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Environmental Cost Accounting and Cost Allocation (a Study of Selected Manufacturing Companies in Nigeria)

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Abstract
The major objective of this paper is to determine the extent to which Nigerian firms have embraced environmental cost accounting in cost allocation. This research adopted a research survey and the main research instrument is the questionnaire. 105 Accountants from twenty-five (25) quoted manufacturing companies were the respondents for this research. The mean, standard deviation and simple percentages were used to analyze the questions while the ANOVA was used to statistically analyze the differences between means. Findings show that majority of the firms have not embraced environmental cost accounting, they still lump all indirect costs under overhead and use mostly, one absorption method which may not have any relationship with the indirect costs to apportion these costs into the product costs. The identified commonest method of overhead allocation basis is the material use. Although the treatments given to environmental costs were conventional in nature, significant differences exist among firms on the method of allocating environmental costs to products/processes. Environmental accounting can be said to be in embryonic stage in the manufacturing firms in Nigeria. This paper offers a valuable insight into the environmental cost accounting practices of Nigerian manufacturing firms. This paper will help firms to understand what environmental cost accounting is all about and how to embrace it.
Keywords: Environmental accounting, Environmental cost accounting, environmental costs, conventional system.

Introduction

Environmental cost accounting is an aspect of environmental management accounting that places emphasis on the acknowledgement and re-classification of environmental impacts and costs to aid in better decision making. It points emphatically at designing an environmentally- friendly cost accounting system in every organization which will help in gathering information on material flows, reclassification of costs to isolate environmental costs from overhead and accounting for costs in relation to efforts towards sustainable development. The need for environmental management accounting was conceived in recognition of some of the limitations of the conventional management accounting approaches for management activities and decisions involving significant environmental costs and impacts. Johnson (2004) sees planning for a good environmental management system as much a part of running a successful business as product/process design, marketing, and sound financial management.

Conventionally, the accounting systems do not fully reflect the costs of managing the environment and the associated benefits rather; the environmental costs are lumped into the general overhead accounts. In other words, they tend to track environmental costs inadequately. Consequently, the environmental costs are hidden and business managers (decision makers) have little or no information on the costs and no incentive to manage and reduce them. Non identification of these costs in turn leads to cross subsidization of costs to one product/ process by another which may even be termed unprofitable or less profitable; inappropriate apportionment of environmental costs from overhead accounts back to processes, products, and process lines; inaccurate accounting for volumes (and thus costs) of wasted raw materials; and the actual absence of relevant and significant environmental costs in the accounting records. These practices are criticized as insufficient for management decision making in general and not just in realm of environmental costs (Bennett, 1999 as in Johnson, 2004). Adoption of environmental cost accounting system will help in the proper identification, recognition and allocation of these environmental costs to products, processes and services that gave rise to them and also be considered in appraising projects to avoid making wrong choices.

The major objective of this paper is to determine the extent to which Nigerian firms have embraced environmental cost accounting in cost allocation. Specifically, the paper seeks to determine: (i) the extent to which environmental costs are allocated directly to products / processes and (ii) identify the common basis of allocating costs to products/processes from overhead costs among Nigerian manufacturing companies.

These objectives have led to the following research questions: (i) To what extent are environmental costs allocated to products / processes directly and (ii) what are the common bases of allocating costs to products/processes from overhead costs among Nigerian firms?

A hypothesis was formulated to establish if there exists significant difference in practices among the firms under study. (i) No significant difference exists among the firms on the allocation of environmental costs.

