



Empirical evaluation of the impact of throughput costing on the financial metrics of manufacturing firms in Nigeria

Osirim Monday^{1*}, Wadike Chile George², Davies Stanley Diepiriye³

¹⁻³ Departments of Accountancy, Ken Saro-Wiwa Polytechnic, Bori, P.M.B. 20, Rivers State, Nigeria

* Corresponding Author: **Osirim Monday**

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Abstract

The main purpose of the study was to empirically examine the relationship between throughput costing and financial metrics of manufacturing firms in Nigeria. Secondary data sourced from audited annual reports of Guinness Nigeria plc and International Breweries Plc for the period 2008-2019 was utilized for the study. The data collected was analysed using ordinary least regression analysis with the aid of SPSS. The result of the study reveal an insignificant relationship between throughput costing (INV, INSALEs) and financial metrics (NPM, ROI) of manufacturing firms in Nigeria. Based on this outcome, it was recommended that manufacturing firms in Nigeria should in addition to implementing the system of throughput costing in the management of resources, should carry out other managerial accounting techniques such as Just-in Time system, Activity Based Costing, Target costing and Kaizen costing system so as to increase their financial performance.

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1. Introduction

Throughput costing is a principle-based and simplified strategic management accounting approach that provides managers with decision support information for cost minimization and enterprise profitability improvement. Of course, the key objective of any business is to make and maximize profit while other secondary objectives include going concern, growth, corporate social responsibility, benefits to employees and so on (Ayinde, 2006)^[4]. Though other objectives are also considered very important as listed above, but profit maximization is usually the ultimate because it maximizes the shareholders wealth which is the ultimate aim of investing in a business. People will naturally prefer to invest in a highly profitable business (Drury, 2005)^[9]. Therefore, in the long run only the profit maximizers survive in the business environment. However, for adequate profit to be recorded from a business there is a need for adequate control of cost. Horngren (2006)^[19] stated that a company with adequate cost structure possess the higher chance of attaining its profit target.

Innes, John, Mitchell and Sinclair (2000)^[21] assert that the survival triplet today for any company is how to manage product/service cost, quality, and performance. The customers are continuously demanding high quality and better performance products/services and at the same time, they want the price to be reasonably low. The shareholders are also demanding a required rate of return on their investment from the company. Thus cost has become a residual. The challenge is being able to manufacture products or provide services within the acceptable cost framework. Innes, John, Mitchell and Sinclair (2000)^[21] concluded their study with a recommendation that cost management has to be an ongoing and continuous improvement activity within the company so as to enhance profitability and survival.

Throughput Costing also called Throughput Accounting (TA) is a principle-based and simplified management accounting approach that provides managers with decision support information for enterprise profitability improvement (Wikipedia, 2018)^[32]. Throughput costing is relatively new in management accounting. It is an approach that identifies factors that limit an organization from reaching its goal, and then focuses on simple measures that drive behavior in key areas towards reaching

organizational goals. Throughput Accounting was proposed by Eliyahu M. Goldratt as an alternative to traditional cost accounting (Goldratt, 1990) ^[11]. As such, Throughput Accounting is neither cost accounting nor costing because it is cash focused and does not allocate all costs (variable and fixed expenses, including overheads) to products and services sold or provided by an enterprise (Eliyahu, Goldratt & Cox, 2013). Considering the laws of variation, only costs that vary totally with units of output e.g. raw materials, are allocated to products and services which are deducted from sales to determine Throughput. Throughput Costing and Accounting is a management accounting technique used as the performance measure in the Theory of Constraints (TOC). It is the business intelligence used for maximizing profits, however, unlike cost accounting that primarily focuses on 'cutting costs' and reducing expenses to make a profit, Throughput Accounting primarily focuses on generating more throughput (Corbett, 2014) ^[7].

Conceptually, Throughput Costing seeks to increase the speed or rate at which throughput is generated by products and services with respect to an organization's constraint, whether the constraint is internal or external to the organization. Throughput Accounting is the only management accounting methodology that considers constraints as factors limiting the performance of organizations (Noreen, 2009) ^[28]. 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 resource. However, workers who come to work on Monday morning almost always work 40 hours 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. Bragg (2015) ^[5] argues that under current conditions, labour efficiencies lead to decisions that harm rather than help organizations.

Throughput Costing and Accounting, therefore, removes standard cost accounting reliance on efficiencies in general, and labour efficiency in particular, from management practice. Many cost and financial accountants agree with Goldratt's critique, but they have not agreed on a replacement of their own and there is enormous inertia in the installed base of people trained to work with existing practices. Management accounting is an organization's internal set of techniques and methods used to maximize shareholder wealth. Throughput Accounting is thus part of the management accountants' toolkit, ensuring efficiency where it matters as well as the overall effectiveness of the organization. It is an internal reporting tool (Corbett, 2014) ^[7]. Throughput Accounting improves profit performance with better management decisions by using measurements that more closely reflect the effect of decisions on three critical monetary variables.

