LIFE CYCLE COSTING AS A STRATEGIC COST MANAGEMENT TOOL IN MANUFACTURING: LESSONS FOR MANUFACTURERS IN NIGERIA

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Abstract

The need to be efficient and remain profitable in business has brought to fore the relevance of implementation of Life Cycle Costing (LCC) by manufacturers in Nigeria. The use of LCC is a technique adopted as a tool for cost management programme used by manufacturing firms in many developed and developing nations of the world. With the use of exploratory research, it was found there is a positive link between cost efficiency, profitability, survival of manufacturing firms and implementation of LCC of products. It is therefore recommended that manufacturers in Nigeria's economy should employ/implement this potent cost management tool in their manufacturing processes for improved performance, profitability and survival in a competitive global economy.

Keywords: Life Cycle Costing; Improved performance, Cost management; Manufacturing firms; Profitability

Introduction

In development literature, industrialisation which largely depends on production (manufacturing) is adjudged as the major driving force of any economy. In most economies of the world, manufacturing is always described as the heart for growth as the sector is the means for delivering goods for both local consumption and export. The sector plays a catalyst role in modern economies in terms of economic transformation and avenue for greater utilisation of local raw materials showcasing innovative abilities of citizens of a nation for self-reliance. Manufacturing sector should be of particular interest to developing nations of sub-Saharan Africa like Nigeria where the sector if efficiently managed, would play a pivotal role in terms of employment generation, enhancement of income of individuals, entrepreneurs and improved standard of living in the society. Efficiency is sacrosanct in manufacturing as it entails better utilisation of organisational resources to increase output in quality and quantity at reduced cost (Edem, 2015). Manufacturing

therefore is a process that begins with identification of wasteful processes that contribute to the drainage of resources and taking steps to eliminate those processes (Momoh, 2017).

For sustained efficiency in production, accurate prediction/estimate of resources required in procuring, operating, maintaining and ultimately disposing a product is strategic cost management in a manufacturing enterprise. Understanding the total costs incurred throughout a product lifecycle and identifying areas where cost reduction can be achieved in the lifecycle of a product are key to profitability in a manufacturing firm. Total cost management through the instrumentality of lifecycle costing (LCC) has been the secret behind the success story of many manufacturing firms in most developed nations of the world (Boateng & Thomas, 2015). For instance, in China, Japan and Germany. Fasheyi and Tolu (2018) discovered that manufacturing firms in these countries have been recording tremendous successes in managing their product for sustained profitability over the last decades. Similarly, Babaye (2018) observed that using LCC tool, manufacturing firms in countries such as UK, USA and Russia have been accurately predicting costs of developing and making new products, identify costs incurred in all stages of manufactured products and identifying areas where cost savings can be achieved for efficiency, quality and profitability.

Implementation of LCC therefore is a means of directing management's attention to the cost of a variety of components and the end products. A reduction in the variety means larger runs with fewer changes on the production line, higher production and lowers unit costs. With LCC, quality tends to be more consistent and inspection or quality ascertainment from design simple and cheaper (Enemah, 2016). In implementing LCC, managerial attention is normally directed towards three (3) key areas particularly in respect to product utilisation namely: (i) accurate determination of proportion of time the product is capable of functioning competitively (ii) product maintainability which usually requires manufacturers' responses to the affirmative or otherwise as to whether the products can be maintained for patronage and (iii) consideration of the disposal costs of the product and associated environmental problems. These three key areas require technical, engineering, scientific and production experts that accountants cannot assess alone (Fasheyi& Tolu, 2018). Product life cycle costing therefore is an exercise requiring the inputs of specialists such as managers, accountants, analysts, engineers, marketers and other specialists within and outside an organisation. The expertise of these people is required in a manufacturing business in pursuit of economic lifecycle cost and profitability determination of a product.

