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# ENVIRONMENT COST ACCOUNTING AS A TOOL IN EFFECTIVE ECONOMIC DECISION MAKING

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### ABSTRACT

The Ministry of Science, Technology and Environment has encouraged all Malaysian companies, domestic and multinationals, to develop, implement and improve the companies environmental accounting system. Also, the government has made a very sound proposal requiring companies to disclose in their annual report information pertaining to economic activities undertaken during a given year and denoting its impact on the environment, their environmental policies and proposed social programs to the community and the public at large. This is a very timely requirement for corporation to extend further their responsibility towards people's health and the environment. Environmental issues must not be ignored or else every entity, juridical or otherwise, will suffer. The mission of this paper is to understand the full spectrum of environmental cost accounting as a tool used by top brass management of an organization in making effective economic decision. This will further dwell on the integration of societal (environmental) costs into business decisions involving capital budgeting, cost allocation, process and product design and product life cycle costing and cost of quality and environmental report in the hope that these accounting techniques would increase the visibility of environmental costs to company managers; thus enabling them to manage these cost effectively for the companies benefits and all other stakeholders. This paper will further demonstrate how accounting information is, or can be, used to support corporate environmental strategy and assess environmental performance.

Keywords: Environmental accounting system, Environmental Costs, Capital budgeting, Cost Allocation, Life cycle Costing.

### INTRODUCTION

Environmental Accounting emphasizes more about environmental costs and performance in business decisions and operations. Co-exist in many fields of accounting; governmental (report on the consumption of and value of natural resources); financial accounting (preparation of financial report for the use of external parties in accordance with the country 's accounting standards); and managerial accounting (providing inputs to managers in making business decisions). Here, the focus is on the managerial accounting perspective applicable to companies regardless of size and mission.

Managers should give importance on environmental cost, as vital constituent of cost in producing a product, as it would promote more accurate costing, ultimately lead to strategic pricing decision. In depth knowledge of environmental risk, waste, energy consumption and cost associated in manufacturing process, companies would continuously strive to design its product into more environmentally friendly in the future (1). Treating environmental issues on a win-win situation, companies would be able to achieve its competitive niche over their rivals as customers preferences, nowadays, shift to a more environmentally preferable products and services. Moreover, managers can implement environmental scanning (5) to spot trends, problems, issues and clues of change that could develop environmental consequences.

We believe that thorough understanding of environmental costs and performance by companies can lead them to establish and implement an environmental management system (3); and if properly implemented and adhered to by the functional managers it can lead to significant benefits not only to humans but also business success.

Proper monitoring of environmental costs such as waste, which are considered as non-value added could result to substantial savings. A research made by a group INFORM in a chemical plant found that a company with some type of environmental cost accounting program had an average of three times as many pollution prevention projects as plants with no cost accounting system. The study also showed that the

average annual savings per pollution prevention project in production facilities were just over US\$ 351,000 or an average savings of US\$ 3.49 for every US dollar spent (2).

Integrating environmental accounting into the sphere of management accounting system would entail collection of environmental data that could be used in planning and attention directing process, decision-making, evaluation, and control measures in an organization. To achieve success requires a total commitment of top management on the program and responsibility measures should given paramount importance.

# ENVIRONMENTAL COST

Basically, environmental costs are costs incurred in relation to conditions and circumstances affecting human lives. These costs can be classified by the way they are incurred. Table 1 shows the different types of environmental costs.

1	Compliance Cost / Permit	9	Property Damage
2	Remediation of Contamination	10	Injury & Death Claims
3	Purchase of Environmental Equipment	11	Legal Expenses
4	Penalties for Non-Compliance	12	Corporate Image (Community Event)
5	Waste Disposal (fees)/Handling	13	Waste Management
6	Environmental Reporting	14	Environmental System Costs
7	Recycling/Reclamation	15	Fuel & Power
8	Environmental Research & Tests	16	Landfill

Table 1: The types of environmental costs commonly incurred by an organization.

