# Performance management

Topic 3

Throughput accounting

Reference: Chapter 2d

**ACCA exam references**

| Topic list | Syllabus reference |
|---|---|
| 1. Theory of constraints | A4 |
| 2. Throughput accounting | A4 |
| 3. Performance measures in throughput accounting | A4 |
| 4. Throughput accounting ratio | A4 |

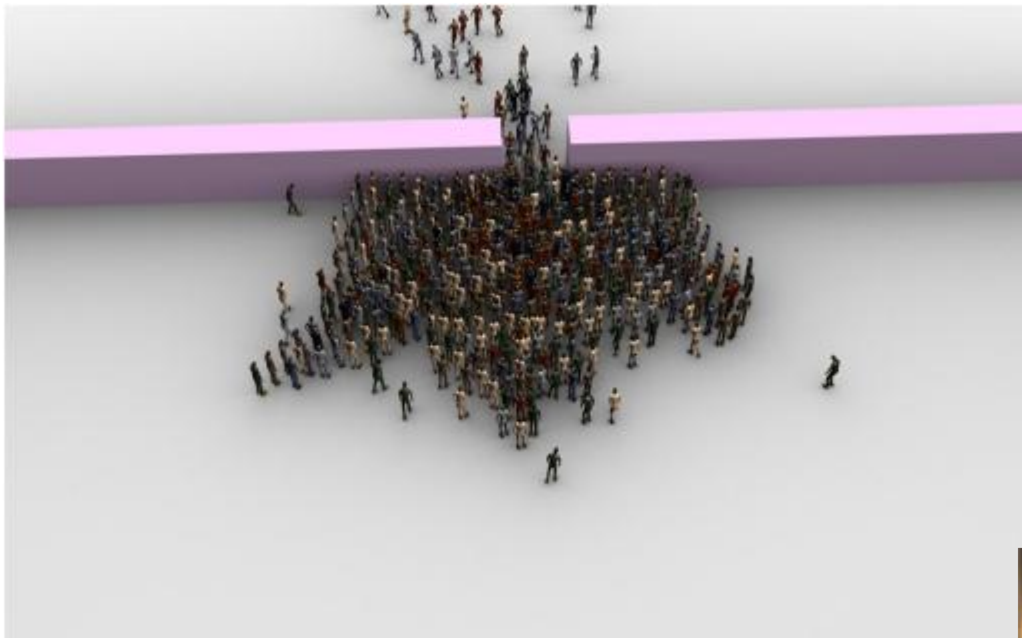
HW: Read the following articles before you proceed with the chapter:

http://www.accaglobal.com/in/en/student/exam-support-resources/fundamentals-exams-study-resources/f5/technical-articles/throughput-constraints1.html

http://www.accaglobal.com/in/en/student/exam-support-resources/fundamentals-exams-study-resources/f5/technical-articles/throughput-constraints2.html

1. ***<u>Theory of constraints</u> – approach to production management and optimizing production performance***

- Was developed by Goldratt and Cox in the US in 1986.
- Turn materials into sales as fast as possible -> maximize net cash generated from sales



### *1.1 Throughput: sales, inventory and operational expenses*

RAW inputs

SALES

Throughput = Sales – Material costs

<u>Costs are treated as:</u>

Variable

Fixed

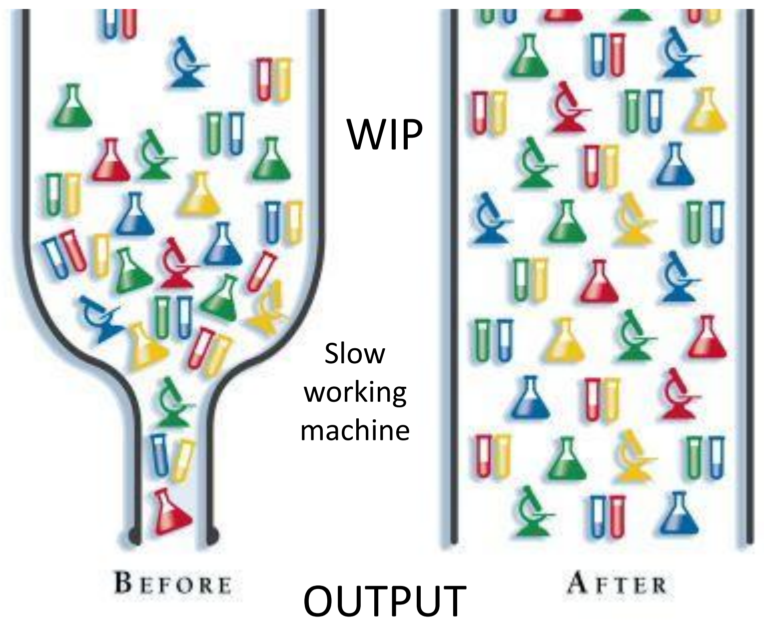
- Inventories = DM
  - Operational expenses = DL + MO

