

# Introduction to the Theory of Constraints

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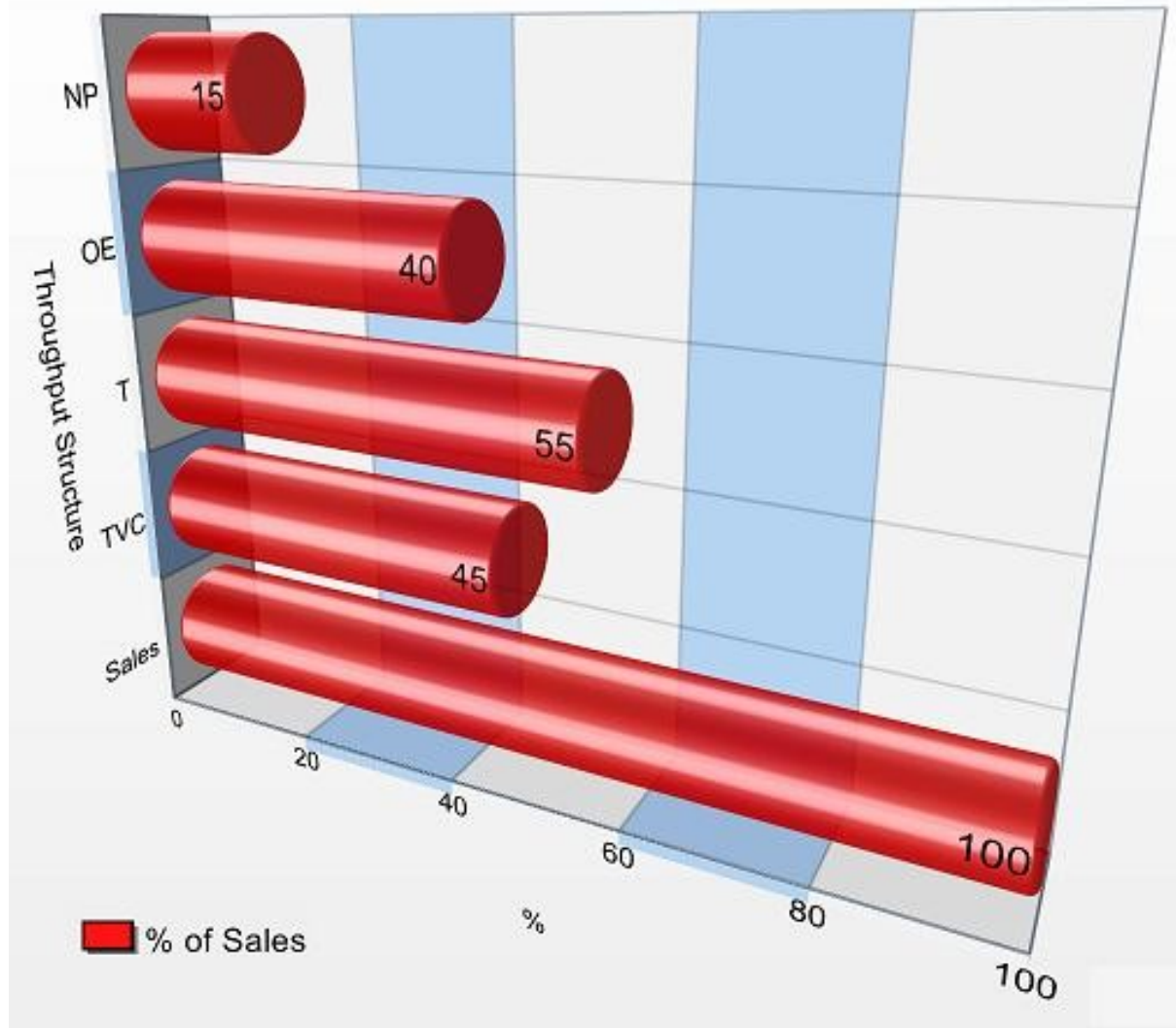
# Measuring the goal (TOC metric)

- Net profit ( $NP=T-OE$ ) : ( T, I and OE will be explained later in this course) ->  $T=Net\ Sales - TVC =S-TVC$
- Cash
- Return on Investment ( $ROI=NP/I$ )

