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The journal calls for articles / papers and book reviews.

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Table of Contents

Comparative Analysis of Fiscal Federalism in Nigeria and India. EKANADE OLUMIDE, Ph.D	1
Globalisation and Third World Development: A Historical Analysis. R. I. OHIKHOKHAI and I. M. ALIU	18
Kabba-Nupe Relations in the 19 th Century. EKUNDAYO, A.T. Ph.D	37
Psychological Aspects of Corruption in Nigeria. BOLANLE OGUNGBAMILA	57
Egoism in Leadership: The Nigerian Experience. OYIBO GODWIN	81
Moral Transformation as a Parameter for Entrenching Social Change, Good Leadership and Governance in Nigeria. JINADU ABIODUN MOSES	98
Morality and Democracy: The Nigeria Dilemma. EZEUGWU CHUKWUDI EVARISTUS & ANICHEBE OBIORAH	107
Ethnic Pluralism and Challenges of Democratic Consolidation: The Nigerian Case. AKINDE, SUNDAY ISRAEL	121
The Role of African Religion in Promoting National Security in Nigeria. ALAMU, AKITI GLORY Ph.D	141
Referential Cohesion in Nigerian Political Discourse. AKINWOTU, S.A.	158
Memoir and Self in Olábímtán's Creative Writings. DURO, A. ADELEKE Ph. D.	174
Femi Osofisan's Historicist Hermeneutics in <i>Aringindin</i> and <i>the Nightwatchmen</i> . AMEH DENNIS AKOH, Ph.D	197
Tayo Olafioye: A Discussion Of Style In The Modern	207

Nigerian No
NNEKA PAT
Tanure Ojai
Feminist Per
The Role of
UNUMEN
Empowering
Contempor
JUSTINA O
The Yoruba
Ethical Con
Theories o
Philosophic
Pythagoras
OLUWASE
The Yorub
Appraisal C
Determinan
Igalaland, I
The Use of
Determinat
G. T. and A
Due Proces
Nigerian P
The Efficac
AKINFEM
The Fourth
Millenium
FOLASAI

- Nigerian Novel. STANLEY ADELODUN ORIOLA and
NNEKA PATRICIA OGBUEHI
- Tanure Ojaide's God's Medicine-Men and other Stories: A Feminist Perspective SOLAOWONIBI 220
- The Role of Women in Esan Pre-colonial Economy. JULIUS UNUMEN Ph.D and O. ODIGIE. 233
- Empowering Women in Nigeria: A Paradigm Shift in Contemporary Development Efforts. ADELEKE, JUSTINA OLUFUNKE 250
- The Yoruba Culture of Aso Ebi [group Uniform] in Socio-Ethical Context. O. O. FAMILUSI, Ph.D. 263
- Theories of Development and Human Progress: A Philosophical Analysis O. G. IDJAKPO, Ph.D. 277
- Pythagoras and The Pythagoreans. BOLARINWA, OLUWASEGUNOTAFELIX OMOLADE. 290
- The Yoruba Concept of Reincarnation: A Philosophical Appraisal OLADIPUPO, SUNDAY LAYI. 301
- Determinants of Oil Palm Production and Export in Igalaland, Nigeria, 1900-1965. ATTAHNOAHECHA. 318
- The Use of Activity- Based Costing System for Product Cost Determination in Manufacturing Companies. AKINLEYE, G. T. and ADIGBOLE, EZEKIEL. A 336
- Due Process and Budget Implementation: An Evaluation of Nigerian Public Sector Auditing OLURAKINSE, FELIX. 357
- The Efficacy of Mortgage as Security for Bank Advances AKINFEMI MICHAEL OWOYEMI, LL.M. 371
- The Fourth Republic Economic Reforms in Nigeria and The Millenium Development Goal One: A Perspective FOLASADE IFAMOSE, Ph.D 400

The Use of Activity- Based Costing System for Product Cost Determination in Manufacturing Companies.

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Abstract

The study examined three basic systems of costing used in determining product cost information, these are: Absorption (Traditional) costing, Direct costing, and Activity- based costing (ABC). Of these three systems, Absorption costing and Activity-based costing are the common systems used for product cost determination as of today. For a very long time, absorption costing was mainly the system available for product costing besides direct costing which is used for special situations. However, in 1989 Activity- based costing was introduced through the works of Cooper and Kaplan. It has been argued that when a company manufactures variety of complex products, ABC is the best costing system to use for product cost determination. To verify this claim, the paper discussed the use of ABC for cost determination and used OSISIONI Nig. Ltd., a medium scale manufacturing company based in Ogun State, Nigeria, as a case study. The study utilized secondary data. The results showed that, ABC has great potentials for use in product costing.