*__1.2 Bottleneck factor: the constraint__*

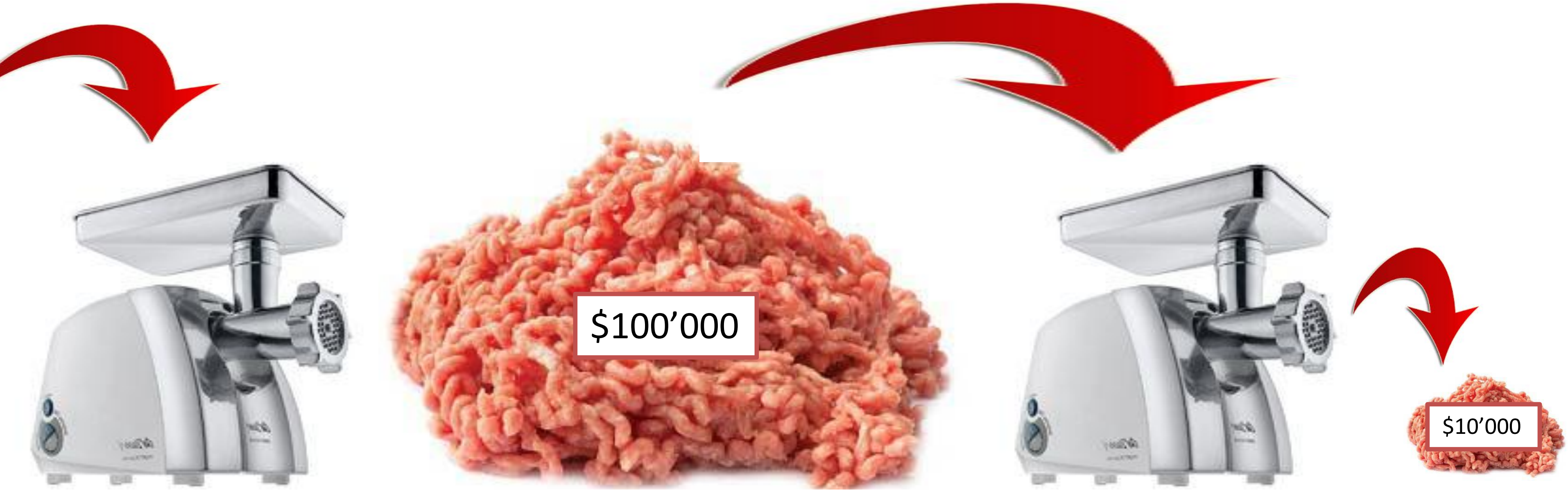
**Bottleneck resource** set a limit on amount of maximum possible output.
Also known as ***binding constraint***.

Examples:

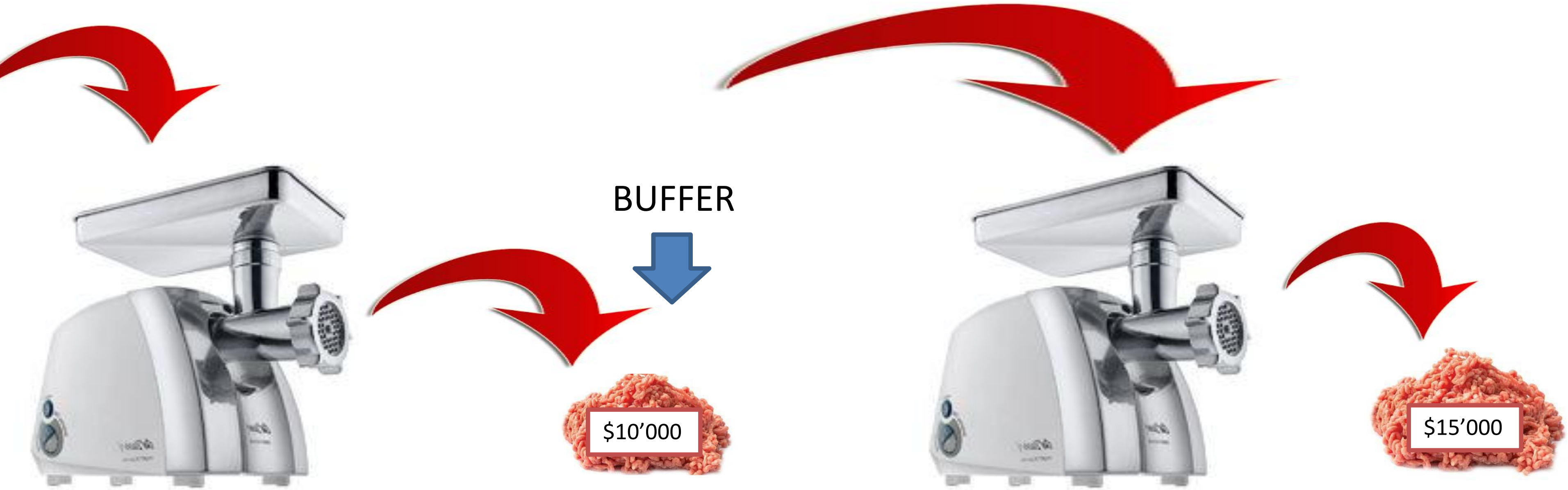
- Production resources, like time available on a machine or amount of available skilled employee time
- Selling resource, like number of sales representatives



