Management Accounting Practices in a Changing Advanced Manufacturing Technology Environment

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Abstract: *The study is set out to examine management accounting practices in a changing advanced manufacturing technology (AMT) environment. Data were collected from 26 Nigerian manufacturing firms. Selected from Nigerian fact books. Collected data were analysed using ordinary least square method reference analysis which shows a significant positive relationship between labour and capital. Accordingly, this finding indicate very low adoption of AMT by the firms under investigation. This is expected, given the level of development in Nigeria yet coming with such a pattern may not attract the much expected global competiveness for Nigerian firms. This cause for public and firm level adjustments that are recommended in this paper.*

Keywords: *management, Accounting, Practices, change, AMT, Nigeria.*

1. INTRODUCTION

The industrial revolution of the18th century in Europe that came as a result of combined forces of Scientific inventions, development in the means of communication and discoveries etc, dichotomized the world into developed and underdeveloped giving European countries an upper hand (George, 1963). This is because the development of a nation was made to be a function of her rank in the manufacturing of goods and services. The enthronement of trade liberalization by the World Trade Organisation (WTO) in 1995, and under pricing of primary products in the global market, makes the system of manufacturing imperative (Abraham 2000; Igwe and Emerole, 2014).

The unequal trade foisted on the developing countries coupled with forcing these nations with the global system is the major source of their slow growth and development. Hence, some of this nations especially those in Asia began to see development as a task that must be accomplished whichever way. This situation threw the world into competition on the area of improved manufacturing technology (Deruntz and Turner, 2003). Thus, Advanced Manufacturing Technology (AMT) is the use of superior technology or technologies or computer applications in production processes and planning, such as computer Integrated Manufacturing System (CIM), Computer Aided Design (CAD), Computer Aided Engineering (CAE), Flexible Manufacturing System (FMS), Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP) and Enterprises Resource Planning (ERP) (Isa and Foong, 2009).

These new approaches involve the adaptation of new technologies that are capital intensive with insignificant labour involvement in the organizational structures and practices. For example, Just In Time (JIT) and Total Quality Management which influence radical changes in various ways in the business conduct.

Nigeria's quest to join the league of the top 20 economies of the world by 2020 may be a mirage if she does not take a giant stride on adapting Advanced Manufacturing Technology. In order words, the epileptic power and other infrastructural decay in the country must be rectified for Nigeria to survive the heat of trade liberalization and remain competitive in the world market. It is in the light of this absolute need for change that Hindson (1999), quoted in Osisioma (2004) buttressed that:

> The world is changing every day. Things are happening so far fast, that we can hardly keep
> up. Every new technological advancement hurtles us further into the future. Emerging trends

pass us bye before we can even comprehend them. The world of tomorrow looks less and less like the world of yesterday with every day that passes.

The insignificant industrial growth rate in Nigeria has continued to provoke doubts whether Nigeria would live up to these global changes and challenges in keeping afloat and being able to deliver goods and services to the teeming population as at and when due. Among the strategies for the actualization of these competitive instincts, is creating an enabling environment that is receptive of the new technological order. This involves government policy to enthrone functional education to produce graduates that are trainable. This should be the case, as the adoption of AMT in a labour surplus economy is likely to introduce frictional unemployment. But with a well informed labour, the intangible asset which is a conveyor belt for growth, will beefed up in the long-run. The intangible asset in the form of skill paves way for innovation and cost-reducing ventures. With this, Nigerian firms can afford to produce goods and services at minimal cost. Experience has shown that most goods manufactured in advanced economies are cheaper, affordable and of better quality. (Egbunike, 2009)

The enormous cost involvement in manufacturing in Nigeria is as a result of structural inadequacies. The difference in the cost of production between the developed and developing countries could be tried to structural diversity (Chukwuemeka, 2014). This situation is worrisome and the question we often ask ourselves is: what is the level of AMT adoption by manufacturing firms in Nigeria and whether these have any significant relationship between capital and labour costs? Provoked by this, the researcher formulated the following hypotheses to guide this investigation:

Ho_1: Adoption of AMT by manufacturing firms in Nigeria is not low

Ho_2: There is no significant relationship between capital and labour operation in AMT in Nigeria.