Introduction

The goal of any costing system is to provide relevant and timely information for management use. In the determination of production service cost information, any of these three costing systems- Direct costing, Absorption costing, and Activity-based costing systems can be used. The use of any of the costing systems will depend on the objective for which the cost information is being measured or sought (Innes, 2005). Before the advent of activity-based costing, the

absorption costing system was the most common system of determining product costs, hence it is regarded as the traditional costing system most of the time. The use of activity-based costing for product or service cost determination is gradually on the increase (Innes and Mitchell 1995). It has been discovered that with the traditional absorption costing, the 'true' cost of producing a product or service cannot be accurately determined in a company with heterogeneous products. The traditional costing system distorts products costs because only one cost driver or at most two cost drivers which are also volume based, typically direct labour hours or machine hours are used in allocating overhead costs to products or services. The use of one or two cost drivers which are also volume based in allocating overhead costs to products could be problematic for a company with diverse products or services. Hence, it is said that absorption costing system is deficient in improving global competitiveness (Johnson, 1990).

Can ABC therefore, achieve improved accuracy in product costs determination by using multiple costs drivers to allocate overheads to products or services? That is the goal of this study.

Literature Review

Hilton, (2002) identified the following reasons for product costs information or service:

- Stock valuation and income measurement for the purpose of financial reporting: Product cost information is the major determinant of stock values of products that have been manufactured. The valuation of stocks and cost of sales during a period enables the income of an organization to be measured and reported in the income statement for that period.
- Planning purposes: The product costs are required for the preparation and actualization of business plan. This is particularly relevant in the area of budgeting and standard costing.

- Decision making purposes: The knowledge of the 'true' cost of a product can enhance effective decision making especially in the following areas: Determination of product price; determination of optimum product mix to produce as the knowledge of 'true' cost of a product can reveal those products which are money spinners and those which are money losers.
- Cost control and reduction: The knowledge of a product cost will go a long way in assisting a company in managing its costs. Opportunity for cost improvement will be revealed when a good cost information is produced. In this era of competition only organizations that know how to effectively manage their costs can survive and maximize profits.

Traditional Costing System

The traditional costing system also known as absorption costing is a system of costing under which all production costs are allocated to products. The unit cost of a product or service under this system will include direct material cost, direct labour cost, variable product overheads and fixed production overheads. Absorption costing allocates all manufacturing overheads whether fixed or variable to products. The non manufacturing costs are simply treated as period costs. Overheads are charged to products using a two-stage allocation process and with the use of a single cost driver at the second stage.

Absorption costing is suitable for both external and internal reporting purposes. For external reporting, absorption cost of a product is the cost normally used for stock valuation and income measurement as it is the one acceptable by the Statement of Accounting Standard (SAS) No. 4 - Stock and Work-in-progress valuation.

Limitations of traditional costing (absorption costing) system

The absorption costing system suffers from the following problems. Firstly, it uses single cost driver such as plant wide or departmental rates in the second stage of the two-stage allocation process. The use

of a single cost driver such as direct labour hour rate or machine hour rate on allocating overheads to products is not adequate and cannot accurately trace overheads to cost object. According to Cooper and Kaplan (1988), organizations with high overheads and a mix of products or services, using a single cost driver may distort product costs. Therefore, where a company produces more than one product or service, the use of a single cost driver may not be adequate. The more the cost drivers used in allocating overhead cost to products the more accurate the product or service costs derived.

Secondly, the use of only a volume based cost driver in allocating overhead costs will not produce an accurate product costs. This is because not all overheads cost components are volume related as there are some overheads which vary with batches of units e.g. set-up costs. The distortion of products costs become evident when non volume (or unit) related overhead form a significant part of the total product cost. It has been found that non unit based overheads costs usually form about 50% to 40% of the total product costs (Cooper, 1990). As a result of this, it has been argued that absorption costing understates the cost of complex low volume products and overstates the cost of a simple high volume product (Awasthi, 1994). The report of inaccurate product cost information for management use will negatively affect management's decisions on product mix and pricing of products (where cost-plus pricing is in use) and this can lead to severe long run losses. Such distorted product cost information is also not suitable for cost control. Cooper and Kaplan (1991) also criticized the traditional costing system when they showed how the allocation of service departments' overheads on the basis of volume could lead to distortion in products setting. They argued that this kind of allocation could result in incorrect decision making by managers.