In contrast to traditional accounting approach, in theory of constraints, **using non-bottleneck resources above the amount required only increases unused inventory levels**



In contrast to traditional accounting approach, in theory of constraints, **using non-bottleneck resources above the amount required only increases unused inventory levels**




**Idle time SHOULD BE ACCEPTED** since operational costs are fixed idle time is not costing any money


**Production must be limited to the capacity of the bottleneck resource** but this capacity should be **fully employed**

*1.4 Increasing throughput: elevating the bottleneck*

Business process cannot go faster than the speed of the bottleneck resource

AIM => maximize total throughput

HOW:

- increase capacity of the bottleneck resource or
- Elevate the bottleneck

**Example:**

Time on Machine type X is a bottleneck resource

-> the only way to increase throughput is to increase the capacity of the Machine type X

HOW?

- Shift from 5 to 7 days per week on the machine
- Shift from 12-hour to 18 or 24-hour day on the machine
- Carry out maintenance when the production process is off

BUT

After first bottleneck is elevated another bottleneck will come apparent.

Then start eliminating the second bottleneck

### *1.5 Example: elevating the constraint*

A company manufactures a single product, which is processed in turn through three machines, Machine type A, Machine type B, Machine type C. The current maximum output capacity per week on the existing machinery is as follows:

Machine type A: 1’800 units / week

Machine type B: 1’600 units / week

Machine type C: 1’500 units / week

Company could purchase an additional Machine type C for $8mln which would increase output capacity on Machines C by 600 units per week. It could also purchase an additional Machine type B that would cost $5mln and increase output capacity by 300 units per week.

An increase in output capacity is worth (in present value terms) $50’000 per unit of additional output.

**What should the company do? Should it buy either or both the additional machines?**

## *1.5 Example: elevating the constraint*

A company manufactures a single product, which is processed in turn through three machines, Machine type A, Machine type B, Machine type C. The current maximum output capacity per week on the existing machinery is as follows:

Machine type A: 1’800 units / week

Machine type B: 1’600 units / week

Machine type C: 1’500 units / week

Company could purchase an additional Machine type C for $8mln which would increase output capacity on Machines C by 600 units per week. It could also purchase an additional Machine type B that would cost $5mln and increase output capacity by 300 units per week.

An increase in output capacity is worth (in present value terms) $50’000 per unit of additional output.

**What should the company do? Should it buy either or both the additional machines?**

| | Initial machine capacity | Purchase additional Machine type C only | Purchase additional Machine type B only | Purchase additional Machines type B and type C |
|---|---|---|---|---|
| Machine type A | 1 800 | 1 800 | 1 800 | 1 800 |
| Machine type B | 1 600 | 1 600 | 1 900 | 1 900 |
| Machine type C | 1 500 | 2 100 | 1 500 | 2 100 |
| Cost of the Machines | | $8mln | $5mln | $8 + $5 = $13mln |
| Additional benefit | | 100 units × $50 000 = $5mln | 0 units × $50 000 = $0 | 300 units × $50 000 = $15mln |
| **Net additional benefit** | | **-$3mln** | **-$5mln** | **+$2mln** |

## *1.6 Theory of constraints - Summary*

**Identify** the constraint (bottleneck resource)

Decide how to **exploit** constraint in order to maximize output

**Subordinate** and **Synchronize** everything else to the decisions made in the step 2
*rest of the system works to help the bottleneck produce maximum value*