Accountability in the manufacturing industry in Nigeria will be effective if throughput costing is applied in the sector because one of the most important aspects of Throughput costing is the relevance of the information it produces. Throughput Accounting reports what currently happens in business functions such as operations, distribution and

marketing. It does not rely solely on financial accounting reports (that still need to be verified by external auditors) and is thus relevant to current decisions made by management that affect the business now and in the future.

1.1. Statement of the problem

The sole aim of every business organisation such as manufacturing firm is to make and maximize profit for the business why at the same time reducing the cost of production. One of the major problems of the management of manufacturing firm is how to reduce the cost of production. In solving this problem, management of manufacturing firm adopt a number of management and cost accounting techniques. One of such technique is the throughput costing method. Research on the impact of throughput costing on firm performance in Nigeria has been very scanty. Moreso, the few existing literature on the impact of throughput costing on performance of manufacturing firm has been split on this issue, with some studies finding a positive effect of throughput costing on performance of manufacturing firm, and others finding a negative effect. Some other research findings reveal a non-significant effect. According to review of literature the research problems arise from two sides namely, first little research has been reported on the quantitative tangible and intangible benefits of throughput costing implementation especially in Nigeria. This has therefore created a research gap in literature that needs to be filled and this study intend to fill this gap, As a result of the above, it becomes relevant for a study to be undertaken to find out if there exist any relationship between throughput costing and performance of manufacturing firm in Nigerian.

1.2. Objectives of the study

The main objective of this study is to investigate the impact of Throughput Costing on the financial metrics of manufacturing firms in Nigeria. The specific objectives of the study are:

1. To investigate the relationship between Inventory Turnover and Net Profit Margin
2. To evaluate the relationship between Inventory Turnover and Return on Investment (ROI).
3. To investigate the relationship between increase in sales and Net Profit Margin.
4. To investigate the relationship between increase in sales and Return on Investment.

1.3. Research questions

Based on the objectives of the study, the following research questions were raised for the study:

1. To what extent does inventory turnover influence net profit margin in your firm?
2. To what extent does inventory turnover affect return on investment in your company?
3. To what extent does increase in sales impact on net profit margin of your company?
4. To what extent does increase in sales affect return on investment of your firm?

1.4. Research hypothesis

Based on the research objectives and the underlying research questions, the following hypotheses are devised:

H₀₁: There is no significant relationship between inventory turnover and net profit margin.

H₀₂: There is no significant relationship between inventory

turnover and return on investment.

Ho₃: There is no significant relationship between increase in sales and net profit margin.

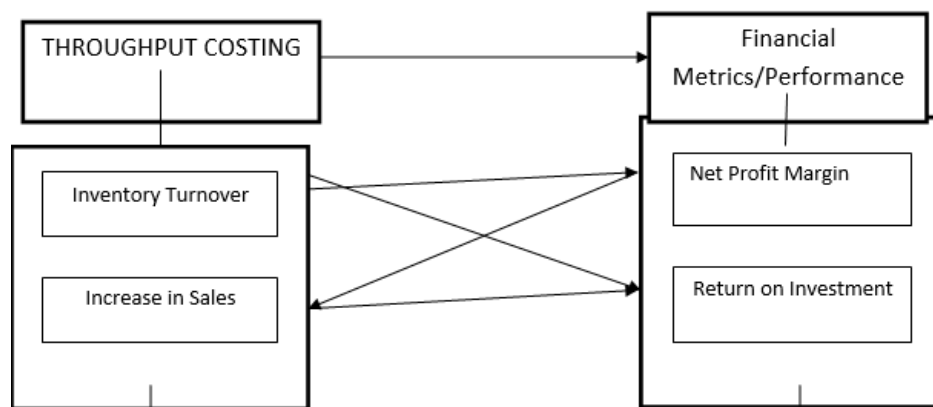
Ho₄: There is no significant relationship between increase in sales and return on investment.

2. Conceptual framework

According to Kombo and Tromp (2006) ^[23], a concept is an abstract or general idea inferred or derived from specific instances. Unlike a theory, a concept does not need discussion to be understood. A conceptual framework is a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation (Kombo and Tromp, 2006) ^[23]. The conceptual framework for the this study showed how Throughput Costing affect the

performance of manufacturing companies in Nigeria which is shown in Figure 1.1 below. The conceptual framework conceptualizes that Throughput Costing (Inventory Turnover) affect performance which is ascertained through Net Profit Margin and ROI.