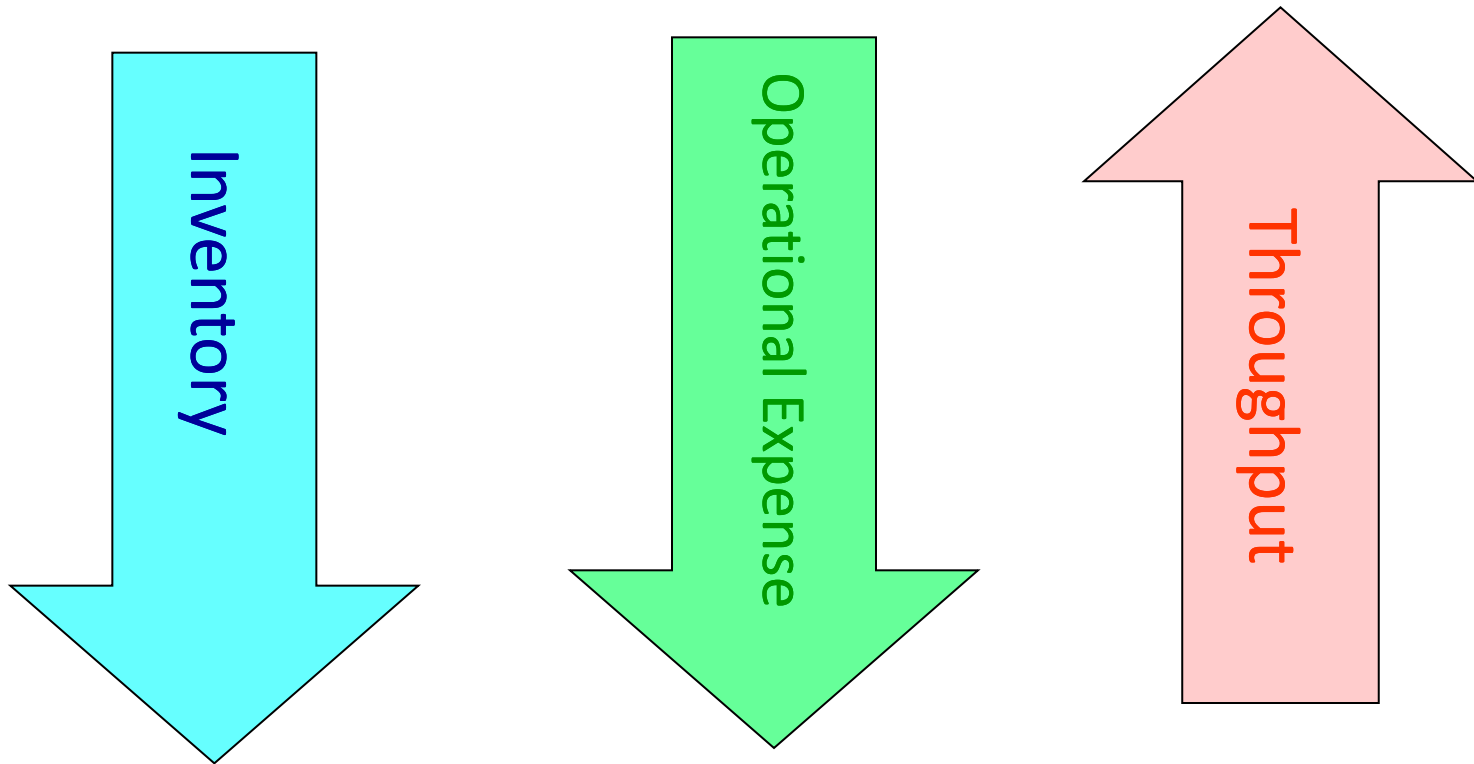
**For a manufacturing enterprise, the goal can also be measured by:**

- Throughput =T
- Inventory = Investment =I
- Operating Expenses =OE

# Metrics and their relationships

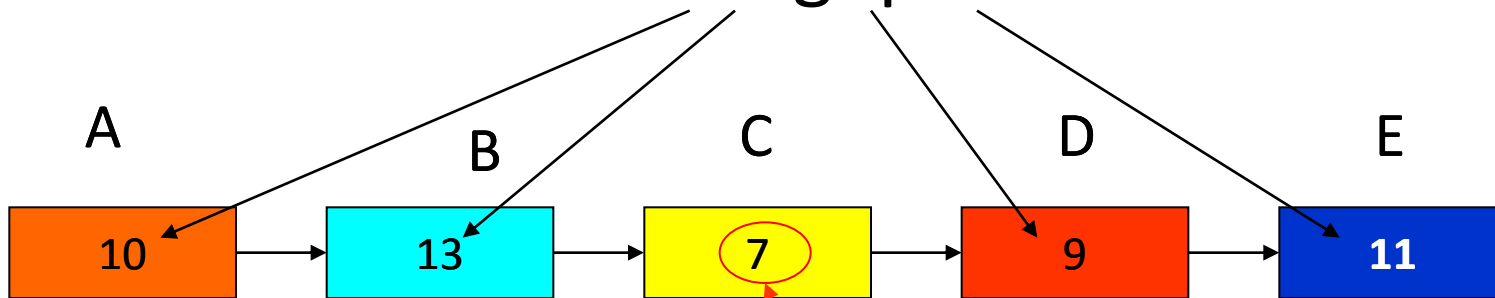


# TOC –required trends



# T,I,OE,NP and ROI example

- $NP = T - OE = (S - TVC) - OE$
- $ROI = (T - OE) / I = NP / I$
- where T = total throughput

