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**2<sup>nd</sup> International TOCPA Conference,  
19-20 May 2012, Moscow**

# ***Practical issues of TOC Operational Measurements T-I-OE***

***Oded Cohen & Jelena Fedurko***



## Oded Cohen

Oded has over 30 years of experience in developing, teaching and implementing TOC methodology, solutions and implementation processes working directly with Dr. Goldratt all over the world. Among the countries to which Oded brings his expertise are the USA, Canada, Japan, India, China, the UK, Poland, Russia, Ukraine, Colombia, Chile, Peru and many others.

Oded is the author of *Ever Improve – A Guide to Managing Production the TOC Way*, published in June 2010. Oded co-authored the book *Deming & Goldratt: The Theory of Constraints and the System of Profound Knowledge – The Decalogue*.

Oded and Jelena Fedurko just recently wrote and published a new book *TOC Fundamentals*.





# **TOC for Financial Decision Making**

- 1. TOC Operational Measurements**
- 2. Deciding on a new customer order (request for quotation)**
- 3. Assessing financial performance after the event (periodic reporting)**
- 4. Issues of registering T:
  - I. Accounts Receivable**
  - II. Point of Registering Throughput****



# 1. TOC Operational Measurements

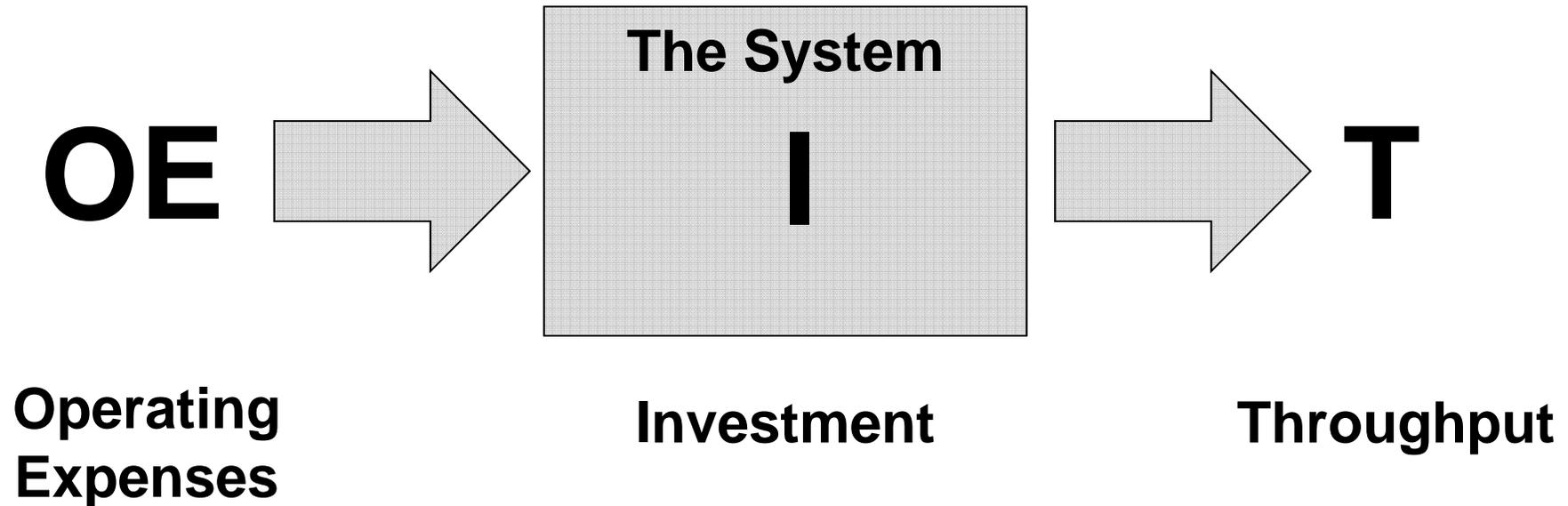
1.1 T – I – OE

1.2 Throughput

1.3 The cost of generating T

1.4 Connecting T, I and OE with NP and ROI

# 1.1 TOC Operational Measurements





## 1.2 The definition of Throughput

- Throughput,  $T$ , is the rate at which the company generates goal units
- Goal units means that for non profit organization the  $T$  is not expressed in money
- For business organizations we can rephrase the  $T$  definition to be: **The periodic revenues minus the truly variable costs per single sale**
- $T$  can be described as the added value of the organization
- The basic definition of  $T$  is a rate: periodical goal units. But, we many times use it for the  $T$  of a product or an order, without the time element.



## 1.2 Throughput

**Throughput, T** – is the revenue from the sales for a certain period minus Totally Variable Costs (TVC).

TVC is the cost of raw materials and components for production of products to be sold or the cost of products bought for reselling.

TVC is the cost that grows directly proportionally to the sales of every additional unit of the product:

- the cost of buying additional raw material/components/product
- subcontracting
- such costs as, for example, commissions paid to an agent that are calculated according to the amount of units sold, etc.

Costs that the company would incur anyway – like the pay for the direct labor that is on regular salaries (not piece incentive), salaries for directors/managers/secretaries, telephone bills, electricity bills, premises rent, etc – are not deducted from the revenue for the calculation of Throughput for a certain period.

Throughput per product unit (or order):

$$T_u = P - TVC$$