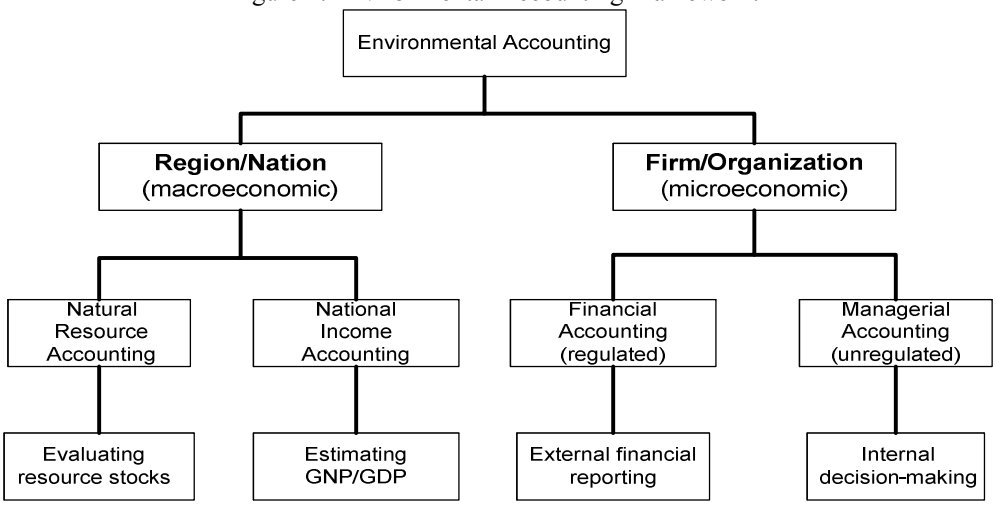
The Concept Of Environmental Accounting

Environmental Accounting (EA) is a broad-based term that refers to the incorporation of environmental costs and information into a variety of accounting practices (Graff et al., 1998). It is a growing field that identifies, measures and communicates costs from a company's actual or potential impact on the environment. In other words, it integrates the environmental cost information into a variety of accounting practices. It relates to the provision of environmental performance related information to stakeholders both within and outside an organization. It provides reports for both internal use, generating environmental information to help make management decisions on pricing, controlling overhead and capital budgeting, and external use, disclosing environmental information of interest to the public and to the financial community. Internal use is better termed environmental management accounting (Bartolomeo *et al.*, 2000 as in Johnson, 2004).

The term environmental accounting is often referred to as Green Accounting and these terms are often used in place of sustainability accounting. An important function of environmental accounting is to bring environmental cost to the attention of corporate stakeholders who may be able and motivated to identify ways of reducing or avoiding those costs while at the same time improving environmental quality (US Environmental Protection Agency, 1995). Yakhuo and Dorweiler, (2004) opine that with increasing social focus on the environment, accounting fills an expectation role, to measure environmental performance.

This Environmental Accounting, which calls to introduce a system that supports Sustainable Development (SD), has many meanings and uses. Figure 1 below depicts some of the different contexts in which environmental accounting is used.

Figure 1: Environmental Accounting Framework.



Source: Graff, Reiskin, White & Bidwell (1998)

From the figure 1 above, environmental accounting is classified into two major groups – environmental accounting at the national level and firm level. At the macroeconomic or national level, environmental accounting is further classified into environmental natural resource accounting and environmental national income accounting. At the microeconomic or firm level which is the level of interest, EA applies to both financial accounting and management accounting. Financial accounting and its environmental requirements need to be standardized to provide consistent and comparable information to investors, regulators and other stakeholders, while management accounting practices will always vary widely from firm to firm.

Environmental Costs

Environmental costs are impacts, monetary and non – monetary, incurred by a firm or organization resulting from activities affecting environmental quality (Graff et al: 1998). In other words, they are costs relating to the use, release, and regulation of materials in facility operations. Ministry of Environment, Japan (2005) defines Environmental cost as the investment and costs, measured in monetary value, allocated for the prevention, reduction, and/or avoidance of environmental impact, removal of such impact, restoration following the occurrence of a disaster, and other activities. These costs are often tracked by or are hidden in the overhead accounts within the traditional management accounting systems, but they can be a significant component of a firm's overall cost structure.

The US EPA presents a useful method for classifying environmental costs. These costs are classified into five groups. They include: the conventional costs (usual costs / direct costs), hidden costs, contingent costs, image/relationship costs and societal costs (US EPA,1995).

Conventional/Direct costs are costs that are clearly and exclusively associated with a product or service and are treated as such in accounting systems. They are associated with capital expenditures, raw materials, other operating and maintenance costs, etc.