The rest of the papers is organized as follows: Section one includes in introduction and formulated hypotheses under investigation. Section two involves the theoretical framework on which the study is based and empirical reviews. Section three includes research designs and methodologies. Section four shows the data presentation, analysis and interpretation; while section five embraces study findings, conclusion and recommendations.

2. REVIEW OF RELATED LITERATURE

2.1. Theoretical Framework

The theoretical underpinning of this paper is structured around Cobb-Douglass production function (Douglas, (1976), AMT is all about large scale production with much of capital and less of labour. The additive growth rate function has variables three growth rates and as parameters the weights a and b. these weights can be interpreted simply as: if we let k/k = 0, then we have

$$\alpha = \frac{\Delta Q}{Q} / \frac{\Delta L}{L} \qquad (1)$$

a and b = $\frac{\Delta Log\ Q}{\Delta Log\ IC}$ \qquad (2)

So that additive growth rate function can be written equivalently in logarithmic form as:

Log Q = a LogL + b LogK \qquad (3)

But the adding logarithms of variables is equivalent to multiplying those variables themselves. So from this logarithmic form of the additive growth rate function may be derived as:

$Q = L^a K^b$ \qquad (4)

Which but for one thing is the required multiplicative production function. The one things required is an adjustment factor. If output Q is measured in say number of cars, L, Labour in number of man years and capital in ₦ at constant prices, how can man years be multiplied and raised to an exponent to get the number of cars?. We cannot unless we put in an adjustment factor which scales man years (exponentiated) to conform with numbers of cars. If we denote this adjustment factor by the letter z, function as:

$Q = Z\ L_a K^b$ \qquad (5)

Another way of dealing with adjustment problem is to measure Q, L, and K not K not in their original problem is to measure Q, L, and K not in their original units bust as indices, each with a base (index) value of units and in this case, the adjustment factor of z will also be equal to 1, because in the base index values the production function will be:

$$1.00 = 1 \times 1.00^a \times 1.00^b \tag{6}$$

If one is raised to power one or any power is still "1"

This form of production function is known as cob-Douglas production function.

Now, we can show that labour productivity is a function of the capital-labour ratio. Suppose that we have the following values for the parameters a and b where a = 0.75, b = 0.25. Then let us also measure Q (output), L (Labour) and K (Capital) in index terms, with base values of 100. In this case, the adjustment factor z will be equal to 1. The production function is therefore:

$$Q = L^{0.75} K^{0.25} \tag{7}$$

If we divide through by L, we get a production function for output per worker as related to capital per worker:

$$\frac{Q}{L} = L^{0.75} L^{-1} K^{0.25} \tag{8}$$

$$L = L^{-0.25} K^{0.25} = \left[\frac{K}{L}\right]^{0.25} \tag{9}$$

Using this rule for indices or exponents that $1/L = L^{-1}$, we can see what it looks like graphically.

In production function, the same quantity of outputs can be produced with different combinations of labour and capital inputs suppose we hold Q constant at 100, denoting this constant value as Q, then we have:

$$Q = L^{0.75} K^{0.25} \tag{10}$$

Hence; $K^{0.25} = \overline{Q} \frac{X\,1}{L^{0.75}}$ so that

$$K = \frac{Q^{-1}}{0.25} \times \frac{1}{L^{\frac{0.75}{0.25}}} = \overline{Q^4} \frac{X_4 1}{L^3} \tag{11}$$

If we put into this function any chosen value of L, to produce 100 units of output, these combinations of L and K trace out what is known as Isoquant.

Now, the amount of money per annum firms spend on Labour and Capital is given by:

$$C = PL \; X \; L + P_{IC} \; X \; I_C \tag{12}$$

Where P_L and P_{IC} are the prices per unit of Labour and capital respectively. This cost equation can be turned into a functional relationship between capital and labour as follows:

$$K = \frac{C - PL}{P_{IC}} \frac{XL}{P_{IC}} \tag{13}$$

This gives a straight line relationship between K and L with a downward slope of $-PL/P_{IC}$. If we hold C constant, then this equation shows combinations of L and K which can be bought for that constant total cost. This is sometimes called in is cost line.