The conceptual framework of the Throughput Costing will be examined as illustrated in figure 1.1 below. The independent variable is Throughput Costing which is explained by two variables namely: Inventory Turnover and increase in sales while the dependable variable is financial metrics which is measured by two variables namely: Net Profit Margin and Return on Investment. This implies that if the independent factors are enhanced by the firm there will be increase in Net Profit Margin and Return on Investment.



Source: Researcher conceptualisation

Fig 1: Conceptual Framework of the relationship between Throughput costing and performance of manufacturing firms

2.1. Concept of Throughput Costing/Accounting

Throughput costing is a costing approach under which only direct materials are recorded as inventory costs while all other manufacturing costs (including direct labour and variable factory overhead) are expensed as period costs. Selling and administrative costs are expensed as period costs as well (Sheu, Chen and Kovar, 2003) ^[30]. Lea, (2007) ^[24] posit that throughput costing treats all costs as period expenses except for direct materials. It is also called super-variable costing. It is very suitable for those companies where labour and overheads are fixed costs. Assembly-line and continuous processes that are highly automated are most likely to meet this criterion. In such company, workers are usually well-educated engineers or technicians employed on permanent basis.

According to Sheu, Chen and Kovar (2003) ^[30], the main features of throughput costing are:

- It helps incremental analysis for meeting special orders when there is an excess capacity. An airline can take passengers much below the normal fare when it observes that some seats are empty for want of booking or cancellation or no-show passengers.
- It is a dynamic, integrated, principle-based approach.
- It provides managers with decision support information for optimization of resources.

Throughput Cost considers only raw materials as product costs, cost information is available instantly. If a university provides every student with a laptop and set of books on admission, the direct costs are available even before the student leaves the admission office (Hilmola, 2004) ^[16].

Hilmola and Lättilä (2008) ^[18] noted that in an automated process direct material may be the only unit-level level activity and so is the only product cost. It would reduce incentive to overproduce. Moreover, average unit cost will not vary with the changes in production levels.

Throughput Accounting (TA) can be understood as a simplified accounting system based on Theory of Constraints (ToC) principles. TA makes growth-driven management and decision making simpler and understandable even for people not familiar with traditional accounting (Dugdale and Jones, 1998) ^[8]. Beyond simplifying, TA has a different approach compared to traditional accounting. The latter will focus on cost control (cost of goods sold) and minimizing the unit cost while TA strives to maximize profit. Throughput Accounting sets the base for Throughput Analysis, helping to make decisions in the Theory of Constraints way (Gupta, 2012).

According to Gupta (2012), throughput accounting is a management accounting approach that focuses on the throughput of cash from sales and the truly variable costs of producing an additional unit of a product or service. It is designed to support management decision making. Throughput accounting is particularly useful for identifying products that are generating the most cash flow for each incremental unit of production. Goldratt's alternative begins with the idea that each organization has a goal and that better decisions increase its value (Goldratt, 1990) ^[11]. The goal for a profit maximizing firm is stated as, increasing net profit now and in the future. Profit maximization seen from a Throughput Accounting viewpoint, is about maximizing a

system's profit mix without Cost Accounting's traditional allocation of total costs. Goldratt and Cox (1993) ^[13] posit that Throughput Accounting actions include obtaining the maximum net profit in the minimum time period, given limited resource capacities and capabilities. These resources include machines, capital (own or borrowed), people, processes, technology, time, materials, markets, etc. Throughput Accounting applies to not-for-profit organizations too, where they develop their goal that makes sense in their individual cases, and these goals are commonly measured in goal units.

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. According to Goldratt and Cox (1993) ^[13], Throughput Accounting uses three measures of income and expense:

- a. Throughput (T) is the rate at which the system produces "goal units." When the goal units are money (in for-profit businesses), throughput is net sales (S) less totally variable cost (TVC), generally the cost of the raw materials ($T = S - TVC$). Note that T only exists when there is a sale of the product or service. Producing materials that sit in a warehouse does not form part of throughput but rather investment. ("Throughput" is sometimes referred to as "throughput contribution" and has similarities to the concept of "contribution" in marginal costing which is sales revenues less "variable" costs – "variable" being defined according to the marginal costing philosophy.)
- b. Investment (I) is the money tied up in the system. This is money associated with inventory, machinery, buildings, and other assets and liabilities. In earlier Theory of Constraints (TOC) documentation, the "I" was interchanged between "inventory" and "investment." The preferred term is now only "investment." Note that TOC recommends inventory be valued strictly on totally variable cost associated with creating the inventory, not with additional cost allocations from overhead.
- c. Operating expense (OE) is the money the system spends in generating "goal units." For physical products, OE is all expenses except the cost of the raw materials. OE includes maintenance, utilities, rent, taxes and payroll.