Notwithstanding the limitations of traditional or absorption costing in distorting product cost information, the system is still much relevant for external financial reporting purposes in stock valuation and income measurement. This is because costs derived from this system are verifiable. Also, where an organization produces only one product, product cost computed using absorption costing

can still be relevant for decision making by the management. In this case there may be no need for an elaborate and expensive costing system like activity-based costing.

Activity Based Costing System

According to the American Institute of Management Accountants (IMA), Activity based costing "is a methodology that measures the cost and performance of activities, resources and cost objects, assigns resources to activities and activities to cost objects based on their use, and recognizes the causal relationships of cost drivers to activities". Sellenberger, and Schneider (1990), also defined Activity-based costing (ABC) as a system of costing that focuses on the activities performed to produce products or services. Activities become the fundamental cost accumulation points. Costs are normally traced to activities and activities are then traced to products based on the utilization of activities by products. Activity-based costing can also be defined as a costing system that identifies activities performed in a firm and uses multiple cost drivers (volume and non volume based) to assign overhead to products or services. Activity-based costing system is based on three premises and these are: Cost objects (products or services) consume activities; Activities consume resources; and Consumption of resources drives costs. This understanding is critical to effective management of overhead costs in an organization. The assumption that products consume resources and drive costs is thus rejected by ABC system.

Activity-based costing was developed by Cooper and Kaplan (1988) as a more refined approach for assigning overheads to products and determination of product costs. It is claimed that ABC provides product cost information that is useful for decision-making purposes. ABC systems provide more accurate product cost information for cost management. It focuses attention on indirect costs (overheads) and traces rather than allocates each expense category to the particular cost, object. By so doing ABC tends to make "indirect" expenses direct". In determining product costs both production and

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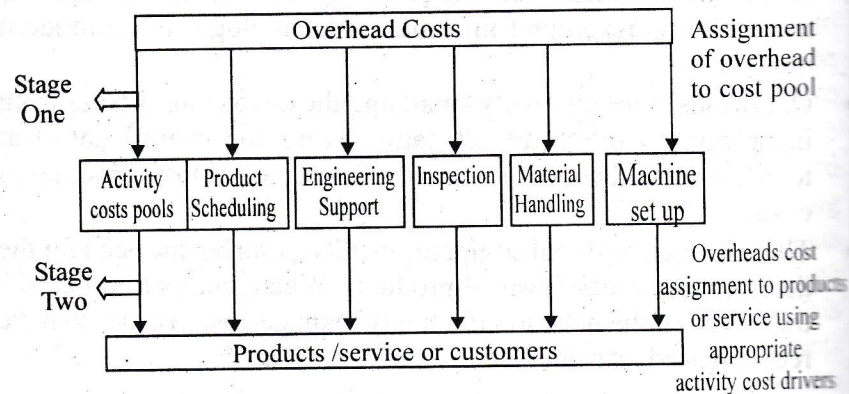
The emergence of ABC system became necessary due to the following reasons:

- There are more numerous products and complicated production systems with varying production requirements (Hilton, 2002). The traditional absorption product costing was developed decades ago when companies had few range of products.
- Labour is becoming an ever smaller component of total product costs (Hilton, 2002). Therefore, labour may not be an appropriate cost driver for allocating all overhead cost items to products.
- Availability of information required for an ABC system due to a more highly developed information technology in the modern day.
- Overheads were relatively small and the distortions arising from inappropriate overhead allocation were not significant. But today, overhead constitutes a significant part of total production costs.
- There is intense global competition thus requiring the need for the determinant of true costs of products. Where competition is stiff there will be the need to effectively manage cost in order to have reduced product prices.

Activity-based costing is different from the traditional costing system in the allocation of overhead costs to products or services. ABC treat direct costs (direct material cost, direct labour cost and direct expenses) in the same way with the traditional costing systems. With ABC nearly all costs are treated as direct except where products do not consume activities which led to the incurrence of the cost. The allocation of overhead costs to products under ABC is done using a two-stage allocation process just as done under the traditional system but in a different approach.