Now with increasing returns to scale with AMT adoption, quantity produced increases in multiple, the unit of ISOquant shifts downwards towards the origin. The least cost unit requirement both decline; and the least cost unit labour and capital costs combined, falls.

Now in Nigeria, the risk and uncertainty in the labour cost is much. For instance, most firms in Nigeria hardly disclose the cost of labour. However with the new global financial reporting system, it is expected that a more transparent disclosures in financial statement of firms in human capital cost reportage. There are many other factors that impact negatively on productivity in Nigeria such as, indiscipline, structural inadequacies. As a result of all these, firms operate at less than constant return to scale. Therefore the level of waste or productivity is determined by the ratio of capital to labour (Lipsey and Chryslate, 2011).

2.2. Amt-Productivity Efficiency Linkage

According to Johnson and Kaplan (1987), AMT adoption leads to changing manufacturing operations and information needs for companies to formulate strategies to meet the rapid changes in business environment. Technological innovations, advance human development in two ways viz: - it increases productivity that raises income and human social conditions. It advances the level of goods and services, quality delivery and the standard of living of the people. It impacts changes on the area of reporting practices (Fukunda-parr, Sakiko (2003).

AMT influences labour cost, expenditure on plants, machinery and output in various ways. For instance, according to Chukwu (2008), mass production has to do with improved method of production, output shift of production function, shifting down of the 150 cost curve of the firm concerned. It does not only influence the cost structure but also suppliers' performance, customers' profitability and pricing method- bench marking (Williams, 2005).

The traditional accounting systems have been found to be inadequate as basis for evaluating performance in companies that have adopted AMT. This view is supported by Kaplan (1996), when he said that traditional management accounting produces wrong measures, reward managers for managing the business and provides no incentive for improvement. The best that can be done is to switch them off and not just doing them.

3. RESEARCH DESIGN AND METHODOLOGY

3.1. Research Design

This section of the paper portrays the major methodological issues in actualizing the adoption of AMT among Nigeria firms. This study applied Ordinary Least Squares (OLS) method. The process of measurement is also central to quantitative research because it provides fundamental connection between empirical observation and mathematical expression of quantitative relationships. This entailed the use of secondary data viz. financial statements of selected manufacturing firms from the fact books.

3.2. Population

Annual reports and accounts of leading blue chip companies for the year 2010 to 2014 were examined. This include:

- Nigerian Breweries PLC
- Golden Guinea Breweries PLC
- Guinea Nigeria
- 7-up Bottling company
- Dangote flour mills
- Cadbury Nigeria
- UTC Nigeria Plc
- Nestle Nigeria Plc
- P Z Nigeria
- Unilever Nigeria
- John Holt Plc
- Cadbury Nigeria
- Coca-cola Nigeria
- Dunlop Nig. Plc
- Neimeth International Pharmaceuticals Plc
- Nigeria German Chemical
- Nigerite Ltd
- Promasidor Ltd
- May and Baker Nig. Ltd
- Friesland Foods Wamco Nig. Ltd.
- British American Tobacco Nig. Ltd.

3.3. Sample Techniques

In view of the fact that the above population size is within manageable tendencies, the researcher purposively adopted the whole to serve as the sample size for purpose of the model analysis. Thus there was no need to further restrict the population size through a given formulae for determining the sample size of a given study.

3.4. Model Specification

To capture AMT adoption, output Q, capital (K) and Labour (L) are involved according to economic principles. Here AMT is captured by the size of capital. Hence the production function of the Nigerian manufacturing firms is specified as follows:

$$Q = F (k \text{ or } AMT, L) \tag{14}$$

$$\text{Or } Q = L_0 + L_{1k} + L_2L_+ U_1 \tag{15}$$

Where Q is the output; is the capital or size of AMT;

K is capital

L is labour

Where $L_O L_S$ is the intercept; L_1 and L_2 are coefficients.