**Elevate** the performance of the constraint

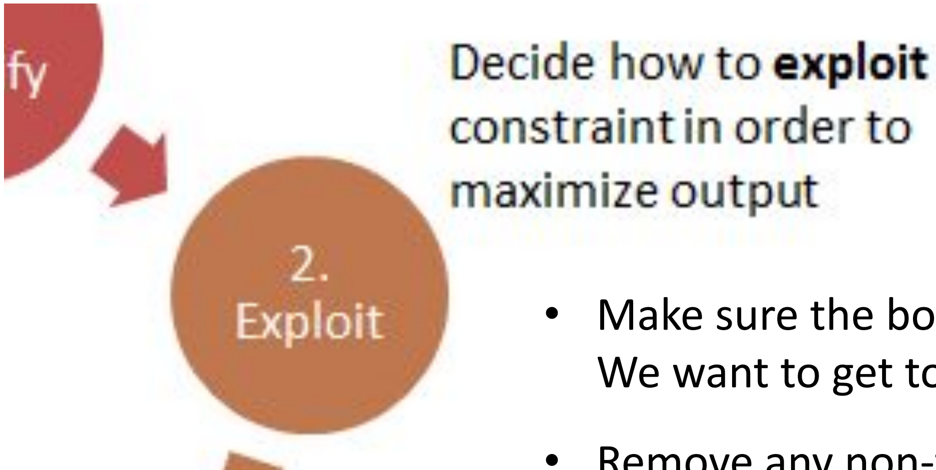
If the **constraint has shifted** during any of the above steps, go back to **step 1**. Do not allow inertia to cause a new constraint.

- 1. Identify
- 2. Exploit
- 3. Subordinate & Synchronize
- 4. Elevate
- 5. Go back to step 1

<u>Maximize throughput</u>

Increase **throughput contribution** (Sales – DM) while **keeping operational costs** (all costs except DM) and **investment costs** (inventory, equipment, etc.) to a **minimum**

## *1.6 Theory of constraints - Summary*




- Make sure the bottleneck works on only one thing at a time. We want to get to done; stop starting and start finishing.
- Remove any non-throughput producing work from the bottleneck.
- Shield the bottleneck from interruptions and quickly remove impediments, but don't shield them from important information like customer input and feedback.
- Make sure that the bottleneck is never idle or waiting for information, equipment, or materials. This type of waste reduces the value producing work that the bottleneck can do.


Elevating the bottleneck requires time and money, so it’s done only after exploiting and subordinating.

You can elevate the bottleneck and improve performance by:

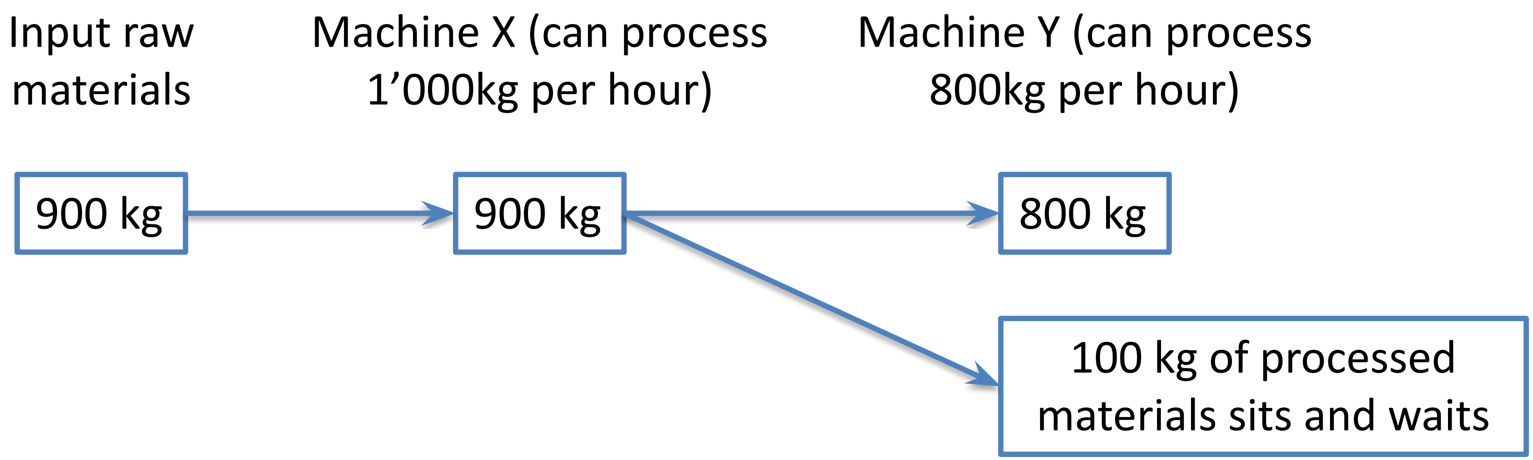
- Get more people that can do the same work as the bottleneck.
- Buy more or faster machines
- Give people training and better tools
- Coach for individual improvement
- Improve the workspace
- Change organizational policies

Often we jump right directly to elevating by adding people, getting training, buying equipment and tools. These changes can be expensive and it takes time to get a positive impact on throughput. They could even have a negative effect in the short term.