$T_u$  – Throughput from the sale of one unit of the product (or one order)

$P$  – selling price of one unit of the product (or one order)

$TVC$  – TOTALLY Variable Cost

**In calculation of Throughput per product or order we DO NOT ALLOCATE direct labor or overhead costs per product/order!**



## 1.3 The cost of generating T

- In order to generate T we must spend two types of costs:
- **Investment (I):** The money that is held within the organization
  - Usually measured by the assets purchased value minus the depreciation
  - Investment includes also the Inventory – the money that was invested in purchasing things to be sold
- **Operating Expenses (OE):** The periodical amount of expenses spent by the organization – these are the expenses that do not vary with a single sale.

(The cost that the organization must have to ensure its functioning.)



## 1.4 Connecting T, I and OE with NP and ROI

- $NP = T - OE$ 
  - The regular approach is  $NP = \text{Revenues} - \text{Expenses}$
  - TOC deducts the truly variable costs (TVC) from the revenues to have T, then the rest of the expenses are the OE
  - Remember, TVC means variable with every single sale
  - This mere re-arrangement of the NP is a key in making T, I and OE much more effective for decision making
- $ROI = (T-OE)/I$



## 2. Deciding on a new customer order (request for quotation)

### Data needed for quotation:

- i. Throughput per order
- ii. TVC – Material, purchased components, Subcontracting, transport, commission, any other payment that goes directly to the product (and not paid if the product is not produced)
- iii. Selling Price (sometimes dictated by the customer and then the decision is if to accept the order or not).
- iv. T/U – when some of the TVC is depended on quantities

This data is needed for reference in order to assess whether the price quoted for the order will give the company a favorable throughput. Should help to make a decision to accept or reject an order when the price is dictated by the customer.



## 3. Assessing financial performance after the event (periodic reporting)

3.1 T of sold products

3.2 T and cash flow

3.3 OE

3.4 Investment

3.5 ROI



## 3.1 Throughput of sold products

Throughput is one of the three operational measurements of TOC.

Throughput is used as Throughput per product, Throughput per order and Throughput per constraint unit and total Throughput per period.

As operational measurement Throughput is defined as: The rate at which the system generates money through sales.

Rate means: quantity of money that is generated in a period of time – daily, weekly, monthly etc.

The question is how we calculate the amount of T for the period.

Basic guideline – the throughput is calculated for all the products that were sold during the period.

**If there is no sale there is no Throughput! (Generally)**

Yet – there is a need to establish the point of time when Throughput is generated. Clear guidelines have to be established in the company.



