



“Never Say I know” and “Never Say I Don’t Know”  
You always know something but never everything

# Back to Basic TOC

## The Five Focusing Steps

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# The power of having an insight

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- Having an insight that is unknown to others gives us huge advantage
- Being able to generalize an insight from one situation to many situations is even more powerful
- We are going to be exposed to a group of powerful insights, developed by Dr. Goldratt during several years of focusing on manufacturing shop-floors
  - Goldratt moved from complex algorithms to inherent simplicity
  - His new understanding shaped the book “The Goal”
  - And then came the Five Focusing Steps
  - And their impact stretches far beyond manufacturing

# The problem with complexity

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- There can be two interpretations for ‘complexity’:
  1. Many variables with some (partial) connections between them
  2. Difficulty to predict the outcome of any move
- Production shop-floors are notorious for being “complex”
  - Equipment, human resources, materials and routings
  - Customers often change their mind and suppliers are slow and erratic
- If manufacturing is truly complex -> its performance cannot be predicted -> customers often don't get what they have ordered -> customers cannot even build stock to keep themselves safe -> the whole industry behaves chaotically
  - Is this what truly happens in reality?
    - We don't mean that in some cases a shipment is somewhat late and what was not supplied on time arrives in less than a week later

# Challenging complexity

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- How come most operational system behave in a way that is far from being chaotic in spite of the complexity?
  - Customers have limited tolerance for their suppliers
  - So, either you solve the internal complexity or you go out of business

- A generic basic insight:

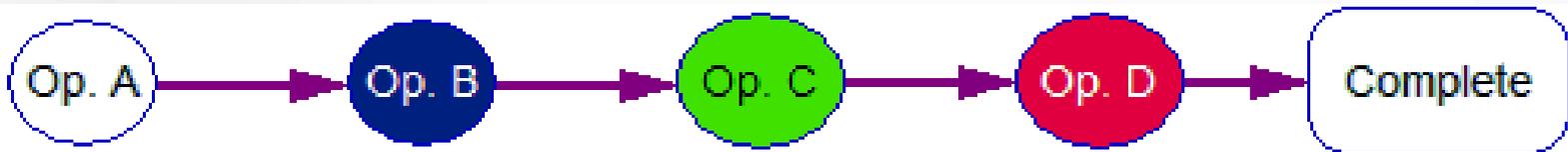
## **Human controlled systems are inherently simple**

- Human controlled systems cannot tolerate chaotic behavior!
- Every operational system must have enough excess capacity in order to be able to handle complexity and uncertainty in an acceptable manner to its customers
  - The system could tolerate very few, usually just one, link that is pretty highly loaded - As long as all the rest have more excess capacity

# Statistical fluctuations and depended events

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- Suppose we have a line of several operations in order to complete a product or service



- What happens when Op. A has a small problem and stops producing for a while?
  - Op. B would be idle - unless
    - There is inventory stuck between Op.A and Op.B
    - Or Op.B is busy processing the previous product
  - In a sequence of operations statistical fluctuations tend to accumulate, even when becoming idle due to fluctuations in the previous operation is not frequent
  - Which practically means that it is impossible that two operations along the line are utilized for 100% of their capacity!

# How operational systems succeed to function?

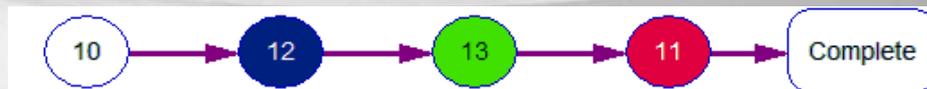
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- Every operational system that is “more or less stable” has to have **considerable amount of excess capacity!!!**
  - On the vast majority of the resources
  - It provides the flexibility to deal with various disruptions
  - Excess capacity vastly reduce the impact of the dependencies between the variables
  - It is possible for ONE resource to be highly loaded in any chain/line/route of connected operations required for delivering a product or service
    - Provided that before and after that resource’s processes there is enough excess (protective) capacity
  - This understanding of statistical fluctuations and depended events can be easily see with simulations or dice-games
- This realization is better known in services than in manufacturing

# Simplifying the complexity

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- Definition: A constraint is anything that significantly limits the performance of the organization from achieving its goal
  - This is the definition from the 80s. Later definition(s) will be discussed later
- The active simplification is gained by understanding that only **one link in the flow truly limits the flow**, so it should define the focus for managing the flow
- Examples:
  - What is the constraint of a farm raising cotton?
    - It could be the land, water, manpower or the market
  - Suppose the numbers of the following line are seconds required for processing and the demand is HUGE – what is the constraint?