Elevate as a last resort when you can’t find any more ways to exploit or subordinate.

### *1.7 Example: an illustration of the theory of constraints*

Machine X can process 1’000 kg of raw materials per hour, machine Y 800kg. Of an input of 900kg, 100kg of processed material must wait on the bottleneck machine (machine Y) at the end of an hour of processing because machine Y doesn’t have the capacity to produce it.




**Shall we keep Machine X working on its maximum?**

## *2 THROUGHPUT ACCOUNTING*

**Throughput accounting (TA)** is an approach to production management which aims to maximize sales revenue less materials cost, while also reducing inventory and operational expenses.

TA is based on the following concepts, all derived from TOC:

**Concept 1**

In the short run, all costs in the factory (with exception of DM) are **fixed costs** (including DL). We group them and call them **Total Factory Costs (TFC)**.

**Concept 2**

In a JIT environment ideal **inventory level is zero**.

- Both JIT production and JIT purchasing
- When goods are made, the **factory effectively operates at the rate of the slowest process**
  - There will be **unavoidable idle capacity** in other operations

**Work in progress should be valued at material cost only** until the output is sold, so that no value will be added and no profit earned **until the sales take place**.

- Building inventories just to keep machines busy is not encouraged.

**Concept 3**

Profitability is determined by the rate at which sales are generated -> by speed of the goods produced (under JIT).

*2 THROUGHPUT ACCOUNTING*

| Conventional cost accounting | Throughput accounting |
| --- | --- |
| Inventory is an asset | Inventory is not an asset. It is a result of unsynchronized manufacturing and is a barrier to making profit. |
| Costs can be classified either as direct or indirect | Costs are classified into materials and others |
| DL is a variable cost | All labor costs are part of TFC, which are fixed |
| Product profitability can be determined by deducting a product cost from selling price | Profitability is determined by the rate at which money and throughput is earned |
| Profit can be increased by reducing cost | Profit = throughput - TFC |

## 2.1 Example: Throughput accounting in a service industry

Throughput accounting can be applied in a service industry as well as in production.

A not for profit organisation performs a medical screening service in three sequential stages.

1. Take an X-ray.
2. Interpret the result.
3. Recall patients who require further investigation / inform others that all is fine.

The 'goal unit' of this organisation will be to progress a patient through all three stages. The number of patients who complete all three stages is the organisation's throughput, and the organisation should seek to maximise its throughput. The duration of each stage and the weekly resource available is as follows.

| *Process* | *Time per patient (hours)* | *Total hours available per week* |
|---|---|---|
| Take an X-ray (stage 1) | 0.50 | 80 |
| Interpret the result (stage 2) | 0.20 | 40 |
| Recall patients (stage 3) | 0.40 | 60 |

The maximum number of patients (goal units) who can be dealt with in each process is as follows.

| | |
|---|---|
| X-rays | 80/0.5 = 160 |
| Interpret results | 40/0.20 = 200 |
| Recall patients | 60/0.40 = 150 |

The recall procedure (stage 3) is the bottleneck resource (constraint), because there are sufficient resources for the recall of only 150 patients. Throughput, and therefore the organisation's performance, cannot be improved until stage 3 can deal with more patients. There are a number of actions that the organisation could take to improve throughput.

(a) Investigate whether less time could be spent on the bottleneck activity.

(b) Ensure there is no idle time in the bottleneck resource, as this will be detrimental to overall performance.

(c) Increase the bottleneck resource available.

There is little point in improving stage 1 and stage 2 if the process grinds to a halt at stage 3. Patients are only helped when the whole process is completed and they are recalled if necessary. Increasing the bottleneck resource or the efficiency with which it is used may be relatively cheap and easy to do, as stage 3 is a relatively simple piece of administration in comparison to the first two stages that use expensive machinery and highly skilled personnel.

## *3. PERFORMANCE MEASURES IN THROUGHPUT ACCOUNTING*

***<u>Profit per unit of bottleneck resource matters</u>***

**Throughput return per factory hour:**

$$\frac{\text{Sales} - \text{direct material costs}}{\text{Usage of bottleneck resource in hours (factory hours)}}$$

## 3.1 Example: Maximising throughput and multiple products

WR Co manufactures three products, A, B and C. Product details are as follows.