Statement of the Problem

Manufacturing is a business where growth and survival of an enterprise thrives and efficient cost management in all production processes without compromising quality. Enemah (2016) viewed that efficiency in production as key in cost management and entails careful tracing and managing all costs on a product by product basis over months, identifying and eliminating those costs that do not add value with the aid of managerial tools. Various authors such as Boateng and Thomas (2015), Fasheyi and Tolu (2018) and Babaye (2018) have discovered that many manufacturing firms in advanced economies such as China, Japan, U.S., U.K. and Germany have adopted the implementation of LCC as a strategic tool for cost management in their manufacturing processes and this has impacted positively on product quality and profitability of these firms.

However, in Nigeria, the level of implementation of this potent cost management tool is low as empirical evidence to substantiate its use in the country is rare. Ebiai (2017) viewed that one of the major endogenous factors responsible for inefficiency in the manufacturing sector of Nigeria's economy is failure of the operators in the business to build accurate and reliable cost data for product(s) they make as a base to identify potential cost reduction/saving areas in the lifecycle of the products. Similarly, Ojalaka (2018) discovered that efficiency improves quality and profitability is impaired in Nigeria's manufacturing sector for failure of entrepreneurs to take proactive measures using tools such as LCC to accurately estimate all the costs involved in procuring, operating, maintaining and ultimately disposing their products. Collaborating Ojalaka (2018), Nashiru and Raymond (2018) stated that many manufacturing enterprises in Nigeria are facing a lot of operational challenges for failure of manufacturers to evolve strategies to accurately track and accumulate actual costs and revenues attributable to product(s) for profitability determination. Collaborating Ojalaka (2018), Nashiru and Raymond (2018), Okpata and Bashaa (2018) viewed that LCC analysis is a multidisciplinary activity involving the use of analysts who are familiar with peculiar cost elements involved in the life cycle of a product, sources of cost data to be collected and accurately matching costs and revenues attributable to a product for profit or loss determination which many manufacturers in Nigeria ignore. Failure to apply this analysis by entrepreneurs in Nigeria according to Ojalaka (2018) is one of the major issues of cost management threatening the survival of manufacturing enterprises in Nigeria.

Objectives of the study

The general objective of the study is to examine the relevance of LCC as an accounting-based cost management technique in a manufacturing environment. The specific objective however is to explore the importance and intricacies of implementing LCC as a strategic cost management tool that can be implemented by manufacturers in Nigeria as an endogenous mechanism for efficiency relying on literature on the subject matter.

Conceptual Review

Life Cycle Costing is a cost management tool that tracks and accumulates actual costs and revenue attributable to each product over the entire product life for profitability determination (Adeniyi, 2009). It is an accounting based managerial technique used to determine the total costs associated with a product. Adeniyi (2009) viewed LCC as a cost reduction and control mechanism of a manufacturing firm that tracks and accumulates the actual costs and revenue attributable to cost object form its invention to its abandonment. Product LCC is an approach used to provide a long-term picture of product line profitability through effective life cycle planning and provision of cost data to clarify the economic impact on the chosen production process (Obayemi& Ajayi, 2011). Clement and Monica (2012) opined that LCC is a cost management tool mostly used in manufacturing firms which entails accurate and realistic assessment of revenues and costs within a particular lifecycle stage of a product. Implementation of LCC is a strategic cost management tool that involves continuous monitoring of actual performance of product lines and identifying areas where cost savings can be achieved in a manufacturing business (Fasheyi& Tolu, 2018).

Stages of Product Life Cycle Costing (PLCC)

Product LCC in a manufacturing setting has nine (9) distinct stages that have to be followed with accurate accumulation of costs incurred in each of the stages. The stages are: (i) market research (ii) specification (iii) design (iv) prototype manufacture (v) development (vi) tooling (vii) manufacture (viii) distribution and sales and (ix) decommissioning. The cost elements/components of each stage of the cycle are mathematically expressed in an equation as follows.

$$PLCC = C_{mr} + C_s + C_d + C_{ptm} + C_d + C_t + C_m + C_{ds} + C_{dec}$$

Where:
PLCC = Product Lifecycle Cost
Cmr = Market Research Cost
Cs = Specification cost
Cd = Cost of design
Cptm = Cost associated with Prototype Manufacture
Cpd= Cost of Product Development
Ct= Tooling cost
Cm = Cost to Manufacture Product
Cds = Cost Associated with Distribution and Sale
Cdec = Disposal Cost Including Cost to Dismantle Plants Used.