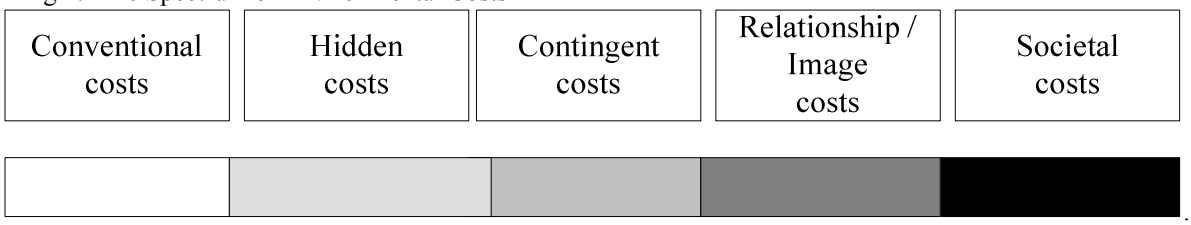
Hidden environmental costs are costs which are captured by the accounting systems, but then lose their identity in "OVERHEAD". They are administrative costs buried in the overhead costs and hidden. They are the results of assigning environmental costs to overhead pools or of overlooking future and contingent costs. Hidden costs arise from activities such as monitoring and reporting, waste management fees, training, site studies, site preparation, research and development cost, designing of environmentally preferable products or processes, evaluation of alternative pollution control equipment costs etc.

Contingent costs are environmental costs that are not certain to occur – they depend on future events. They are Contingent liabilities arising from remediation of contaminated sites, fines and penalties for non-compliance, etc.

Image/relationship environmental costs are called less tangible or intangible because they are incurred to affect subjective (though measurable) perception of management, environmentalist, customers, community relations, employees and regulators. These costs can arise from impaired perception of stakeholders. This category of cost can include the costs of annual environmental reports and community related activities, cost incurred voluntarily for environmental activities e.g. tree planting etc**.** These costs themselves are not intangible but the direct benefits that will result from relationship or corporate image expenses are often intangible.

Societal or External costs are the costs of an organisation's impact on the environment and society for which it is not currently financially responsible. Examples include depletion of natural resources, reduced air quality. These are considered costs for environmental conservation efforts consisting of social activities with no direct relationship to the business activities of the company or other organisations).

Fig 2: The Spectrum of Environmental Costs



Source: US Environmental Protection Agency (US EPA) (1995)

Conventional Vs Environmental Cost Allocation Systems

Under the conventional accounting system, costs are usually classified into direct and indirect costs. Direct costs here are costs that are easily identified with a product; examples include material cost, labour costs and direct expenses to a product. These direct expenses are regarded as conventional costs under the environmental cost accounting system. Indirect expenses on the other hand are regarded as overheads under the conventional system. They are costs that are not easily traceable to a product examples include factory rent, energy cost, supervisor's salary, lubricants etc. Under the environmental accounting system, these indirect costs are further broken down into hidden costs (upfront costs, regulatory costs and back-end costs), contingent costs and image and relationship costs.

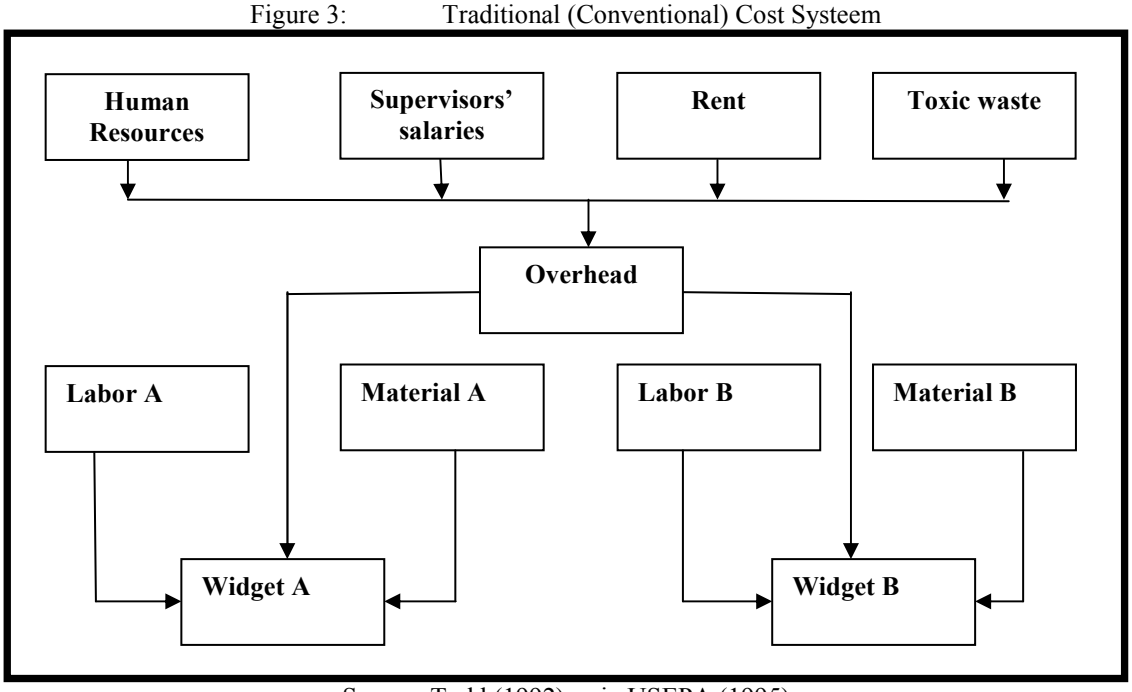
Under the conventional accounting system, overheads are usually absorbed into the products costs using any of the following absorption method; the number of employees, floor area, value of plant and/or building, direct labour (direct wage) hours, machine hours, etc. These absorption methods most times do not have any relationship with the existing costs (overheads).

