Throughput Accounting
(Relevant to PBE Paper II – Management Accounting and Finance)

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Processing Using Limited Resources

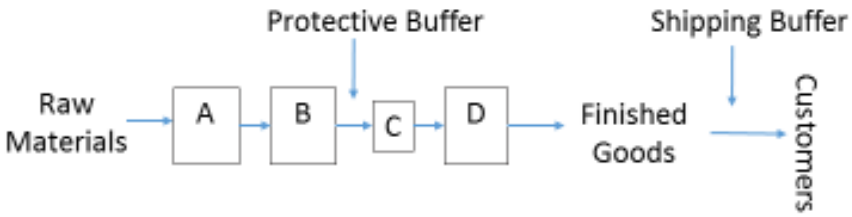
In the operations of a modern business, no matter whether the entity in question is a factory engaged in manufacturing, a bank, or a trading company, sequential chains of processes are typically involved. These sequential operational processes may be carried out in different manners, under different approaches or at different speeds. In general, though, the following methods for improving processes are used in the majority of situations in which resources are limited:

- removing scrap before the constraint
- using pricing to manage the constraint
- re-designing the process or the product so as to use less of the constraint under consideration (materials, labour, area, etc)
- avoiding wastage of the constraint's scarce resource, such as keeping the resource in continual operation
- having workers continue working through lunch
- performing maintenance tasks outside of working hours
- using a drum-buffer-rope system to control stock.

Drum-Buffer-Rope System

in a particular production system: Processes A, B, C and D. Process C has a smaller capacity than the other three processes. Under the drum-buffer-rope system, there would be one drum, two buffers, and one rope, as shown in the illustration below:
A drum, Process B, plays a role in conveying information about the speed of the slowest

Figure 1 Drum-Buffer-Rope System



bottleneck persons to everyone in the group and cheering on those bottleneck persons to bring their performance up to speed. Two buffers, a protective buffer and a shipping buffer, absorb the changes in the marching speed of the bottleneck, Process C. When the rope, Process C, is stretched out to its limit, it is necessary to impose a constraint on

those tied to the rope so that the speed is not raised any further. In this case, it is better to prioritize work according to maximum output, i.e. throughput, per unit of the constraint.

Theory of Constraints (TOC)

The production process model represented above demonstrates the Theory of Constraints (TOC). In the example, *throughput* is constrained by Process C. That is to say, the production flow is hindered as it moves from Process B, via Process C, to Process D.

A *constraint* is any blockage that prevents the company from achieving its general objective, i.e. profit maximization. Under the TOC, the management emphasis is put on the achievement of profits.

In Figure 1 above, managers should attempt the following:

- in the short run, to exploit the financial output of the system
- in the long run, to develop the capacity of Process C, and thus eliminate it as a bottleneck
- Once the first bottleneck in Process C has been addressed, the process should be repeated to identify a new bottleneck.

The method of throughput accounting was developed to handle the constraints presented by adopting the TOC.

Throughput Accounting

Throughput accounting is a management accounting technique used as the means of measuring performance according to the TOC. It in fact consists of an assembly of techniques, which have as their goal the maximization of output from a production system. Put simply, throughput accounting is a simplified, principle-based approach that offers managers supporting information for their decision-making in order to improve company profit.

Throughput accounting provides the business intelligence used for maximizing profits. However, unlike cost accounting, which primarily focuses on 'cutting costs' and reducing expenses to make a profit, throughput accounting basically emphasizes generating more throughput. Conceptually, throughput accounting attempts to increase the speed or rate at which throughput is generated by the company’s products and services with respect to a company's constraint, whether that constraint is internal or external to the company.

Throughput Accounting versus Marginal Costing

There are differences in the treatment of cost under throughput accounting and marginal costing. Under throughput accounting, the only cost considered to be a variable is the cost of raw materials. Sales revenue minus the variable cost, i.e. the cost of the raw materials, is called throughput, or the throughput contribution margin.

The other variable costs, i.e. labour and variable overhead, are not used to calculate the throughput contribution margin. Labour and overhead are regarded as being semi-variable, and therefore appear within the other operating expenses.

Managing the Constraint

In order to manage a constraint, the following steps should be taken.

1. Identify the systems constraint(s)

A constraint may be plant capacity, or something more indirect, such as a company policy. In an efficient company, a constraint is easy to identify: WIP (work-in-progress) will be seen stacked up between two processes. In an inefficient company, there may be WIP everywhere, making the constraint(s) more difficult to identify. Moreover, a constraint may move if the mix of products changes, which is called a *flexible constraint.*

2. Decide to exploit the system's constraints

This step is meant to generate the most products out of the existing resources. That means prioritising work according to the throughput per unit of the constraint. The typical methods for this have already been mentioned above in the list following the first paragraph of this article. Taking such actions usually leads to a cost-and-benefit decision-making situation.

