Analytical evaluation of cost elements and their influence on productivity of manufacturing firms

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Abstract

This study aimed at establishing the degree of influence of cost elements on the productivity of manufacturing companies. The study made used of a survey research design method and data were obtained through questionnaire and analyzed with the Ordinary Least Square (OLS) method. The study revealed that three major categories of manufacturing costs affect the overall productivity of manufacturing companies; viz, raw materials, labour and overhead costs. This study established that the ability or inability of manufacturing companies to properly control and minimize these costs has a direct bearing on how productive or unproductive these companies are. It was recommended that the major cost elements of material, labor and overhead should be individually managed in the light of overall productivity. Also manufacturing companies should pay closer attention to cost reduction, cost management and cost control in order to remain increasingly profitable.

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1 Introduction

Since the goal of most companies is to earn profit by providing services and selling goods manufactured by them, paying a closer attention to the overall cost elements is both extremely important and inevitable. Manufacturing cost is the cumulative total of resources that are directly used in the process of making various goods and services.

Manufacturing cost consists of the raw material or direct material costs used in the production of goods or services, labour or wages costs engaged directly or indirectly in turning the raw materials to finished products and the overhead costs which consist of the supervisor's salary, utilities, supplies and other incidental expenses which must be necessarily incurred in the production of these products. There are however different costs for different purposes, as well as different cost classifications. Namely, variable costs, fixed costs direct and indirect costs, controllable and uncontrollable costs etc. All these costs classifications are in a bid to understand costs so as to control them, associate them with the activities that cause them and measure them against output for the overall productivity and profitability of the company.

The consideration here is that, the level of attention paid by manufacturing companies to the overall manufacturing costs is directly influencing the level of productivity and profitability these companies are earning.

2 Preliminary Notes

The most volatile variable in any business is volume; that is, units produced or units sold. A change in volume has an immediate impact on variable costs. Variable costs are those costs that increase or decrease correspondingly with changes in volume. However, the exact relationship between total variable cost and volume in practice is in the shoulders of the management accountant. The conversion of ordinary financial data as typically found in the general ledger accounts requires that the management accountant has a thorough understanding of cost behavior theory.

The identification and measurement of fixed and variable costs is somewhat complicated by the fact that some costs are fixed or variable at the discretion of management, while other costs are not. Furthermore, for those expenditures that are inherently variable, management has the ability, within limits, to control the magnitude of the variability of these costs. In order to exercise this control, management also needs a solid understanding of the nature of cost behavior and cost management concept.

In management accounting, the classification and measurement of fixed and variable costs is based on a body of knowledge that involves a number of assumptions. In many cases, the usefulness of fixed and variable cost data depends on the validity of these assumptions. In order to avoid poor operating results and

faulty decision-making that are likely to occur when false cost assumptions are made, the ability to recognize and measure cost behavior is essential. The following sections examine, in some depth, the theory of cost behavior.

2.1 Management accounting theory of variable costs

The most volatile variable in any business is volume; that is, units produced or units sold. A change in volume has an immediate impact on variable costs. Variable costs are those cost that increase or decrease with corresponding changes in volume. However, the exact relationship between total variable cost and volume in practice is not always easy to describe or measure. Therefore, in both management accounting and economic theory, the relationship between volume and total variable costs is often determined by assumption.

In management accounting, the relationship between activity level and total variable cost is assumed to be linear. There are several reasons for this assumption. First, mathematical equations involving curvilinear relationships can be quite complex. Fitting costs data to nonlinear equations may be difficult as well. Although the use of nonlinear equations may be preferable, the use of linear equations which are much easier has been found very useful.

Also, in many cases, actual cost behavior for a significant portion of the activity range tends to be linear. The use of standard measurements and automated equipment in many cases results in a uniform rate of output. Within a relevant range of activity, the cost per unit of output is always almost similarly constant. Consequently, the use of linear relationships in management accounting is justified only in what is called the "relevant range of activity." If the cost per unit of output sharply changes outside of this range of activity, then the use of a constant average cost per unit values will need to be avoided, (Kaplan, 1982).