According to Goldratt and Cox (1993) ^[13], organizations that wish to increase their attainment of *The Goal* should therefore require managers to test proposed decisions against three questions. Will the proposed change:

1. Increase throughput? How?
2. Reduce investment (inventory) (money that cannot be used)? How?
3. Reduce operating expense? How?

The answers to these questions determine the effect of proposed changes on system wide measurements:

1. Net profit (NP) = throughput – operating expense = $T - OE$
2. Return on investment (ROI) = net profit / investment = NP/I
3. TA Productivity = throughput / operating expense = T/OE
4. Investment turns (IT) = throughput / investment = T/I
5. Throughput = Net profit + operating expenses

These relationships between financial ratios as illustrated by

Goldratt are very similar to a set of relationships defined by DuPont and General Motors financial executive Donaldson Brown about 1920. Brown did not advocate changes in management accounting methods, but instead used the ratios to evaluate traditional financial accounting data.

2.2. Strengths of throughput costing to manufacturing firms

One of the most important aspects of Throughput Accounting is the relevance of the information it produces. Throughput Accounting reports what currently happens in business functions such as operations, distribution and marketing. It does not rely solely on GAAP's financial accounting reports (that still need to be verified by external auditors) and is thus relevant to current decisions made by management that affect the business now and in the future. Throughput Accounting is used in Critical Chain Project Management (CCPM), Drum Buffer Rope (DBR)-in businesses that are internally constrained, in Simplified Drum Buffer Rope (S-DBR) - in businesses that are externally constrained (particularly where the lack of customer orders denotes a market constraint), as well as in strategy, planning and tactics, etc (Goldratt, 1994) ^[12].

The main tenet of throughput accounting is that a company must carefully manage the bottleneck operation in its production facility, so that the largest possible contribution margin is created. The main advantage of throughput accounting is that it yields the best short-term incremental profits if it is religiously followed when making production decisions.

Throughput costing using Theory of Constraint (TOC) concept avoids cost allocation semantics and restructures the financial control system from one based on reporting entities, such as departments, to a companywide overview of value streams.

Throughput costing using Theory of Constraint (TOC) recognises that some non-critical machines or production facilities will not be used to capacity. Its proponents believe simple recognition is very advantageous because TOC prevents non-critical machines being run to capacity for no purpose if not all their total output can be used (Goldratt, 1990) ^[11].

The advantage lies in avoiding the accumulation of the associated excess stocks and work in progress. It also addresses the weakness of managers seeking to optimise production on particular machines if this is sub-optimal for the firm. Markets and customer requirements are constantly changing and the business model must respond quickly. Goldratt's fifth step recognises this requirement (Goldratt, 1994) ^[12].

Throughput Accounting is an important development in modern accounting that allows managers to understand the contribution of constrained resources to overall profitability. It also refocuses away from cost accounting's reliance on efficiencies. TA improves profit performance through better analytical decisions based on three critical monetary variables, namely throughput, inventory and operating expense. It is sometimes referred to as throughput contribution and is similar to the concept of 'contribution' in marginal costing i.e. sales revenue less 'variable' costs. Supply chains transform components into a finished product that is delivered to the end customer. Goldratt's fundamental rethinking of chain management is best described as a shift from the 'cost world' to the 'throughput world'.

2.3. Shortcomings of throughput costing

Specific criticisms have been levelled at throughput costing by Souren Ahn and Schmitz (2005) ^[31] and are discussed below:

1. They are short-term decision tools.
2. They may only be valid concepts if applied to the totality of the supply chain including management, production, resources and support.
3. Dependent on circumstances, operating expenses under TOC/TA are regarded as fixed, which is simplistic in the view of detractors. Therefore TOC and TA is basically the same thing as variable costing.

The credibility of TOC was seriously debased when Galloway and Waldron discovered a number of difficulties with their TA formulation. They amended their TA departmental performance measures and withdrew TA product costing in favour of an activity based costing (ABC) approach. Since then ABC has been strongly attacked by Goldratt as a fruitless attempt to save the old 'cost world' thinking.

2.4. Concept of financial metrics/performance

Financial metrics are indicators that measure the financial well-being /performance of a firm and they are the most frequently used type of performance measured in economic studies, and this metrics is most frequently measured using indicators based on revenues, while other indicators that are often used include return on assets and profitability indicators (Hult *et al.*, 2008) ^[20]. According to research by Allouche and Laroche (2005) ^[25], indicators based on accounting data display a significantly stronger relationship to competitive factors than other types of indicators.