The environmental accounting system advocates the use of activity-based costing (ABC) system for charging overheads to costs units. ABC is a method of charging overheads to cost units on the basis of the benefits received from the particular indirect activity (Lucey, 2003) i.e. using absorption method that is closely related to the cost(s). ABC uses absorption bases that show relationship between overhead costs and the activities that caused the overhead, this shows that ABC uses diverse absorption rates for the absorption of overheads. The reason behind the use of ABC is to produce a more realistic product cost and more realistic basis for decision making. ABC improves internal company cost calculation by allocating costs typically found in overhead costs to the polluting activities and products. Significant material flows are traced throughout the company and their costs are allocated back to the polluting cost centres. ABC represents a method of managerial cost accounting that allocates all internal costs to the cost centres and cost drivers on the basis of the activities that caused the costs,' (UNDSD, 2003). ABC as applied to environmental costs distinguishes between environment-related costs and environment-driven costs. The former are attributed to joint environmental cost centres, for example

incinerators or sewage plants. The latter are hidden in the general overheads and do not relate directly to a joint environmental cost centre, e.g. increased depreciation or higher cost of staff.

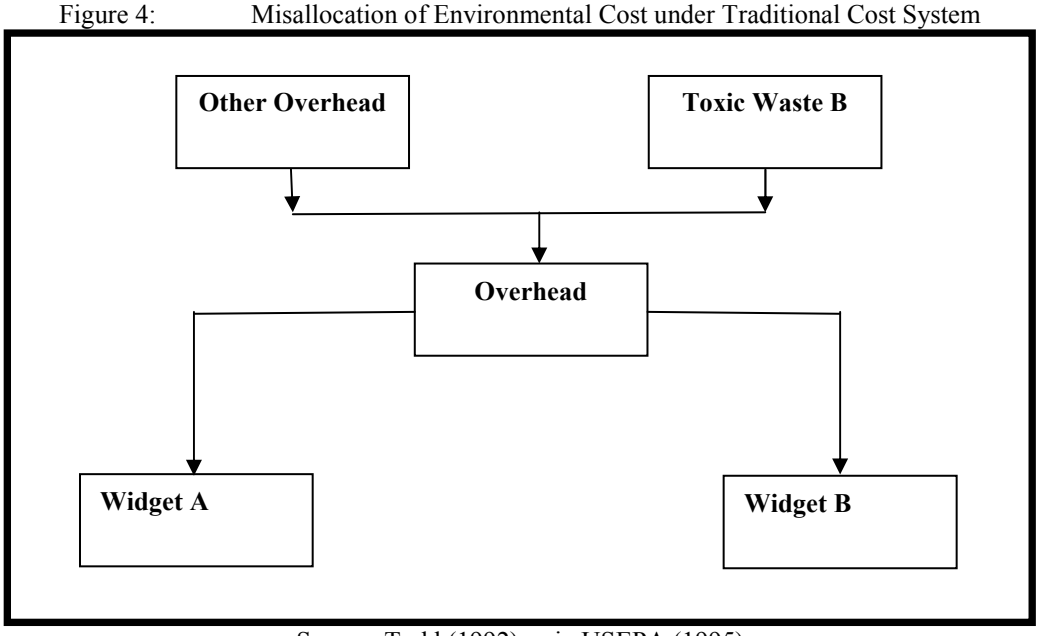
The key difference between the conventional cost system and environmental cost system is the way the overhead are classified and allocated to product costs. Proper allocation of costs to the individual products/ process that instigated the costs leads to more realistic pricing than the usual pricing without true costs. Figure 3 describes the traditional cost allocation system which lumps all the indirect costs under the overhead before being absorbed by the products. Figure 4 shows that lumping of these costs in the general overhead without allocating the cost of toxic waste to the product that originated it is misallocation of costs. Figure 5 is a revised cost allocation system which uses ABC to allocate costs to the originating product/process.