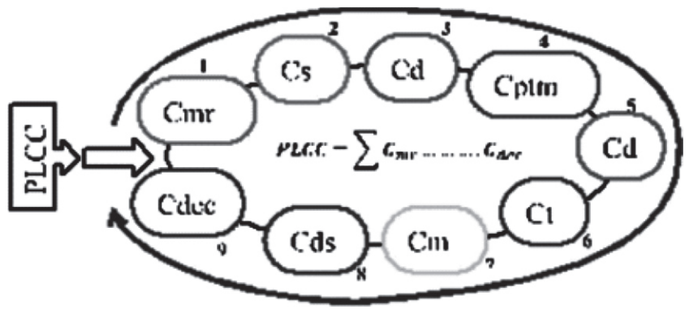

Fig 1. Product Life Casting Cycle Model
Source: Author's Illustration of PLCC

The above equation is diagrammatically represented in Figure 1.

i. Market Research: This is the first stage of product LCC that is done in order to establish exactly the product(s) customers want. A thorough and vigorous market research is undertaken by manufacturer to know in advance the quality, the quantity and the price customers are prepared to pay for the product (Ogamu & Cletus, 2014).

ii. Development: At the development stage of PLCC, all testings and changes necessary to meet the expected performance of the product and requirements of the customers/consumers are effected.

iii. Specification: At specification stage, details such as product's required life, product maintenance costs, manufacturing costs, required delivering date and expected performance of the product are established.

iv. Design: This is the stage where decision of how the product will look like will be depicted in drawings. The desired shapes, colours and sizes are properly defined and put down in drawings for comparison when proper production commences (Enemah, 2016).

v. Prototype Manufacture: From the design, a small quantity of the product will be manufactured and the initial run of the product is made. A satisfactory prototype will lead to further development of the product.

vi. Tooling: Tooling up for production is that stage where decision to build up a production line, building jigs, purchase of necessary tools and equipment for initial substantial investment is made (Faloyi & Osman, 2011). Decision to go into tooling for production is predicated upon assurance that product(s) developed has meet the expected performance and requirements of customers/consumers.

vii. Manufacture: Manufacturing entails the purchase of raw materials, machines, labour required for production and other manufacturing expenses involved to make the product, are incurred.

viii. Selling and Distribution: Costs to incur in distribution and sales of manufactured products are considered at this stage of the PLCC.

ix. Decommissioning: In the final stage, when the life of the product ends, plants and machineries used to build the product will have to be sold or scrapped. For toxic and hazardous products, disposal and environmental restoration costs have to be considered. Again, for continuity in business, a decision has to be made by manufacturer either to go into production of new brand product (s) or improve the quality and competitiveness of the old product. In either of these decisions, a team of researchers will be commissioned for product research and design and the lifecycle continues.

Total Product Life Cycle Costs

Estimated costs for the elements that comprise the total PLCC as indicated in the equation will have to be aggregated/summed up for comparison of the product design and production under consideration. For accurate estimation, all predetermined/estimated costs associated with each stage of the product life cycle would have to be clearly tabulated to give the PLCC values for comparison with actual cost incurred throughout the life cycle of the product. Predetermination of LCC for a product will assist manufacturers in planning, contracting, budgeting and proactive actions that could be taken to generate revenue at lower cost to the enterprise (Clement & Monica, 2012).