In this paper there was selected for performance measurement a traditional and commonly used indicator for financial proportional performance based on accounting data – Net Profit Margin (NPM) and Return on Investment. Net profit margin is the percentage of revenue remaining after all operating expenses, interest, taxes and preferred stock dividends (but not common stock dividends) have been deducted from a company's total revenue. The formula for net profit margin is:

Net Profit Margin = (Total Revenue – Total Expenses)/Total Revenue

Net Profit Margin = Net Profit/Total Revenue * 100

By dividing net profit by total revenue, a manufacturing firm can see what percentage of revenue made, which is good for investors.

Return on investment (ROI) is a ratio between the net profit and cost of investment resulting from an investment of some resources. A high ROI means the investment's gains favorably to its cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiencies of several different investments (Chen, 2019). In purely economic terms, it is one way of relating profits to capital invested. Return on investment is a performance measure used by businesses to identify the efficiency of an investment or number of different investments.

In business, the purpose of the return on investment (ROI) metric is to measure, per period, rates of return on money invested in an economic entity in order to decide whether or not to undertake an investment. It is also used as an indicator to compare different investments within a portfolio. The

investment with the largest ROI is usually prioritized, even though the spread of ROI over the time-period of an investment should also be taken into account. Recently, the concept has also been applied to scientific funding agencies (e.g., National Science Foundation) investments in research of open source hardware and subsequent returns for direct digital replication (Pearce, 2015).

ROI and related metrics provide a snapshot of profitability, adjusted for the size of the investment assets tied up in the enterprise. ROI is often compared to expected (or required) rates of return on money invested. ROI is not net present value-adjusted and most schoolbooks describe it with a "Year 0" investment and two to three year's income.

Marketing decisions have an obvious potential connection to the numerator of ROI (profits), but these same decisions often influence assets usage and capital requirements (for example, receivables and inventories). Marketers should understand the position of their company and the returns expected (Farris, 2010) ^[10]. In a survey of nearly 200 senior marketing managers, 77 percent responded that they found the "return on investment" metric very useful (Farris, 2010) ^[10]. ROI can be calculated using the following formulas:

Return on investment = Net income / Investment

Where: Net income = gross profit – expenses.

Investment = stock + market outstanding + claims.

Or **return on investment** = (gain from investment – cost of investment) / cost of investment

Or **return on investment** = (revenue – cost of goods sold) / cost of goods sold

2.5. Theoretical Review

2.5.1. Theory of constraint

This study is anchored on the theory of constraint (TOC). TOC began in 1970s when a physicist called Eliyahu Goldratt faced with problems which resulted from production logistics. He had no previous knowledge of business. Yet, he applied physics problem-solving methods for solving problems concerning production logistics. In the same line, some of his advocates like Corbett consider TOC accounting to be a paradigm shift in management accounting. Based on TOC, a company is a system. A system, then, is a set of interconnected components. Each is related to the system's general objective and performance as a part of common attempts. One of the most fundamental concepts is to distinguish the important role of "system's constraint or bottleneck. The first step is to distinguish the goal which the system must accomplish. Before discussing the improvement of each part of the system, the whole system's objective and the assessment criteria of the effect of each subset and each trivial decision on the general objective must be defined. System's constraint is also defined as any factor constraining system performance in line with its objectives"

In fact, each system includes a few constraints. In a specific time, any system contains at least one constraint (Goldratt, 1990) ^[11]. Otherwise, company's profit would be infinite. Continuous improvement process and TOC originate from this thinking that all attempts must always be focused on system's objective. This process is the basis of methods used in TOC and management accounting (Corbett, 1998). It includes five stages below, which are detection of system's constraint(s), decision making on how to exploit system's constraint, obedience of all parts from constraint to further exploit it, enhancing system's constraint(s) performance level and if constraint is removed in previous stages, go back

to the first stage. Yet, resolving system's constraint(s) process should not be stopped by removing a constraint. TOC is developed based on the presence of at least one constraint. Hence, exploring the nature of this fundamental concept is considerably advantageous. Constraint is a source confining total company's output. The most conventional system's constraint is not tangible or visual. This is the same operational policy or policies. Policy is the rule stating how a system works. For example, rules concerning batch size and resources use guidelines can be implied.

2.6. Empirical Review

Hilmola and Gupta (2015) ^[17] conducted a study on Throughput accounting and performance of a manufacturing company under stochastic demand and scrap rates by taking into consideration the impact of resource inter-dependencies, feedback loops, and importantly, statistical fluctuations ever presenting any dynamic business environment. They proposed a system dynamics (SD) based simulation model to investigate product mix problem under stochastic demand and scrap rates. They analyzed various scenarios by employing the drum-buffer-rope approach and constraint focused systematic scrap rate reduction approach, and importantly, evaluating performance using throughput accounting based global measures such as throughput and inventory. The study concluded by suggesting that future research efforts should be directed to develop an enabling hybrid expert simulation system to learn fundamental and powerful concepts underlying the theory of constraints.

