Explain and describe what a limiting factor is

Limiting factor is any factor that restricts a company or an organisation’s activities. In simple words, a limiting factor is the factor which is limited or not freely available to the company. Limiting factors in an organisation can be labour time, raw material, machine hours or space. For example, when sales demand excess the productivity capacity, the company do not have enough resources to produce the product, the scarce resource will be the factor that restricts the company’s activities. The production constraints can be removing and additional resources can be acquired when the scarce resources are existed. Hence, the scarce resources should be identified to make sure the company has enough resources to produce their products as many as their wish. By using limiting factor, we can maximize the profit when obtained the greatest possible contribution to profit each time.

Example1:

A

B

C

Contribution per unit of output

RM 24

RM 20

RM 12

Machine hours required per unit of output

6 hours

2 hours

1 hours

Estimated sales demand

3, 000 units

3, 000 units

3, 000 units

Required machine hours

18, 000 hours

6, 000 hours

3, 000 hours

The machine hour is limited to 18, 000 hours for the period because of the breakdown of one machine.

Consider Example 1.

From the example 1, we know that the company required total 27, 000 machine hours to produce the total sales demand of the product A, B and C that they estimated. However, the company only has 18, 000 machine hours for the period because of the breakdown of one machine. In this situation, company’s activities are limited in the available of machine hours. When we looking at the available information, we will think that the company should produce the product A first since the contribution per profit for product A is

the highest but this assumption can be wrong. This is because produce a product A required 6 machine hours, whereas product B required 2 machine hours and product C required 1 machine hours only. The company can concentrates on producing 3, 000 units of product B and C respectively and still have machine hours left to produce product A. In other words, if the company only concentrates on produce the product A, there will no machine hours left to the company to produce B and C. In order to maximize the company's profit, we should use limiting factor to calculate the greatest possible contribution per profit for each product and rank profitability of the product to obtain the optimum production plan.

(b) Explain the techniques that have been developed to assist in business decision- making when single or multiple limiting factors are encountered

(16 marks)

Single limiting factor- Limiting factor analysis

When single limiting factor are encountered, we have to use limiting factor analysis to help companies to identify the scarce resources and maximize profit by using the best combination of available resource. In limiting factor analysis, we should identify the bottleneck resources first. Secondly, we should calculate the contribution per unit for each product. Next, we should calculate the contribution per unit of the bottleneck resource for each product. After we get the contribution per unit of bottleneck resource, we can rank the products of the contribution per unit of bottleneck resource. Finally, we can allocate the resources from the highest contribution per profit to the lowest contribution per profit by the ranking. By doing so, we can

obtained the greatest possible profit when resources are limited by single limiting factor.

Example 2:

X

Y

Machine hours per units

3 hours

4 hours

Sales demand

2, 000 units

3000 units

RM

RM

Selling price

32

50

Less :

Direct Material

10

20

Direct Labour

5

8

Variable Overhead

5

8

20

36

Contribution

12

14

The supply of materials for the period is unlimited, but the machine hours are limited to 15, 000 hours.

In order to maximize the profit, we should using limiting factor analysis to solve the problem when there is only one limiting factor.

Step 1: Identify the bottleneck resource.

At sales demand level:

Sales demand

Machine hours per unit

Total machine hours

X

2, 000 units

3 hours

6, 000 hours

Y

3, 000 units

4 hours

12, 000 hours

18, 000 hours

Thus, machine hours are the limiting factor.

Step 2: Calculate the contribution per unit for each product.

The contribution has been given at the above.

X

Y

Contribution per unit

RM 12

RM 14

Step 3: Calculate the contribution per unit of the bottleneck resource for each product.

To calculate the contribution per unit of the bottleneck resource for each product, the formulae is:

Contribution per units of the machine hours =

Contribution

Machine hours

Product X =

RM 12

3 hours

=

RM 4. 00

Product Y =

RM 14

4 hours

=

RM 3. 50

Step 4: Rank the products from the highest contribution per machine hour to lowest contribution per machine hour.