Figure 3: Traditional (Conventional) Cost Systeem



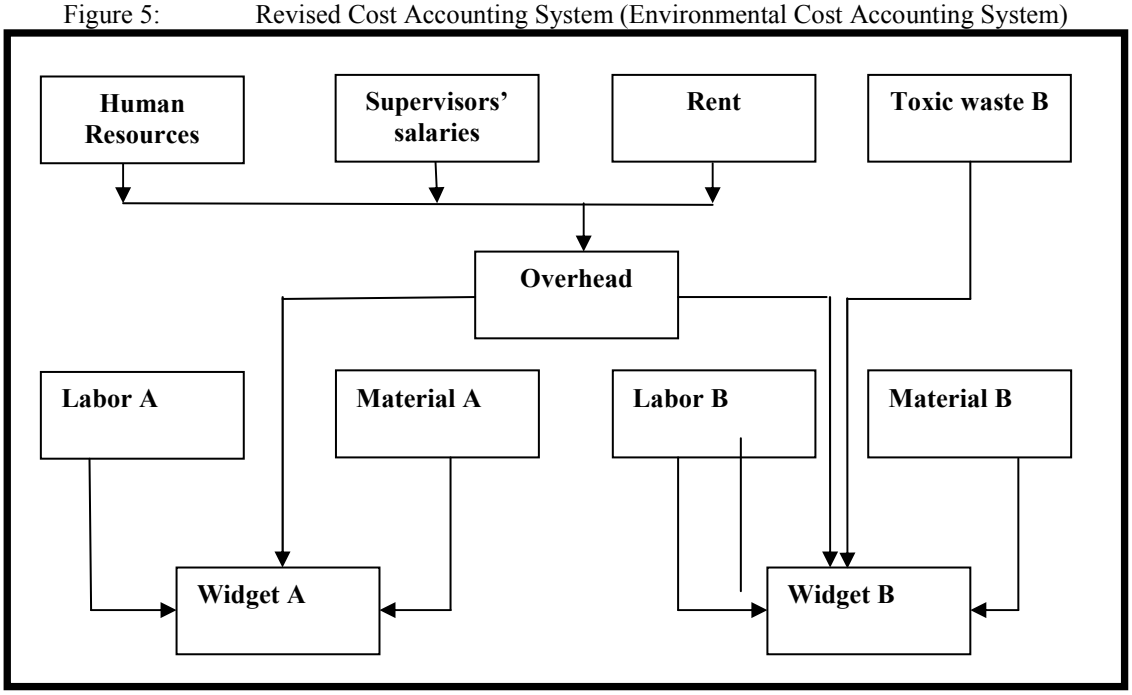
Source: Todd (1992) as as in USEPA (1995)

Figure 4: Misallocation of Environmental Cost under Traditional Cost System



Source: Todd (1992) as as in USEPA (1995)

Figure 5: Revised Cost Accounting System (Environmental Cost Accounting System)



Source: Todd (1992) as in USEPA (1995)

Methodology

This study examined the extent to which Nigerian firms have embraced environmental cost accounting in cost allocation using manufacturing companies as case study. It specifically examined the extent to which environmental costs are allocated directly to products / processes and basis of allocating overhead to products/processes. This research adopted a research survey in order to accomplish the objective of the study. Data were collected from both primary and secondary sources through the use of questionnaire and extensive library research. Accountants from twenty-five (25) quoted manufacturing companies were the respondents for this research. These companies are from different industries: building, chemical, food/beverages, electrical, brewery, industrial/domestic, conglomerates, printing, health and petroleum. The respondents studied were made up of Management accountants, Departmental/Divisional accountants, Factory accountants, and Chief Accountants of the different companies. Out of about 150 questionnaires issued, only 105 were duly completed and returned. Data from the research questions were analyzed using simple percentages, mean and standard deviation of responses from the respondents. Then the analysis of variance (ANOVA) test was used to analyse the hypothesis using SPSS VERSION 17.0.