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Direct labour cost | 1.00 | 0.80 | 0.80 |
| | | | |
| Weekly sales demand | 4,000 units | 4,000 units | 5,000 units |
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |

Machine time is a bottleneck resource and maximum capacity is 4,000 machine hours per week. Operating costs including direct labour costs are $10,880 per week. Direct labour workers are not paid overtime and work a standard 38-hour week.

*Required*

Determine the optimum production plan for WR Co and calculate the weekly profit that would arise from the plan.

## *3. PERFORMANCE MEASURES IN THROUGHPUT ACCOUNTING*

### 3.1 Example: Maximising throughput and multiple products

WR Co manufactures three products, A, B and C. Product details are as follows.

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Direct labour cost | 1.00 | 0.80 | 0.80 |
| | | | |
| Weekly sales demand | 4,000 units | 4,000 units | 5,000 units |
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |

Machine time is a bottleneck resource and maximum capacity is 4,000 machine hours per week. Operating costs including direct labour costs are $10,880 per week. Direct labour workers are not paid overtime and work a standard 38-hour week.

*Required*

Determine the optimum production plan for WR Co and calculate the weekly profit that would arise from the plan.

### Solution

**Step 1** **Determine the bottleneck resource**

The bottleneck resource is machine time (4,000 machine hours available each week).

# 3. PERFORMANCE MEASURES IN THROUGHPUT ACCOUNTING

## 3.1 Example: Maximising throughput and multiple products

WR Co manufactures three products, A, B and C. Product details are as follows.

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Direct labour cost | 1.00 | 0.80 | 0.80 |
| | | | |
| Weekly sales demand | 4,000 units | 4,000 units | 5,000 units |
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |

Machine time is a bottleneck resource and maximum capacity is 4,000 machine hours per week. Operating costs including direct labour costs are $10,880 per week. Direct labour workers are not paid overtime and work a standard 38-hour week.

*Required*

Determine the optimum production plan for WR Co and calculate the weekly profit that would arise from the plan.

**Step 2 Calculate the throughput per unit for each product**

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Throughput/unit | 1.60 | 1.00 | 1.20 |

## *3. PERFORMANCE MEASURES IN THROUGHPUT ACCOUNTING*

# 3.1 Example: Maximising throughput and multiple products

WR Co manufactures three products, A, B and C. Product details are as follows.

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Direct labour cost | 1.00 | 0.80 | 0.80 |
| | | | |
| Weekly sales demand | 4,000 units | 4,000 units | 5,000 units |
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |

Machine time is a bottleneck resource and maximum capacity is 4,000 machine hours per week. Operating costs including direct labour costs are $10,880 per week. Direct labour workers are not paid overtime and work a standard 38-hour week.

*Required*

Determine the optimum production plan for WR Co and calculate the weekly profit that would arise from the plan.

**Step 3** **Calculate throughput per unit of limiting factor (machine hours)**

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |
| Throughput per machine hour | $3.20* | $5.00 | $4.00 |

* $1.60 / 0.5 hours = $3.20

*3. PERFORMANCE MEASURES IN THROUGHPUT ACCOUNTING*

## 3.1 Example: Maximising throughput and multiple products

WR Co manufactures three products, A, B and C. Product details are as follows.

| | *Product A* | *Product B* | *Product C* |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Direct labour cost | 1.00 | 0.80 | 0.80 |
| | | | |
| Weekly sales demand | 4,000 units | 4,000 units | 5,000 units |
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |

Machine time is a bottleneck resource and maximum capacity is 4,000 machine hours per week. Operating costs including direct labour costs are $10,880 per week. Direct labour workers are not paid overtime and work a standard 38-hour week.

*Required*

Determine the optimum production plan for WR Co and calculate the weekly profit that would arise from the plan.

**Step 4 Rank products**

| *Product A* | *Product B* | *Product C* |
|---|---|---|
| 3rd | 1st | 2nd |

## 3. PERFORMANCE MEASURES IN THROUGHPUT ACCOUNTING

### 3.1 Example: Maximising throughput and multiple products

WR Co manufactures three products, A, B and C. Product details are as follows.

| | Product A | Product B | Product C |
|---|---|---|---|
| | $ | $ | $ |
| Sales price | 2.80 | 1.60 | 2.40 |
| Materials cost | 1.20 | 0.60 | 1.20 |
| Direct labour cost | 1.00 | 0.80 | 0.80 |
| | | | |
| Weekly sales demand | 4,000 units | 4,000 units | 5,000 units |
| Machine hours per unit | 0.5 hours | 0.2 hours | 0.3 hours |

Machine time is a bottleneck resource and maximum capacity is 4,000 machine hours per week. Operating costs including direct labour costs are $10,880 per week. Direct labour workers are not paid overtime and work a standard 38-hour week.