Production should be concentrated on product X first, up to maximum sales available, then product Y.

Step 5: Finally, allocate the available resources using that ranking that we decided at step 4 and calculate the maximum contribution.

Production plan

Units produced

Machine hours per unit

Total machine hours

Balance of machine hours

15, 000 hours

Product X

2, 000 units

3 hours

6, 000 hours

9, 000 hours

Product Y

2, 250 units

4 hours

9, 000 hours

So, the maximum contribution is as follow:

RM

Product X (2, 000 units x RM 12)

24, 000

Product Y (2, 250 units x RM 14)

31, 500

55, 500

Multiple limiting factors- Linear programming

We can use limiting factor analysis when there is one limiting factor. However, when there is more than one of scare resources which restricts organisation’s activities, we can use linear programming to solve the problem. Firstly, we must defined the variances when we using linear programming. After this, we can define and formulate the objective. Thirdly, we can formulate the constraints to formulating the problem. Next, we must draw a graph to identify the feasible region and we can get the optimum production plan from the graph. Finally, we can solve the problem and get the maximum contribution by doing so.

Example 3:

A

B

Contribution per unit

RM 20

RM 10

Machine hours per unit

6 hours

3 hours

Kilos per unit

4 kilos

8 kilos

Maximum available :

Machine hours

= 18, 000 hours

Kilos

= 24, 000 kilos

What should be the production plan?

To answer the example 3, we should use linear programming to get the optimum production plan because there is two or more of scarce resources.

Step 1: Define the variances

Let x = the number of units of the product A.

y = the number of units of the product B.

Step 2: Define and formulate the objective function.

The objective is to maximize the contribution C, given by:

Maximum contribution = 20 x + 10 y

Step 3: formulate the constraints.

The limitations here are machine hours and kilos.

For the machine hours, product A required 6 hours and product B required 3 hours’ machine hours.

So, total machine hours required = 6 x + 3 y

For the kilos, product A required 4 kilos and product B required 8 kilos.

So, total kilos required = 4 x + 8 y

Constraints

Utilised

Available

Machine hours

6 x + 3 y

Ë,

18, 000

Kilos

4 x + 8 y

Ë,

24, 000

Step 4: Draw a graph and identify a feasible region.

For the equation 6 x + 3 y = 18, 000 – machine hours

When x = 0, y = 18, 000/ 3 = 6, 000

When y = 0, x = 18, 000/ 6 = 3, 000

Draw a straight line between the point (0, 6000) and (3000, 0) on the graph to represent the line for machine hours constraint.

For the equation 4 x + 8 y = 24, 000 – kilos

When x = 0, y = 24, 000/ 8 = 3, 000

When y = 0, x = 24, 000/ 4 = 6, 000

Draw a straight line between the point (0, 3000) and (6000, 0) on the graph to represent the line for kilos constraint.

The constraints can be show as below:

The original constraints were “<" types, so the feasible region is shown by the area bounded by the thick black line on the graph. Production can be at point P, Q or R.

Step 5: Determine the optimal solution

Calculate the contribution earned at each point P, Q and R

Point P

= RM 20 (0) + RM 10 (3, 000)

= RM 30, 000

Point Q

= RM 20 (2, 000) + RM10 (2, 000)

= RM 60, 000

Point R

= RM 20 (1, 500) + RM10 (0)

= RM 30, 000

Point Q gives the maximum contribution.

Step 6: Answer the question

The optimal point is at x = 2, 000 and y = 2, 000. This gives a maximum contribution of

C = (20 x 2, 000) + (10 x 2, 000) = RM60, 000

(c) Explain the management idea known as throughput accounting. State and justify your opinion on whether or not throughput accounting and limiting factors are the same thing.