Analysis Of The Questionnaire / Hypotheses Testing

Research question 1: To what extent are environmental costs allocated to products / processes directly? This question is answered using responses to the question which asks " how do you allocate the following environmental costs to products/ processes (see table 1).

To obtain a glimpse of current cost allocation practices, respondents were asked to describe their current cost allocation practices across a range of 15 environmental costs. For each cost item, respondents were asked to check whether their initial cost assignment was always to overhead, usually to overhead, usually to product and always to product. From the analysis in Table 1, "usually to overhead" is the most frequent response for almost all the cost items. Well over half of the respondents reported initially assigning environmental costs always to overhead. The pattern of initially assigning costs to overhead before allocating to products holds steadily for all entries regardless of how tangible the costs are. The implication of this practice is that environmental costs caused by a particular product/process may not be traceable to that process/product if initially assigned to overhead costs.

Research question 2: What are the common bases of allocating costs to products/processes from overhead costs among Nigerian firms? (see table 2)

Table 2 shows the further allocation method for costs initially assigned to the overhead costs. Firms were asked to indicate their commonest basis of allocating overhead to product and process costs. Material use (42.9%), labour hours (21.9%) and square meter (20%) bases are the most common bases for allocating costs from overhead back to the products/processes. Some of these bases have little or no relationship with the activities that

gave rise to the environmental costs in overhead pool. Therefore may bring about cross subsidization of cost by a product / process line that may be termed unprofitable.

Test of Hypothes1s

Hypothesis (Null): No significant difference exists among the firms on the allocation of environmental costs.
Hypothesis (Alternate): Significant difference exists among the firms on the allocation of environmental costs.
Table 3 shows the analysis of variance test for comparing data obtained from accountants in the different industries, building, chemical, food/beverages, electrical, brewery, industrial/domestic, conglomerates, printing, health and petroleum, on the extent to which environmental costs are allocated to products / processes costs directly. Taking each of the costs individually, we see that the calculated f-values in all the cases except one are greater than the critical values. Thus we reject Ho, and conclude that there is a significant difference among firms on the method of allocating environmental costs to products/processes. While very few allocate these costs always to product directly, the remaining majority allocate them always to overhead which will attract further allocation processes.

Findings

From the analysis in Table 3, we found out that Majority of the firms still use the conventional system of cost allocation, they lump all indirect costs under overhead and use only one absorption method to absorb these costs into the product costs. The implication of this practice is that environmental costs caused by a particular product/process may not be traceable to that process/product if initially assigned to overhead costs, and this may cause cross-subsidization of cost by other products. Although the treatments given to environmental costs were conventional in nature, there is a significant difference among firms on the method of allocating environmental costs to products/processes. The commonest method of overhead absorption is material use, followed by labour hours which may not have any direct relationship with the overhead. The respondents also identified some of the expected benefits of environmental cost accounting adoption to include enhanced company reputation, proper use of resources, reduced waste within the production process, improved position in the market, better product design and development and improved product quality. The common barriers to the adoption of this system as identified by some of the respondents are poor understanding of environmental costs and its accounting, cost of establishment and the fact that there is no policy demanding the adoption (it is voluntary).

Conclusion

Environmental accounting can be said to be in embryonic stage in the manufacturing firms in Nigeria. Majority of the Nigerian firms under study are just trying to understand the concept of environmental accounting and yet to embed it in their accounting system and practices. For early development of this area of accounting, the common people of Nigeria and industries need to be made to understand the importance of environmental conservation and accounting. An important function of environmental accounting is to bring environmental cost to the attention of corporate stakeholders who may be able and motivated to identify ways of reducing or avoiding those costs while at the same time improving environmental quality and health of people in the environment. The environmental accounting system advocates the use of activity-based costing (ABC) system for charging overheads to costs units. ABC uses absorption bases that show relationship between overhead costs and the activities that caused the overhead; to produce a more realistic product cost and more realistic basis for decision making. Firms are therefore encouraged to prepare an environmental management policy that will adopt a new cost accounting system which advocates the use of activity-based costing (ABC) for charging overheads to costs units. Embracing environmental cost accounting will help in the management of the environment through proper resources management, reduced wastes within the production process and promotion of production in general.