# The first three steps of 5FS

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1. **Identify** the system constraint(s).
    - This is an obvious step – with the full responsibility on the CEO
  2. Decide how to **exploit** the system constraint(s).
    - Design the scheme that generates the maximum value from the constraint → and by this to the whole organization
    - This is the essence of the operational strategy
  3. **Subordinate** everything else to the above decisions.
    - All the parts in the organization have to cooperate in order to achieve the exploitation plan
    - This step is NOT intuitive at all
- These are the rules of **the well behaved organization** that draw the maximum from the current state of resources and market

# And the next two steps

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## 4. **Elevate** the system constraint

- This is a natural step, but needs to be taken with caution and usually only after good exploitation and subordination
- Usually this step requires investment, many times also an implementation process
- It could be good if we could predict the next constraint

## 5. If in the previous step the constraint was broken – **go back to step 1. Beware inertia!**

- One reservation on my part: It is relevant even when the constraint was not broken. Changes in the market demand, or in the other resources might turn something else to become the constraint!
- “Beware inertia” is definitely right all the time

# Back to the definition of 'constraint'

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- In 2012 the TOCICO dictionary has changed the definition of the constraint
  - It led to too many effects that limit the performance, but could not be treated by the five focusing steps:
    - Is failing to recognize a new opportunity a constraint?
    - Is lack of specific knowledge, which could lead to wider market a constraint?
    - Is a flawed policy a constraint?
- A new definition emerged:

**The factor that ultimately limits the performance of a system or organization. The factor that, if the organization were able to increase it, more fully exploit it, or more effectively subordinate to it, would result in achieving more of the goal**



# What might limit the performance and is not a constraint?

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- **Policy Constraints**

- Goldratt has used this term to describe policies that achieve the opposite of their stated objectives

- Achieving high efficiency everywhere
- Investing money and efforts to improve the performance of a non-constraint
- Producing stock based on long-term forecast

- The point with all those policies is that it does not make sense to “exploit” a flawed policy

- Goldratt formally backed off from the term “policy constraints” and claimed they should be simply removed as soon as possible

- Another observation: **A constraint limits a FLOW!**

- The system constraint limits the key flow of the system





# Identify

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- Identifying the constraint might be difficult due to a clash with the existing perception of reality
  - Either there are “many constraints and they constantly move”
  - Or, the constraint is what we want it to be
    - Like the most expensive machine
- The norm of ‘efficiency’ as a value everywhere distorts the real perception of reality
  - People try to hide excess capacity, either by maneuvering the measurements and pretend to be busy all the time, or by working on what is not needed now!
- Thus, not always we can rely on simple capacity calculation to identify the constraint
  - TOC developed better ways to identify effects that point to the real constraint



# Exploit

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- Exploit means drawing from the resource all it is able to give
  1. Making sure all the capacity is utilized – no waste of capacity
  2. The constraint is used for products and services that maximize the Throughput / profit
- Why '**decide** how to exploit'?
  - Because, when the constraint is internal we still need to make sure that the market satisfaction is not harmed!
  - Eventually the market demand is ALWAYS the major constraint
    - Even though an internal constraint can still be active
- Some common means for exploitation
  - Improvement in how the constraint work, like setup reduction, best operators, engineering improvements, offloading etc.
  - Managing the product mix accordingly



# Subordinate

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- The third step defines **the objective for all the procedures in operations** given the constraint(s) and the exploitation scheme
- When the constraint changes – the key difficulty is not so much the different exploitation, but the impact on all procedures
  - Note the change in behavior of airlines and hotels during the peak season period – for instance, using award miles
- Another key difficulty with the subordination-step is that it crosses functions and hierarchy
- Dealing with common and expected uncertainty plays a major part in subordination
  - Because the non-constraints have to cover the constraint from the rolling impact of Murphy and other types of uncertainty



# Inherent priorities

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- Understanding the role of the constraint dictates the priorities for ‘what to improve now?’
  - The insight is that a small improvement in the effectiveness, or efficiency, of the constraint yields a leap in performance of the organization
  - While, improving a non-constraint might have a minor impact on the subordination and may, at most, reduce some WIP
  - This insight should bring new understanding of what true ‘efficiency’ means
- Note, a non-constraint could become the constraint by refusing, or sabotaging, the smooth subordination
  - Which means, being a non-constraint should reflect that it has clear excess capacity and capability, and thus should be trusted to do what is right



# Elevate

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- What is the dividing line between ‘Exploit’ and ‘Elevate’?
  - Small improvements in the constraint are still part of ‘exploit’
  - Elevate is a **substantial increase in basic capacity**
  - So, in the vast majority of the cases ‘elevate’ requires significant investment – and this is the core need for the dividing line
    - It means, for instance, that overtime should not be regarded as ‘elevation’
- Planning the elevation requires predicting the identity of the constraint after the elevation
  - Identifying the next constraint provides the basic information on the limit the new performance might reach
  - Making sure the ROI of the investment is high
- Step 5 should be carefully followed at all times – making sure nothing else has emerged as a constraint