Benefits of LCC to Manufacturers

Momoh (2017) viewed that implementation of LCC has become a critical and valuable tool for continuous cost evaluation and management's benefits to manufacturers in the following ways:

i. Analysis of LCC of products can assist managers and producers in understanding all the cost components that make up the total cost of a product thereby providing opportunities for identifying areas where cost reduction/savings effort can be possible.
ii. Controlling and managing product costs using LCC approach usually result to managerial actions to lower operational costs (waste minimisation) for profit maximisation.
iii. Better decisions of management regarding a product or products as a result of accurate and realistic assessment of revenues and costs within a particular lifecycle stage of a product.
iv. Implementation of LCC being a strategic managerial tool helps in promoting long-term rewarding decisions on product. Cost curtailments at every phase of product lifecycle. Quality improvement and competitiveness of a product acceptable in both local and international market are some of the rewarding strategic decisions that are usually taken using LCC approach.
v. Using LCC analysis provides management of a manufacturing enterprise with an overall framework for considering incremental costs over the entire life span of a product since LCC approach is primarily concerned with cost data analysis at all phases of a product lifecycle.

Theoretical Framework

The study is anchored on production theory cited in Edem (2015). The theory is an explanation that guides managers of manufacturing enterprises in decisions making relating how much of a commodity to produce, the costs, sales and profit prospects of good(s) produced. The theory envisaged that managers have good sense of what to produce, how the goods are to be produced and the associated costs. The theory therefore relates to LCC of a product as a tool that enables managers to accurately predict/estimate how much it will cost a business to make a product and the benefits (profit) derivable from production of such goods.

Embedded in the theory is a cost function which Khalifa and Muyiwa (2016) defined

as the relationship between the cost of a product and the output mathematically expressed as C = f (Q) where C is the cost and is a function of the quantity (Q) produced. The theory has three (3) key assumptions namely (i) that managers want to produce the quantity of output that will maximise profit; (ii) that business can increase production or output by using more inputs and more output leading to increase profit and (iii) that there is more than one way or one recipe for producing a product (Edem, 2015). The use/implementation of LCC as a strategic cost management tool by manufacturers for profit maximisation underscores the relevance of this theory to the study.

Empirical Review

Studies in Developed and Developing Nations.

Nasieku and Olayinka (2016) investigated cost accounting techniques adopted by manufacturing and service industries within the last decade. The purpose of the study was to review literature on cost accounting techniques practised by manufacturing and service firms. It was discovered that LCC is one of those cost accounting tools used by most manufacturing firms in both developed and developing nations to manage costs for improved performance in the last decade.

Alex (2013) conducted a study on the application of whole life costing in the UK construction industry: Benefits and barriers. The aim of the study was to examine the importance of lifecycle costing in construction firms in the UK. Results of analysis obtained from 100 questionnaires administered on respondents revealed that LCC implementation was significant as it aided manufacturing firms attained efficiency and profitability.

Nor and Dan (2011) did a study on implementation of LCC in Malaysia construction industry. The study was a review of the usage of LCC that brought to fore the understanding of LCC for construction industry. It was found that LCC implementation was important for product maintenance and cost reduction.

Boateng and Thomas (2015) carried out a study on the implementation of LCC in manufacturing firms: A study of selected firms in Accra. The aim was to investigate the impact of LCC on efficiency of manufacturing firms. Data for the study were obtained through questionnaires distributed to twenty (20) managers of manufacturing firms in Ghana to express their views on the impact of LCC in production process and product costs. Responses from sixteen (16) returned

questionnaire were analyzed with the aid of descriptive statistics of simple percentage. The result revealed that thirteen (13) representing 81 percent of the respondents agreed that adoption of LCC technique had enabled their organisations attained efficiency through continuous tracking and tracing of costs to product and matching costs with revenue generated by each product.

Samindi, Samarakoon and Ode (2012) conducted a study on LCC as tool for selecting the best available technique for managing physical assets. The aim of the study was to examine the level of usage of LCC by manufacturing organisations in selecting the Best and Qualified Technique (BAQT) from available alternatives. Using questionnaires distributed to top managers in three manufacturing firms in New Zealand,the finding from the responses analysed descriptively indicated that the use of LCC method had assisted the manufacturing organisations to select assets that impacted positively on their productive efficiency.

