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PRINCIPLES OF COSTING AND COST ANALYSIS AS A TOOL FOR PRODUCTION COSTS CONTROL: A CASE STUDY OF NIGERIAN COMPANIES

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ABSTRACT

Cost is the amount of resources sacrificed or given up to achieve a specific objective which may be the acquisition of goods or services. Efficient execution of a project depends considerably on effective control of costs and costs can only be controlled if they have been previously analyzed and so identified. The conventional cost components of materials, labour and overheads are analyzed to analyze to reveal hidden aspects which are often overlooked by less skilled operators/manager. Methods of recovery of overhead costs are also discussed together with depreciation accounting methods and rationalized equipment cost recovery techniques. The finding shows that the most crucial aspect of inventory cost in the Nigerian habitually speculative industry is that the stored goods represent capital (money) which would have been yielding interest if invested in a bank but tied down as stock in the company. The framework of the study is based on the knowledge of mathematical, experience and practice, which is applied with judgment to develop the ways to utilize economically the materials and other natural resources for profit making purpose. The study would be of significant to the manager in terms of analytical decision making, inventory control policies and determination of the company's profit level.

KEYWORDS: Direct Material Cost, Inventory Cost, Labour Cost, Overhead Cost, Depreciation

INTRODUCTION

The principal requirement for effective budgeting and budgetary control is efficient costing and cost analysis. In planning a project all the works and services to be required are isolated in a "works breakdown structure" (WBS) and all direct/indirect costs associated with the works and services are identified and analyzed following conventional techniques in cost accounting (Harberger, 1997). The omission of some aspects of costs, as often happens in Nigeria's construction, manufacturing and service industries, among others, causes planning handicaps and failures in project implementation. Adhoc measures to correct these habitual errors introduce instabilities like inflation and labour unrest into the economy. Inefficient costing also leads to serious errors in profit calculations and may eventually force the business to close down (Watson, 1997). For example a stationary shop that acquires extra stores to enable it to bulk-purchase to beat inflation and get benefits of bulk-purchase discounts, should inventory consequent on the increased quantity now stored. Unless the components of this comprehensive inventory costs are known, the computation would be erroneous. This will be dealt with latter in this paper under "inventory costs".

SCOPE AND LIMITATION OF THE STUDY

The study concentrates on Nigerian companies, both small and medium scale companies. This study would be limited to identification of different costs of a manufactured product and they worth to the companies in decision making.

THE PROBLEM STATEMENT

Operating an efficient and cost-effective manufacturing process with strict control of material and production costs is the goal of every successful company, Nigerian companies inclusive. Fueled by consumer demand for the products, rapid and continuous advances in technology make this goal a necessity for manufactures in Nigeria attempting to compete in today's global marketplace. The manufactures are forced to continually evaluate and eventually replace aging manufacturing processes that are unable to keep up with the ever-increasing technology threshold. When coupled with the typically slim profit margins of manufacturers, these process changes represent a major capital investment to a company and emphasize the importance of selecting an efficient, cost-effective process that will allow the company to remain competitive.

THE COST OF A MANUFACTURED ARTICLE

The factors to be mobilized to manufacture an article are:

1. Man
2. Materials
3. Machines and
4. Manufacturing processes or procedures.

Therefore the cost of a manufactured item has the components from:
(1) Labour
(2) Direct materials
(3) Equipment used and
(4) Overhead expenses from indirect labour and materials and tools.

Generally:
Cost of article = Material + Labour + general Overhead costs (1) (Martand, 20011)

DIRECT MATERIAL COST

All the material that form part of the article after manufacture are referred to as "direct material". The cost of the material is evaluated before the material is processed using the proper equipment to shape it according to its final design of the article. Therefore the complete material cost is the final processed material plus the scrap allowance:
Materials cost = Cost of final material + cost of scrap allowed or removed. (Khanna, 2009)
It can therefore be seen that increase in scrap also increases material cost.

Those materials like lubrication oil, coolant, emery cloth (sand-paper), etc which are not found on the finished part are referred to as indirect materials and are included with general overhead costs.

DIRECT LABOUR COSTS

All work that is directly applied to manufacture the article and its components are included in direct labour. All salaries or wages of workshop staff who are directly involved in making the article using their hands or equipment constitute direct labour. The wage rate of the operator of equipment or manual worker on the manufacturing line is multiplied by the time the operator has been working to find the cost of his labour.

Wage rate (Wr/Hr) x Time (Hrs) = Labour cost (3) (Stanbury and Vertinski, 1989)

All direct labour, over time and bonus pay are included in direct labour cost.