## 3.2 Throughput and Cash Flow

When calculating Throughput of an a specific customer order we need to consider the financial aspects of the order and especially the cash flow of the order. Typical cases can be:

- Case 1 (Regular) - Agreed payment terms fully or in installments after delivery - Throughput should be recorded on the day of delivery while calculating the Net Present Value of the order at the DD. This means reducing from the order price the interest paid on borrowed working capital until the money will arrive.

(Some companies elect to record the interest paid on working capital as OE rather than reducing price, hence – reducing Throughput).

- Case 2 - Prepayment – partial or complete – the money received first accounts to cover for the TVC. If the prepayment is more than the TVC then the residual is recorded as Throughput at the point of receiving the money. The balance of the Throughput should be recorded on day of delivery to the client.



## 3.2 Throughput and Cash Flow (cont.)

**Build ahead** – the company decided to build the products in advance of the agreed delivery date.

If money prepayment is received – it is treated as case 2

Case 3 – Build ahead without prepayment – all the money paid out for building the products – the TVC - is recorded as investment. Throughput is recorded on the Delivery Date as per Case 1

Build to stock – is handled as case 3.



## 3.2 Operating Expenses - OE

Operating Expenses – All the money the company spends, in a period, in turning investment into throughput

OE includes all the money that is paid out and cannot be directly associated with a specific product or specific customer order (all the non TVC)

Usually, it includes:

- Salaries
- General expenses (utilities, office expenses, T&L etc.)
- Bank interests
- Depreciation
- Etc.



## 3.3 Investment

Investment (I) – all the money the company invests in purchasing things (and services) that will support the creation of Throughput

(the investment tends to appear on the asset part of the balance sheet of the company)

Usually, Investment includes:

- Inventories in warehouses
- Facilities – buildings and machinery
- Systems – such as IT, Design s/w etc.
- R&D – Research & Development projects
- Cash - Loan for working capital

Please note that management may decide to move money between Investment and OE according to own considerations, provided it is allowed by the regulations.



## 3.3 Inventory

Inventories in the company can be found in:

- Raw material warehouse
- Component warehouse
- Intermediate warehouses (semi-processed materials and products)
- FG – Finished Goods

TOC treats inventory in a unique way which differs from the way inventory is usually treated by the financial community.

- Inventories are recorded at the purchasing prices (at RM prices, price of components or goods to resale), no added value due to internal processes and no overhead absorption.
- Any other money that is paid for a product or an order and is declared as a part of the TVC – should be recorded as TVC – such as Subcontracting, transportation that increases or reduces **proportionally** with each sold order or unit, Commission etc.



## 3.3 Inventory – the TOC Way

### WIP as a reflection of the flow

If we look at the production area as a “pipe” – then the amount of WIP captured in the system in relation to the level of sales of products that come out from this pipe can reflect average flow time.

The conversion of monetary value of inventory to time is done by using the term called **DIOH – Days Inventory On Hand**.

A “Day” for this conversion means the value of average day of sales.

For TOC we use the average daily sales in terms of the purchasing price of the materials or even better – in terms of the TVC portion of the sale price.

Example: the company sells 10m dollars a year (in 250 selling days). TVC is 40%. A day for DIOH is calculated as:

$$\text{“A Day”} = (10\text{m} \times 40\%) / 250 = \$16\text{K}$$



## 3.3 Inventory – the TOC Way

### WIP as a reflection of the flow

“A Day” =  $(10m \times 40\%) / 250 = \$16K$

Let's assume that the company has a machining shop.

Average WIP in the machining shop (measured in TVC) is 80K.

This means that the amount of money captured in WIP is equivalent to 5 (80/16) days of sales.

So, we can state that on average material flows through the machining shop in 5 days.

In reality some of the parts will be processed faster while others will take more than 5 days to go through the machining shop.