Marketa and Renata (2015) did a study on cost efficiency evaluation using LCC as a strategic method for cost reduction. The aim of the study was to examine the impact of LCC in optimising lifecycle costs of an asset on investment project without loss of performance. A structured questionnaire was used to collect data from respondents comprising forty-five (45) staff of ten (10) manufacturing companies in Czech Republic. The data collected were analysed using Kruskal-Wallis inferential test. It was found that there was a significant relationship between implementation of LCC and efficiency of manufacturing business.

Studies in Nigeria

Efurum and Osudumi (2015) carried out a study on adoption of LCC in manufacturing business a case of selected enterprises within Osun state. The aim of the study was to investigate the implementation and usefulness of LCC in a manufacturing business. Data for the study were obtained through questionnaire distributed to ten (10) managers in two (2) manufacturing business in Oshogbo. Responses obtained were analysed descriptively with use of simple percentage. The result indicated that the use of LCC is a potent tool that has helped these enterprises to significantly curtail costs in all segments of their manufacturing processes.

Odipe and Taiwo (2014) conducted a study on the role of LCC in manufacturing organisations: A study of selected firms within Lagos. The aim of the study was to examine the impact of LCC on efficiency and profitability of manufacturing firms.

With the use of primary source, data was collected from a sample of thirteen (13) manufacturing organisations through questionnaires distributed to one hundred and forty (140) respondents comprising managers and accountants in these firms. Respondents obtained from one hundred and ten (110) respondents were empirically analysed using simple regression. Result of empirical evidence indicated that LCC implementation in these firms has impacted significantly on operational efficiency, cost reduction and their survival.

Generally, empirical studies on implementation of LCC by manufacturing enterprises in Nigeria are still rare. This therefore implies that the overwhelming role of this strategic cost management tool is yet to be given adequate attention for implementation by manufacturers in the country.

Methodology

The study is a conceptual exposition that explored relevant literature on the subject matter. This exposition was accomplished by making use of previous presentations derived from theoretical and empirical studies. Since the aim is to encourage manufacturing firms in Nigeria to implement LCC, the study examined the benefits of LCC to manufacturers in advance and developing economies as obtained from literature. The study therefore is a presentation that ended with feasible recommendation to manufacturing firms in Nigeria where LCC implementation is low.

Findings and Discussion

LCC is an essential planning and decision-making tool for manufacturing enterprises. It's emphasis on cost savings in manufacturing processes has triggered firms to continuously monitor their performance for efficiency and profitability (Alex, 2013; Boateng & Thomas, 2015; Nasieku & Olayinka, 2016). The implementation of this strategic management tool has enabled manufacturing firms in developed and developing nations attain appreciable level of efficiency. Manufacturing firms in countries such as UK, USA, Russia, China, Japan, Germany, Ghana and New Zealand rely extensively on LCC implementation in their manufacturing processes with positive impacts on efficiency and profitability (Samindi, Samarakoon & Ode, 2012; Thomas, 2015; Jasheyi & Tolu, 2018; Babaye, 2018). Controlling and managing product(s) costs, realistic assessment of revenues and costs within a particular lifecycle stage of a product and taking action to lower operational costs are some of the benefits of LCC (Boateng & Thomas, 2015).

Unfortunately, the level of implementation of LCC by manufacturers in Nigeria is still very low (Ebiai, 2017). Collaborating Ebiai (2017), Ojalaka (2018) and Nashiru & Raymond (2018) all stated that inefficiency, poor quality output problems have impaired the survival of most manufacturing for failure to take proactive actions in estimating costs of production and actions to control and manage costs at every stage of the manufacturing process. It is quite obvious that the issue of cost management is the major endogenous problems threatening the quality of the output and the survival of manufacturing firms in Nigeria which implementation of LCC, an accounting-based managerial technique has addressed in some developing and developed economies.

