TOCICO 0 to 60
Introduction to Finance and Measures

Lisa Anne Ferguson, PhD
CEO and founder, Illuminutopia
The Goal & Necessary Conditions

Satisfy market now and in the future

Your Company

Satisfy employees now and in the future

Make money now and in the future

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Measurement conflict

Objective

Put company on process of ongoing improvement

Important Needs

Induce people to improve

Convert local improvements into bottom line results

Actions/Wants

Do not lay-off people

Lay-off people in the departments which have improved the most

MARKET MONEY

Source: Goldratt Satellite Program (1999)

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Financial Measurements

**The Goal:** To make money now ... and in the future

What indicators do we use to tell us whether we're achieving this goal or not?

- Net Profit
- Return on Investment
- Cash Flow

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Operational Measurements

- **Throughput (T)**: The rate at which the organization generates ‘goal units’ (i.e. the rate at which the system generates money through sales)

- **Investment (I)** (formerly Inventory): The money tied up in the organization.

- **Operating Expense (OE)**: All the money the organization spends to generate ‘goal units’ (to turn investment into throughput)
Measurements

Net profit:

\[ NP = T - OE \]

Return on investment:

\[ ROI = \frac{(T - OE)}{I} \]

Cash flow:

Cash inflows – cash outflows (in terms of changes in T, I and OE)
Measurement Relationships

Source: Goldratt and Fox, 1986

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Making decisions

1. System
2. Investments
3. Make versus Buy
4. Sub-systems
5. Product/service viability

Source of material: Goldratt, Insights into Finance and Measurements (see for more detail explanations of the following material)

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The problem

Are the major problems the timeliness and accuracy of the judgments?

Or are the decisions based on the wrong measurements, thus leading to distortions in judgments?

Eli Goldratt claimed that the “current measurements are enemy number one of productivity.”
True Story

A large heavy agriculture equipment (tractor) manufacturer ($10B/yr annual sales) hired a new CEO after a small loss one year (about 1981). The new CEO asked for a list of all manufactured parts and their costs. Outsourcing was mandated if it was cheaper to buy. This was done on a huge scale. The reality is the only savings is direct labor. A new list was created, thus resulting in more outsourcing.
True Story

The CEO also asked for efficiency calculations based on the fact that equipment can be used 24 hours. Since efficiencies were low, the plants were asked to increase production. The company borrowed money to build to forecast. The profit increased due to the increase in inventories (absorption costing). The company had products everywhere.
Distortions

Make-buy
The cost to make it internally was compared to the cost to outsource.

Investments
To exploit the significant equipment investments, the plants increased production even when it meant increasing producing to stock.

System
At the end of the year, the balance sheet and P&L statements improved.
True Story

The CEO left the company not knowing what to do. The next year, the company fired 30,000 people. Tractors were dumped for a low price. Farmers borrowed money to buy. Many farmers failed after a drought of two years. Within a few months, the company performance deteriorated due to these decisions, almost driving it into bankruptcy.
Decisions are made based on impact to the Balance Sheet, Profit and Loss and Cash Flow Statements.

The main distortion for the system relates to inventory.

Inventory is a liability (reduces ability to compete), but is viewed in the financial statements as an asset. Overhead is allocated to inventory.
The conflict

Healthy business

Increase company's ability to compete

Reduce inventory

Avoid jeopardizing profitability

Not reduce inventory

Assumption: The financial statements regard inventory as an asset and a reduction in assets decreases profitability

Source: Goldratt, 2003
Investments in equipment

- Judgments are made based on a return on investment calculation of the estimated cost savings. Overhead is allocated to equipment.
- If the equipment is a non-bottleneck, the savings will not materialize.
- If the equipment is a bottleneck, the decision may be inaccurate. We need to consider the impact on throughput.
Make versus Buy

- Judgments are made by comparing the price to buy from the outside relative to the cost to make it internally. Overhead is allocated to the cost to make the part.
- If the part is only processed by non-bottlenecks, the savings will not materialize. Usually overhead is not reduced, nor are direct labor expenses. The only tangible savings are raw material costs.
- If the part is processed by a bottleneck, the additional sales should be considered, not reduced costs.
Sub-systems

- Judgments are made based on making sub-systems profit centers and providing each with a profit and loss statement.
- Transfer prices become the selling price from one sub-system to another of the same company.
- Costs are \textit{allocated} to sub-system parts.
- The transfer price is based on the costs of the sub-system, resulting in a lack of motivation to improve costs.

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Product/service viability

Judgment is made by calculating “product cost” for each product/service.

Costs are allocated to the product/service.