A Worked Example

ABC Company is offered a contract to produce 15 electric car engines each month, using a design that includes computerized foundation work. The buyer offers to pay $5,600 per car engine completed. The company also has a stable order for 40 coach engines each month, for which it is paid a price of $7,000 per unit.

The company accountant determines that the cost of operating the computerized foundation and the assembly line each month is as follows:

Department Fixed Overhead Cost	Total Cost ($)	Hours Available per Month	Cost per Hour ($)
Computerized foundation	146,000	160	912.50
Assembly	66,000	160	412.50
Total	212,000	320	662.50

At present, ABC Company is making 40 coach engines each month. As the computerized foundation is expensive to operate, and purchasing raw materials for the car engines is also costly, the accountant determines that the company will lose money on any car engines that it produces. He demonstrates an analysis of the estimated product costs based on standard cost accounting and declares that the company should refuse to construct any car engines.

Standard Cost Accounting Analysis	Electric Car Engine	Coach Engine
Monthly demand	15	40
Price	$5,600	$7,000
Computerized foundation time (hours)	3.0	2.0
Assembly time (hours)	1.5	4.0
Total time	4.5	6.0
Computerized foundation cost	$2,737.50	$1,825.00
Assembly cost	$618.75	$1,650.00
Raw materials cost	$2,400.00	$1,200.00
Total cost	$5,756.25	$4,675.00
Profit per unit	$ (156.25)	$2,325.00

ABC Company's operations manager realizes that the current investment in computerized foundation equipment has generated idle time for the department workers. The constraint on production is therefore the assembly line. The accountant conducts a profit and loss analysis for the engines. The company then proceeds to analyse the contract using throughput accounting to determine the profitability of products by calculating the "throughput" (revenue less material cost) in the assembly line.

Throughput Cost Accounting Analysis	Decline Contract	Take Contract
Coach engines manufactured	40	34
Electric car engines manufactured	0	15
Computerized foundation hours	80	113
Assembly hours	160	158.5
Coach engine revenue	$280,000	$238,000
Electric car engine revenue	$0	$84,000
Coach engine raw material cost	$(48,000)	$(40,800)
Electric car engine raw material cost	$0	$(36,000)
Throughput contribution	$232,000	$245,200
Fixed overhead expense	$(212,000)	$(212,000)
Profit	$20,000	$33,200

After the presentations from the company accountant and the operations manager, the general manager realizes that the assembly line capacity is a constraint on the company's profitability. That is to say, the 160 hours needed for a product to pass through the assembly line limits the overall production capacity and hence the throughput of the department. At present, the company can make only 40 coach engines per month. By taking the contract for the electric car engines, the company can manufacture most of the coach engines ordered, i.e. 34 out of the 40 coach engine orders, and also meet all of the demand for electric car engines. Taking the contract will therefore result in an increase in profit from $20,000 to $33,200, and throughput will increase from $125 ($20,000/160) to $207.50 ($33,200/160) per hour of available time, increasing company profit by 66 per cent.

Impacts of Throughput Accounting and the Theory of Constraints

To conclude, besides the accounting benefits outlined above, there are other non-accounting impacts:

1. Subordinate Everything Else

As a modern processing system comprises a series of connected processes, any action regarding a non-constraint must be evaluated with regard to how it will affect the constraint. The car engine manufacturing example above requires the plant to work at full capacity during most of its processes. Referring back to Figure 1, some people may notice that Process B runs too fast and hence further piles up the WIP before the constraint, Process C. At the same time, increasing the capacity of the non-constraint(s), i.e. Process A, B, and/or D, will not improve overall efficiency until Process C is addressed.

2. Elevate the Constraint

Elevating the Constraint means increasing the capacity of the constraint. Common methods for doing so include: making further capital investment to upgrade the processing capacity, sub-contracting the tasks to outside parties, and arranging for staff to work overtime so as to meet the requirements or letting staff work additional shifts.

3. Back to Step 1

Once the original constraint has been removed, then a new process becomes the constraint. So, the company is likely to return to step 1 and to start again in considering how to remove that constraint. The TOC assumes that the constraint is within the company's processes. Consequently, as internal constraints are successively removed, market demand becomes the constraint. Then the TOC assumption ceases to operate.

4. Change in Culture

Use of the TOC implies a certain amount of idle time in non-constraints. This means that performance may no longer be measured in terms of efficiency and utilization, and that workers in non-constraint roles may become de-motivated. As they are spending less of their time making a noticeable contribution, they may begin to feel less valued, and may become afraid of being made redundant.

Concluding Remark

Throughput Accounting is an important development in Management Accounting that allows managers to appreciate the contribution of constrained resources to the company profit.

Throughput Accounting and Theory of Constraints are involved with techniques to maximize operating profit by maximizing throughput. In the short-run this involves optimizing product mix using a contribution per unit of limiting factor approach. In the long-run throughput is maximized by successively removing each constraint as identified.