ALTERNATIVE TO DISTORTIONS CREATED BY TRADITIONAL COST ACCOUNTING: THROUGHPUT ACCOUNTING

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ABSTRACT

Managers in manufacturing organizations rely on accurate information from accounting practices to take real-time decisions in order to maximize profitability from their product-mix or across business units. All the existing cost accounting approaches rely on allocating costs of labour and overheads across business-units or product-lines or individual products. The practice of allocating indirect cost is rarely precise, and therefore opens up the possibility of distorted information being placed to managerial decision-makers leading to wrong decisions.

Throughput accounting, which is a result of Goldratt's Theory of Constraints, offers a simple and viable alternative to the distortions created by cost accounting approaches. Throughput accounting suggests a paradigm shift in analysing contribution of product-mix and business units by changing focus of managers from emphasizing on managing cost-per-unit to managing throughputs. This study presents a conceptual discourse with hypothetical illustrations on the distortions created by cost accounting and how throughput accounting removes such distortions and presents factual information to decision-makers.

Keywords: Throughput Accounting, Throughputs, Theory of Constraints, Cost Accounting, Cost Per Unit.

INTRODUCTION

Rapid change in a globalized business environment is forcing businesses especially manufacturing organizations to frequently evaluate their product offerings (Kareh, 2018). The role of managerial accounting in such situations is crucial in providing real-time profitability information to management in order to optimize the product-mix (Londhe, 2014). By the time contribution margins of products are revealed by prevailing cost accounting approaches, the organization or its' units have already haemorrhaged a significant amount of profits due to decisions taken based on allocation of costs done through cost accounting methods. This problem is a major issue especially with manufacturing organizations that offer multiple products in their portfolio (Ettenson et al., 2013).

Traditional cost accounting methods including the relatively newer cost accounting systems such as those that determine costs based on activities such as Activity based costing (ABC) (Cooper & Kaplan, 1988) or time such as Time Driven Activity Based Costing (TDABC) (Kaplan & Anderson, 2004), all have one thing in common; they allocate indirect costs (Woeppel, 2010). However, the reality is that indirect costs can never be precisely allocated whether it is based on historical performance, activities or time. In light of the above dilemma, Goldratt's Theory of Constraints (TOC) offers a new approach in profitability determination by eliminating the need to allocate indirect costs to products or units of an organization, and instead focuses on generating *"Throughputs"* (Goldratt & Cox, 1984).

Throughput Accounting (TA), which is a by-product of TOC, has emerged as a pragmatic approach towards determining a fairly precise idea about true contribution of a product to the organization (Elsukova, 2015). TOC enables management to identify factors that limit a firm in reaching its' goals and focuses on simple measures to drive behaviour in key areas towards removing the constraints and achieving organizational objectives. This approach presents more useful data to managerial decision-makers, as opposed to other cost accounting approaches that allocate overhead costs to products, units and activities (ACCA, 2016).

The current study presents a detailed conceptual discourse on TA and contrasts it with cost accounting that basically depends on allocation of indirect costs through some methods, and explains how the two systems differ in presenting profitability related information for effective managerial decision-making. Prior to the detailed discussions on comparison between cost accounting and throughput accounting, a summary of the prevailing literature on theory of constraints and throughput accounting is presented.

The primary objective of this study is two-fold: first, to highlight how cost information is distorted by all the cost accounting methods, and second to explain how TA offers a paradigm shift in approach to decision-making based on focus on maximizing throughputs rather than on minimizing cost-per-unit.

LITERATURE REVIEW

In order to present a narrative on the current literature on TA, it is necessary to elaborate on the TOC since TA is a by-product of TOC. Therefore, the following subsections present a summary of TOC and TA.

Theory of Constraints

The origin of TOC is attributed to Goldratt (1990) and Goldratt & Cox (1984). The concept is basically a management approach that visualizes any system as being limited in achieving some of it's' goals due to a small number of constraints or bottlenecks. The assumption is that there is at least one constraint in every system and a clearly defined focusing process is required to identify the constraint and restructure rest of the systems around it. Hence, TOC suggests that the entire chain is as strong as its' weakest link, meaning that the entire system can be vulnerable because of the weakest component in the system (Freeman, 2007; Putra, 2014).

The basic premise of TOC is that an organization is a system, and the system is made up of interconnected components. Each of these components is related to the system's general objectives and performance goals, hence it is vital to identify and distinguish the role of bottlenecks or constraints to the system. System constraints are defined as any factor that constrains system performance in the line with its objectives (Goldratt, 1990). The process starts by identifying the goal that system is expected to accomplish. Therefore, before addressing the necessary improvements to each component of the system, assessment criteria of the impact of each subsystem and minute decisions on the general objectives must be clearly defined (Souren et al., 2005).

The process of implementing TOC is somewhat similar to the concept of Continuous Process Improvement, which follows five steps (Corbett, 1998):

1. Identifying the system constraint that is acting as a weak link (i.e., bottleneck) in achieving the system goal.
2. Exploiting the constraint by taking decision on how to address the constraint with existing resources. Hence, an opportunity to remove the weak link from the system chain.
3. Disseminating information along the system on the constraints and remedial measures on how to address them, and synchronize the measures with other components in the system.
4. Monitoring performance related to remedial measures. If the constraint is not removed, then elevate the efforts to more intense level such as breaking up the constraint and removing those parts that are actionable.
5. Once constraints are removed, then return back to step-1 and identify new constraint and follow the subsequent steps again.

The final step mentioned above, indicates that TOC assumes that there will always be at least one constraint to the system, which suggests that the focus is always on the current constraint (Utku et al., 2011). Therefore, it is a continuous process, and is assumed on the premise that there will always be some constraints that will hold back the company from achieving its goal (Dugdale & Jones, 1998). Typically, the source of constraints can be due to reasons related to plant and equipment (e.g., capacity of the machinery), or workforce (e.g., skill levels of the workforce) or policies (e.g., government regulations such as waste disposal or licensing, etc.) (Inman et al., 2009). An example of policy constraint is the Keystone Pipeline Project that was proposed for transporting oil from Alberta, Canada to Nebraska, USA, but due to U.S. government polices motivated by environmental concerns the pipeline construction was blocked (Krauss, 2019). Therefore, the policy represents a constraint for oil and gas companies as well as the Canadian and U.S. governments. The current U.S. government is trying reviving the Keystone Pipeline project, but faces obstacles from court decisions (Harris, 2018).

Theory of Constraints suggests that systems (i.e., organizations) can be measured and thereafter controlled through variations in 3 key elements: operational expenses, inventory and throughputs (Islam, 2015). Where inventory represents all the resources invested to procure materials that are expected to be sold, and operational expenses on the other hand are the resources spent to convert material inventory into throughputs (includes salaries, rents, taxes, etc.). Finally, throughputs represent the rate at which the organization generates cash flow through sales. Therefore, one of the vital objectives of TOC is managing *"throughput"*.

Throughput Accounting

Throughput accounting (TA) is a fairly new method developed by Goldratt (1990) which tries to eliminate distortions induced by traditional cost accounting approaches, especially distortions that are detrimental to achieving profitability of business organizations (Amorim et al., 2014). For instance, in traditional accounting, inventory is considered a liquid asset as it can be viewed as an item that is easily convertible to cash if desired through sale. As a result of this misconceived notion about all inventory, management often piles up inventory thus inflating asset value, even though many such inventory are not useful to the organization (Parkhi et al., 2016). Therefore, building up more inventories, artificially inflates value of assets and generates higher profits on paper (i.e. financial statements) even though many such inventories may never be sold or may become obsolete.

In traditional cost accounting, inventory is shown as a valuable short-term asset as it can be converted to cash in theory. However, the TA has an opposite view of inventory, and considers it as a liability, because inventory ties up cash that could have been used in more productive components of the system, and most organizations a substantial portion of inventory

remains unsold (Khan et al., 2018). In traditional cost accounting there is strong focus on reducing expenses, whereas, in TA the focus is on increasing throughputs rather than cost cutting. Proponents of TA argue that cost cutting has its limits, but increasing throughputs can be a continuous process. Therefore, throughput accounting uses following three core measures: Throughputs, Investment and Operating Expenses (OE) (Cox & Schleier, 2010).

(i) Throughput: Measured as the rate at which customer sales are generated after deducting the true variable cost (TVC) based on items such as raw material, transportation charges, commissions deducted for sales, etc. However, in TA, labour is not regarded as a TVC (unless firm pays on a per piece or per unit basis for labour). Labour in manufacturing organizations are usually not tied to units produced, because most organizations invest in developing the skills of their workers, and will rarely terminate their employment due to lean periods as it will be difficult to replace them in normal times (Cox & Schleier, 2010). Therefore, management's primary objective will be to determine; "*how to increase throughput?"*

(ii) Investments: Investments represent funds tied up in physical assets such as machinery and equipment, land and buildings, product inventory, etc. In the TOC these all referred to as inventory (Cox & Schleier, 2010). Thus, the objective of the organization related to investments will be; "*how to reduce investments without affecting the goal of increasing throughput?"*

(iii) Operating Expenses: Operating expenses (OE) refer to other cash outflows needed for creating the throughputs (excluding actual variable costs). Some examples are, payments made for salaries and benefits of employees, rental expenses, lease expenses, taxes and license fees, cost of utilities, etc. Hence, the goal of the decision-makers will be; *"how to reduce operating expenses, while ensuring that throughput will be increased?"*

Over decades, traditional accounting practices have presented distorted information whereas TA approach provides a simple remedial measure to such distortions (ACCA, 2016; Woeppel, 2010). Based on the three key elements of TA, TA tries to determine the rate at which the business enterprise generates money from the products or services that the firm can produce and sell in a stated period.

The calculation procedure requires direct material cost to be deducted from the sales revenue, keeping in mind that OE are all costs incurred to produce the throughput (excluding the direct material cost), hence OE is more related to manufacturing overheads (Elsukova, 2015). Direct labour is included with OE and considered as a fixed expense. Investment in TA includes physical assets (i.e., similar to traditional accounting) and also inventory. Inventory is treated as the cost of acquired material that is amount of money the organization spends on items it intends to convert into throughput (Northrup, 2004). Hence the TA approach does not assign any value to inventory, unless the product is sold, as it does not produce throughput (ACCA, 2016). Therefore, there are some essential conceptual differences between TA approach and Variable Costing approach in traditional cost accounting methods (Table 1).

Table 1
COMPARISON BETWEEN THROUGHPUT ACCOUNTING AND TRADITIONAL VARIABLE COST ACCOUNTING APPROACHES

Throughput Accounting	**Variable Costing Approach**
Revenue	Revenue
Less: Direct Material	Less: Direct Material
	Less: Direct Labour
	Less: Variable Overheads
Throughput	Contribution Margin
Less: Operating Costs	Less: Fixed Costs
Profit	Profit

Source: Northrup, (2004)

The traditional variable costing approach calculates the contribution margin by deducting all variable costs from sales revenue, where direct labour is considered as part of total variable cost. The reality is that labour is rarely a TVC since it does not vary with volume of sales (Goldratt, 1990). Most organizations do not retrench or terminate workers when low sales volumes are in season, because such workers may be difficult to replace in high volume periods (Freeman, 2007). Furthermore, there are other significant cash outflow implications such as pensions and benefits that management takes into consideration before deciding to make fluctuations in the size of their workforce. Finally, labour unions and worker's protection regulations may prevent any drastic decisions with regards to workforce.

The TA approach recognizes this reality, and does not consider direct labour costs in calculating throughput. The TA approach includes direct labour as part of operating expenses, and therefore for organizations to implement such as system would require some pertinent change in their accounting measurements and procedures (ACCA, 2016). Therefore, TA emphasizes that management should focus on increasing throughputs which will reflect on actual profitability of the organization. TA is also closely related to a term referred to as Drum-Buffer-Rope (DBR), which is a scheduling method based on Goldratt's TOC (Lutilsky et al., 2018). The DBR provides a system for synchronizing flow of products starting from customer orders till the throughput is out. The aim of this approach is to minimize inventory build-up by focusing on issues such as avoiding late orders, etc.

Measurement Metrics in Throughput Accounting

The metrics applied in TA are typically based on four measures; Net Profit (Throughput – Operating Expenses), Return on Investment (Net Profit/Investment), Productivity (Throughput/Operating Expenses), and Investment Turns (Throughput/Investment) (Woeppel, 2010). The main accounting ratios for throughput are computed based on making product-mix decisions that are (ACCA, 2016):

(i) Return per factory hour=Throughput per unit/Product time on bottleneck resource (either machinery or facility).
(ii) Cost per factory hour=Total factory costs/total time available on bottle-neck resource (either machine or facility).
(iii) Throughput accounting ratio (TAR) =Return per factory hour/cost per factory hour. In order for a firm to generate cash from sales at a rate greater than the rate at which it is incurring cost, the expected TAR for an efficient production facility should be greater than 1.

The return per factory hour is calculated for each product group. The total factory cost in the operating expenses of the organization. The cost per factory hour is across the whole factory, thus it has to be calculated only once (Lutilsky et al., 2018).

Discourse on Costing Accounting and Throughout Accounting

The remainder of this article presents elaborate discussions on the differences between cost accounting and TA, with conceptual differences explained along with hypothetical examples to illustrate the ideas and how they relate to organizational decision-making.

Information Distortion by Cost Accounting and Alternative View of Throughput Accounting

In a seminal study by Goldratt & Cox in 1984 titled: *"Cost Accounting: The Number One Enemy of Productivit"*, the author explains exactly how the whole approach of allocation of costs, that is the core premise of cost accounting, distorts information presented to decision-makers (Goldratt & Cox, 2004). Typically uses of cost allocation are aimed at deriving information on *"product-cost*, *cost to operate*, *cost to purchase* and *cost when selling"*. The principle metrics that cost accounting derives is cost per unit (CPU) (Cox & Schleier, 2010). In a product manufacturing environment, the CPU value comprises of direct material, direct labour and manufacturing overheads allocated to the unit.

Throughput accounting challenges the concept of CPU value calculated through cost accounting and considers it as a distortion, because labour cost and manufacturing costs do not vary with volume of units produced. The only TVC in TA is direct material, unless labour cost is paid on per piece or per unit basis, which is not the case in most organizations. Most organizations pay a salary to their workers, and typically do not eliminate workforce or add them in the short-term based on volumes produced. Similarly, overhead costs are also allocated by cost accounting based on the type of cost accounting being applied. The proponents of TA contend that allocation of costs can never be accurate, because they are based on historical information and hence are not forward looking (Cox & Schleier, 2010). Therefore, in TA direct material varies with units produced and is the only TVC.

Another distortion referred to by Goldratt & Cox (2004) regarding cost accounting is the myth that by producing more units of a product, the CPU of the product decreases. This concept is a widely held belief, but is considered as an illusion by TA proponents, because the reality is that the total cost does not decrease with volume of units produced, and the reduction in per unit cost is an aberration. The following hypothetical example in Table 2 illustrates the point. The table shows that in the first month, the firm produces 50,000 units and in the second month the production goes to 100,000 units. The salaries and wages are the same each month, yet the unit cost of labour appears to go down from $20/unit to $10/unit, however total labour cost is the same in both months. Therefore, the reduction in unit cost due to volume is only an illusion, and the only thing that increases with more units produced and sold is the gross profit margin.

Table 2
ILLUSION OF COST PER UNIT

	MONTH-1	MONTH-2
Total Labour Cost*	$ 1,000,000	$ 1,000,000
Units Produced	50,000	100,000
Cost of Labour per Unit	$ 20/unit	$ 10/unit

Note: *Total labour cost = monthly amount of salaries and wages paid by the firm.

Throughput accounting offers a completely new way of looking at accounting information presented to decision-makers without allocating any costs. Where the objective of cost accounting would be to reduce costs, the goal of TA is to increase throughput instead (Goldratt, 1990). Cost accounting prioritizes focus on managing operating expenses and inventory, with less attention paid to throughput as the assumption is that net profit figures will depend on how well operating expenses and inventory are managed.

However, TA completely reverses the prioritization and argues that management should primarily focus on increasing the rate of throughputs produced and then look at investments and

finally operating expenses. Throughput would then be (TA=Revenue–TVC), where TVC is the true value of costs that is mostly direct material, freight, sales commissions, etc. that actually vary with unit volume. By doing so, the firm's managers will have a real picture of profitability and not the distorted view presented by cost allocation made through cost accounting approaches. Inventory in TA is considered as part of investments along with other machinery and fixed assets. In throughput accounting, inventory is investments made in all materials that are procured to convert to outputs.

With regards to inventory, cost accounting practices create scope for manipulating inventory value to show higher or lower amount of profits on the financial statements of the organization. The distortion comes from assigning value to the inventory. If senior management inflates the value of inventory, the income statement will show higher net profits, and if the value of inventory decreases then net profits will decrease. Therefore, even if raw material inventory sits idle and unused in the warehouse, management can still show it as having value, and whether it has become obsolete or is not reflected anywhere in financial statements. Throughput accounting therefore eliminates scope for such distortions by only showing true value of costs that is the actual material used to produce the goods. The remaining inventory is clustered with investments and kept out of the calculation of throughput, thus avoiding any distorted information on profit generated by products or business units.

In terms of operating expenses (OE), TA considers all other costs such as depreciation, interests, rents, taxes and especially salaries and wages as part of OE. Therefore, by isolating investments and operating expenses from throughput, TA approach allows managers to determine real information about the firm's product mix by asking: *"Exactly what 'product-mix' will generate maximum throughputs for the organization?"*

The core assumption is that there are no good products (i.e., winners) and bad products (i.e., losers) in a product-mix, because all products are assumed to be generating throughput, hence the only issue that needs to be identified is which of the products maximize throughput, and hence focus should be to design the product-mix based on maximizing this product. Therefore, TA offers a paradigm shift in the approach towards profit-oriented decision-making to optimize product-mix of a company. Hence, management should decide on its' product mix by considering the change in values of delta values of Throughput (T), Inventory (I) and OE): ΔT, ΔI and ΔOE between options.

Decision-Making based on Accounting Information

Typically, in manufacturing organizations financial decisions are centred around five (5) major areas:

1. Company-Wide Decisions.
2. Business-Unit Decisions.
3. Product-Level Decisions.
4. Investment Decisions.
5. Make vs Buy Decisions.

Company-Wide Decisions

Company-wide decisions (CWD) are measured and monitored based on financial statements generated by a business firm. Typically, senior management seeks to determine the answers to the following questions in terms of CWD:

(i) Is the organization achieving its' stated goals?
(ii) Where should management focus their efforts?
(iii) What are the weak areas that need to be improved?

The reality is that traditional financial statements do not answer the above questions. In fact, the CWD cost allocations made through cost accounting methods distorts the actual performance indicators of the company, which is mostly done by allocating costs to inventories. In doing so, the allocation process essentially defers expenses from one period to the next. This is usually done by taking expenses from the Profit and Loss Statement and placing it in the Balance Sheet as a deferred cost. Such practice leaves open scope for manipulating, the profit figures on financial statements shown to stakeholders.

The following hypothetical example (Table 3) illustrates how CWD expenses are treated by cost accounting and contrasts it to how it is dealt with in TA. The two hypotheticals firms, *"P"* and *"Q"* shown in Table 3 have the same revenues, costs and are operating in the same environment with similar business models and product-mix, the difference is that *"P"* uses cost accounting and *"Q"* uses throughput accounting. Data provided in Table 3 for both firms are:

Table 3
COMMON DATA FOR BOTH FIRM-P AND FIRM-Q

	Year-1	Year-2
Revenue	$500,000	$750,000
Direct Material	$100,000	$150,000
SG&A or OE	$400,000	$500,000

Note: SG&A: Selling, General & Administrative Costs (known as Operating Expenses in TA)

Table 4 below shows the contrast in how each approach treats expenses. Firm-P allocates $50,000 as cost to convert material to products that contains allocation of direct labour and direct overheads. The firm's accountants assigned this figure by taking it out of SG&A. For instance, in year-1 total SG&A was $400,000 but the accountants at Firm-P showed only $200,000 in SG&A on the P&L statement in year-1, and $50,000 as conversion cost, which leaves out $150,000 missing in year-1 and similarly $250,000 missing in year-2 from the P&L statement.

Table 4
P & L STATEMENT WITH COST ACCOUNTING AND THROUGHPUT ACCOUNTING

	Firm-P Cost Accounting			**Firm-Q** Throughput Accounting	
	YEAR-1	**YEAR-2**		**YEAR-1**	**YEAR-2**
Revenues	500,000	750,000	**Revenues**	500,000	750,000
Direct Material	(100,00)	(150,000)	**Direct Material**	(100,000)	(150,000)
Conversion Cost	(50,000)	(50,000)	**Conversion Cost**	0	0
Gross Margin	350,000	550,000	**Throughput**	400,000	600,000
SG&A	(200,00)	(200,000)	**SG&A**	(400,000)	(500,000)
Net Profit	150,000	350,000	**Net Profit**	0	100,000

Note: Conversion Cost: Calculated by allocating Direct Labour & Direct Overheads

The information displayed in Table 4 may raise the question that for Firm-P, where the missing $150,000 is in Year-1 and $250,000 in Year-2 from the SG&A which is shown as $400,000 and $500,000 for Firm-Q. The reality is that the accountants using the cost accounting approach deferred the $150,000 from Year-1 and $250,000 from Year-2 under SG&A to the next year and placed it in the Balance Sheet as deferred expenses (Table 5). While, in TA such

manipulations are not possible because TA focuses on throughput and does not distort the expense figures. The balance sheet below shows that in Year-1, Firm-P shows $150,000 under the head of conversion (as part of inventory) as deferred amount and adds $250,000 of deferred amount in year-2 to the year-1 figure and shows $400,000 under conversion cost. Therefore, by manipulating the allocation of inventory costs, the managers that use cost accounting can show higher net profits in Year-1 and Year-2, but eventually in Year-3 onwards the net profits will be lower than the system under TA. In the TA system, there is no scope for such arbitrary CWD cost allocations, as the focus of management is to increase throughput.

Table 5
BALANCE SHEET WITH CONTRAST BETWEEN COST ACCOUNTING & THROUGHPUT ACCOUNTING APPROACH

	Firm-P Cost Accounting		**Firm-Q** Throughput Accounting	
	YEAR-1	**YEAR-2**	**YEAR-1**	**YEAR-2**
Cash	$100,000	$100,000	$100,000	$100,000
Inventory				
Raw Material	$75,000	$150,000	$75,000	$150,000
Conversion	$150,000	$400,000	0	0
Total Assets	$425,000	$750,000	$175,000	$250,000
Total Equity	$425,000	$750,000	$175,000	$250,000

Therefore, for company-wide decisions, by showing higher inventory values, management can report higher net profits and when inventory value falls, the net profit value will automatically decline. Such scope for manipulations means that senior management as well as shareholders are unable to gauge the true financial health of their firm due to the distorted information presented to them by cost accounting approach.

Business-Unit Decisions (BUD)

As companies grow in size and complexity, they often create different strategic business units that operate autonomously under one overall umbrella. Such units have to face myriad sets of complexities in each BUD that often creates conflict between the business units under one organization. Leadership of each business unit are typically rewarded or chastised for meeting their own financial targets and in doing so they have to independently report financial performance. Two main areas of conflicts that arise between BUDs are:

(i) Arbitrary allocation of general organizational overheads to each business unit. For example, the cost of IT services can be arbitrarily allocated to each business unit; regardless of how much of the IT services have been used by the units. The leaders of each unit try to fight and resist any allocation of general overheads to their business unit, because it will lower their profits and impact their bonuses.

(ii) The other area that creates conflicts is related to transfer pricing. When one business unit is mandated to purchase some service or component from another business unit, they may be forced to acquire it at a higher value than they could have done by outsourcing from external entities. For instance, a business unit may need additional space that they could possibly rent at a lower price from outside, but, if a sister business unit has vacant space, they may be influenced by senior management of the company to rent the space at a higher cost. By procuring at higher prices, unit level profits will be adversely affected leading to resistance form the leaders of the unit.

The above conflicts arise mainly because of the system of allocation of costs. Therefore, TA offers a unique solution, because unit level leaders will be judged on the basis of how much

throughput they can generate and not net profits that are loaded with expenses that are based on allocations.

Product-Level Decisions (PLD)

At the product level, the predominant driver of decisions in cost accounting is the CPU. Throughput accounting considers CPU as a metric based on flawed assumptions. The concept of CPU distorts profit margins often leading to wrong decisions on product-mix. On the other hand, TA approach focuses on generating additional throughput and not on saving costs, which fundamentally changes the approach to PLD by managers. The following hypothetical example demonstrates how cost accounting distorts product-level profit margins and TA deals with such distortions.

A firm is assumed to be producing two products; A and B and summary of data on cost information are presented in Table 6:

Table 6
PROFITABILITY DATA FOR PRODUCTS A & B BASED ON COST ACCOUNTING

	PRODUCT-A	PRODUCT-B
Selling Price	$90/unit	$100/unit
Raw Material Cost	($45)/unit	($40)/unit
Direct Labour Cost	($10)/unit	($8.33)/unit
Manufacturing Overheads	($27.50)/unit	($22.92)/unit
Product Profit Margins	$7.50/unit	$28.75/unit

Note: Direct labour and manufacturing overheads are both allocated costs.

Based on Table 6, with no other constraints being presented, the obvious decision for management would be to maximize production of product-B as it yields the highest amount of profit per unit for the firm. Therefore, based on cost accounting method, the decision would be to maximize production of B to meet all demand, and then produce product-A with remaining capacity.

Alternatively, if constraints such as machine constraints are added to the decision scenario then the product mix needs to be re-evaluated. The following example provides two product-mix options and places it for decision on which product-mix yields maximum benefit to the firm. The constraint is that in each week the plant can produce either one of the options (product-mix) shown in Table 7.

Table 7
TWO OPTIONS WITH WEEKLY PRODUCTION OF A AND B

Weekly production	Option-1: Maximize A	Option 2: Maximize B
Product-A	100	60
Product-B	30	50

As stated earlier, cost accounting would start by assuming that the best option is the one that maximizes production of B. However, in TA the decision will be determined after calculating and comparing values of ΔT, ΔI, and ΔOE between option-1 and option-2. Table 8A and Table 8B show the contrast in throughput between option-1 and option-2.

Table 8A THROUGHPUT CALCULATION WITH PRODUCT-MIX: OPTION-1			
	Option-1: Maximize Production Of A		
	Weekly Units	Price	Weekly Revenue
Product A	100	$90/unit	$9,000
Product B	30	$100/unit	$3,000
Total Revenue			$12,000
Material Cost: A	100	$45/unit	($4,500)
Material Cost: B	30	$40/unit	($1,200)
Total Material			($5,700)
Throughput			$6,300

Table 8B THROUGHPUT CALCULATION WITH PRODUCT-MIX: OPTION-2			
	Option-2: Maximize Production Of B		
	Weekly Units	Price	Weekly Revenue
Product A	60	$90/unit	$5,400
Product B	50	$100/unit	$5,000
Total Revenue			$10,400
Material Cost: A	60	$45/unit	($2,700)
Material Cost: B	50	$40/unit	($2,000)
Total Material			($4,700)
Throughput			$5,700

Therefore, based on the results of the above tables, the values of ΔT, ΔI, and ΔOE are presented in Table 8C below:

Table 8C DELTA VALUES FOR PRODUCT-MIX DECISION			
	Maximize-A	**Maximize-B**	**Delta (Δ) Value**
Δ Throughput	$6,300	$5,700	+$600
Δ Operating Expense	------	------	------
Δ Net Profit	$6,300	$5,700	+$600
Δ Investment	------	------	------

Table 8C indicates that by selecting option-1 (i.e., maximizing production of A), the firm benefits by an additional amount of $600 worth of throughput. Therefore, when TA is applied, the decision changes from the results indicated by cost accounting. Since, no arbitrary allocations were made in TA; the product-mix decision is based on actual costs.

Investment Decisions

Traditional cost accounting methods including the newer methods that allocate costs based on activities (e.g., ABC) or time (e.g., TDABC), all rely on cost savings in order to maximize success metrics such as Return on Investment (ROI), Payback Period, etc. Hence, all investments are justified based on such metrics. For instance, the desired payback period in manufacturing investments range from 5 to 10 years, while ROI of 10% is more than satisfactory (Cox & Schleier, 2010). However, TA takes a different approach to justifying investments, and is more applicable in short-term investment decisions. Generally, payback periods of less than 2 years and ROI not less than 20% is considered benchmarks in investment decisions based on TA (Cox & Schleier, 2010).

The following two examples illustrate how TA approaches investment decisions:

Example-1

The firm mentioned in the precious section, can sell all the products-A and B they produce if the firm holds an extra amount of inventory worth $20,000. In order to maintain the new inventory an additional worker needs to be employed whose salary will be $19,200/year. The company's hurdle rate for new investments is 20%. The firm operates 48 weeks each year. The investment decision question would be that using the option of maximizing production of product-A, should the firm invest in the additional amount of inventory? Table 9 displays all information that is required to decide based on TA approach.

Table 9
DECISION-MAKING ON INVESTING IN ADDITIONAL INVENTORY UNDER THROUGHPUT ACCOUNTING (MAXIMIZING PRODUCT-A)

	Maximizing Product-A		
	Units	Price	Total
Product-B: Additional weekly revenue	20	$100/unit	$2,000
Product-B: Additional weekly TVC	20	$40/unit	($800)
Product-B: Additional weekly throughput			
Work week per year			48 weeks
Delta ΔT Additional throughput generated			$57,400
Delta ΔOE (hiring one extra worker)			($19,200)
Delta ΔI (additional inventory)			$20,000
ROI (ΔT/ ΔI)			182%
Hurdle rate of the firm			20%

Based on the calculations generated in Table 9, the ROI generated by the option to invest an additional amount of $20,000 on inventory is justified because by investing in the additional inventory and also hiring a new worker, the investment shows a return of 182%.

Example 2

Table 10
DECISION MAKING ON INVESTING IN ACCOUNTS RECEIVABLES UNDER THROUGHPUT ACCOUNTING (MAXIMIZING PRODUCT-A)

	Maximizing Product-A		
	Units	Price	Total
Product-B: Additional weekly revenue	20	$100/unit	$2,000
Product-B: Additional weekly TVC	20	$40/unit	($800)
Product-B: Additional weekly throughputs			
Work week per year			48 weeks
Delta ΔT Additional throughput generated			$57,400
Delta ΔOE (additional bad debt)			($24,000)
Delta Net Profits (NP)			$23,400
Delta ΔI (additional accounts receivables)			$30,000
ROI (ΔNP/ ΔI)			118%
Hurdle rate of the firm			20%

The second example (Table 10) is that the same firm can sell all the products A and B they produce, if the company sells on credit to customers. Therefore, by increasing Accounts

Receivable (A/R) by $30,000 there will be a possibility of additional bad debt of $24,000. The investment decision question would be that by increasing A/R by $30,000 would the investment be justified if hurdle rate is 20%.

Once again, the above computed figures indicate that after investing $30,000 more for A/R, even after incurring $24,000 in bad debt, the firm can get an ROI of 118%, suggesting that the investment is attractive.

Make vs. Buy Decisions

Another important managerial decision that requires real-time information for accurate decisions is whether to make the product or components in-house or to buy them from vendors. The way cost accounting presents information on this matter is different from the information revealed by TA. To illustrate this, point an example is presented below (Table 11), where a firm requires 10,000 units of component #5707.

Table 11
MAKE VS BUY DECISION BASED ON COST ACCOUNTING

	Make Component #5707	Buy Component #5707
Material Cost	$35/unit	N/A
Direct Labour Cost	$60/unit	N/A
Direct Overhead Cost	$55/unit	N/A
Total Cost	$150/unit	$87.67/unit

Note: Direct labour and direct overheads are allocated costs.

The above table indicates only per unit cost and that buying the component from a vendor will be a more economically justifiable choice. Hence buy decision will easily supersede the make decision using cost accounting approach. However, in TA the information is presented in a different manner (Table 12).

Table 12
MAKE VS BUY DECISION BASED ON THROUGHPUT ACCOUNTING

	Make Component #5707	Buy Component #5707
Material Cost (TVC)	$35/unit	$87.67/unit
Units Required	10,000 units	10,000 units
Total Cash Outlay	$350,000	$876,700
Delta ΔT	(350,000)	(876,000)

Therefore, based on TA by making the component in-house, the firm has a ΔT=876,000 – 350,000= $526,700, in other words the firm will save $526,700 by making instead of buying. The inference would be that by making the product in-house the firm will increase its' throughput, in other words the decision is reversed in TA in contrast to the information presented by cost accounting.

CONCLUSION

This study presented an elaborate discussion on how TA offers a viable and simple alternative to the distortions created by cost accounting methods that lead to flawed managerial decisions. All existing cost accounting approaches rely on allocation of indirect costs. Furthermore, traditional cost accounting that assumes labour cost as variable cost is

mischaracterization of facts. The reality is that labour cost rarely varies with unit volume of sales on a one-to-one basis. In fact, the relationship between labour and units produced is typically a step function and not a perfect linear relationship. Therefore, the practice of assigning direct labour cost to products is a result of arbitrary allocation based on historical records that lead to distorted information. TA effectively deals with this issue by considering inventory as a part of investment along with other fixed assets, and takes it out of the picture by not considering it as part of TVC.

Another major concern that cost accounting poses is the way inventory is dealt with. As evidenced from the hypothetical examples in this study, inventory value can be manipulated to reflect higher or lower amounts of profits, by deciding how much to show as expense and how much to defer to subsequent periods by placing them on the balance sheet. Furthermore, inventory values mask the real value of inventory because a significant portion of the inventory may be obsolete, but unfortunately such information is not revealed in financial statements. In TA the scope of distortions by inventory value is dealt with by placing inventory as part of investment and only considering direct material used in the product as part of TVC.

Traditional cost accounting emphasizes cost control by focusing attention of decision-makers to SG&A (operating expenses) and then managing the costs incurred from inventory or fixed assets. However, TA completely flips the perspective by suggesting that focus should be primarily on generating more throughputs, and subordinating investments and operating expenses under it. Therefore, whether it is for company-wide decisions, business-unit decisions, product-level decisions, additional investment decisions or make-vs-buy decisions, the information presented to decision-makers by TA has no distortions and is based on real-time facts.