Nasieku and Oluyinka (2016) ^[27] conducted an empirical review on Cost Accounting Techniques Adopted by Manufacturing and Service Industry within the last decade. The study reviews the literature on cost accounting techniques being practiced by manufacturing and service industry within the last decade. Virtually all techniques that are appropriate for manufacturing companies are also appropriate for service companies. However, the most common techniques in manufacturing companies include Just in Time (JIT), Activity Based Costing (ABC), Target Costing, Life Cycle Costing, Throughput Accounting and Kaizen costing while Activity Based Costing is the most commonly used technique in Service sector. However, Activity Based Costing, Budgetary, Control, Cost Volume profit analysis, and standard costing are common to both manufacturing and service sectors. In contrast to the postulations of many academic authors that the traditional techniques have lost relevance and should be discontinued, this review shows that traditional techniques including the heavily criticized Standard Costing, Absorption Costing and Marginal Costing were still used frequently by many companies within the last decade. The modern costing techniques used frequently within last decades include; Just in Time principle, Activity Based Costing, Target Costing, Life Cycle Costing, Kaizen Costing and Throughput Accounting. The usage of the techniques depends on the situation on the ground, that is, the level of technological advancement, the size of the company, organizational culture and stage of the product.

Khan (2011) ^[22] did a PhD dissertation study on "Measuring the Functional Power of TOC-Based Throughput Accounting To Assess Production Companies' Economic Performance", the study examined the relationship between traditional performance assessment criteria (net profit, return on investment, and return on equity), TOC-Based criteria (TOC-

Based net profit and return on investment), and value-making criteria (economic value-added and market value-added) with companies' economic performance – as a representative of cash recovery rate.

Anwarul (2015) ^[3] did a research work on the topic, Throughput Accounting: A Case Study. The study examines the development of various forms of throughput accounting (TA) inspired by Goldratt's Theory of Constraints and also discussed the potential of TA to change accounting practices, and evidence of change in Indian Power loom textile enterprises. The study concluded that transformational (paradigmatic) change is most likely in companies in extreme circumstances: elsewhere TA is more likely to be adopted pragmatically in a portfolio of different accounting techniques. Leen Howard (1999) ^[25] conducted a study on "Planning and Controlling Production and Cost Accounting Systems: its Effect on Managers' decisions and Institute's Performance", they examined four cost accounting systems. These systems include: traditional cost system, Activity-Based Costing (ABC), Direct Costing (DC), and Throughput Accounting. Results indicated that Throughput Accounting led to making better decisions and also more desirable performance as compared to other systems.

Elias Tadeu (2002) ^[9] in his PhD dissertation also studied and compared Activity-Based Costing (ABC) with Throughput Accounting approaches in terms of profitability and management's decisions. He reported interesting results regarding the importance of the type and nature of institute operation using these techniques. The finding of the study reveals a significance relationship between throughput costing and firm performance.

Dugdale and Jones (1998) ^[8] conducted a study titled "Throughput Accounting:

Transforming Practices" by analysing the development of various forms of throughput accounting (TA) inspired by Goldratt's Theory of Constraints. They discuss the potential of TA to change accounting practices, and evidence of change in UK enterprises. The study concluded that transformational (paradigmatic) change is most likely in companies in extreme circumstances: elsewhere TA is more likely to be adopted pragmatically in a portfolio of different accounting techniques.

Mabin & Balder stone (2003) ^[26] did a case study analyses from a number of TOC implementations (total amount was 81) in manufacturing companies. It was found that in approximately half of the cases, improvement of cycle times, lead times and due date performance have effects on inventory holding (lower) and/or financial performance (higher). However, they couldn't analyze route to profitability further, as simultaneous changes in inventory holdings and profits were reported in only three out of 81 case studies.

3. Methodology

3.1 Research design

The study adopted the ex post facto research design. This method was considered appropriate by the researcher as it measures the type of relationship between two variables (dependent and independent variables). It also becomes appropriate given that the study adopted the use of secondary data only which was extracted from the audited financial statement of the selected companies and the security and exchange commission fact book.

3.2 Population of the study, sample and sampling techniques

The population of the study consists of all the manufacturing firms quoted on the Nigerian Stock Exchange. International Breweries and Guinness Nigeria Plc serve as the sample for the study. The sample for the study was selected through the use of purposive sampling technique due the availability of robust financial statement of the sampled firm.