ABC Two-stage Overhead Costs Allocation Process

Under ABC, overhead costs are allocated to products using a two-stage allocation procedure just like the traditional costing systems. The two-stage allocation procedure here is however different from that of traditional costing in the following ways: Firstly, in the first stage of the allocation process of ABC overheads are not allocated to departments but to activities (which are many); and secondly, in tracing costs to products under ABC many cost drivers are used instead of a single cost driver normally used in the traditional costing system. The two-stage process for allocating overhead to cost objective (products / service) under the ABC system can be depicted in the following model:



(Source: Adopted from Hilton, 2002)

First stage allocation process

In the first stage allocation process of activity - based costing systems activities are identified and costs are then assigned to them (called activity cost pools). The activities identified are classified as activity cost pools which are likened to cost centers to which the traditional costing system allocates overheads before absorbing them into products. Activity cost pools cut across departments and are usually many unlike few departments regarded as cost centers in the

traditional costing. In ABC system the accumulation point for overheads is the activity cost pool which could be: production scheduling, engineering support, inspection, material handling, machine set up etc. These activity cost pools replaced departments used as first accumulation point under the traditional costing system.

Second stage allocation process

After overheads costs have been assigned to the various activity cost pools, activity cost drivers which drive the activities are determined and used in allocating overheads to cost objects (products or service). Activity cost drivers are measures of consumption of activities by products or services. Examples of activity cost drivers are : number of moves of materials, inspection hours, number of purchase orders, number of set-up, production runs, number of designs etc. A good cost driver should be a true driver of the cost of an activity and must be measurable.

The ABC system uses multiple cost drivers to allocate overhead cost from activity cost pools to products or service. This is one major factor that makes ABC to be superior to traditional costing system that uses a single cost driver or at best a two cost driver in allocating overheads costs to products or service. The number of costs drivers to be used will depend on the activities identified in an organization.

Steps in Determining Product or Service Costs Using Activity-Based Costing System

The steps involved in determining product cost under the ABC system can be examined under four to six steps, but in this paper, we have decided to use five steps. Which ever number of steps being used, the most important thing is to fully cover the two-stage allocation process in the ABC system. In determining product or service costs using the steps given here, the allocation of direct costs (direct material cost, direct labour cost and direct expenses) has been taken for granted since they are directly traceable to products or services; these costs do not constitute problem in cost allocation.

Hence, the focus here is the inclusion of overhead costs in the cost of a product or service. The five steps examined are:

- Identification and classification of activities
- Collection of overhead cost by activities into cost pools
- Determination of activity cost drivers which drive costs in the activity cost pool
- Compute cost driver rate for each activity cost pool
- Compute product or service costs

Identification And Classification Of Activities

The first step in implementing ABC system for product cost computation is the identification and definition of activity in an organization. Activities are actions which give rise to the consumption of resources. To determine the activities in an organization, the questions to be asked are:

- (a) What kind of staff work here (Department)?
- (b) What does each person do?

Initially, too many detailed tasks and sub-activities will be identified but to minimize costs, similar activities are grouped into main activity centers called activity cost pools. The most useful way of combining activities into cost pools is to organize them into five general levels or layers and these are: unit level, batch level, product level, customer-level, and organizational sustaining activities. Cooper, (1990) identified and described these levels as follows.

Unit-level activities

These activities are performed each time a unit is produced. The cost of unit-level activities should be proportional to the number of units produced e.g. provision of power to run processing equipment will be a unit level activity since power tends to be consumed in proportion to the number of units produced.

Batch-level activities

These activities are performed each time a batch is handled or processed regardless of how many units are in the batch. For example tasks such as; placing purchase orders, setting up equipment, and arranging for shipments to customers are batch-level activities. The cost for these activities is a batch or customer order. Costs at the batch level depend on the number of batches processed rather than on the number of units produced.

Product-level activities

These are activities which relate to specific products line and are usually carried out regardless of how many units of products are produced or batches are run. Examples of product level activities are research and development, product design, advertising a product etc. the cost of these activities vary with number of product line developed or designed or advertised.

Customer-level activities

These relate to activities on specific customers such as mailing customers, checking customers' account.

Organization-sustaining activities

These activities are carried out regardless of which customers are served, which products are produced, how many batches are run or how many units are made.

Organization-sustaining activities include: preparing annual reports to shareholders, arranging for loans, cleaning of offices, administrative and general management activities etc.