PQ example (section 5 of Insights)
Goldratt’s ‘P and Q’ Problem

**P**
- Price = $90/Unit
- Mkt. demand = 100 units/wk

**Q**
- Price = $100/Unit
- Mkt. demand = 50 units/wk

Resource D
- 15 min/unit

Purchased part = $5 per unit

Resource C
- 10 min/unit

Resource A
- 15 min/unit

RM1
- $20/unit

RM2
- $20/unit

RM3
- $20/unit

Source: Goldratt, 1990
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Problem information

- Operating expenses are $6000/week (only costs not included are those of raw materials)
- Suppliers deliver on-time, complete orders at the set price
- Resources work consistently producing perfect outputs (no downtime, absenteeism, breaks)
- One of each resource (A, B, C, D)
  - Each resource is available 5 days a week, 8 hours a day (2400 minutes)
  - Resources can not be cross-trained further
Problem information

- There are no setup times
- Resources do not lose any productive time waiting for work (Therefore, we can assume that all of their time available could be used to produce output)
- Customers are willing to pay the set price and will buy all the output of P and Q delivered as long as it does not exceed market demand (which is known, not a forecast)
Management’s dilemma

Control Costs

Judge according to local impact

Protect Throughput

Not judge according to local impact

Source: Goldratt, 2003
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Resolving the conflict

Assumption: Local impact is EQUAL to impact on the organization

Control Costs

Judge according to local impact

Many decisions affect throughput and costs simultaneously

Not judge according to local impact

Assumption: Local impact is NOT EQUAL to impact on the organization

Manage Well

Protect Throughput

Source: Goldratt, 2003

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Local impact (cost world)

**Chain analogy:** measurement is weight

The additive rule applies – the total costs are the sum of the costs of each sub-system.

Reducing the costs of a sub-system by $X$ reduces total costs by $X$. Therefore local improvements are global improvements.
Cost world

- Since global improvements are equal to local improvements, the way to judge decisions is according to the local impact only.

- To quantify local impact, we allocate costs.
Time to THINK

Managers will take actions to maximize local optima.

Do “easy” work first

A “good decision” is generally viewed as one that requires the least cost.

In the “cost world” an improvement in ANY link is an improvement to the chain.

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Global impact
(Throughput World)

- **Chain analogy**: measurement is strength
- The additive rule does not apply. Making one link stronger may not be a global improvement.
- Global improvement ≠ sum of local improvements
Time to THINK

Managers must take actions to maximize global optima.

A “good decision” is one that increases $T$ and reduces or does not increase $I$ or $OE$.

In the “throughput world” the only way to improve the system is to improve it not the constraint.

Process FIFO not just ‘easy ones’

then

A "good decision" is one that increases $T$ and reduces or does not increase $I$ or $OE$.

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<table>
<thead>
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<th></th>
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<th>Cut OE</th>
<th>Raise T</th>
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<td>$100.00</td>
<td>$120.00</td>
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<tr>
<td>Materials</td>
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<td>5.0</td>
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<td>Throughput</td>
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<td>Direct Labor</td>
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<tr>
<td>Overhead</td>
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<td>60.0</td>
<td>60.00</td>
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<tr>
<td>Operating Expense</td>
<td>90.0</td>
<td>84.0</td>
<td>90.00</td>
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<td>Net Profit</td>
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Source: Newbold (1998)
Resolving Management’s dilemma

Manage well

Control Costs

Protect Throughput

Judge according to local impact

Not judge according to local impact

Assumption: Local impact is equal to impact on the organization

The assumption is invalid!

There is no conflict

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A reference environment for analyzing problems – *The Goal*

Most people identify with the problems with which Alex Rogo was struggling.

High WIP

Long lead times

Missed due dates

Frequent expediting

Insufficient capacity

No wonder his profitability and cash flow were suffering.

As work flowed through his system, he experienced (more and more)

Most people identify with the problems with which Alex Rogo was struggling.
The logical outcome of these problems’ remaining unresolved?

- Poor Cash flow & profitability
- Internal & external customer dissatisfaction
- Poor morale, high turnover
- Finger-pointing & conflicts
- Frequent expediting
- Due dates are often missed
- Lead times are too long
- Queues increase
- Inventory is too high
- Work is released to keep everyone busy

Alex Rogo’s problems in The Goal?
The significance of interdependency...

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A core, unresolved conflict...