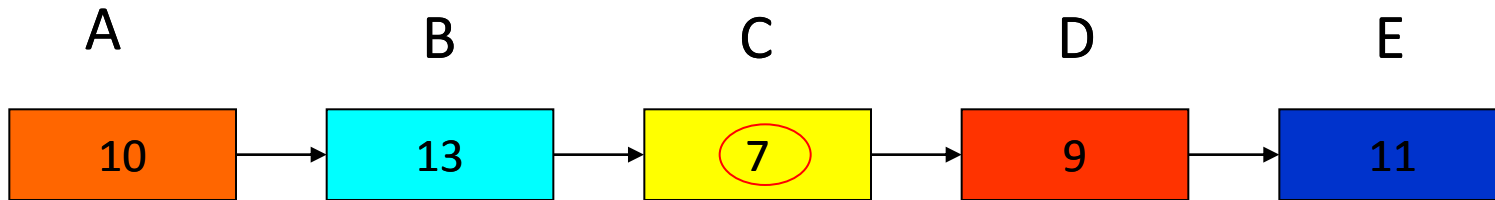


1. Only one product
2. Unit Price (Selling price) = **100 USD**
3. Raw material /one product = **35 USD = OE**
4.  $T/\text{product} = 100 - 35 = 65$  (S-TVC)
5. 176 hours/month (constraint of the company)
6.  $T = 176 * 7 = 1232$  parts/month
7. Monthly T = **1232** \* **65 USD** = 8 080 USD

**CCR**=Capacity  
 Constraint Resource=  
 =weakest link of the chain=  
 bottleneck

# T,I,OE,NP and ROI example

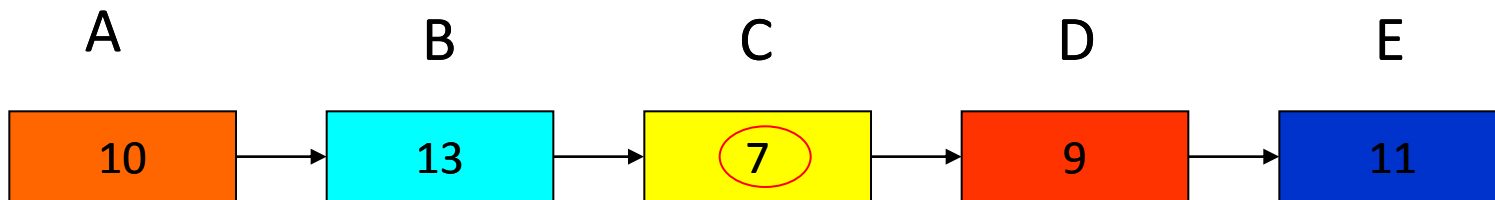
- 1st suggestion is to optimize B from 13->14 parts per hour
- T will not increase -> **You cannot produce more than 7 !!!!**
- Investment to optimize B=5000 USD with depreciation 10 %
- $OE(\text{month}) = (5000 \text{ USD} * 0,1)/12 = 41,67 \rightarrow 42 \text{ USD}$



**CCR**=Capacity  
Constraint Resource=  
=weakest link

# T,I,OE,NP and ROI example

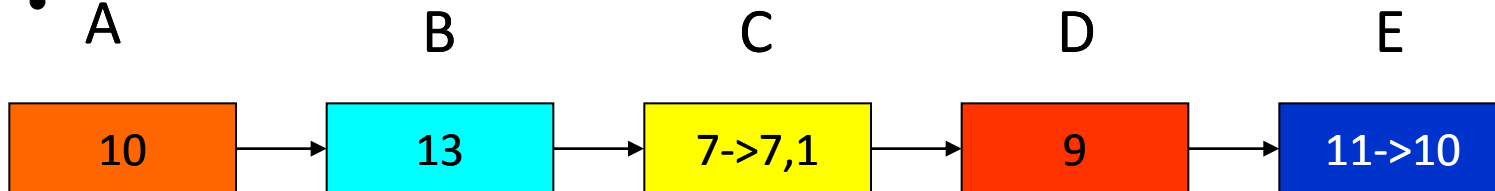
- T = **throughput** will not increase
- NP (Net Profit) will decrease based on increased OE (**41,67 USD /month**)
- Based on NP decrease ROI is negative
- **Bad suggestion !!!!!**



**CCR**=Capacity  
Constraint Resource=  
=weakest link

# T,I,OE,NP and ROI example

- 2nd suggestion is to optimize C from 7->7,1 parts/hour
- part of the 2nd suggestion is an extra load of E so it goes from 11->10
- Necessary investment is 5000 USD (remains the same)
- Increase of the production/month =  $0,1 * 176 = 17,6$  parts
- Increase of the company T =  $17,6 * 65 \text{ USD} = 1\,144 \text{ USD}$
- 





# T,I,OE,NP and ROI example

- Necessary investment is **5000** USD = I = Inventory = Investment
- Increase of the production/month =  $0,1 * 176 = 17,6$  parts
- Increase of the company T =  $17,6 * 65$  USD = **1 144** USD
- **OE**/month =  $(5000 * 0,1) / 12 = 41,67 \rightarrow$  **42** USD
- **OE** will be increased by 41,67 USD/month
- Annual increase of the NP =  $(T - OE) * 12 = (1144 - 42) * 12 = 13 244$  USD
- $ROI = NP / I = 13 244 / 5000 = 265\%$  !!!
- **T** does not measure local efficiencies, except at the constraint