(18 marks)

To reduce company's cost and improves the profitability, every company's managers are using cost accounting to help them on decision-making. Theory of constraints (TOC) or Throughput accounting (TA) is another method for decision making others than Standard Based Costing, Activity Based Costing and Marginal Costing. TOC/TA is new management accounting approach based on factors identification when constraints are restricts companies to achieving their goals and hence reduces company's profits.

Throughput accounting is used when there are only few constraints, normally just one. The constraint can be a resource, company policy or management mindset. According to Goldratt's ideas, TOC is forecasting on a limit capacity at certain critical points in any production plan. TOC can maximise organisations' profit by increases the speed of producing through an organisation to eliminating bottlenecks.

Additionally, throughput accounting is not costing because it does not allocate all expenses (variable and fixed expenses, including overheads) to the products and services. Thus, throughput accounting helps managers to

get better management decision in order to improve organisations' profits by three measurements. They are:

Throughput (T) is the rate that company produces " goal units". When the " goal units " are money, throughput is net sales (S) less total variable costs (TVC), usually is cost of raw materials (T = S – TVC). However, T exists when there is only one product or service sold. Besides, finished goods of inventory in a warehouse are not count because it has not yet sold.

Operating expenses (OE) is all others expenses except the total variables cost that used to calculate the throughput. Basically, OE is total cost to operating the production system. Fixed or partially fixed costs no difference in throughput accounting. On the contrary, there only have either total variable cost or operating expenses in throughput accounting. Examples for OE include maintenance, utilities, rental, etc.

Investment (I) is total amount of money that invest in a new system to enhance its ability to improve the capacity, for examples machinery, inventory, building, and other assets and liabilities.

Therefore, throughput accounting use difference formulas to make difference types of accounting decisions by combined the throughput, total variable costs and operating expenses:

Net profit (NP) = Throughput – Operating Expense = T-OE

Return on investment (ROI) = Net profit / Investment = NP/I

Productivity (P) = Throughput / Operating expense = T/OE

Investment turns (IT) = Throughput / Investment = T/I

We can use the above formulas when making a decision that related to changes in revenue, expenses or investments to get the right decision, which must generate a positive answer from one out of three questions below:

Does it increase throughput?

Does it reduce operating expense?

Does it improve the return on investment?

Finally, there are five steps in the TOC to help managers maximize the throughput which causes them to achieve organisations' goals. The five steps are as follows:

Identify the system constraints. There is an internal constraint? For example, in production, engineering or planning. There is an external constraint? For example, in the market. The constraints a resource or a policy?

Decide how to maximise the output from the constraint. Prepare all other activities subject to this decision. While Non-constraints need to be subject to constraints.

Consider the appropriate level of resources once the resource constraint has been identified. Therefore, the capacity constraints can be improved.

Enhance the system's constraints.

Once the constraint has been corrected, return to Step 1 to determine the next most serious constraints and duplication.

In my opinion, throughput accounting and limiting factor is not the same thing but there are similarities and differences in between throughput accounting and limiting factor. For example, throughput accounting and limiting factor are using to assist companies to identify bottleneck resources instead to maximize companies' profits.

However, throughput accounting is used when there are very few constraints; often just one but limiting factor is used when there are one or more than one constraints. Besides, limiting factor is focus on working to obtain greatest contributions while throughput accounting is focus on the premise that the limited capacity in some critical point of any production plan.

In addition, limiting factor maximise the organisations' profit by using the best combination of available resources but throughput accounting is maximise the profit by increase the producing speed through organisation to eliminate bottlenecks. Throughput accounting calculates the products throughput as the selling price minus all variable costs. Variable costs or in another words cost of materials in throughout accounting included direct material costs only, labour and overhead costs are fixed and categories to total factory costs. In contrast, limiting factor calculated by sales price minus variable costs to get the contribution but variable costs in limiting factor are including the labour and overhead costs, this is difference from throughput accounting.