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Table 1 Cost Allocation

S/N	Environmental costs	Always to product (4)	Usually to product (3)	Usually to overhead (2)	Always to overhead (1)	Mean (X)
1	Material costs	105	0	0	0	4.00
2	Water costs	23	20	32	30	2.34
3	Energy costs	24	22	35	24	2.44
4	On site waste testing	6	36	26	37	2.10
5	Waste water treatment	6	30	18	51	1.91
6	Air emission treatment	6	35	13	51	1.96
7	Onsite harmful waste treatment/handling	6	27	17	55	1.85
8	Licensing costs	1	11	40	53	1.62
9	Employee safety claims	0	11	40	54	1.59
10	Offsite hazardous waste transport	0	4	40	61	1.46
11	Staff training	0	8	39	58	1.52
12	Regulatory compliance costs	0	8	33	64	1.47
13	Environmental fines / penalties	0	12	34	59	1.55
14	Insurance costs	0	2	39	64	1.41
15	Environmental staff labour time	6	8	27	64	1.58

Source: Field Survey Data (2010/11)

Table 2: Commonest Overhead Allocation Basis

Overhead Allocation Basis	Frequency	%	Ranking
Material Use	45	42.9	1st
Labour Hours	23	21.9	2nd
Square Meter	21	20.0	3rd
Production Volume	14	13.3	4th
Others	2	1.9	5th
Total	105	100.0	

Source: Field Survey Data (2010/11)

Table 3a: Industrial Analysis of Allocation of Environmental Costs to Product Costs

Cost	Source of variation	Sum of square	d.f	Mean square	f-cal	f-crit	Decision
Material	Between groups Within groups Total	0.095 1.867 1.962	9 95 104	0.011 0.020	0.539	1.96	Accept Ho
Water	Between groups Within groups Total	52.799 76.858 129.657	9 95 104	5.867 0.809	7.251	1.96	Reject Ho
Energy	Between groups Within groups Total	47.797 74.050 121.848	9 95 104	5.311 0.779	6.813	1.96	Reject Ho
On-site waste testing	Between groups Within groups Total	29.299 66.549 95.848	9 95 104	3.255 0.701	4.647	1.96	Reject Ho
Waste water treatment	Between groups Within groups Total	28.135 76.093 104.229	9 95 104	3.126 0.801	3.903	1.96	Reject Ho
Air emission Control	Between groups Within groups Total	41.763 68.084 109.848	9 95 104	4.640 0.717	6.475	1.96	Reject Ho
On-site hazardous waste, treatment & handling	Between groups Within groups Total	29.731 73.81 103.562	9 95 104	3.303 0.777	4.251	1.96	Reject Ho
Licensing costs	Between groups Within groups Total	13.719 39.043 52.762	9 95 104	1.524 0.411	3.709	1.96	Reject Ho
Employee safety & health compensation claims	Between groups Within groups Total	11.065 36.326 47.390	9 95 104	1.229 0.382	3.215	1.96	Reject Ho
Off-site hazardous waste transport	Between groups Within groups Total	13.347 20.710 34.057	9 95 104	1.483 0.218	6.803	1.96	Reject Ho
Staff training for environmental compliance	Between groups Within groups Total	7.313 34.878 42.190	9 95 104	0.813 0.367	2.213	1.96	Reject Ho
Regulatory compliance cost	Between groups Within groups Total	7.006 35.127 42.133	9 95 104	0.778 0.370	2.105	1.96	Reject Ho
Environmental fine/penalties	Between groups Within groups Total	10.898 39.064 49.962	9 95 104	1.211 0.411	2.945	1.96	Reject Ho
Insurance cost	Between groups Within groups Total	7.377 22.014 29.390	9 95 104	0.820 0.232	3.537	1.96	Reject Ho
Environmental staff labour time	Between groups Within groups Total	17.253 60.309 77.562	9 95 104	1.917 0.635	3.020	1.96	Reject Ho

Source: Result obtained from Analysis of Field Survey Data (Derived from Table 1)