In an ABC system the combination of activities is carried out in regards to levels. Limit-level activities should not be combined with batch-level activities or product-level activities etc. Only those activities that are highly correlated with each other within a level are combined.

Collection Of Overheads Into Activity Cost Pools

After activities have been identified, the next step is to identify cost of activities and then assign them to these activities. The classified of costs according to activities is called activity cost pool. An activity cost pool is a "bucket" in which costs are accumulated that relate to a single activity in an ABC system (Garison and Noreen, 2000).

Overhead costs are collected from the accounting records of the organization and then assigned to activity cost pools.

Typical activity cost pools with their levels and drivers are:

Activity cost pool	Level or layer of Activity	Activity measures (Cost driver)
Machine power	Unit level activity	Machine hour
Machine set-up	Batch level activity	Number of set-ups
Customer orders	Batch level activity	Number of Customer orders
Product design	Product level activity	Number of designs
Customer relations	Customer level activity	Number of active Customers

Determination Of Activity Cost Drivers

At this stage, appropriate cost drivers for assigning cost of activities to cost objects (products or service) are selected. Cost drivers are the factors that affect the cost of an activity; they are measures of consumption of activity by cost objects (products or services). To determine appropriate cost driver the question to be asked is: what is the main driver of costs in each activity pool? Some of the criteria for a good cost driver, according to Innes, J. (2005) are: It must be a true driver of the cost of an activity; it must be measurable; it should be the best measure of capacity of that activity and it must have positive effect on employee's behavior.

Activity cost drivers consist of three types according to Dey (2004) and these are explained as follows:

Transaction driver:

These drivers count the number of times an activity is performed e.g. number of purchase orders processed, number of customer order processed, number of set-up undertaken, etc.

Duration drivers:

These represent the time required to perform an activity. Examples of duration drivers are set-up hours and inspection hours. The use of duration drivers can be preferred to transaction drivers if for example, one product requires a short set-up time and another require a long time. In this case using set-up hours as the cost driver will more accurately measure activity resource consumption than the transaction driver (number of set-ups) which assumes that an equal amount of activity resources are consumed by both products.

Intensity drivers:

These drivers directly charge for the resources used each time an activity is performed. Intensity drivers involve direct charging based on the actual activity resources committed to a product. The cost driver is expressed per unit of a product. Examples of some cost drivers with their activity cost pools are given above (refer to previous table under activity cost pools).

Computation Of Cost Driver Rate

Having selected the cost drivers, the next step will be to compute cost driver rates. The cost driver rate is a cost function that links costs and cost drivers with resources used. This cost function is used to convert the pool of costs and cost driver data into a rate per cost driver, unit or percentage of other costs amount or an allocation percentage (Sollenbenger and Schneider, 1996). A cost driver rate is arrived at by dividing activity cost pool overheads by its cost driver.

Computation Of Product Or Service Costs

The final step in determining product cost in an ABC system is to compute product or service costs. In computation of costs direct costs (direct materials, direct labour cost and direct expenses) which

are easily traceable to products is directly charged to them. In an ABC system all overhead costs whether production or non production which is incurred as a result of the consumption of activities by products or services are traced and charged to such products. If it can be proved that a product consumed activity then it must bear part of the cost of that activity. In allocating overheads costs to products, each cost driver rates computed is multiplied by the amount of activities consumed by the products service. This is the tracing of costs assigned to activities to cost objects (products or service).

It should be noted that the first two steps in determining product cost under ABC explained above is the first stage of overheads allocation process in an ABC system; while the last three steps constitute the second stage overheads allocation process.

Research Methodology

The study utilized secondary data from the cost department of OSISIONI Nig. Ltd., a medium scale manufacturing company in Ota, Ogun State, Nigeria. The company produces leather wallets, bags and folders in batches. OSISIONI Nig. Ltd. was judgmentally chosen to fairly represent manufacturing companies because of its steady production flow and profitability over the years. The data relates to the production activities of the first quarter of 2008. The descriptive analytical technique was adopted.

Production Data of Osisioni Nig. Ltd.