In order to be used, many management accounting decision-making models explicitly require that all costs be classified as either fixed or variables. On the surface, it would appear that the measurement and use of fixed costs is fairly a simple matter. After variable costs have been measured, the remaining costs may be treated as fixed. However, the very nature of fixed costs presents conceptual problems that far exceed those pertaining to variable costs.

While direct material and direct labor are variable in nature, manufacturing overhead may be both variable and fixed. Accounting for fixed costs is at the same time a problem of accounting for manufacturing overheads. An understanding of fixed manufacturing overhead also requires an understanding of the concepts underlying the setting of fixed overhead rates. Because of the complexity of accounting for fixed manufacturing costs two concepts exist which are: absorption or normal costing and marginal or direct costing. These two approaches treat fixed manufacturing overheads quite differently.

Fixed costs provide the capacity to manufacture or to sell. When actual activity is less than capacity available, a major problem arises which is normally a less than optimum productivity and low profitability.

2.2 Theory of productivity

Certain theories have been propounded concerning productivity of a company, one of them states that; the level of productivity is a major determinant of cost efficiency: higher productivity tends to reduce average costs of production. Increases in productivity on macro perspective tend direct economic growth.

Unlike Marxist political economy, which regards productivity as the capacity of concrete labour to produce or use value, Bourgeois political economy considers the productivity of the factors of production to be the source of value. The first theory of productivity was the theory of the factors of production, which grew out of the remains of classical economists in the first half of the 19th century. The principal authors of the theory of the factors of production ascribed the capacity to produce value to the three factors of production- labor, land (as a means of production), and capital. Accordingly, the income from each factor (wages, land rent, and interest) was declared equal to the productive contribution of the factor. Moreover, the income from each factor was said to correspond to the factor's share in the total value of the product, (Koutsoyiannis, 1979).

The theory of the factors of production was the foundation for the apologetic conclusions that under capitalism, social distribution is just and class interests are in harmony, (Lucey, 1990). However, the insubstantial, tautological character of the theory was obvious. The earnings of the various factors of production were explained by their contributions to production, and the size of their contributions was, in turn, explained by their earnings.

The theory of marginal productivity, developed in the 19th century, was intended to resolve the logical contradictions in the theory of the factors of production. The most complete elaboration of the tenets of the theory of marginal productivity is associated with J.B. Clark (USA). Like the theory of the factors of production, the theory of marginal productivity proposes that the value of a product is created by the three basic factors of production (labor, capital, and land). All of the factors participate in the process of production. Therefore, all of them are equally productive and create equal amounts of value.

The share of any factor of production in the creation of the value of a product is determined by its marginal productivity, that is, the amount of marginal product it can create. The concept of "marginal product" is based on the assumption that technological conditions remain constant, each increase in one of the factors of production, with the others remaining the same, will result in the diminished growth in output. In this instance, the term "marginal product" refers to the growth in output as a result of an increase of one unit in a particular factor of production, with all the other factors remaining constant.

According to the theory of marginal productivity, the marginal product is precisely the level that determines the "just" or "natural" level of income payable to each of the factors. A number of conditions are necessary if wages, profits and rents are to represent the prices of the factors of production corresponding to the factors' marginal productivity. There must be no restraints on free competition, the relative "prices" of the factors of production must change in conformity with changes in the productivity of the factors, and there must be no government intervention or monopolistic reallocation of income. In the theory of marginal productivity, the processes of production and distribution have a single basis- the marginal product of the factors of production. The value of output is defined as the sum of the inputs from each factor of production at its marginal productivity, and these sums functionally define each factor's share in the distribution of the social product. The theory of marginal productivity was also expressed in specific mathematical terms in the productivity function: $y = f(K, L, N)$.

Far-reaching conclusions were drawn from the theory of marginal productivity. The first of these conclusion asserted that a system of "perfect competition" in the factors-of-production market ensures the minimum outlay per unit of output, or, in other words, the most efficient utilization of productive resources. The second conclusion, which deals with the distribution or created value, claimed that the income earned by each factor is proportional to the quantity and value of its marginal product, (Drury, 1987).