3.3 Model specification

The model for the study is given as:

$$\begin{aligned} \text{NPM} &= f(\text{INV}, \text{INSALES}) & (1) \\ \text{ROI} &= f(\text{INV}, \text{INSALES}) & (2) \end{aligned}$$

Where;

NPM = Net Profit Margin (proxy for performance of manufacturing firms)

ROI = Return on Investment (proxy for performance of manufacturing firms)

INV (Inventory Turnover) and INSALES (Increase in Sales) = Throughput Costing (explanatory variables)

The general formula for the study model was as follows:

$$Y = \beta_0 + \beta_1\text{INV} + \beta_2\text{INSALES} + \mu \quad (3)$$

Where;

Y = Performance;

INV = Inventory Turn over

INSALES = Increase in Sales

In the model, β_0 = the constant term while the coefficient β_1 was used to measure the sensitivity of the dependent variable

(Y) to unit change in the predictor variables. M is the error term which captures the unexplained variations in the model.

3.4. Data analysis techniques

The data analysis technique used to analysed data for the study is the ordinary least Square (OLS) of Regression Analysis. The Statistical Package for Social Science (SPSS 21.0) was employed for the computation and data analysis.

4. Presentation of Data

The data employ for the study is presented in table 1 below.

Table 1: Net Profit Margin (NPM), Return on Investment (ROI) and Throughput (TC) of manufacturing firm in Nigeria

YEAR	INV (N'000)	INSALES (N'000)	NPM (%)	ROI (%)
2008	12933042	6792425	13.87	92.68
2007	12720898	8613632	17.13	82.36
2008	12867442	6907439	17.15	94.24
2009	16847699	19975355	15.19	94.80
2010	16152706	20218768	12.56	77.34
2011	17381132	14296150	14.50	80.21
2012	21998519	2625059	11.62	80.18
2013	12400102	-3824646	9.69	84.47
2014	13469248	-13261418	8.77	88.71
2015	10750598	9293762	6.58	86.45
2016	13021248	-16522852	1.98	69.49
2019	23094499	23946787	1.53	62.26

4.1. Analysis of Data

The results of the data analysis are presented in table 2, 3 and 4 below.

Table 2: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.454 ^a	.207	.030	5.25608	.626
a. Predictors: (Constant), Increase in Sales, Inventory Turnover					
b. Dependent Variable: Net Profit Margin					

Source: Researcher's Computation using SPSS 21.0

Table 3: ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	64.720	2	32.360	1.171	.353 ^b
	Residual	248.637	9	27.626		
	Total	313.357	11			

a. Dependent Variable: Net Profit Margin

b. Predictors: (Constant), Increase in Sales, Inventory Turnover

Source: Researcher's Computation using SPSS 21.0

Table 4: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	18.106	6.794		2.665	.026
	Inventory Turnover	-5.564E-007	.000	-.408	-1.215	.255
	Increase in Sales	1.957E-007	.000	.468	1.391	.198

a. Dependent Variable: Net Profit Margin

Source: Researcher's Computation using SPSS 21.0

Table 5: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.558 ^a	.312	.159	9.02887	1.505
a. Predictors: (Constant), Increase in Sales, Inventory Turnover					
b. Dependent Variable: Return on Investment					

Source: Researcher's Computation using SPSS 21.0

Table 6: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	332.455	2	166.227	2.039	.186 ^b
	Residual	733.684	9	81.520		
	Total	1066.139	11			
a. Dependent Variable: Return on Investment						
b. Predictors: (Constant), Increase in Sales, Inventory Turnover						

Source: Researcher's Computation using SPSS 21.0

Table 7: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	105.737	11.670		9.061	.000
	Inventory Turnover	-1.577E-006	.000	-.628	-2.005	.076
	Increase in Sales	1.753E-007	.000	.227	.726	.487

a. Dependent Variable: Return on Investment

Source: Researcher's Computation using SPSS 21.0

4.2. Interpretation of Result

The regression equation based on the model put forward in section 3.0 is analyzed based on our stated method of analysis. Table 2, 3, 4, 5, 6 and 7 shows the result of the data analysis.

Constant: The Constant had a coefficient of 18.106, showing that if all other variables are kept constant, NPM (manufacturing firm performance) will increase by 18.106 units. INV and INSALES exhibit a negative and positive relationship with the dependent Variable (NPM) based on their outputs of -5.564 and 1.957 respectively. Also, the constant had a coefficient of 105.737 showing that if all other variables are kept constant, ROI (manufacturing firm performance) will increase by 105.734 units. INV and INSALES exhibit a negative and positive relationship with the dependent Variable (ROI) based on their outputs of -1.577 and 1.753 respectively.

The Coefficient of Determination (R-Square): From the estimated linear regression model shown in table 2 and 5, the SPSS computed R-square obtained were 0.207 for NPM and 0.312 for ROI. this implies that 20.7 percent variation in NPM (manufacturing firm performance) and 31.2 percent variation in ROI are explain by the selected explanatory variable (INV and INSALES) within the period of study while the remaining 79.3 and 68.8 percent variation are explained by other variables that are not captured in the model.

