for success in achieving the goal is to identify which measurements will be used to judge success.

What measurements should we use?

Conventional Wisdom

- Net profit?
- Efficiency?
- Utilization?
- Return On Investment?
- Cash Flow?

“Are you using the right measurements?”

Jonah in The Goal

What measurements should we use? (continued)

Generally Accepted Performance Measures

- Net Profit
- Return on Investment/Equity/Assets
- Cash Flow

TOC does *not* question the validity of these 3 measures; they are vital and must be satisfied. However, TOC *does* question their usefulness as *Operational* Measures.

What measurements should we use? (continued)

- For the average worker it is almost impossible to see the effect that any of their actions has on Net Profit (NP) or ROI.
- As a result we have created measures like efficiency and utilization because we believe they are linked to NP and ROI.

But are they?

Utilization

- Suppose more material is released for the purpose of improving the **Utilization** of a certain resource. Further suppose that this resource can produce faster than the pace setter resource. This “improvement” in utilization will not increase shipments but will increase your investment in inventory. Does that improve net profit and/or ROI?

Efficiency

- In a similar fashion, suppose you spend money to “improve” the **Efficiency** of a non-bottleneck resource. You will not increase shipments, you will probably increase WIP, and (depending on the nature of the expenditure) you will either increase your investment or operating expenses. Does that improve NP and/or ROI?

What measurements should we use? (continued)

TOC Measures

- Throughput
- Inventory&Investment
- Operating Expense

Throughput ("T")

The rate at which *contribution dollars* (*monies*) are entering the organization.

- Only \$ generated by your system get counted; i.e., raw materials and purchased services (like heat treating) don't count because those \$ pass through your books to your suppliers.
- "T" = (Selling Price - Unit Variable Costs)/time, or "T" = "Contribution\$"/time
- Building to stock does not generate throughput

Inventory/Investment (“I&I”)

All the *money* currently tied up inside the system.

- “I” really is made up of two categories
 1. Investment in machinery, buildings, etc. (if owned)
 2. Inventory in the form of raw materials, work in process (WIP), and finished goods (FG)

“I&I” (continued)

Is the Inventory portion of “I&I”
a liability or an asset?

- To the extent that it protects against lost sales it is an asset.
- To the extent that too much (especially WIP and FG) ties up cash and retards responsiveness to market preferences (causing lost sales) it is a liability.

Operating Expense (“OE”)

All the *money* the system spends to turn inventory into throughput.

- All expenses are lumped together and usually considered as one big expense.
- All employee labor expenses are almost always Operating Expense (direct, indirect, sick, operating, etc.).

Operating Expense ("OE")

(continued)

Allocation of operating expenses often leads to local decisions that reduce global profit and ROI. For example:

- Some companies sell all their products at a price that the fully allocated cost system says includes some net profit, yet they go bankrupt.
- Others sell some of their products "at a loss" according to their fully allocated costing system, yet total net profit goes up.

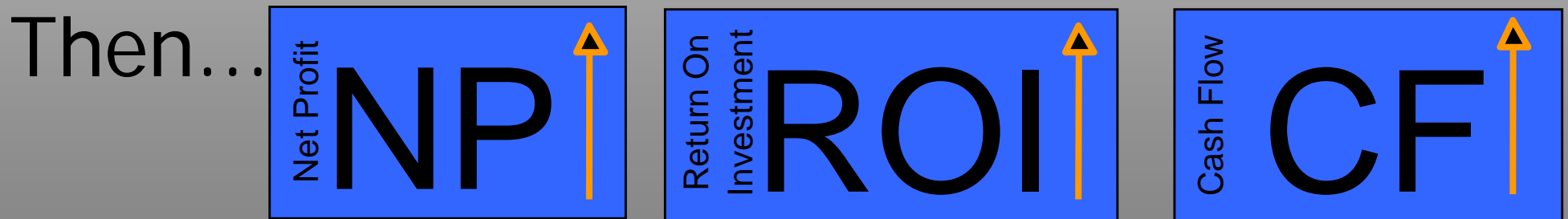
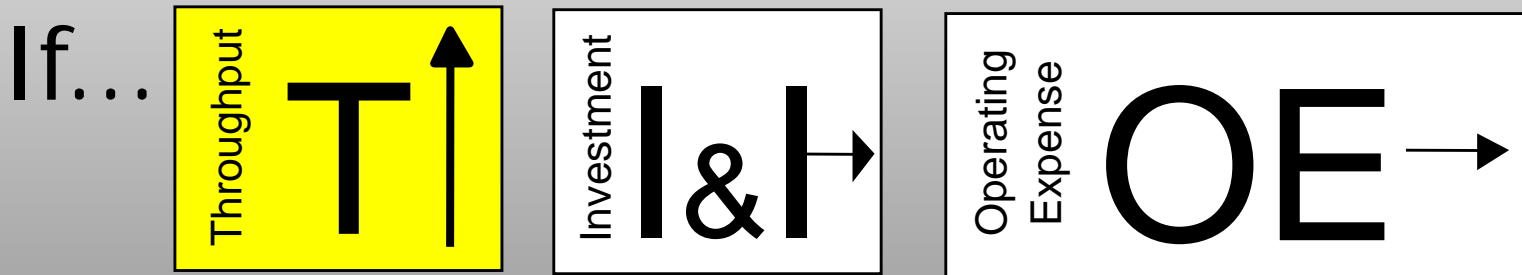
A Very Important Question