In estimating the labour cost for making say, 1, 000 vehicle wheel nut, the time spent in the different machine tool operations are calculated and added up. For such small articles, like the wheel nut, large numbers are made using special automatic machine centers such that set-up time batch may be large but time per nut would be low, thus reducing the cost per nut. This is the benefit of mass production. For the wheel nut in:
Mass production:

Set up time (per day) = 2 hours (for 1, 000 nuts) = $\frac{2 \times 60 \times 60}{1000}$ = 7.2sec

Machining:

Drilling time per nut = 5 sec.
Cut-off time per nut = 2 sec
Turning time per nut = 5 sec
Chamfering time per nut = 3 sec
Manipulation time per nut = 5 sec
Tapping time per nut = 5 sec
Machining time per nut = **25 sec**
Set-up time per nut = 7.2sec

Total Time per Nut = **32.2 sec**

If the wage rate of the operator/setter is N360.00 per hour, i.e 0.1 per second.
Cost of labour per **NUT** = 0.1 x 32.2 = N3.22 (4)

The manufacturing cost of the NUT is found by adding the material cost per NUT and the overhead cost to labour cost.

ANALYSIS OF OVERHEAD COSTS

In the manufacture of an article like the wheel nut the overhead cost element include the following; cost of rent, lighting, heating, power, general suppliers, wages of maintenance staff, typist, draughter-men, cleaners, salaries of departmental heads, mangers, directors, consumable or indirect materials, communication, etc

Overheads are made up of two parts namely; **Fixed Overheads and Variable Overheads.**

The fixed overhead costs remain constant no matter the quantity of articles produced while the variable overhead cost vary with the quantity of articles produced, e.g. cutting tools (Jenkins and Harberger, 1995).

Variable overheads are further subdivided into semi-variable and fully variable Overheads. For example, telephone charges are constant for the first three minutes in Nigeria and then a different rate (higher) is charged per subsequent minute. It is not advisable to keep semi-variable overhead facilities in the control of shop floor staff in order to avoid possible excessive overhead costs in the company.

This is equally true of administrative establishments where such facilities should be located in the management offices.

The initial cost of the equipment used in production is recovered through depreciation charges. Since depreciation is usually fixed with respect to time periods it falls within the category of fixed overheads. However in machine-intensive

production, the machine cost is usually isolated from overheads and calculated separately within depreciation of assets.

Overhead Absorption Costing Techniques

The techniques of overhead absorption fall into three categories namely:

1. As a proportion of direct materials
2. As a proportion of direct labour
3. Blanket absorption

The problem of overhead absorption arises from the fact that often overhead costs are complex consisting of so many components tangible, intangible, calculable and not so calculable. For example, how much of the cost of adverts and other public relations expenditures will be charged to each article made in this period? The answer is not easily rationalized and so some kind of general overhead absorption technique has to be determined as company public relations expenditures will be charged to each article made in this period?. The answer is not easily rationalized and so some kind of general overhead absorption technique has to be determined as company policy.

Overhead Absorption As A Proportion Of Direct Materials

Usually the total overhead expenditures are known to the company management and so is the total material cost for a particular operation. For example:

Let total overhead cost =H
Let total material cost =M
Therefore overhead/material ratio =H/M (5)

Now to allocate overhead cost to subsequent units of articles made this ratio is used. For example if the cost of direct materials used in the unit of the article = m, then overhead cost per article, h = mxH/M (6) (Van Pelt and Timmer, 1992).

Thus the total cost of each article can be found.

Overhead Absorption as a Proportion of Direct Labour

Similarly the allocation procedure in 3.1 is used but this time; the ratio is between overhead and labour costs.

$$\frac{\text{Overhead cost}}{\text{Labour cost}} = \frac{H}{L} \quad (7)$$

Where L= Direct labour cost

$$\text{Therefore } h = 1 \times \frac{H}{L} \text{ (Naira)} \quad (8)$$

where l = Labour cost per unit of article.

Usually the total cost of labour a batch of the articles made is known precisely as well as the total overhead cost and so the absorption proportion can be calculated and allocation then made to each unit of the articles made.

Blanket Overhead Absorption

The "blanket" absorption technique is used efficiently when all the articles made are similar (or more or less so). Then the total number of such article, N is used to share equally the total overhead cost for that batch of production. Thus, the overhead allocation per article, h= H/N (Naira) (9)

Although the calculation of the allocated overhead using blanket absorption is less burdensome, the technique has the weakness of being limited to environments where all the goods (or article) made are similar. Often this is not case and so allocations can be made based on direct materials and then direct labour and the costs is adopted for that batch.