Thus, the naively apologetic theory of the factors of production gave way to a more sophisticated picture of the interaction of the factors of production, based on a system of mathematical analysis. Nonetheless, despite these refinements, the ideological content of the theory of marginal productivity did not change. It examined not real classes (capitalists and workers) but the operation of the nonsocial factors of production. The impersonal relations of 'factors are substituted for class relations, concealing the fact that the income from the various factors (for example, profits, dividends, interest on capital, and land rent) becomes the property of the capitalist and the landowner and that this happens not as a result of the abstract interaction of the factors of production but as a consequence of the laws of property, which govern production relations under capitalism. Marxist literature also includes critiques of certain contemporary varieties of theories of productivity, such as the theory of the firm and the theory of the production function.

3 Main Results

An analytical survey approach was used. Secondary information were obtained from specialized studies, and scientific sources, while primary information was generated through a questionnaire.

A total of 10 manufacturing companies listed in the Nigerian Stock Exchange (NSE), based on capacity utilization, were studied. On the basis of

previous studies, a Likert five point measurement scale was used to show the opinions of production workers of the studied companies. In order to find the arithmetic means of the opinions of sample members, weights were assigned in agreement with the significance of each paragraph of the questionnaire.

The reliability and validity of the measurement model is necessary to secure its fit to the data. Cronbach's alpha coefficients can range from 0.0 to 1.0, and may be interpreted as the percent of "true score" variance in a multiple item measure. The experts' validity was established three academic research experts who confirmed the suitability of the items chosen for survey. The validity of the survey instrument was identified by taking the square-root of the reliability coefficient as it had been proved that the maximum validity coefficient equals the square-root of the reliability coefficient, (Balsely and Clover,1988).

In order to develop a suitable questionnaire, a pilot survey of 5 manufacturing companies was conducted. The pilot survey helped to uncover the real situation of firms and identified possible irrelevant details. Based on the pilot survey, some questions were eliminated or modified and some new questions were added. In addition, the instrument's reliability was tested by conducting nonparametric-Wilcoxon test in order to identify whether the mean difference was statistically significant or not. This method examined the effect of every demographic factor (non-metric independent variables) on every item (metric dependent variables). Thus, the research applied Cronbach's Alpha coefficient to measure whether the internal consistency of the responses was similar across items and how they represent the variable. The higher the Cronbach's alpha values are, the higher the reliability of the instrument used for data collection.

Using SPSS for the calculations, the Cronbach's alpha of the tested variable in this research was 0.92 (see Table 1). This number indicated that the items form a scale that has very good internal consistency or they were regarded as 'high' reliability or that items were measuring the same underlying construct. The Cronbach's Alpha of Material costs, Labour costs, Overhead costs, and Profitability were in turn: 0.79, 0.78, 0.72 and 0.93, these are presented in Table 1.

3.1 Discussion of Results

To investigate the relationship between Cost elements, (material cost, labour cost and overhead cost), on profitability (productivity), linear regression analysis was the appropriate multivariate analysis technique.

The equation for the linear regression is as follow:

$$PROF = b_0 + b_1 MC + b_2 LC + b_3 OC$$

where:

PROF : Profitability

b_0 : regression intercept

b_1, b_2, and b_3 : correlation coefficients
MC : Material Cost
LC : Labour Cost
OC : Overhead Cost

Table 2 shows the regression results of the essence of cost elements on the productivity of manufacturing firms. The regression results showed that the estimated coefficient of the regression parameters have positive signs and thus conform to our economic a-priori expectation. The implication of these signs is that the dependent variable Productivity (PROD) is positively influenced by the indices of cost elements (MC, LC and OC). This means that an increase in the independent variables will bring about credibility in the dependent variable - Productivity (PROD).