“Wait a minute,” someone exclaims. “If I monitor Throughput, Inventory/ Investment, and Operating Expense in the short term, how can I be sure that I will have a Profit, with reasonable Return On Investment in the long term, and maintain a positive Cash Flow?”

Financial Links

The following are based on
"The Race" by Goldratt and Fox (North River Press, 1986)

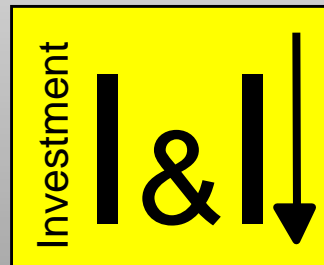
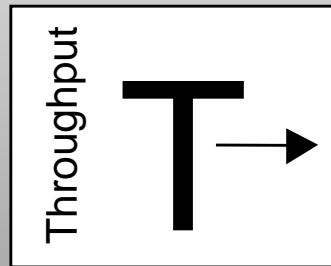
Case 1: If we can increase "T" while maintaining level "I&I" and level "OE", what will the impact be on Net Profit, ROI, and Cash Flow?



Financial Links (continued)

Case 2: If "I&I" decreases (by reducing WIP) while "T" and "OE" remain level, what will the impact be on Net Profit, ROI, and Cash Flow?

If...

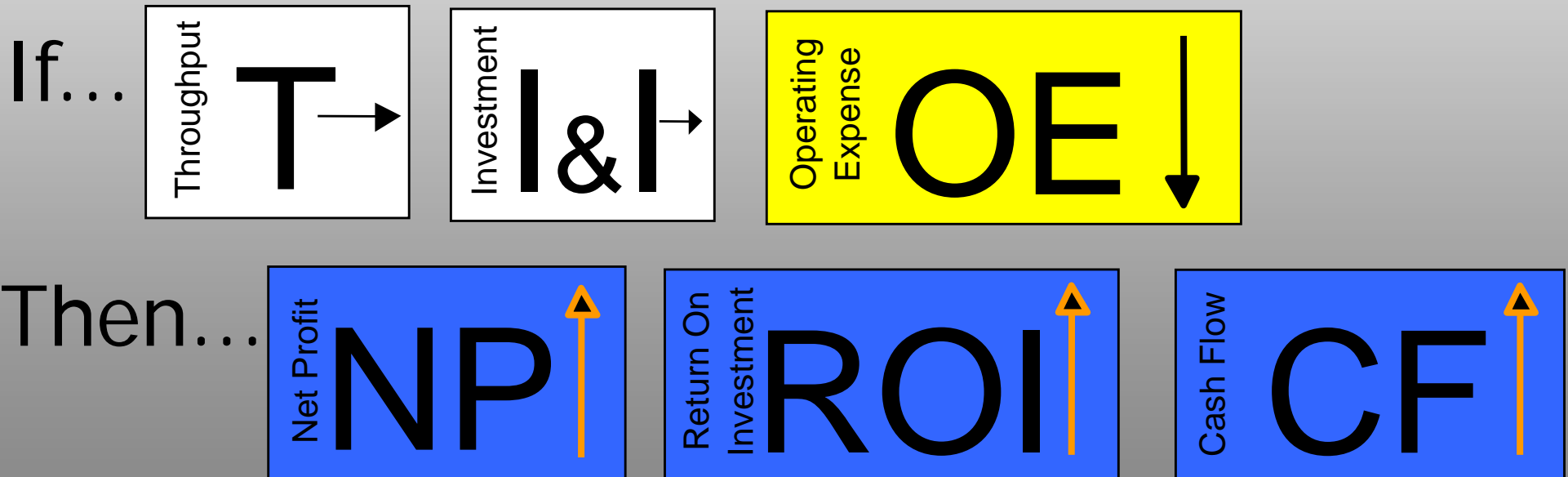


Then...



Financial Links (continued)

Case 3: If we can decrease "OE" while maintaining level "T" and level "I/I", what will the impact be on Net Profit, ROI, and Cash Flow?



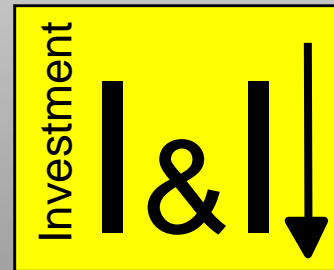
Financial Links (continued)

- So the answers in all 3 cases show unquestionably that by determining the impact that an action will have now on Throughput, Inventory&Investment, and Operating Expense we can predict the future impact on Net Profit, ROI, and Cash Flow.

Financial Links (continued)

Case 4: What about Inventory&Investment?
Because it has no direct impact on Net Profit, it seems to be less powerful at impacting the bottom line. But...

Even though when...

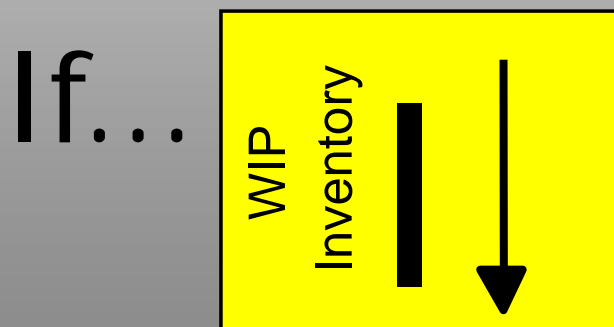


There is no Direct impact on...