Classifying these costs as to its cost behavior gives no greater importance; what matters most is whether these costs are relevant to a product or service; or are they incurred during the process; or incurred by the division or segment. If yes, then, these costs could be considered as another elements of cost of a product or service rendered.

Public environmental costs i.e. property damage, personal poisoning, injury and death, are beyond the sphere of the organization's domain; thus they are not within the legal obligation of the firm. Should these costs be integrated in the product costing system? Are these costs relevant to the manager's decision? Considering the impact of these environmental phenomena to the lives of the people, then it is just vital for the company to integrate them into product costing, planning and decision-making as these are related to the primary activities of the operation. These costs should be given an impact to the profitability of the firm not only to make the stakeholders aware of significant environmental transaction affecting the community but directs managers to vital environmental threats affecting the firm.

# ENVIRONMENTAL ACCOUNTING SYSTEM

As the primary purpose of a costing system is to collate relevant information about the product cost accurately; and that production operation co-exist with environment and nature, it is then important to incorporate environmental costs into the system. This helps management to track the amount of cost incurred related to the environment in addition to finding strategic measure at reducing environmental cost causing activities or coming up with positive alternative in solving environmental problems.

In costing parlance, manufacturing costs consists of raw materials, labour and production overheads. For simplicity sake, all costs indirectly related to producing a product or rendering services are classified into an account called overheads. These costs are accumulated by product line, process, or department and allocated to the product on the basis of direct resources consumed i.e. output, labour or machine hours; or sometimes based on activities consumed. The choice of allocation bases rests upon the sensitivity of the costs and resources consumed. Accordingly, environmental costs are then treated as overheads in the cost accounting system and follow the same cost allocation.

Table 2 that follows shows a traditional costing system adopted by most companies where manufacturing operations are heavily dependent on labour force. This system affords ease on its application and it's less expensive; however, it may lead to distorted product cost.

Table 2. A diagrammatic presentation of Traditional Costing Accounting System (TCAS)



Right allocation of overhead costs to product lines is vital to achieve the true costs of the product; if overhead is allocated incorrectly then it may result distortion of product cost, which ultimately result to overstated/understated selling price. Manager's will then received misleading information as the costing system fails to reflect adequate and true representation of costs. This may impair the effectively of managerial functions relating to planning, control and decision-making.

Companies manufacturing multiple product lines, with faster machine set-up, using numerically controlled machines may use different allocation basis i.e. activity consumed. Here, environmental costs can be treated as a separate account of manufacturing/rendering products and services. These costs can be accumulated by costs pools and allocated to products/services based on activities consumed. Giving prominence to environmental costs in the system, directs manager's attention to the various cost incurred; helping them to monitor the activities causing these costs; thus apply corrective or improvement measures in maintaining the quality of the product and environment.

The costing system can be tailored based on the information needs of the company taking into consideration some critical factors as complexity of the production operations, multiplicity of its products and its value chain. Table 3 below highlights the way an alternative/modern costing system.



Table 3. A Diagrammatic presentation of an Alternative Cost Accounting System (ACAS)

### ACTIVITY BASED COSTING

The emergence of Activity Based Costing (ABC) started two decade ago due to the lack of reliable information offered by traditional costing method as mentioned above. The major difference of ABC and the traditional costing methods is that the former is process-oriented and activities are considered as cost drivers while the latter is volume based where costs are assumed to consume more resources i.e. machine hours and labour hours (1).

Since various activities serve as cost drivers to calculate overhead costs, it opens up more detailed measures in improving productivity and equally monitors activities that cause more costs. By monitoring all activities from the time the customers order to the time goods are delivered including customers service activities, an organization would be able to identify non value added activities that incur more costs, allocate surplus resources, reallocate capacity but most importantly managers are forced to focus more on environmental activities and its costs. Many have left out this attention!

ABC is process oriented and gathers information from the processes or activities undertaken it can identify both what the company needs are, what to be done and also directs attention towards continuously improving the process, product or design as these may be the cause waste and other environmental costs in each process.