Conclusion and Recommendation

Implementation of LCC is a strategic endogenous managerial tool for sustained cost management employed by manufacturing enterprises all around the world. Continuous monitoring of the actual performance of a product during its operation and maintenance in order to identify areas in which cost savings may be achieved without impairing or comprising product quality and its competitiveness is a survival strategy for manufacturers in developed and developed economies. This is therefore a lesson for manufacturers in Nigeria to employ this potent cost management and efficiency tool for survival and competitiveness in a global economy.

References

Adeniji, A. A. (2009). *An insight into management accounting*. Lagos. Value Analysis Publishers.

Alex, O. (2013). The application of whole lifecycle costing in the construction industry: Benefits and barriers. *International Journal of Architecture, Engineering and Construction* 2(1), 35-42.

Babaye, I. S. (2018). Revitalizing ailing textile industry. A paper delivered at a workshop by Nigerian Textile Workers. Lagos. March 10th.

Boateng, W.V & Thomas, M.O (2015). Implementation of lifecycle costing in manufacturing firms: A study of selected firms in Accra. *Journal of Contemporary Studies in Entrepreneurship* 5(2), 49-58.

Clement, P.B & Monica, S.L (2012). *A practical approach to management accounting.* (1st Ed.) City of Publisher: Fillbond Publishers.

Ebiai, U. (2017). Industries in Nigeria at crossroad: How to save them from glaring collapse. Unpublished Lecture delivered at Federal Polytechnic, Idah. 10th June.

Edem, N.F (2015). How to save Nigerian's manufacturing industry from troubled conditions? *Journal of Management Science and Entrepreneurship,* 2(4), 115-120.

Efurum, B. N & Osudumi, D. A (2015). Adoption of life cycle costing in manufacturing firms: A case of selected firms within Osun State. *Journal of Accounting and Finance*, 7(3), 96-109.

Enemah, D. A (2016). *Operations research in perspective*. (Ist Ed.): Asaba ELT Ltd. Publishers.

Faloyi, G.R & Osman, A.D (2011). *Management: A practical guide*. (3rd Ed.) Jos PAAT Publishers.

Fasheyi, R.M & Tolu, K.S (2018). Adoption and implementation of lifecycle costing approach in manufacturing enterprises. *International Journal of Management and Entrepreneurship* 3(1), 81-89.

Marketa S. & Renata, M (2015). Cost efficiency evaluation using lifecycle costing a strategic method. Conference paper on Business Economic and Management held at University of Paradubice Czech Republic.

Momoh, U.N (2017). Entrepreneurship development: Panacea to unemployment in Nigeria. *Multidisciplinary Journal of Contemporary Studies*, 8(3): 45-67.

Nashiru, S.O & Raymond, B.U (2018). Productivity in Nigeria's manufacturing sector. *Journal of Contemporary Management* 8(3), 78-87.

Nasieku, T. & Oluyinka, LO (2016). Cost accounting techniques adopted by manufacturing and service industry within the last decade. *International Journal of Advance in Management and Economics*, 5(1):113-128.

Nor, A.M.R & Dan, Z.A.A (2011). Implementation lifecycle costing in Malaysia construction industry; A review. *Intl. Building and Construction Technology Conference Malaysia,* 7-8 June, 2011.

Obayemi, A.O & Ajayi, T.N (2011). *Cost and management accounting made simple.* (2nd Ed.) City of Publisher: Odun Ltd Publishers.

Odipe, N.L & Taiwo R.O (2014). The role of lifecycle costing: A study of selected firms in Lagos. *Asian International Journal of Contemporary Research,* 5(3), 73-85.

Ojalaka, C.N (2018). The state of Nigeria's textile industry. A paper presented at a workshop organised by Modem Nigeria's Textile Workers. Lagos.

Okpata, H.L & Bashaa, A.E (2018) Cost management techniques in a manufacturing setting. *Journal of Entrepreneurial Studies,* 1(3), 17-26.

Saminidi, M.K, Samarakoon, T.M & Ode T.G (2012). Lifecycle costing as a tool for managing physical assets. *International Journal of Perform-ability Engineering*, 8(3):26-37.