A white square box with a black border containing the letters "NP" in a large, bold, black font, followed by a rightward-pointing arrow.

Financial Links (continued)

However, reducing Inventory&Investment, especially by reducing the amount of work in process Inventory (WIP), and finished goods (FG) *does* reduce some operating expenses, known as carrying costs.



Financial Links (continued)

And...

If... **Carrying Costs** ↓

Then...

Net Profit **NP** ↑

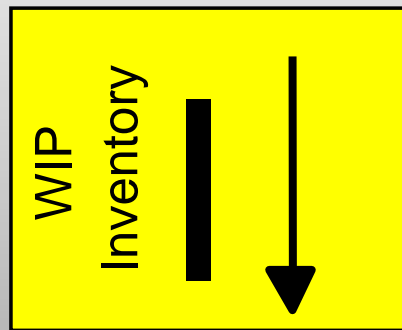
Return On Investment **ROI** ↑

Cash Flow **CF** ↑

Financial Links (continued)

Therefore, there is an indirect link...

If...



Then...



And since we already saw that a reduction in WIP causes a direct increase in ROI and Cash Flow, we can see that reducing WIP has a significant financial impact.

Financial Links (conclusion)

- Throughput, Inventory&Investment, and Operating Expense are valuable operational measures that can be used to guide our decisions.
- The next question must be: which of these 3 is the most important -- or do they all have equal weight?

Where should a manager focus?

Decreasing Operating Expense?

Decreasing Inventory&Investment, or
Increasing Throughput?

The “Cost World”

- Decreasing “OE” is definitely #1 because we have relatively high control of our expenses.
- Increasing sales is always important, but it ranks #2 because we are at the mercy of the marketplace and have less control over sales.
- The Inventory portion of “I” tends to fall into a “grey area”; it is a “necessary evil” that must be lived with to protect sales, but too much is clearly bad.