Determining the Selling Price of a Product

To determine the ex-factory price of an article all the elements of cost should be found. The elements of cost are the following;

1. Direct material cost.
2. Direct labour cost
3. Direct expenses (Machinery and tools)
4. Factory overhead cost (power, lube oil, rent, etc)
5. Selling costs (Adverts, distribution, discounts etc)
6. General administration/management cost (salaries of staff in management)
7. Profit

The selling price of the product is the sum of the elements of cost 1 to 7.

Element 3: **Direct expenses** are the cost of depreciating the equipment, and tools and the cost of the processes used for converting the original raw material to finished goods. The sum of elements 1, 2 and 3 is referred to as Prime cost.

Depreciation Cost Accounting

The initial cost of the machinery and equipment used is recovered under direct expenses cost element through depreciation charges. The principle of depreciation accounting is that every equipment purchased for production has a limited productive life and so must soon be replaced. The money realized from depreciation charges is later to be used to replace the equipment so that production can continue; otherwise the company will fold up. Therefore depreciation is a cost in production and is treated as such to form a "sinking fund".

The commonest techniques used in depreciation accounting are as follows;

1. Straight line depreciation.
2. Sum-of-digits technique
3. Declining and double declining techniques

Usually a service life in years is rationally chosen for the equipment. Equipment in rapidly changing technology area has short life (2 to 4 years or less). Services life in the electronic equipment area in Nigeria would soon be less than 2 years but today it

is about 6 months overseas. This is so because the production life of an equipment implies that such equipment is founded on the competitive technology of the period and of the market. This money realized by finally disposing the equipment is called the "scrap value".

In the straight line depreciation technique (which is commonly used) the initial cost of the equipment is recovered by equal amounts every year of its productive services life.

$$X = \frac{Bi - S}{L} \quad (10)$$

(Sassone, 2009)

Where, X = Depreciation cost per year
Bi = Initial value
S = Scrap value
L = Service life

In both the sum of digits and double declining methods of depreciation accounting, account is taken of the fact that equipment performs best at the earlier stages of its life before its dependence on maintenance to perform in later years.

So the cost of the equipment is recovered at the highest rate after the first year, followed by the second year and so on.

The double declining method ensures that the cost is completely recovered in the last year. The "Book Value" of the equipment is the cost of the equipment remaining to be recovered at the beginning of a new service year. The "scrap value" therefore is the "book value" at the end of the productive service life.

The Direct expenses charged to an article produced is the depreciation cost on all equipment used in producing it in the proportion of the number of hours spent in making it to the total number of hours the equipment was running to produce the batch of articles.

$$D = \frac{t}{T} \times X \quad (11)$$

Where
d= depreciation allocated to an article
t= time spent on machining an article
T= total time equipment was in use during the batches that year.
X= the depreciation cost that year.

STORAGE (INVENTORY) COST

When a distributor buys a batch of goods he provides a warehouse (store) for the goods until they are completely disposed of to retailers or users. Just as the maker incurs costs to sell his goods, the buyer bears the cost of ordering and holding the goods after the ordered goods are received. Therefore to the distributor, the total cost of ach article is.

C**T** = Constant cost + ordering cost + inventory (i.e. Holding) cost (12)
Where C**T** = total cost per article
Constant cost = ex-factory cost
Ordering cost= cost of transport and administration for placing and receiving orders.

Holding and inventory costs = Cost of rent on storage space, air-conditioning, equipment interest cost by not investing the money in a bank, insurance against fire or theft and obsolescence (Martina et-al, 2000).

Often Nigerian enterprises ignore holding costs and do not feature it in their balance sheets. Because small scale businesses are not properly informed about the enormity of inventory costs on their businesses, they see the habit of hoarding materials and manufactured goods as wise and business like policy.

The availability problem in the Nigerian industry is only temporary and so the hoarding and other speculative habits would be devastating to company profitability in future as evidenced by the analysis of holding or inventory costs above.

CONCLUSION

The principles of in-factory, ex-factory and total costing have been clearly highlighted. The comprehensive analysis of all the aspects of cost is very informative for cost reduction and cost control exercise. Although a manufactured article is used throughout as an example, the analysis is applicable to service, construction and other businesses.

Taxation of profit is not a problem provided every aspect of cost has been included in the deducted production or service costs. If costs like inventory (holding) charges are ignored, the business is continually cheated in taxation. The most crucial aspect of inventory cost in the Nigerian habitually speculative industry is that the stored goods represent capital (money) which would have been yielding interest if invested in a bank but tied down as stock in the company.

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