4. PRESENTATION OF ANALYTICAL RESULTS

4.1. Data Analysis

Table: Regression Results of the 26 manufacturing firms in Nigeria

Model: $Q = -55.9 + 25.4l + 35.6k + Ui$

Variables	Coefficients	Std error	t-stat	Prob.
C	-55.9	23.3914	23.3100	0.0097
K (AMT)	35.6	7.4901	4.7500	0.00104
L	25.4	1.1813	21.500	0.0009

R- Squared = 0.72

R- Squared $a0_j$ = 0.69

SE = 0.00639

Log likelihood = 0.004783

F - Statistic = 7.84

D - W = 2.74

4.2. Results and Discussions

Diagnostic test of the model

To test for the reliability of the overall model, R-squared, F-statistic and Durbin-Watson were measures and criteria used

The R-squared adjusted was slightly high (0.69) indicating that the model can explain 69 per cent of the relationship between output and the two explanatory variables (Labour and Capital).

The F-statistic is significant at 5 percent level of significance, indicating that there is no case of multi-collinearity.

The Durbin-Watson measure of 2.74 per cent indicates that there is a case of autocorrelation, but it is a minor case of autocorrelation.

However, the overall model is significant as the model can explain 69 percent of the relationship between capital, labour and output.

In examining the stability of the coefficients, there is every indication that the coefficients of constant, capital and labour are significant at less than 5 percent (see table 1.00). Now the ratio of capital to labour is 0.58:0.42, indicating that AMT adoption is not yet significant among the Nigerian firms.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary of Findings

- Manufacturing firms in Nigeria especially the 21 manufacturing firms sampled for the study showed that labour and capital have significant effect on output. The ratio of labour to capital is an indication that AMT is yet to be adapted in Nigeria. It indicates weakness in AMT adoption among Nigerian manufacturing firms.

The implication of weak adoption of AMT in Nigeria shows that most firms adopt standard cost accounting practices in their operations.

- It has been discovered that advanced manufacturing Technology brings about changes in cost structure in such a way that cost evaluation of products are properly done. And that the products are cheaper and of high quality.

- Manufacturing firms that adopt Advanced manufacturing Technology make adequate use of modern innovative reporting system to complement AMT reports such as system performance, customer profitability analysis, product line profitability analysis, and bench marking reports.

- Advanced manufacturing Technology improve efficiency, reduces operating costs, improves delivery costs and ultimately derivatives high quality goods and services. AMT ensures operating cost-savings, resulting from a reduced labour force and costs, giving rise to inventory savings, faster set ups, reduced waste, scamp and network with more orderly product flow and speedier approach. This arises from more reliable equipment.

- AMT improves delivery time the certainty that delivery promises can be met which comes as a result of reduction in through put, lead times and greater flexibility, which in turn arises from economy of scale.

Now, the reason why adoption of AMT is slow in Nigeria is that the cost of capital is high. It's much adoption is likened to transfer of technology which is significantly expensive. Then with the surplus labour in Nigeria, the cost labour seems to be low. And since the cost of capital is high and that of labour being low, for firms to maximize profit is within the confines of affordability of AMT and manipulation of capital and labour to achieve least cost at the Isocost line.

5.2. Conclusion

From the ongoing, it is crystal clear that AMT, is expensive. If it is fully adopted, may give rise to improve scale of production. It is observed that, capital-Labour ratio in the Nigeria manufacturing firms is a demonstrations of the much expensive nature of capital. It is therefore concluded that the adoption of AMT has not been significant.

5.3. Recommendations

In line with findings, the following are recommended:

- Nigeria needs to create an enabling environment for AMT adoption. Both the capital and financial markets should be strengthened.
- The power sector is still weak. Electric generation and supply is still epileptic. Also the transfer system is not perfectly functioning for all their areas should be given serious attention.
- Nigeria needs to revolutionize its manufacturing sector. Dependence on traditional manufacturing practices will not record the needed success to propel the nation as one of the 20 economies of the world by 2020. And AMT holds the key to the future. And the formulation must be laid now by revolutionizing infrastructures, building of efficient and dependable power sector and transport system.

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