Theory of Constraints
Outline

1. Introduction to Constraints
2. Five Steps Of Theory of Constraints
3. Drum Buffer Rope
4. Issues with TOC
5. Measurements
Any system can produce only as much as its critically constrained resource.

Maximum Throughput = 40 units per day
Significance of Bottlenecks

- Maximum speed of the process is the speed of the slowest operation
- Any improvements will be wasted unless the bottleneck is relieved
Theory of Constraints

- Purpose is to identify constraints and exploit them to the extent possible
  - Identification of constraints allows management to take action to alleviate the constraint in the future
Theory of Constraints

- Assumes current constraints cannot be changed in the short-run
  - What should be produced now, with current resources, to maximize profits?
    - Question cannot be answered by traditional accounting methods
Theory of Constraints

- Based on the concepts of drum, buffer and ropes

  - Drum
    - Output of the constraint is the drumbeat
      - Sets the tempo for other operations
      - Tells upstream operations what to produce
      - Tells downstream operations what to expect
Theory of Constraints

- **Buffer**
  - Stockpile of work in process in front of constraint
  - Precaution to keep constraint running if upstream operations are interrupted

- **Ropes**
  - Limitations placed on production in upstream operations
  - Necessary to prevent flooding the constraint
What is the Theory of Constraints?

“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”. 
What is TOC? (continued)

“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”

Noreen, Smith, and Mackey, The Theory of Constraints and its Implications for Management Accounting (North River Press, 1995)
How does TOC help companies?

1. Focusing improvement efforts where they will have the greatest immediate impact on the bottom line.

2. Providing a reliable process that insures Follow Through!
Five Steps Of TOC

1. Identifying the constraint
2. Decide how to exploit the constraint
3. Subordinate everything else to the decision in step 2
4. Elevate the constraint
5. Go back to step 1, but avoid inertia
Theory of Constraints

1. Identify the appropriate measures of value
2. Identify the bottlenecks
3. Use bottlenecks properly
4. Synchronize all other processes to the bottlenecks
5. Increase the bottleneck’s capacity
6. Avoid inertia and return to Step #1
Steps in the TOC Process

- Identify the system constraints
  
  ■ Internal
    ■ Process constraints
      ■ Machine time, etc.
    ■ Policy constraints
      ■ No overtime, etc.
  
  ■ External
    ■ Material constraints
      ■ Insufficient materials
    ■ Market constraints
      ■ Insufficient demand
Steps in the TOC Process

- Decide how to exploit the constraint
  - Want it working at 100%
  - How much of a buffer?
Steps in the TOC Process

- Subordinate everything else to the preceding decision
  - Plan production to keep constraint working at 100%
  - May need to change performance measures to “rope” upstream activities
Steps in the TOC Process

- Elevate the constraint
  - Determine how to increase its capacity
- Repeat the process
  - Always a new constraint
Drum Buffer Rope

- Drum-Buffer-Rope for Shop Floor Control
  - **Drum**: The Pace Setting Resource - constraint
  - **Buffer**: The amount of protection in front of the resource
  - **Rope**: The scheduled staggered release of material to be in line with the Drum’s schedule.

A Pull System

```
  60 ----> 70 ----> Buffer ----> 40 ----> 60
     |              |                      |
     |              |                      |
     |              |                      |
     |              |                      |
     Rope         Constraint (Drum)
```

Constraint (Drum)
Lean: How DBR Supports it

Fundamentally, Don’t Build Until Needed

- **Overproduction avoided** because DBR is “pull” system
- **Inventory minimized** because only buffer at constraint
- **Transportation reduced** because “unbuilt material” doesn’t move
- **Processing waste minimized** because “unbuilt material” left until required
- **Unnecessary Motion decreased** because don’t build unneeded
- **Waiting is eliminated at the constraint** – only place that counts
- **Defects avoided** because of “small lot”, non conformance, and corrective action
Why Drum Buffer Rope?

- A proven method to*:
  - Reduce Lead times an average of 70%
  - Reduce inventory an average of 49%
  - Reduce Operating Expenses
  - Improve on time delivery performance an average of 44%
  - Increase Revenue an average of 63%
  - Better control
- DBR delivers ALL of these results AT THE SAME TIME.

*The World of the Theory of Constraints by Mabin & Balderstone, St. Lucie Press 2000
Issues with TOC

- Upstream operations must provide only what the constraint can handle
- Downstream operations will only receive what the constraint can put out
- Constraint must be kept operating at its full capacity
  - If not, the entire process slows further
Issues with TOC

- Advantages
  - Improves capacity decisions in the short-run
  - Avoids build up of inventory
  - Aids in process understanding
  - Avoids local optimization
  - Improves communication between departments
Issues with TOC

■ Disadvantages

■ Negative impact on non-constrained areas
  ■ Diverts attention from other areas that may be the next constraint
  ■ Temptation to reduce capacity
Issues with TOC

- Ignores long-run considerations
  - Introduction of new products
  - Continuous improvement in non-constrained areas
- May lead organization away from strategy
- Not a substitute for other accounting methods
Measurements

Conventional Wisdom

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

“Are you using the right measurements?”

Jonah in *The Goal*
Measurements

TOC Wisdom
- Throughput
- Inventory
- Operating Expense
Traditional vs JIT, TQM and TOC

Traditional Ranking
- Operating expense
- Throughput
- Inventory or Assets

JIT, TQM and TOC
- Throughput
- Inventory or Assets
- Operating expense

All Three methods attack the underlying assumption that created a problem related to inventory levels. They ask:

WHY DO WE NEED INVENTORY TO PROTECT THROUGHPUT?
The “Cost World”

- Decreasing “OE” is definitely #1 because we have relatively high control of our expenses.
- Increasing “T” is always important, but it ranks #2 because we are at the mercy of the marketplace and have less control over sales.
- Inventory tends to fall into a “grey area” that we don’t know exactly what to do about; it is a “necessary evil” that must be lived with to protect sales.
The “Throughput World”

- Increasing “T” is unquestionably #1 because it has the greatest potential impact on the bottom line.
- Decreasing “I” is #2 because excess WIP and finished goods jeopardize future throughput.
- Decreasing “OE” is #3 because significant reductions (workforce reductions) usually jeopardize future throughput.
Financial Issues

- TOC is a management tool, not a financial tool
- Not used to determine inventory values
- Not used to allocate overhead to inventory
- Does not comply with GAAP
- Does indicate how to use available resources most effectively
Conclusion

- In the throughput world, constraints become the main tools of management and the previous tool, product cost, can be discarded.