*Required*

Determine the optimum production plan
the plan.

**Step 5 Allocate resources to arrive at optimum production plan**

The profit-maximising weekly output and sales volumes are as follows.

| Product | Units | Bottleneck resource hours/unit | Total hours | Throughput per hour | Total throughput |
|---|---|---|---|---|---|
| | | | | $ | $ |
| B | 4,000 | 0.2 hours | 800 | 5.00 | 4,000 |
| C | 5,000 | 0.3 hours | 1,500 | 4.00 | 6,000 |
| | | | 2,300 | | |
| A (balance) | 3,400 | 0.5 hours | 1,700 | 3.20 | 5,440 |
| | | | 4,000 | | 15,440 |
| | | | | Less: operating expenses | (10,880) |
| | | | | Profit per week | 4,560 |

## *4. Throughput Accounting Ratio (TA ratio)*

$$\textbf{Throughput accounting ratio} = \frac{\text{Throughput per unit of bottleneck resource}}{\text{Factory cost per unit of bottleneck resource}}$$

**Note**. Instead of 'per unit of bottleneck resource', you may come across the term 'per factory hour'. This means the same thing in this context.

The throughput per unit of bottleneck resource has been described above.

$$\text{Factory cost per unit of bottleneck resource} = \frac{\text{Total factory costs}}{\text{Total units of bottleneck resource}}$$

**Note**. 'Total factory costs' are also described as 'Total operating costs'. They are all the costs other than material costs, and are regarded as a fixed cost per period.

For example, suppose that a factory manufactures a single product. Each unit of product takes two hours to make on Machine X and output capacity is restricted by the available time on Machine X, which is restricted to 500 hours per week. The product has a material cost of $20 per unit and sells for $160 per unit. Total operating costs are $30,000 per week.

Throughput per Machine X hour = $(160 – 20)/2 hours = $70

Factory cost per Machine X hour = $30,000/500 hours = $60

TPAR ratio = $70/$60 = 1.17

## 4.1 Interpreting the TPAR ratio

Total throughput should exceed total factory costs otherwise the organisation will make a loss. This means that **the TPAR ratio should exceed 1.0**.

A TPAR ratio that is not much higher than 1.0 is barely profitable. The aim should be to achieve as high a TPAR ratio as possible.

TPAR ratios can also be used to assess the **relative earning capabilities** of different products. Products can be ranked in order of priority for manufacture and sale in order of their TPAR ratios. (Higher TPAR ratios should be given priority over lower TPAR ratios).

However, ranking products in order of priority according to their TPAR ratio will always give the same ranking as putting them in order of throughput per unit of bottleneck resource.

## 4.2 Example: TPAR ratios and ranking products

Corrie Company produces three products, X, Y and Z. The capacity of Corrie's plant is restricted by process Alpha. Process Alpha is expected to be operational for eight hours per day and can produce 1,200 units of X per hour, 1,500 units of Y per hour and 600 units of Z per hour.

Selling prices and material costs for each product are as follows.

| *Product* | *Selling price* | *Material cost* | *Throughput* |
|---|---|---|---|
| | $ per unit | $ per unit | $ per unit |
| X | 150 | 80 | 70 |
| Y | 130 | 40 | 90 |
| Z | 300 | 100 | 200 |

Operating costs are $720,000 per day.

*Required*

(a) Calculate the profit per day if daily output achieved is 6,000 units of X, 4,500 units of Y and 1,200 units of Z.

(b) Calculate the TPAR ratio for each product.

(c) In the absence of demand restrictions for the three products, advise Corrie's management on the optimal production plan.

## 4.2 Example: TPAR ratios and ranking products

Corrie Company produces three products, X, Y and Z. The capacity of Corrie's plant is restricted by process Alpha. Process Alpha is expected to be operational for eight hours per day and can produce 1,200 units of X per hour, 1,500 units of Y per hour and 600 units of Z per hour.

Selling prices and material costs for each product are as follows.

| *Product* | *Selling price* | *Material cost* | *Throughput* |
|---|---|---|---|
| | $ per unit | $ per unit | $ per unit |
| X | 150 | 80 | 70 |
| Y | 130 | 40 | 90 |
| Z | 300 | 100 | 200 |

### Solution

(a) Profit per day = Throughput contribution – Operating costs

= [($70 × 6,000) + ($90 × 4,500) + ($200 × 1,200)] – $720,000
= $345,000

(b) TPAR ratio = Throughput per factory hour/Operating costs per factory hour

Operating costs per factory hour = $720,000/8 = $90,000

| *Product* | *Throughput per factory hour* | *Cost per factory hour* | *TPAR ratio* |
|---|---|---|---|
| X | $70 × 1,200 = $84,000 | $90,000 | 0.93 |
| Y | $90 × 1,500 = $135,000 | $90,000 | 1.50 |
| Z | $200 × 600 = $120,000 | $90,000 | 1.33 |