Strategic moves such as this will then brings an improved accuracy and monitoring of product costs and effective decision-making as compared to the traditional techniques. Other techniques (1) such as Total Quality Management (TQM) and Product Life Cycle Costing (PLCC) can be implemented simultaneously with ABC to achieve greater results.

# PRODUCT/SERVICE LIFE CYCLE COSTING (PLCC)

PLCC requires that all cost to be incurred throughout the entire life span of the product to be determined as early as the designing stage until the waste disposal and customers service stage. Here, total costs are assessed and charged to the product; thereby a target cost can be ascertained. Environmental related activities and costs during the life cycle of the product are highlighted and incorporated in the design. Thus, products are made and designed at the early stage to be environmentally friendly. Adhering to this approach will force companies to consider environmental issues and instill commitment and responsibilities towards healthier and safer environment.

In this context, the International Standards Organization (ISO) has proposed a new environment management standard, the ISO 14000 standards (3), to help companies deal with these issues. Implementation and compliance of this standards and laws are imperative to the existence of the business. Another essential step is that the company should devise its own environmental management system committed to tract down environmental variables. This tasks often falls to the responsibility of the controller's office.

Another management technique that is complimentary to PLCC is Life Cycle Assessment Program (LCAP) that will enable the company to identify the environmental consequences of a product, process, activity or plant throughout its life span. Integrating LCAP will help managers, engineers and the top management to identify segments for improvement and correction. Manager's focus will be directed to environmental aspects that need immediate solution and attention.

Continuous monitoring and assessment of product performance or impact to the environment will enable designers and engineers to redesigning the process that will significantly reduce environmental effect.

# CASE STUDY: OLEOCHEMICAL COMPANY

The case study concerns an Oleo Chemical firm producing 3 product lines i.e. Methyl Ester, Crude Glycerin and Fatty Alcohol. Majority of these products are sold to foreign pharmaceutical companies and detergent firms. To give a rough idea of the production operation, there are 160 employees working for 24 hours a day for 365 days; Department of Occupational Safety and Hazards does inspect every 18 months operating cycle. Table below shows an overview of the model presented:

Resources:

- = operates 365 days a year for 24 hours
- = 4 Buildings with 50,000 square meters
  - = 204 major machine installation
  - = 1,350,000Metric tones of chemical components/yr

Yearly Resources Consumption:

	Methyl Ester	Fatty Alcohol	Total	
Units Produced	160,000 MT	69,000 MT	229,000MT	
Production Cost	RM 48 M	RM 72.8M	RM120.8M	
Cost Structure: 30%/10%/60%			100%	
Machine Hours	1,250,900	536,140	1,787,040	
Waste Generated			1,700 MT	
Air Waste			300,000 MT	
Energy Consumption			780,000 Gj	
Water Usage			300,000 Cu. M	
Environmental Cost			RM 1 M	
Environmental Waste Rate	70%	30%	100%	
Environmental			RM18 M	
Equipment/plant at cost				

Ascertaining the true cost of both products requires the proper allocation of overhead costs including environmental costs. Using either machine hours or manufacturing activities as the base in the allocation of cost of both waste and overheads provides a distorted product costs as its usage does not drive most overhead costs. As per the table, there is a high correlation percentage on the use of energy, water, waste and cost. To achieve more accurate costing it is preferable to allocate the overhead cost based on activities consumed. Environmental costs can be accurately charged to the product by way of the weight of waste generated and disposed.

Table that follow shows the product cost using these methods that may influence the manager's economic financial decision- making.