The 5 days is used just an indication



## 3.4 Inventory – the TOC Way

### Inventory in warehouses

There are several types of Warehouses:

- Raw Material (RM)
- Intermediate (semi-finished products)
- Components, bought out parts, packaging materials etc.
- Finished Goods (FG)
- Incoming products for resale

Warehouses are built for purpose: to improve the level of service to the clients and by that secure throughput and competitive edge.

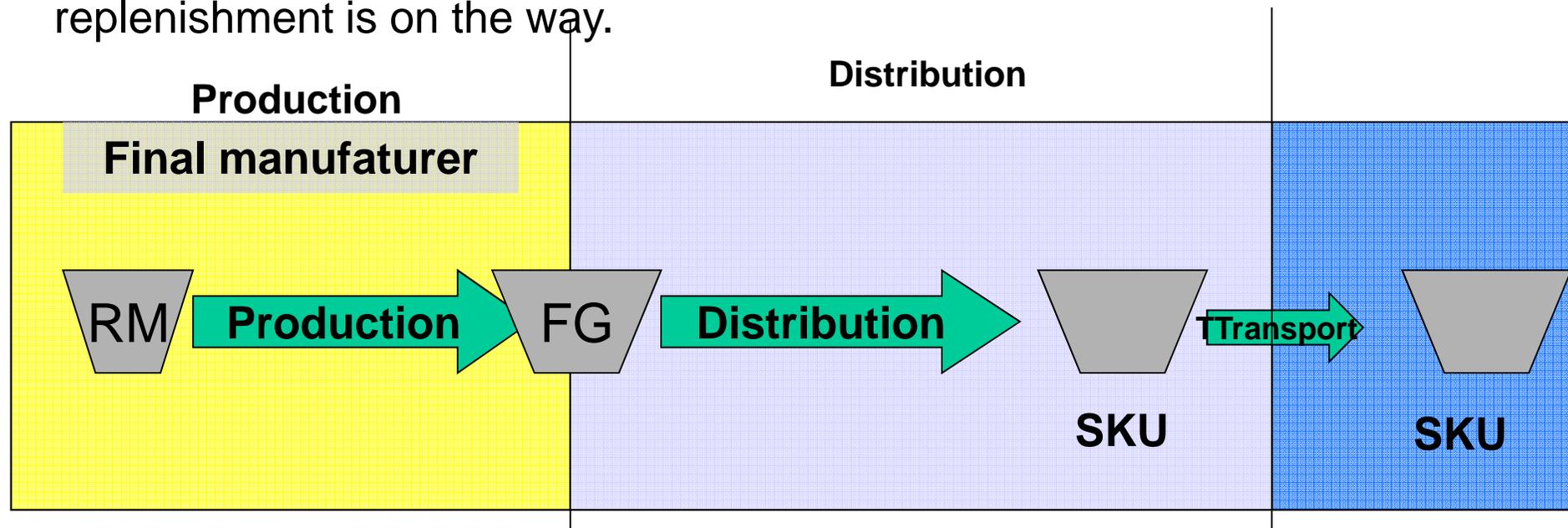
It is management decision to invest in purchasing or building the inventory in the warehouses.

The amount of inventory in the warehouse is measured in money but also can be measured in terms of DIOH.

## 3.4 Inventory – the TOC Way

### Inventory in warehouses

To ensure the required level of service to the customers warehouses have to be able to supply the demand for the items (SKUs) they hold while replenishment is on the way.



The TOC way of planning and controlling the level of stock in the replenishment system is to ensure that what is on hand in the warehouse, what is already on its way to the warehouse and what is ordered for replenishment is equal to the maximum consumption during reliable replenishment time.



## 3.4 Inventory – the TOC Way

### Inventory Turns

Inventory is built for a purpose – to support the creation of Throughput.

Inventory is investment – it is the shareholder money that is used.

As such it is only legitimate that the shareholder (through top management) would like to know how well their money is used.