## Solution

(a) Profit per day = Throughput contribution – Operating costs

$$= [(\$70 \times 6{,}000) + (\$90 \times 4{,}500) + (\$200 \times 1{,}200)] - \$720{,}000$$
$$= \$345{,}000$$

(b) TPAR ratio = Throughput per factory hour/Operating costs per factory hour

Operating costs per factory hour = $720,000/8 = $90,000

| *Product* | *Throughput per factory hour* | *Cost per factory hour* | *TPAR ratio* |
|---|---|---|---|
| X | $70 × 1,200 = $84,000 | $90,000 | 0.93 |
| Y | $90 × 1,500 = $135,000 | $90,000 | 1.50 |
| Z | $200 × 600 = $120,000 | $90,000 | 1.33 |

(c) If it is not possible to increase the number of factory hours available, priority should be given to making and selling Product Y, since it has the highest TPAR ratio. If only Product Y is made and sold (since there is no restriction on sales demand), total output per day would be (1,500 × 8 hours) = 12,000 units of Product Y. Total throughput would be $1,080,000 (= 12,000 units × $90) per day. Total profit per day would be $1,080,000 – $720,000 = $360,000.

This is $60,000 more per day than the profit from the production mix in the answer to part (a).

The TPAR ratio of Product X is 0.93, which is less than 1.0. Product X makes less throughput per hour than its factory cost per hour.

Management should consider ways of raising the TPAR ratio above 1.0, or should give consideration to ceasing production of Product X entirely.

## Performance measurement in throughput accounting

Growler manufactures computer components. Health and safety regulations mean that one of its processes can only be operated eight hours a day. The hourly capacity of this process is 500 units per hour. The selling price of each component is $100 and the unit material cost is $40. The daily total of all factory costs (conversion costs) is $144,000, excluding materials. Expected production is 3,600 units per day.

*Required*

Calculate:

(a) Total profit per day
(b) Return per factory hour
(c) Throughput accounting ratio

## Question — Performance measurement in throughput accounting

Growler manufactures computer components. Health and safety regulations mean that one of its processes can only be operated eight hours a day. The hourly capacity of this process is 500 units per hour. The selling price of each component is $100 and the unit material cost is $40. The daily total of all factory costs (conversion costs) is $144,000, excluding materials. Expected production is 3,600 units per day.

*Required*

Calculate:

(a) Total profit per da

(b) Return per factory

(c) Throughput accou

## Answer

(a) Total profit per day

$$= \text{Throughput contribution} - \text{Conversion costs}$$

$$= (3{,}600 \times (100 - 40) - 144{,}000)$$

$$= \$72{,}000$$

(b) Return per factory hour

$$= \frac{\text{Sales} - \text{direct material costs}}{\text{Usage of bottleneck resource in hours (factory hours)}}$$

$$= \frac{100 - 40}{1/500}$$

$$= \$30{,}000$$

(c) Throughput accounting ratio

$$= \frac{\text{Return per factory hour}}{\text{Total conversion cost per factory hour}}$$

$$= \frac{30{,}000}{144{,}000/8}$$

$$= 1.67$$

## 4.3 How can a business improve a throughput accounting ratio?

In an exam question on throughput accounting, you may be asked about ways in which the TPAR ratio for a product might be increased. The ratio is increased by either:

(a) Increasing the throughput per bottleneck hour, or
(b) Reducing the operating cost per bottleneck hour.

The TPAR ratio could be increased in any of the following ways.

(a) Increase the selling price for the product. This will increase the throughput per unit, and so will increase the throughput per unit of bottleneck resource.

(b) Reducing the material cost per unit. This will increase the throughput per unit, and so will increase the throughput per unit of bottleneck resource.

(c) Reduce expenditure on operating costs/factory costs. This will reduce the operating cost per unit of bottleneck resource.

(d) Improve efficiency, and increase the number of units or product that are made in each bottleneck hour. Thi[illegible] unaffecte[illegible]

(e) Elevate th[illegible] Through[illegible] fixed cos[illegible] would fal[illegible]

However, there may be adverse consequences from some of these measures.

| Measures | Consequences |
|---|---|
| • Increase sales price per unit | • Demand for the product may fall. |
| • Reduce material costs per unit, eg change materials and/or suppliers | • Quality may fall and bulk discounts may be lost. |
| • Reduce operating expenses | • Quality may fall and/or errors increase. |