	Methyl E	ster (TCAS)	Fatty Alcohol (ACAS)	
Prime Cost	RM 120	RM 120	RM 422	RM 422
Production Overheads/waste:				
- Based on machine hours	RM 185		RM 637	
- Based on activity		RM 225		RM 778
Total Product Cost	RM 305	RM 345	RM 1,059	RM1, 200
Price per MT	RM 900	RM 900	RM 1,950	RM 1,950
Margin per MT	RM 595	RM 555	RM 891	RM 750
Percent	66%	61%	46%	39%

Table 4: Product Costs and Margin Percent Using TCAS and ACAS

# **CAPITAL BUDGETING**

Acquisition of plant and equipment requires a comparative analysis between the net inflows of the project against cost of capital of an organization. Similar process should be applied to transactions relating to environmental plant and equipment. Environmental cost savings, revenue and costs should be taken into consideration in investment decisions. Environmental investment programs must be given equal footing to that of other profit motive investment decisions. For example, implementing change whereby a requirement should be imposed to industrial firm with high volume consumption of water to come up a water-recycling program. This is another strategic measure to control water shortage, which primarily caused by high consumption of the resource in the industrial sector.

Sound financial investment analysis tools such as net present value and payback period and profitability index are commonly used which can be applied to environmental project analysis as well. Table 5 below shows the investment analysis using net present value (NPV) and payback period (PB).

Table 5: Investment Analysis Using NPV and PB approaches

Net Present Value at 14% for 40 years			RM	Payback Period	RM'000
<b>'000</b>					
Annual cost	savings	RM 850,000 x	45.26	Annual Cost savings	850
38,471					
Maintenance &	inspection	cost RM 250,000 x	45.26	Maintenance	(250)
(11,315)					
Tax shield	at 28%	RM126,000 x	45.26	Depreciation	(126)
5,700					
Environmental			Plant	Net	474
(18,000)					
Net	Pres	sent	Value	Payback	38
14,856				years	

### **CLOSURE AND DISCUSSION**

We have tried to illustrate that an integrated approach to environmental costing as an integral part of product cost using Activity Based Costing and Product Life Cycle Costing provides higher degree of cost ascertainment. We find that there is greater sensitivity of environmental cost to the activities consumed rather than volume produced taking into account the product diversity. Overheads are, then, charged accurately whereby it shows the real cost structure and position of the products. Accurate tracing of cost coupled with a continuous implementation of environmental life cycle assessment program would be useful for managers to undertake economic and environmental management, forecasting and design in one framework. In my opinion, these approaches would aid companies to allow them to improve both product and process design more efficiently and in a more strategic manner. However, there was no benchmarking made on this matter as such comparative analysis with other companies is desirable. Also, we find that investment on environmental expenditure yields a positive return and takes a longer period to recoup analyze on a segment basis. Companies can strive continuously to be cost efficient as trade off.

Finally, environmental accounting (4) has received increased attention since the 1990's in most part of the world, but in the absence of any statutory requirements or professional standards, little will be achieved in the program. Added tax incentives should be provided to those companies and individuals implementing environmentally safe projects in addition to the current tax benefits/allowances.

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Activities:	= 15 common operating a = 22 qu = 6 ship		activities uality assurance activities pping activities	
	Assessment Objects: = Oleo = 3 prod = 9 ope		Chemical Company oduct lines erating processes	
	Production:	<ul> <li>Fatty Alcohol, 69,000 metric tones per</li> <li>Unit cost, RM1, 055 per metric ton</li> <li>Yield, 85%</li> <li>Ester, 160,000 metric tones per year</li> <li>Unit cost, RM 300 per metric ton</li> <li>Yield, 92%</li> </ul>		
	Environmental costs		= RM 1,100,000 p. a.	
	Wastewater sludge		<ul> <li>Waste generated, 1,700 tons p.a.</li> <li>Waste disposed, 1,200 tons p.a.</li> <li>Waste recycled, 500 tons p.a.</li> </ul>	
	Air Waste		= 300,000 tons p. a.	
	Energy Consumed:		= 780,000 GJ p.a.	
	Water Usage:		= 300,000 cubic meter p. a.	
	Percent of Environmental Costs:		= Wastewater, 77% = Solid waste, 33%	
	Percent of Capit Investment (Env Equipment)	al ironment	al = Amount, RM 18,000,000 per plant = