THROUGHPUT ACCOUNTING IMPACT ON PERFORMANCE, EVALUATION - AN APPLIED STUDY AT INTEGRATED COACH FACTORY

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ABSTRACT
Changes in technology, level of competition, new business processes, uncertainties and risk in business environment birthed new methods of costing like throughput accounting(TA) for decision making. The goal of this study is to test for the impact of the use of Throughput management accounting method and to determine the usefulness of this method in providing management with the essential information for performance evaluation and accountability. TA is a cost accounting and management accounting technique that enables management to evaluate performance. The Integrated Coach Factory being a sub division in the ministry of railway was subjected to the research as one of India's industrial sector companies. Most Nigerian companies checked (Nigerian breweries, flour mill and Nestle) do not use TA method. The study followed a scientific methodology that incorporated both theory and practice. The study discovered a number of findings, the most significant of which is that the company did not make optimal use of available resources. This is due to a flaw in the implementation of plans and policies; because typical systems designed to operate efficiently result in a large amount of inventory, this has a negative effect on the business. It was concluded that throughput accounting is primarily concerned with sales as the sole source of (profit), as well as providing accurate and critical information about the most profitable product mix by rearranging coaches according to the completion rate for each minute the product consumes the limited resource during the manufacturing stages.

Keywords*: Constraint Theory, Performance Evaluation, Throughput Accounting, Traditional Income Statement.*

1. INTRODUCTION

Changes in the contemporary business environment which came as a result of many issues like globalization in the markets, new business processes, change in technology etch e-tare has necessitated the need for new accounting methods in business organizations as these changes requires taking measures and steps to appropriate these changes in order to remain in the competition market. For an organization to remain in business in the competitive environment there is need to manage the resources of the organization very well so that the customers will be maintained and the organizational goal and profitability is achieved.
With competition at an all-time high across organizations and corporations of diverse businesses, effectiveness and top-notch productivity has necessarily left behind the traditional and standard methods of accounting as it concerns performance evaluation and accountability. To utilize every bit of resources and harvest the greatest possible profit, organizations must make sure that they are up to date with current happenings in business (such as operations, distribution, marketing and so

on) which will ensure relevant current decisions that will affect business now and in the future. This is where Throughput Accounting becomes indispensable. Throughput Accounting, introduced by Eliyahu M. Goldratt in 1984, is a modern technique of management accounting which presents an alternative to conventional forms of accounting. Its main goal is to identify and take care of the limitations and constraints that can delay production and related processes, and thus lead to a delay in sales. Importantly, it takes time factor into account and helps to minimize any time loss that can cause a delay in revenue generation. Throughput accounting is a new management accounting approach that provides managers with support in decision making aimed at increasing a company's profitability (Egbunike, 2019). The aim of the use of throughput accounting is to achieve goal and increase profitability.

Despite advancements in science and technology throughout the years, the greatest challenge to humanity on our planet has always been challenges emerging from risk and uncertainty that result in material and financial losses (Ebere et al 2016). Businesses had no option but to alter their manufacturing processes and stay flexible in order to preserve profitability and sustainability when consumer and market needs changed (Lei & Li, 2017). As a result, it's critical to look for new ideas and ways for managing spending and providing data for performance evaluation. In management accounting, TA is a relatively recent concept. It is a method for identifying obstacles that prevent an organization from achieving its objectives and then focusing on basic measurements that drive behaviour in key areas toward achieving organizational objectives.

Throughput Accounting is a modern technique that has took shape to meet management's specifications for implementing continuous improvement concepts, as it provides needed insight into the development of operational performance by focusing on bottleneck areas and reducing completion times, as well as attempting to link throughput and operational resources expended. Intuitively we all know that generating greater revenues via sales need to be the principal focus of agencies in profit maximization. In line of this, emphasis has shifted in recent instances from cost-based accounting models such as managerial costing to a revenue-based accounting system recognized as throughput Accounting. Throughput Accounting is a vital development in present day accounting that approves managers to apprehend the contribution of restrained sources to the common profitability of the commercial enterprise(Bragg, 2007).

Throughput accounting view is that output should be confined to the extent of customers' demand and focal point of recreation need to be to locate approaches of raising customers' demand to a higher level. Any accounting system that does no longer take into account these constraints can't exact painting the functioning of an organization. This would possibly lead to administration taking wrong choices of product pricing. Make or purchase decision, discontinuance of a product or division and a host of different key managerial problems thereby affecting managerial effectiveness. It is in opposition to this backdrop that this learns about tends to check out the extent to which throughput accounting enhances fantastic managerial choices in commercial enterprise organizations. Perhaps the idea of throughput accountability with its recent applications has contributed extensively through offering a facts gadget in assisting financial gadgets when confronting tough stipulations and problems. This thinking has a modern understanding about the price structure with the aid of focusing directly on the cost of materials solely as variable costs while all different costs are fixed, and this is what made them gorgeous to the cutting-edge

manufacturing surroundings and that is due to the low contribution of the human element to the dependence of this environment on computerized work. In addition, throughout accounting in phrases of records is beneficial for supporting the administration in planning profitability through choosing it for the foremost combine that achieves its easiest profitability. To reap the above objective, the following proposition was once made by means of the researchers. H: throughput accounting notably enhance high quality managerial selections in enterprise business enterprise.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWPORK

2.1 Concept of Throughput Accounting

The concept of throughout accountability with its recent applications has contributed significantly through providing an information system in assisting economic units when confronting difficult conditions and problems. This concept has presented a modern perception about the cost structure by focusing directly on the cost of materials only as variable costs while all other costs are fixed, and this is what made them appropriate to the modern manufacturing environment and that is due to the low contribution of the human element to the dependence of this environment on automated work. In addition, throughout accounting in terms of information is useful for assisting the administration in planning profitability by selecting it for the optimal mix that achieves its highest profitability. Throughput Accounting emerged as a result of the development of the Theory of constraint by Goldratt.

When cost accounting was developed in the 1890s, labour was the largest fraction of product cost and could be considered a variable cost. Workers often did not know how many hours they would work in a week when they reported on Monday morning because time-keeping systems were rudimentary. Cost accountants therefore, concentrated on how efficiently managers used labour since it was their most important variable source. Now however, workers who come to work on Monday morning almost always work 40hours or more, their cost is fixed rather than variable. However, today many managers are still evaluated on their labour efficiencies and many "downsizing" "rightsizing" and other labour reduction campaigns are based on them. Goldratt argues that under current conditions, labour efficiencies lead to decisions that harm rather than help organizations. Throughput accounting therefore removes standard cost accounting's reliance on efficiencies in general and labour efficiency in particular from management practice. Many cost and financial accountants agree with Godlratt's critique, but they have not agreed on a replacement of their own and there is enormous inertia in the installed base of the people trained to work with existing practices.

Throughput Accounting also pays particular attention to the concept of 'bottleneck' (referred to as constraint in the Theory of Constraints)in the manufacturing or servicing processes. The aim of throughput accounting is to identify bottleneck resources and remove them or, if this is not possible, ensure that they are fully utilized at all times. Non-bottleneck resources should be scheduled and operated based on constraints within the system, and should not be used to produce more than what the bottleneck resources can absorb. It is therefore advocated that non-bottleneck resources should not be utilized to hundred percent of their capacity, since this would merely result in an increase in inventory. This, idle time in non-bottleneck areas is not considered detrimental to the efficiency of the organization If it were utilized, it would result in increased inventory without

a corresponding increase in throughput for the system (Drury, 2008). Goldratt and Cox (1992) advocated that organizations that wish to achieve their objective should test proposed managerial decisions against three measures:
(i) How much money is coming in') (Throughput)
(ii) How much money is held in inventory,) (Investment)
(iii) How much money is going out (Operating expenses)

A feasible decision is that one which increases throughput while simultaneously reducing inventory and operating expenses. However, the scope for reducing the latter is limited since they must be maintained at some minimum level of production to take place at all. In other words, operating expenses are assumed to be fixed. But management has the tendency to create more inventory than the firm's requirement so as to improve their reported profit because increase in closing inventory increase gross profit. Throughput accounting uses the minimalist approach of only assigning to the value of inventory, the cost of materials consumed in its production on the ground that raw material is the only totally variable cost involved. This approach therefore results in complete elimination of any incentive-for managers to produce excess quantities for inventory because they can no longer improve their financial results by storing operating expenses in inventory.

2.2 Application of throughput Accounting system

The application of throughput accounting depends on different concepts. Lucey (2003) identified three basic theorems for the application of throughput accounting:

Theorem I:
With the exception of material cost in the short-run, most factory costs (including direct labour) are fixed. These fixed Costs can be grouped together as total Factory Costs (TFC), thus:
Throughput = Sales –total variable cost, Net profit= Throughput -total factory cost.

Theorem 2:
With Just-In-Time System, products should not be made unless there is a ready market for them because the ideal inventory is zero. The effect of this is that there will be unavoidable idle capacity in some operations, except for the operation that is the bottleneck of the moment working on output just to increase Work-In- Progress (WIP) on finished goods stocks create no profit and so would not be encouraged. If the resource cannot be exploited fully because of the bottleneck's limited capacity then letting it stand idle when it has completed the work required, costs nothing. This means that profit is inversely proportional to the level of inventory in the system. This can be expressed thus;
Profit= F(1/MRT)
MRT Where MRT = Manufacturing Response Time.

Theorem 3:
Profitability is determined by how quickly goods can be produced to satisfy customer's orders. Producing for stock does not create profits. Improving the throughput of bottleneck operations will increase the rate at which customer demand can be met and will thus improve profitability. Contribution in its traditional form (sales -variable costs) is not a good guide to profitability

because capacity factors and the rate of production are ignored. Using throughput accounting, Product returns should be measured thus;
(i) Return per factor hour (sales -material cost) -:-Time on key resource
(ii) Cost per factory hour, Total factory cost/Total time available on key resource
(iii) Throughput accounting ratio = return per factory hour/cost per factory hour. The throughput accounting ratio must be greater than I for effective decision

3. RESEARCH METHODS

An overview of integrated coach factory
The integral coach factory (ICF) was inaugurated by the first prime minister of India pt. Jawaharlal Nehru on 2nd October 1955. Later, the furnishing division was inaugurated on 2nd October, 1962 and the production of fully furnished coaches steadily increased over the years. Spread over nearly 511acres, it has about 10,000 employees to turnout more than 3500 coaches every year which includes conventional and distributed power rolling stock (DPRS). ICF is capable of manufacturing various types and variants simultaneously. It has produced 59,635 coaches' since its inception in 500 plus variant. ICF excelled not only in production of coaches in other aspects also by feathering various certificates, awards like platinum rated green building, platinum rated green school, Green Co Gold for best industrial practices and maintaining green environment.

Throughput accounting in practice at the Integral Coach Factory
The use of this concept's fundamental assumptions is necessary for determining the cost structure of products, as well as the time required to complete each product in the stages through which it goes, in order to apply the processes of accounting for achievement. These assumptions will be monitored throughout the cost structure, constraint determination, and time management processes as follows:

To begin, the cost structure of the products is determined using throughput accounting:
1. **Variable costs**: Because they are the only variable element, it is the only costs under the usage of Throughput accounting.
2. **Operating expenses**: These are fixed expenditures that are allocated to the period in which they were incurred regardless of production volume. Indirect materials, direct and indirect salaries, and indirect industrial costs are also included.
Second: determining production costs based on Royal coach company records as follows:
According to statistics derived from the integral coach factory Division, total production expenses in the Royal coach company were 81,964,998,973.32 ID in Table 1:

THE COST OF INTEGRATED ROYAL FACTORY 2018		
Serial no	Details	Cost (ID)
1	Raw material(variable cost)	80,055,766,187.00
2	Operating cost	1,909,232,786.32
3	Total cost	81,964,998,973.32

2- **For each product**, the production quantities, sales, and selling prices for the year 2018 were computed as given in Table 2.

THE AMOUNT OF PRODUCTION AND FREIGHT(INCIDENTIAL CHARGES)			
Serial no	Type of coaches	Number of coach	Freight charges
			(crore)
1	AC EMU series	708	-243,311.28
2	MEMU	72	-5,980.32
3	TRAIN 18	16	-784,768.00
4	KM	16	-339.20
5	DMU	105	-1,180.20
6	SPART	21	-129.36
7	LHB COACHES	2222	-272,195.00
8	SPIC & OTHERS	63	-141,174.16
9	EXPORT	39	-14,174.16
TOTAL		3262	-1,463,251.68

NOTE: Freight charge is computed from the factory report used for this research

3- **Calculating the cost of production of each coach under each type:** In this phase, the entire cost of raw materials, production costs, and administrative services costs are already lumped together, which it will be used to calculate the cost of producing a coach under each type, as shown in the Table 3 below:

DISPLAYS THE COST OF PRODUCING A COACH

Serial no	Coaches types	No of coaches	Raw material per coach	Administrative cost per coach	Cost per coach	Total cost
1	AC EMU series	708	22,677.52	5,669.38	28,346.90	20,069,606.00
2	MEMU	72	24,252.95	6,063.23	30,316.19	2,182,766.00
3	TRAIN 18	16	49,465.60	12,366.40	61,832.00	989,312.00
4	KM	16	42,360.00	10,590.00	52,950.00	847,200.00
5	DMU	105	21,331.80	5,332.92	26,664.76	2,799,800.00
6	SPART	21	30,080.00	7,520.00	37,600.00	789,600.00
7	LHB COACHES	2222	10,500.97	2,625.24	13,126.22	29,166,480.60
8	SPIC&OTHERS	63	185,184.00	46,296.00	231,480.00	14,583,240.30
9	EXPORT	39	99,714.48	24,928.62	124,643.10	4,861,081.10

Note: values for total cost and number of coached produced is computed from integrated coach factory 2018/2019 report, the cost of raw material and administrative is derived by dividing the cost of producing a cost of coach in the ratio of the two cost as available in the manufacturing account.

4- **Preparing the traditional income statement for each product**: For the year 2018/2019, the income statement will be prepared using the traditional method used in the company on the basis of products for research purposes, whereas the income statement in the integrated coach factory is prepared on the basis of total sales, so it will be calculated using the amount of sales and selling prices as well as the cost of one coach of total costs Production and administrative service, as shown in Table 4 below:

THE TRADITIONAL INCOME STATEMENT FOR EACH COACH BASE ON INTEGRATED ROYAL FACTORY

Serial no	**Product**	**Sales Revenue**	**Production cost**	**Margin profit**	**Administrative service cost**
1	AC EMU series	172,264,386.24	16,055,684.80	156,208,701.44	4,013,921.20
2	MEMU	430,583.04	1,746,212.80	-1,315,629.76	436,553.20
3	TRAIN 18	12,556,288.00	791,449.60	11,764,838.40	197,862.40
4	KM	5,427.20	677,760.00	-672,332.80	169,440.00
5	DMU	123,921.00	2,239,840.00	-2,115,919.00	559,960.00
6	SPART	2,716.56	631,680.00	-628,963.44	157,920.00
7	LHB COACHES	604,817,290.00	23,333,184.48	581,484,105.52	5,833,296.12
8	SPIC & OTHERS	8,956,972.08	11,666,592.24	-2,709,620.16	2,918,648.06
9	EXPORT	552,792.24	3,888,864.88	-3,336,072.64	972,216.22
TOTAL		799,710,376.36	61,031,268.80	738,679,107.56	15,259,817.20

NOTE:
Sales revenue = sales quantity (table 2) * Sales Price
Production Cost = Sales Quantity * Total of production cost
= Sales Quantity *Admin. cost + Production Cost
Margin Profit = Sales Revenue - Production Cost
Admin. Cost = Sales quantity (Table 2) * Admin. Cost for 1m3
Net Profit = Margin Profit – Admin. Cost

Constraints Determining
The time it takes for each product in the production Process to reach the stage where it becomes fully manufactured, which can be identified in the next step of the application of the Throughput accounting, is used to determine the production process's obstacles.

Time Management

The research findings were chosen based on the daily transfer, so the available time is 1440 minutes per day, measured by 24 hours x 60 minutes, when the shift system is divided into three groups of workers divided on one day at a rate of (8 hours) for each worker. The coach pass through numerous stages which includes bogie frame, bogie bolster, centre pivot pin, wheel set assembly, roller bearing assembly, brake beam assembly, brake head, brake block brake lever, brake cylinder, primary suspension, dashpot arrangement, spring seating, buffer height adjustment, secondary suspension. As a result of the unstructured interview with the engineers in the production department, it was discovered that the average time for assembling of a coach will take 24hours but it varies according to the types of coach for instance AC EMU takes an average of 20 hours but it takes more time for the assembling of LHB coaches.

TABLE 5

TIME REQUIRED TO ASSEMBLE EACH TYPE OF COACH		
Serial no	Product	Time required(minutes)
1	AC EMU series	1200
2	MEMU	600
3	TRAIN 18	336
4	KM	600
5	DMU	600
6	SPART	600
7	LHB COACHES	1470
8	SPIC & OTHERS	660
9	EXPORT	600

Looking at the company's practical reality, it was discovered that the time required to assemble LHB coaches is 1470minutes, when all products are done at the same time, but the time taken for each type of coach varies.

4. RESULTS AND DISCUSSIONS

Creating an income statement using Throughput Accounting

To prepare an income statement using Throughput accounting, the operating expenses must be distributed based on the time of completion, depending on the amount of sales and the selling price:

Calculating the value of Throughput time

The value of Throughput time must be known in order to extract the share of each product from the operating expenses, as shown in Table 6 below

DERIVING THE VALUE OF COACH THROUGHPUT TIME

Serial n	Product	Sales quantity	Sales price	Operating time/seconds	Value of throughput time
1	AC EMU series	708	343.66	1.69%	412,392.00
2	MEMU	72	83.06	8.33%	49,836.00
3	TRAIN 18	16	49.4	21%	16,598.40
4	KM	16	21.2	37.50%	12,720.00
5	DMU	105	11.24	5.71%	6,744.00
6	SPART	21	6.16	28.57%	3,696.00
7	LHB COACHES	2222	122.5	0.66%	180,075.00
8	SPIC OTHERS	63	363.44	10.47%	239,870.40
9	EXPORT	39	363.44	15.38%	218,064.00
TOTAL					1,139,996.00

NOTE:
Operating time = Total product time (Table 5) / Production quantity (Table 2.)
Throughput time value = sales quantity (table 2) * selling price (table 2) *

Determining the product's share of the value of Throughput time

The product's share of the value of Throughput time = the value of the product completion time (Table 6) / the total value of the time of Throughput of the products (Table 6) x 100 = using AC EMU series as example291,815,870.29/ 1,061,830,336.89*100 =27.48%throughput time value The Table 7 below shows the percentage of each product based on the value of throughput time.

THE PERCENTAGE OF EACH COACH BASE ON THE VALUE OF THROUGHPUT TIME			
Serial no	Coach	Throughput time value	Product share from throughput value
1	AC EMU series	27.48%	291,815,870.29
2	MEMU	0.33%	3,588,048.47
3	TRAIN 18	24.83%	263,682,048.00
4	KM	0.02%	203,520.00
5	DMU	0.07%	708,084.59
6	SPART	0.01%	77,614.84
7	LHB COACHES	37.67%	400,086,637.34
8	SPIC OTHERS	8.77%	93,164,357.54
9	EXPORT	0.80%	8,504,155.82
	Total	100%	1,061,830,336.89

Calculate the Product's Percentage of Total Operating Expenses

Using Tables (1) and (7), the share of each coach in operating expenses can be calculated as follows (using AC EMU coach as an example): The product's share of the total operating expenses = the total operating expenses (Table 1) * product's share of the Throughput time value (Table 7)

Serial no	Coach	Sales revenue	Raw material cost	Margin profit	Production cost	Net profit
1	ACEMU series	172,264,386.24	39,718,800.00	132,545,586.24	412,392.00	171,851,994.40
2	MEMU	430,583.04	1,249,272.00	-818,688.96	49,836.00	380,747.04
3	TRAIN 18	12,556,288.00	1,236,624.00	11,319,664.00	16,598.40	12,539,689.60
4	KM	5,427.20	1,326,400.00	-1,320,972.80	12,720.00	-7,292.80
5	DMU	123,921.00	1,333,500.00	-1,209,579.00	6,744.00	117,177.00
6	SPART	2,716.56	1,075,200.00	-1,072,483.44	3,696.00	-979.44
7	LHB COACHES	604,817,290.00	49,995,000.00	554,822,290.00	180,075.00	604,637,215.00
8	SPIC OTHERS	8,956,972.08	2,247,021.00	6,709,951.08	239,870.40	8,717,101.68
9	EXPORT	552,792.24	912,600.00	-359,807.76	218,064.00	334,728.24
TOTAL		799,710,376.36	99,094,417.00	700,615,959.36	1,139,996.00	798,570,380.56

PRODUCT SHARE OF TOTAL OPERATING EXPENSES			
Serial no	Coach	Percentage	Product share from operating expenses
1	AC EMU series	27.48%	524,701,930
2	MEMU	0.33%	6,451,520.10
3	TRAIN 18	24.83%	474,115,679
4	KM	0.02%	365,940.81
5	DMU	0.07%	1,273,177.30
6	SPART	0.01%	139,555.99
7	LHB COACHES	37.67%	719,379,075
8	SPIC OTHERS	8.77%	167,514,941
9	EXPORT	0.80%	15,290,967
	Total	100%	1,909,232,786.32

Creating an income statement using the Throughput accounting approach, based on the results of calculating and determining the share of each product in operating expenses

INCOME STATEMENT BASED ON THE THROUGHPUT ACCOUNTING METHOD
The raw material costs and throughput margins in Table (9) were calculated using the following equations (Light oil as a sample):
Raw Material costs = sales quantity (Table 2) x the cost of producing one coach
Throughput Margin = Revenue - Raw Material Costs

5. CONCLUSION/RECOMMENDATIONS

We have a look at that the cost of some coaches are higher than they have been in the ordinary system, owing to the exceptional bases for allocating costs, where in the traditional system the allocation of cost is primarily based on the extent of production, whereas in throughput accounting the allocation is based on the amount generated on the use of coach through freight charge. The ordinary system's distribution bases may additionally be deceptive in terms of coach unit cost, whereas Throughput accounting focuses on time as groundwork for distributing running expenses. As a result, the company's exercise yielded a earnings of in accordance to Throughput accounting 798,570,380.56), while the traditional resulted in a earnings of (723,419,290.36) in accordance to the usual income statement, this reduction in profit is due to the high cost charged to the merchandise, according to normal method of accounting. In the typical accounting system, product stock is charged with each direct materials and direct wages, as well as oblique industrial costs, this consequences in a expand in cost charged to sales, which leads to minimize profits, while in throughput accounting system, inventory is charged with the cost of raw material for completion (direct materials). Sales are solely charged for direct wages and oblique industrial overheads

We also noticed that the outcome of each coach's activity ranged from high to low, profit increased by (ID 75,151,090.2) over what it was under the traditional system, while the result of other products' activity decreased from what it was under the traditional system Looking at the income statement, it is clear that the company's throughput of some coaches, specifically MEMU, KM, DMU and EXPORT, does not cover its operating expenses. As a result, the company should strive to increase Throughput by increasing sales.

Distributing costs to products in pre-determined proportions based on samples is an incorrect procedure because it misleads the cost of the unit produced, as a product is charged with more or less than necessary, weakening the company's cost accuracy The use of a single basis, time spent in operation according to Throughput accounting, provides accuracy and fairness in cost distribution to products. As a result, the company should strive to increase Throughput by increasing sales.

The study recommends using the Throughput accounting approaches especially Nigerian manufacturing companies because it provides better template and accurate information for planning, administrative decision-making, and its role in more accurately measuring and evaluating performance. In addition, the cost structure classification should be reconsidered in light of the modern manufacturing environment and in accordance with the Throughput accounting approach.

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