The “Throughput World”

- Increasing “T” is unquestionably #1 because it has the greatest potential impact on the bottom line.
- Decreasing the Inventory portion of “I&I” is #2 because excess WIP and finished goods jeopardize future throughput.
- Decreasing “OE” #3 because significant reductions (which are usually capacity reductions) jeopardize future throughput.

TOC Question...

TOC does not claim to have been the factor that determined the proper ranking of the 3 operational measures. The vital contribution of TOC is to answer the following critical question:

How should we manage a company in a world where increasing Throughput is the #1 priority, reducing Inventory is #2, and reducing Operating Expense is a tactic of last resort to be employed only after comprehensive efforts at #1 and #2?

Chain Analogy

A company 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 parts until they are manufactured, etc.



Chain Analogy (continued)

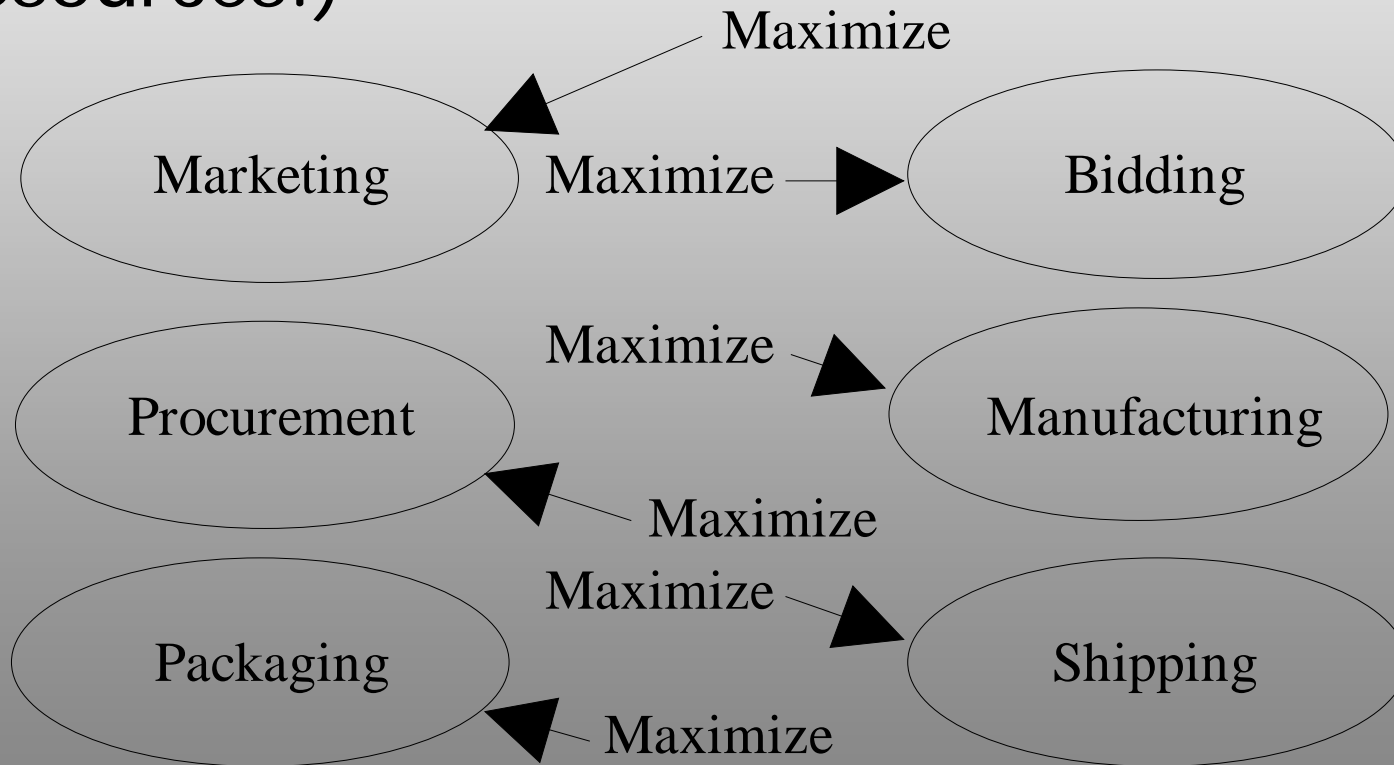
Conventional Wisdom believes that...