The F- Test: This is the test for the overall significance of the model. The null hypothesis of this test states that the estimated model is not statistically significant. The decision rule follows that we accept the null hypothesis of the tabulated F-value, if the tabulated F-value is greater than the computed F-value. The computed F-value for linear regression result is 1.171 and 2.039 for NPM and ROI respectively, while the tabulated F-value is 7.714 Therefore; we accept the null hypothesis and conclude that the overall parameter estimated of the regression is not significant.

Durbin-Watson Test values were 0.626 and 1.505 for NPM and ROI respectively. Using the rule of thumbs, the calculated result which is far from 2 means that there is the presence of autocorrelation.

4.3. Test of Hypotheses

The hypothesis stated in section 1.5 is tested in this section.

The test of significance of each variable is carried out at 5 per cent critical level. The t- statistic is employed to perform the test; hence the acceptance or rejection of any of the hypotheses is based on t-value and level of significance of the regression coefficient of the explanatory variable.

Ho₁: There is no significant relationship between inventory turnover and Net Profit Margin.

From the SPSS version 21.0 regression analysis carried out as shown in table 4, the computed t- value of the regression coefficient of INV is -1.215. This value is less than 5 percent tabulated value of 2.665. Moreso, the significance value of 0.255 (INV) is greater than 0.05 which is the level of significance. We therefore accept the null hypothesis (Ho₁) and conclude that there is no significant relationship between Inventory turnover (INV) and financial metrics (NPM) of manufacturing firms in Nigeria. This implies that inventory turnover (INV) has no significant impact on the financial performance of manufacturing firms in Nigeria.

Ho₂: There is no significant relationship between inventory turnover and return on investment.

From the SPSS version 21.0 regression analysis carried out as shown in table 7, the computed t- value of the regression coefficient of INV is -2.005. This value is less than 5 percent tabulated value of 2.665. Moreso, the significance value of 0.076 (INV) is greater than 0.05 which is the level of significance. We therefore accept the null hypothesis (Ho₂) and conclude that there is no significant relationship between Inventory turnover (INV) and ROI (financial performance) of manufacturing firms in Nigeria. This implies that Inventory turnover (INV) has no significant impact on performance of manufacturing firms in Nigeria.

Ho₃: There is no significant relationship between increase in sales and Net Profit Margin.

From the SPSS version 21.0 regression analysis carried out as shown in table 4, the computed t- value of the regression coefficient of INSALES is 1.391. This value is less than 5 percent tabulated value of 2.665. Moreso, the significance value of 0.198 (INSALES) is greater than 0.05 which is the level of significant. We therefore accept the null hypothesis (Ho₃) and conclude that there is no significance relationship between Increase in sales (INSALES) and performance (NPM) of manufacturing firms in Nigeria. This implies that

Increase in sales (INSALEs) has no significant impact on performance of manufacturing firms in Nigeria.

Ho₄: There is no significant relationship between increase in sales and return on investment.

From the SPSS version 21.0 regression analyses carried out as shown in table 7, the computed t- value of the regression coefficient of INSALEs is 0.726. This value is less than 5 percent tabulated value of 2.665. Moreso, the significance value of 0.487 (INSALEs) is greater than 0.05 which is the level of significance. We therefore accept the null hypothesis (Ho₄) and conclude that there is no significant relationship between Increase in sales (INSALEs) and performance (ROI) of manufacturing firms in Nigeria. This implies that increase in sales has no significant impact on performance of manufacturing firms in Nigeria.

4.4. Brief discussion of Findings

Overall, the findings of the study show that there is an insignificant relationship between the independent and dependent variables of study; suggesting that throughput costing has no significant effect on the financial metrics/performance (NPM, ROI) of manufacturing firms in Nigeria. The findings of the study collaborate with the work of Hilmola & Gupta (2015) ^[17] when they assert that throughput costing has an insignificant relationship with performance of a manufacturing company under stochastic demand and scrap rates. However, findings of the study is in disagreement with the findings of Sheu, Chen & Kovar (2003) ^[30] when they posit that throughput costing has a significant impact on financial performance and manufacturing decision making.

4.6 Recommendations

Based on the findings of this study, the following recommendations are made:

1. Manufacturing firms should in addition to throughput costing carry out other managerial accounting techniques such as Just-in-Time, Activity Based Costing Kaizen costing, target costing, etc so as to increase their financial performance.
2. Manufacturing firms are encouraged not to waste their efforts, but rather to concentrate on solving problems that may jeopardize the performance of these bottleneck resources, which in turn jeopardizes the financial performance of the business as a whole.
3. Management of manufacturing companies in Nigeria should apply throughput costing during the short-run as a direct costing approach as it is more suitable for short-term product mix decisions.

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