The coefficient of determination R-square of 0.992 implied that 99.2% of the sample variation in the dependent variable Productivity (PROD) is explained or caused by the explanatory variable while 0.8% is unexplained. This remaining 0.8% could be caused by other factors or variables not built into the model. The high value of R-square is an indication of a good relationship between the dependent and independent variables.

The value of the adjusted R^2 is 0.989. This shows that the regression line captures more than 98.9% of the total variation in productivity and is caused by variation in the explanatory variables specified in the equation with less than 1.1% accounting for the stochastic error term.

Testing the statistical significance of the overall model, the F-statistic was used. The model is said to be statistically significant at 5% level because the F-statistic computed of 18.270 was greater than the F-statistic table value of 2.60 at df1=3 and df2=396.

The test of autocorrelation using Durbin Watson (DW) test shows that the DW value of 2.612 falls within the inconclusive region of DW partition curve. Hence, we can clearly say that there exists no degree of autocorrelation.

In management accounting, the relationship between activity (volume) and total variable cost is assumed to be linear. It is also interesting to note that increased productivity could be attributed to cost reduction and conscious cost management and control by manufacturing firms over the years, because this empirical results show a significant relationship between material cost, labour cost, overhead cost and productivity of manufacturing companies. With sustainable business practices and cost management, there is a predictable increase in productivity. The annual statements of manufacturing companies investigated disclose improved sales turnover, which is an indicator that these companies are capturing larger market shares through efficient cost management. From this finding, the paper deduced that, cost management and cost control directly and proportionally affect corporate performances and corporate productivity. Hence, cost management and value chain focus are not wasteful but is part of corporate

strategy, as well as, corporate responsibility to achieve corporate productivity as well as the economic goals of the firm.

4 Labels of Tables

Table 1: Cronbach's Alpha of all factors

	Factor	Cronbach's Alpha	No. of Items
1	Material cost	0.79	4
2	Labour cost	0.78	4
3	Overhead cost	0.72	4
4	Profitability	0.93	4
5	Total factor	0.92	16

Source: Researcher's Estimation, 2012

Table 2: Regression results of the analytical evaluation of cost elements and its influence on productivity

DEPENDENT VARIABLE: Productivity (PROD)

VARIABLE	ESTIMATED COEFFICENTS	STANDARD ERROR	T-Statistic	P- Value
Constant	10.301	.192	5.567	.000
MC	.005	.002	3.920	.000
LC	.020	.004	2.229	.000
OC	.002	.007	2.361	.000

R	= .996
R-Square	= .992
Adjusted R-Square	= .989
SEE	= 15.499
F – Statistic	= 18.270
Durbin Watson Statistic	= 2.612

5 Conclusions

The findings of this study were that cost control measures have positive influence on the productivity of manufacturing firms. Therefore to make manufacturing companies productive, they must identify the high cost elements and apply measures to reducing them. Materials, labour and overheads are the major cost elements influencing the productivity of manufacturing companies, making proper system of cost management to eventually gulp in increased profits becomes more imperative. The most productive business therefore is the one that has developed and is consciously implementing cost management techniques.

The most volatile variable in any business is volume; that is, units produced or units sold. A change in volume has an immediate impact on variable costs. These costs are increased or decreased with corresponding changes in volume. However, the exact relationship between total variable cost and volume in practice is not always easy to describe or measure.

5.1 Recommendations

In the light of this research findings albeit from a purely historical perspective given the time constraints and the vastness of the study in question; it remains the fact that without a proper and conscious effort on the part of management of manufacturing companies to analyzed, record and monitor their overall costs, they will be experiencing under productivity of all factors of production with the resulting low profit. Thus it must be stated as fact that indeed the major cost elements of material, labor and overhead have positive or negative influence on the productivity of companies depending on how they are managed and harnessed.

Based on these findings the study recommends that manufacturing companies should begin an aggressive programme of cost management in order to survive in the economy. That the major cost elements of material, labour and overhead should be individually managed in the light of overall productivity. Manufacturing companies should equally pay close attention to the cost reduction, cost management and control of the manufacturing costs in order to remain consistently profitable.

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