Production and costs

Product	Wallets	Bags	Folders
Production units	20,000	6,000	16,000
Unit in batch per run	1000	10	100
Direct material cost per unit	N50	N36	N48
Direct labour per unit (hrs)	5	3	4
Direct labour rate per unit (N)	N4	N6	N4

Total estimated labour hours = 182,000 hours

The total overhead cost of N1, 201,200 is composed of the following four costs:

	N
Machine power	331,200
Production Setup	358,800
Product design	241,200
General management	<u>270,000</u>
	<u>1,201,200</u>

Cost driver information is given below:

Products:	Wallets	Bags	Folders
(i) Machine time (in hours) per unit:	1.5hrs	2.5hrs	1hr
(ii) Number of production runs (Batches):	20	600	160
(iii) Number of product design for each product line:	10	30	20
(iv) The proportion of time spent by General Management on the products is:	2	1	2

Source: OSISIONI Nig. Ltd. January-March, 2008.

OSISIONI Statement of Product Cost using Activity Based Costing system

	Wallets (20000 units)		Bags (12000 units)		Folders (16000 units)	
	Total N'000	Unit Cost N	Total N'000	Unit Cost N	Total N'000	Unit Cost N
Direct Material cost.	1,000,000	50	216,000	36	66,000	48
Direct labour cost	400,000	20	108,000	18	256,000	16
Overhead Costs:						
Machine Power cost	99,360	4.97	165,600	27.60	66,240	4.14

(See appendix 1)							
Production Set-up	9,200	0.46	276,000	23.00	73,600	4.60	
cost (See appendix 2)							
Product Design	40,200	2.01	120,600	20.10	80,400	5.03	
cost (See appendix 3)							
General Management	108,000	5.40	54,000	9.00	108,000	6.75	
Cost (See appendix 4)							
Total	1,656,760	82.84	940,200	133.7	650,240	84.52	

Source: Computed by the authors (2009)

Summary of Unit and Total Product cost computed using ABC

<u>Products</u>	<u>Unit cost (N)</u>	<u>Total cost (N)</u>
Wallets -----	82.84	1,656,760
Bags -----	133.70	940,200
Folders -----	84.52	650,240

OSISIONI Statement of Product Cost using Traditional Approach

	Wallets (20000 units)		Bags (12000 units)		Folders (16000 units)	
	Total N'000	Unit Cost N	Total N'000	Unit Cost N	Total N'000	Unit Cost
N						
Direct Material cost.	1,000,000	50	216,000	36	66,000	4
Direct labour cost	400,000	20	108,000	18	256,000	16
Overhead Costs:						
N1,201,200	360,360	18.018	600,600	50.05	240,240	15.015
(See appendix 5)						
Total	1,760,360	88.018	924,600	104.05	562,240	35.14
79.015						

Source: Computed by the authors (2009)

Summary of Unit and Total Cost computed using Traditional Approach

<u>Products</u>	<u>Unit cost (N)</u>	<u>Total cost (N)</u>
-----------------	----------------------	-----------------------

73,600 4.60

80,400 5.03

108,000 6.75

650,240 84.52

Product cost computed**Total cost(N)**

1,656,760

940,200

650,240

Cost using Traditional

Bags		Folders (16000 units)	
Unit	Total	Unit	Total
Cost N	N'000	Cost	N'000
36	66,000	48	121,760
18	256,000		
50.05	240,240	15.015	
104.05	562,240	2.4	

(2009)

Cost computed using**Total cost(N)**

Wallets-----	88.018	1,760,360
Bags-----	104.05	924,600
Folders-----	79.015	562,240

Discussion Of Abc Results

From the case of OSISIONI Nig. Ltd., it is discovered that the direct costs- direct material cost and direct labour cost have been allocated to the three products, Wallets, Bags and Folders. These costs are directly traceable to the products. The overhead costs have also been allocated to the five activity cost pools in the company (i.e. Machine power, Production Set-up, Product design, and General management). This is the first stage of the two-stage overhead cost allocation process in ABC system of determining product cost. The activities identified in OSISIONI Company are the consumers of the resources of the company as far as overheads are concerned. They drive overhead costs. At the second stage of the overheads allocation process, cost accumulated in activity cost pools are re-allocated to the three products- Wallets, Bags and Folders, being the cost objects. The following cost drivers which are the measures of the consumption of activities by the products were used in allocating the overheads to the products:

Machine hours used for Machine power cost; Number of batches of units per production run used for Production set-up cost; Number of product line designed used for Product design cost; and Proportion of time spent by General management for General management cost.