- Poor Cash flow & profitability
- Poor morale, high turnover
- Finger-pointing & conflicts
- Internal & external customer dissatisfaction

- Due dates are often missed
- Lead times are too long
- Queues increase
- Work is released to keep everyone busy

- Frequent expediting
- Inventory is too high
- Constraint is not exploited or known

- Control costs
- Take actions to achieve good dept'l perf.
- Take actions to achieve good org'l perf.

- Manage properly
- Protect throughput
TOC cause-effect tools help clearly delineate the policies, measures and behaviors that lead to EACH specific symptom.

**Symptom**
Too much work in process / inventory.

No WONDER Alex Rogo ended up here...

The resulting behaviors are...

Which manifests itself with this measure...

POLICY: Idle time is bad.

Typical “silo” from The Goal.

Managers try to have good dept’l performance

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But there’s more…

- Large batch
  - Good efficiencies
  - Minimize shipping cost
  - Ship complete orders
  - Build/ship to order

- Small batch
  - Short cycle time
  - Increase sales
  - Ship partial orders
  - Build/ship to stock

- Lower price to get the bid
  - Don’t lower price to get the bid
  - Increase sales
  - Minimize shipping cost
  - Build/ship to stock

- Don’t lower price to get the bid
  - Minimize shipping cost
  - Build/ship to stock

- Factor in quality obsolescence/storage
  - Factor in quality obsolescence/storage
  - Minimize shipping cost
  - Build/ship to stock

- Buy least cost raw materials
  - Minimize shipping cost
  - Build/ship to stock

- Keep market promise
  - Minimize shipping cost
  - Build/ship to stock

- Maximize labor/machine efficiency
  - Minimize shipping cost
  - Build/ship to stock

- Respond to the market
  - Minimize shipping cost
  - Build/ship to stock


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Using a Strategy and Tactics Roadmap to understand why Organizational Conflicts exists

The real problem:
Many times, conflicts are only experienced at the lower level – those at the top are many times not even aware of these conflicts and bad compromises that cause the current UDEs

Organizational conflicts (and their associated UDEs) will exist as long as there are resource constraints (same resources are required to improve different parts at the same time) during times when demand exceeds capacity

Organizational conflicts (and their associated UDEs) will exists as long as the policy or metric to improve one part is in direct conflict with that needed to improve another part

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The “price we pay”

Less ROI

Less profitability

Higher operating expense

Solutions don’t bring significant or expected results

Our overall efforts are uncoordinated

Results benefit one link but hurt another

Improvements are hit or miss in getting results.

Work in silos

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The solution

- We need a mechanism to judge local decisions in line with the throughput world paradigm.
- We need to focus on strengthening the chain.
- To do so we need to focus on the weakest link.
- What are the steps we need to follow?
Five Focusing Steps

1. Identify the system’s constraint(s)
2. Decide how to exploit the system’s constraint(s)
3. Subordinate everything else to the above decision
4. Elevate the system’s constraint(s)
5. If in the previous steps, a constraint has been broken, go back to step 1.

Warning: Do not allow inertia to cause a system’s constraint.
Making decisions

1. System
2. Investments
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5. Product/service viability
Making decisions using TOC

Use T, I and OE to make decisions

1 System
   Inventory = RM costs, etc. only

2 Investments
   Consider effect on constraint

3 Make versus buy
   Do not allocate fixed costs
Making decisions using TOC

4 Profit Centers
   Apply T to each area; no transfer prices;
   Use inventory-dollar days and throughput-dollar days

5 Product or service profit
   Use T/constraint increment (i.e. minute or square foot)
Local performance measure criteria

- Relatively few measures
- Within control of the individual
- Real-time information provided
- Tied to the constraint and the five focusing steps/process of ongoing improvement (POOGI)
About the presenter

Lisa A. Ferguson, PhD, is the founder and CEO of Illuminutopia, an organization that is focused on “Illuminating the way to utopia for individuals, organizations and society” (www.illuminutopia.com). Dr. Ferguson is the author of the chapter on Strategy and Tactic trees in the *Theory of Constraints Handbook*. Professor Ferguson has taught several programs on how to write S&T trees. Until June 2008, Dr. Ferguson spent a year working one-on-one with Dr. Eli Goldratt, the founder of the Theory of Constraints (TOC), while learning how to write. Professor Ferguson has trained TOC Experts and Supply Chain Logistics implementers in India, Japan and the U.S. as a faculty member of Goldratt Schools. Professor Ferguson has a PhD in Business (in Operations Management) and an MBA. Dr. Ferguson taught operations management full-time at a university for 10 years. Dr. Ferguson was a TOCICO board member from 2008 to 2011 and is TOCICO certified in Supply Chain Logistics, the Thinking Processes and Critical Chain Project Management.