Despite the obvious merits of using TA, business organizations around the world are still mandated by GAAP (Generally Accepted Accounting Principles) and also by IFRS (International Financial Reporting Standards) to use traditional accounting methods to prepare financial reports. Therefore, for TA to find its' place in the world of managerial accounting as an alternative to distorted information presented by cost accounting, the international bodies need to officially acknowledge its' merits and allow for tangible changes in corporate financial reporting systems based on TA.

REFERENCES

ACCA. (2016). Throughput accounting and the theory of constraints, part 2. Retrieved July 01, 2017 from https://www.accaglobal.com/gb/en/student/exam-support-resources/fundamentals-exams-study-resources/f5/technical-articles/throughput-constraints2.html

Cooper, R., & Kaplan, R.S. (1988). Measure costs right: make the right decisions. *Harvard Business Review, 66*(5), 96-103.

Corbett, T. (1998). *Throughput accounting: TOC's management accounting system*. Great Barrington: North river press.

DugDale, D., & Jones, T.C. (1998). Throughput accounting: transforming practices?. *The British Accounting Review, 30*(3), 203-220.

Elsukova, T.V. (2015). Lean accounting and throughput accounting: An integrated approach. *Mediterranean Journal of Social Sciences, 6*(3), 83-83.

Ettenson, R., Conrado, E., & Knowles, J. (2013). Rethinking the 4 P's. *Harvard Business Review, 91*(1), 26-27.

Freeman, J. (2007). Theory of constraints and throughput accounting. *Topic Gateway Series and Technical Information Service.*

Goldratt, E.M. (1990). *Theory of constraints*. Croton-on-Hudson: North River.

Goldratt, E.M., & Cox, J. (1984). *The goal, croton-on-Hudson*. NY: North River Press Inc.

Goldratt, E.M., & Cox, J. (2016). *The goal: A process of ongoing improvement*. Routledge.

Harris, A.M. (2018). Keystone XL pipeline project blocked by judge in montana. Retrieved December 31, 2018 from https://www.bloomberg.com/news/articles/2018-11-09/keystone-xl-pipeline-project-blocked-by-judge-in-montana

Inman, R.A., Sale, M.L., & Green, K.W. (2009). Analysis of the relationships among TOC use, TOC outcomes, and organizational performance. *International Journal of Operations & Production Management*, *29*(4), 341-356.

Islam, K.A. (2015). Throughput accounting: a case study. *International Journal of Finance and Banking Research*, *1*(2), 19-23.

Kaplan, R.S., & Anderson, S.R. (2004). Time-driven activity-based costing. *Harvard Business Review*.

Kareh, A. (2018). *Evolution of the four Ps: Revisiting the marketing mix.*

Khan, A., Faisal, S., & Omar Abdullah Al Aboud, D. (2018). An analysis of optimal inventory accounting models-pros and cons. *European Journal of Accounting, Auditing and Finance Research*, *6*(3), 65-77.

Krauss, C. (2019). *Trump signs orders to speed up oil and gas pipeline construction*. New York Times.

Cox III, J.F., CFPIM, C., & Schleier Jr, J.G. (2010). *Theory of constraints handbook*. McGraw-Hill Education.

Londhe, B.R. (2014). Marketing mix for next generation marketing. *Procedia Economics and Finance*, *11*(1964), 335-340.

Lutilsky, I.D., Liović, D., & Marković, M. (2018). *Throughput accounting: Profit-focused cost accounting method.*

Northrup, C.L. (2004). *Dynamics of profit-focused accounting: Attaining sustained value and bottom-line improvement*. J. Ross Publishing.

Parkhi, S., Tamraparni, M., & Punjabi, L. (2016). Throughput accounting: an overview and framework. *International Journal of Services and Operations Management*, *25*(1), 1-20.

Putra, L.D. (2014). Types of costing methodology advantages and disadvantages. Retrieved February 22, 2017 from http://accounting-financial-tax.com/2011/10/types-of-costing-methodology-advantages-and-disadvantages/

Souren, R., Ahn, H., & Schmitz, C. (2005). Optimal product mix decisions based on the theory of constraints? Exposing rarely emphasized premises of throughput accounting. *International Journal of Production Research*, *43*(2), 361-374.

Utku, B.D., Cengiz, E., & Ersoy, A. (2011). Comparison of the theory of constraints with the traditional cost accounting methods in respect to product mix decisions. *Doğuş Üniversitesi Dergisi*, *12*(2), 317-331.

Woeppel, M. (2010). How to Grow Profit with Throughput Accounting. Report by Pinnacle Strategies, retrieved on 16 December 2016 from: http://3escp33iuwsj485tugc1mb91.wpengine.netdna-cdn.com/wp-content/uploads/bsk-pdf-manager/2016/07/How-to-Grow-Profit-with-Throughput-Acounting.pdf

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