With the use of four cost drivers by ABC system in the company for allocating the whole overheads to the products, the product cost computed will be more accurate than the product cost computed under the traditional costing system that uses only one cost driver. The reason for this is that the higher the cost drivers used in allocating costs to products the more accurate will be the product costs computed.

It is also observed in this case of OSISIONI that of the four cost drivers used in allocating overhead costs to products, only one (Machine hours) is related to volume of production, while the three

others (Number of Batches run, Number of designs, and Proportion of Management Time spent) are non volume related. Under the traditional costing, the single cost driver normally used in allocating overheads to product is usually volume related notwithstanding the fact that the substantial parts of overheads are not volume related most of the time. In OSISIONI Nig. Ltd., only the machine power (of N331,200) representing 28% of the total overhead cost is volume related, while the three other components- Production set-up, Product design and General management costs representing 72% of the total overheads cost are non-volume related. Thus the use of both volume and non volume related cost drivers in allocating overheads to product as done under the ABC system make the product cost computed to be more accurate.

Summary And Conclusion

Efforts have been made in this paper to examine activity based costing as a good tool that can be used in determining accurate product costs especially where a company produces more than one product. Activity-Based costing system emerged mainly because of the failure of the traditional costing system in producing accurate product or service costs. ABC charges all costs to products whether production or non production cost provided activities which consumed the resources were used by products or service.

ABC is based on the premise that activities consume resources and products or service consumes activities. The system is different from absorption costing (traditional costing) systems in allocation of overhead costs to product or service. ABC system determines many activity cost pools and uses multiple cost drivers to allocate overheads to product. It is for this reason that ABC product costs are much more accurate than that of the traditional costing system.

In conclusion, implementing activity-based costing for product cost determination, care must be taken to ensure that the right environment is available. ABC system should not replace the traditional costing system but should complement it since it cannot

used for external reporting purpose. The ABC system has tremendous benefits if properly installed in an organization as it can ensure the effective management of cost in a competitive environment.

Appendix

ABC cost driver rates and costs allocated

(1) Machine Power cost = (N 331,200)

Cost driver = machine hour (Unit level)

Products	Hrs	Cost driver rate (N)	Cost allocated (N)
Wallets-----	1.5hrs	X 66,240	= 99,360
Bags-----	2.5hrs	X 66,240	= 165,600
Folders-----	1hr	X 66,240	= 66,240
	<u>5hrs</u>		<u>331,200</u>

$$\text{Machine Power per cost driver} = \frac{\text{N } 331,200}{5} = \text{N } 66,240$$

(2) Production Set-up cost allocation (N 358,800)

Cost driver = Number of production in Runs (Batch level)

Products	Batches	Cost driver rate (N)	Cost allocated (N)
Wallets----	20	X 460	= 9,200
Bags-----	600	X 460	= 276,000
Folders-----	<u>160</u>	X 460	= <u>73,600</u>
	<u>780</u>		<u>358,800</u>

$$\text{Set-up cost per production} = \frac{\text{N } 358,800}{780} = \text{N } 460$$

(3) Product Design cost (N 241,200)

Cost driver = Number of production line designed (product level)

No of Designs	Cost drivers rate (N)	Cost allocated (N)
Wallets ----- 10	X 4020	= 40,200
Bags ----- 30	X 4020	= 120,600
Folders ----- <u>20</u>	X 4020	= <u>80,400</u>
	<u>60</u>	<u>241,200</u>

$$\text{Product Design cost per product line} = \frac{\text{N}241200}{60} = \text{N}4020$$

(4) **General Management** (N 270,000)

Cost driver = Proportion of time spent (Organizational sustaining level)

Cost drivers rate N		Cost allocated (N)	
Wallets -----	2	X 54,000	= 108,000
Bags -----	1	X 54,000	= 54,000
Folders -----	<u>2</u>	X 54,000	= <u>108,000</u>
	<u>5</u>		<u>241,200</u>

$$\text{General management cost per proportion} = \frac{\text{N}270,000}{5} = \text{N}54,000$$

(5) **Traditional Cost Driver:**

Machine hour (Unit level)

Products	Hrs	Cost driver rate (N)	Cost allocated (N)
Wallets-----	1.5hrs	X 240,240	= 360,360
Bags-----	2.5hrs	X 240,240	= 600,600
Folders-----	<u>1hr</u>	X 240,240	= <u>240,240</u>
	<u>5hrs</u>		<u>1,201,200</u>

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