- Improvement of any link is an improvement to the chain.
- Global improvement is the sum of the local improvements.
- Primary Measurement: Link Weight

Result: Every link wants/needs more resources all the time

Conventional Wisdom

“Take actions that will maximize any/all local operations.” (i.e. Fight constantly for scarce resources.)



Chain Analogy (continued)

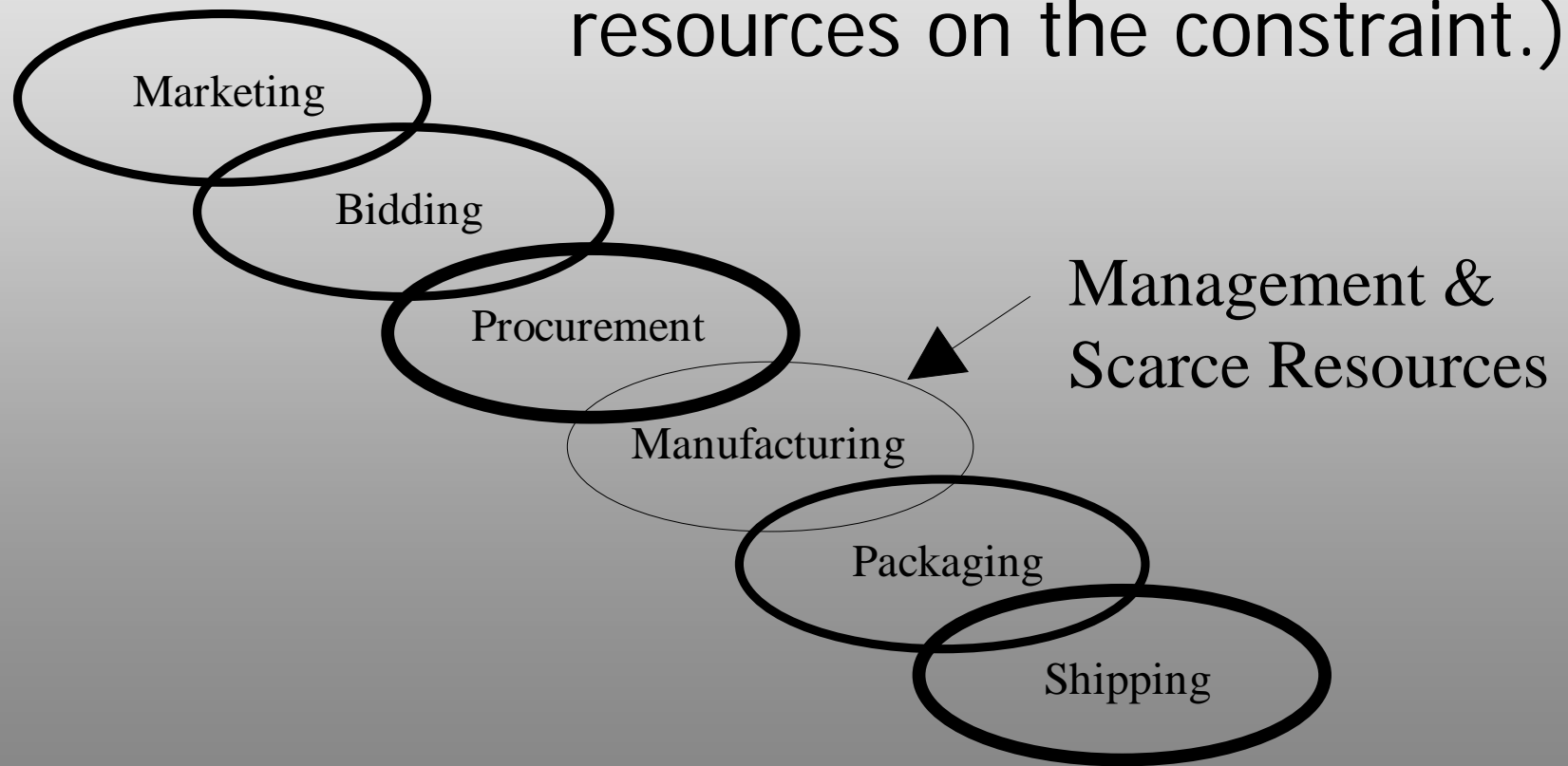
Throughput World Approach believes that...