# Overcoming Inertia

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- We cannot live with constantly challenging all our assumptions!
- When a key basic assumption, like we know that X is our constraint, becomes invalid, we could see the signals that something is wrong
  - For instance, when subordination fails to keep the exploitation scheme too often
    - This generic insight is supported by the technique of Buffer Management

**So, the key insight of Step 5 is to constantly look for signals that “something” is not what it is expected to be**

# The difference between a bottleneck and a constraint

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- The definition of “bottleneck” is:  
**The current load is higher than the existing capacity of that link**
- When there are several bottlenecks that the most loaded one is definitely a constraint
  - But, notice that by becoming a bottleneck the damage to the market has already been done
    - Some demand is not going to be delivered according to expectations
    - This violates the idea of “Decide how to exploit ...”
- A constraint might be a resource that is NOT a bottleneck
  - The resource might have, on average, enough capacity, but without an exploitation scheme, some sales are lost
    - Because of too slow delivery time, due to lack of short-term capacity

# The 5FS in manufacturing

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- A certain basic planning and execution procedure has been developed from the 5FS for manufacturing
  - If there is an internal capacity constraint then the key planning, under the exploitation guidelines, is to clearly check every incoming order with the current load on the constraint, and based on it decide when to promise the delivery in a safe way
  - A plan for releasing the raw materials, not too early (!) and not too late is a key subordination step
    - Called “chocking the release” - preventing early release
  - Inserting buffers and monitoring the state of the buffers (buffer management) is the other key step of subordination
- General steps for exploiting the internal constraint
  - Off-loading, engineering improvement, quality check prior to the constraining resource and rejection of anything that is not required NOW

# The 5FS in a hospital

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- The generic constraint in a hospital is the availability of “beds”
  - The “bed” is actually a whole group of resources, both equipment and human that are considered to be the standard for being able to treat a patient
  - The flow of incoming patients can be only partially controlled
    - By the schedule for elective operations, but the number of emergencies is quite random
  - So, in order to exploit the constraint the efforts have to be directed at:  
**Being able to release patients from the hospital as soon as possible without compromising their health and wellbeing**
  - This puts a lot of emphasis on the subordination processes to ensure that **every treatment or check that might delay the release are done on time**
  - Alex Knight book “Pride and Joy” describes the resulting thinking and practice to achieve that

# The 5FS in transportation

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- The obvious “should be the constraint”, certainly the weakest link”, in transportation has to be the vehicles
  - Not drivers or other crew members
  - Usually every trip is done by one vehicle, so the different trips are usually independent of each other
    - An exception is when the client requires several vehicles at the same time
    - Another case is supporting “connections” between different trips
  - Thus, the resulting planning scheme has to exploit every vehicle to achieve as much as possible from two different parameters:
    1. Do as many trips as possible
    2. When one trip serves many clients, then every trip should be filled up as much as possible
  - When the two above clash the determination should be according to the periodical revenues minus the fuel and maintenance expenses (Throughput)

# The market-demand and the weakest link

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- The market-demand is the major constraint of all organizations
  - The higher is the demand the higher the performance
    - Even when we cannot serve so much market, we can achieve higher price!
    - If you don't subordinate to the market – it might go down in the near future
      - And then you won't have an internal constraint!
  - Management should always ask themselves: **how come we cannot have more demand?**
- Even when the market-demand is the major constraint, the identity of the 'weakest-link' in the flow to the market is critical to the global performance
  - The weakest-link might easily become an active constraint
  - The strategic challenge is to properly balance between the internal constraint and the demand, without losing the credibility in the eyes of the market

# Peak and off-peak periods

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- Many organizations face seasons with high demand and then seasons with much lower demand
  - In the lower-demand period the market-demand is the only constraint!
  - In the peak period it is likely that the internal constraint becomes active
- When the weakest link moves from being an active constraint to having excess capacity and back, management has to implement TWO different exploitation and subordination schemes
  - Regarding product-mix, response time, pricing and the flow procedures
- In manufacturing of standard products, where stock can be prepared, the overall exploitation scheme has to include building stock before the peak
  - This gives more meaning to “Decide how to exploit ...”

# Strategic constraint

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- **Every organization should choose it's constraint!**
  - There is ALWAYS a constraint
    - Otherwise performance would be infinite
- Where should an organization have its constraint?
  - Should it be internal or external???
- If it is internal – what are the worthy resources?
  - It should be a resource that is either very expensive to elevate or very difficult to elevate
  - The location of the constraint within the network-routing makes a certain impact – but it is not the most important issue
  - Some operations are very difficult to control
  - Eventually the ultimate choice lies with the first characteristic: **the cost of elevation**



# Ask me questions: it cannot be that obvious!

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- Eli Schragenheim strives to:

## **Support TOC Implementations Everywhere!**

Feel free to contact Eli regarding questions, reservations and collaborations in TOC initiatives

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