Generally, shareholders are interested in ROI.

As for inventory – there is another measurement to reflect the well use of the money – Inventory Turns. This measurement reflects the speed at which the money invested in the inventory is returned through sales. The higher the inventory turns the better is the use of the money.

For TOC  $\text{Inventory Turns} = \text{Yearly Sales (in terms of TVC)} / \text{average Inventory}$



## 3.5 Throughput and ROI

How is Throughput connected to ROI – Return on Investment?

The three operational measurements serve as a bridge between the actions or decisions of management and the bottom line performance of the company.

The link of T-I-OE to the bottom line is:

$$NP = T - OE$$

$$ROI = NP/I = T-OE/I$$

Every decision has an impact on Throughput, Investment and/or Operating Expenses. This impact may increase or decrease the level of T-I-OE. The change in them is denoted as Delta (  $\Delta$  ).

If management takes actions that increase T more than the increase in OE than the increase (Delta) NP is positive. That also have a positive impact on ROI – if there is no additional Investment.



## **4. Issues of registering T**

4.1 Throughput and Accounts Receivable

4.2 The point of Throughput



## 4.1 Throughput and Accounts Receivable

### How is Throughput connected to Account Receivable?

**“Regular” situation:** Customer orders, products are shipped together with invoice.

While the customer order is being produced – all the money that is directly spent on this customer order (not including salary or overhead!) is recorded as TVC.

When the order is shipped together with an invoice:

The invoice is recorded on Accounts Receivable.

The TVC is transferred from the Investment to Accounted Receivable.

The company may decide when the Throughput is registered:

- 1) T is on hold until the money is paid.
- 2) T is registered at the time of shipment

## 4.2 The point of Throughput

### When Does Throughput Happen?

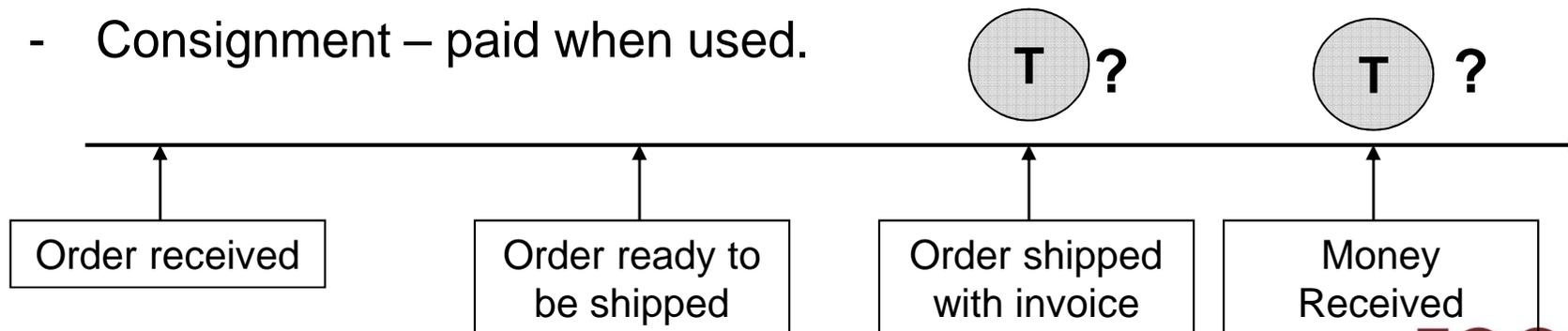
“**Regular**” situation: Customer orders, products are shipped together with invoice.

The company may decide when the Throughput is registered:

- 1) T is on hold until the money is paid.
- 2) T is registered at the time of shipment

Other potential times:

- Prepayment (when the amount is larger than TVC)
- Invoice for the order has been presented and paid
- Consignment – paid when used.



## 4.2 The point of Throughput

**When Does Throughput Happen?**

**Other situation:** What are other payment models?

?

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