- Most improvement of most links do not improve the chain.
- Global improvement is *NOT* the sum of the local improvements.
- Primary Measurement: Chain Strength

Result: Resources are channeled to the weakest link (aka: Herbie, the constraint, "CCR").

TOC/Global Wisdom: **FOCUS**

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



A Process for **Follow Through**

The Process Of On Going Improvement

1. **Identify** the constraint
2. Decide how to **Exploit** the constraint
3. **Subordinate** all other decisions to the necessity to exploit the constraint
4. If after #2 and #3 more capacity is needed to meet market demand, **Elevate** the constraint.
5. **Go back** to #1, but *don't let inertia become the system's constraint.*

Follow Through: Step 1

Identify the constraint

- The effect of the true constraint can be “visible” internally (i.e. you can’t supply fast enough) or externally (i.e. there is not enough demand).
- Don’t confuse factors that limit your ability to exploit the constraint with the constraint itself. For example, bad policies are never the constraint, though they frequently limit your ability to exploit the actual constraint.

Follow Through: Step 2

Decide how to **Exploit** the constraint

- What is it going to take to get the most that is reasonably possible out of the capacity constrained resource (CCR)?
- Utilization and efficiency are crucial *at the CCR*.
- This step is often treated as indistinguishable from step 4, but it is usually beneficial to Exploit *before* Elevating.

Follow Through: Step 3

Subordinate all other decisions to the necessity to exploit the constraint

- The focus is on being a high quality, reliable supplier to, or customer of the constraint.
- Utilization and efficiency are **not** factors to emphasize at the *non-constraint resources*.
- This step is often skipped, and thereby the majority of financial benefit of TOC is lost!
- This is the toughest step because you must change your measurements/culture.

Follow Through: Step 4

If after #2 and #3 more capacity is needed to meet market demand, then **Elevate** the constraint.

- Add more capacity through capital investment or outsourcing, or off-load the constraint by defining alternative routings, process or product redesign, etc.
- Often times, Exploitation and Subordination are sufficient to reach the needed output; *do not increase investment too soon!*

Follow Through: Step 5

Go back to #1, but *don't let inertia become the system's constraint.*

- Often times, when a new constraint is identified, it is necessary to change your focus (and many of the policies you just made)!
- **CAUTION!** The long term strategic application of TOC does not call for the continuous removal of the constraint; rather, in order to best exploit business opportunities, the idea is to choose strategically which resource should be designated as the "Drum" (or pace setter) and then keep that "constraint" stationary!

Management based on **Feedback**

- TOC solutions are robust because they provide not only a means for creating a plan, but also a powerful means for executing the plan. (Many other methods rely on frequently changing the plan – usually causing chaos.)

Feedback (continued)

- 'Buffer management' provides dynamic feedback for short term (expediting) and long term (adjusting buffer sizes).
- 'Buffer management' works differently in different applications
- Poorly implemented 'buffer management' means wasted profit.

Three “f-words” of TOC

The Theory of Constraints provides proven methodology for three vital needs in any organization:

- *Focus*
- *Follow Through*
- *Feedback*

TOC Summary: Focus

- A company must first know its Goal and the necessary conditions for achievement.
- Then it must identify the correct set of measures that can be used to judge their efforts to achieve the goal.

TOC Summary: Follow Through

The Process Of On Going Improvement

1. **Identify** the constraint
2. Decide how to **Exploit** it
3. **Subordinate** all other operations to the necessity to exploit the constraint
4. If after #2 and #3 more capacity is needed to meet market demand, **Elevate** the constraint.
5. **Go back** to #1, but don't let inertia become the system's constraint.

TOC Summary: Feedback

- Buffer management
 - Know if you need to expedite before the order is late
 - Know when you should reduce or increase the size of the buffer(s)

About the Author

Tim Sullivan has retired as a Industrial Specialist for Iowa State University's Center for Industrial Research and Service. He specialized in constraint management and assisted manufacturers in the successful implementation of TOC. He has a Master of Science in Industrial Relations from Iowa State University, and has completed the "Jonah", and "Jonah's Jonah" training at the Goldratt Institute.

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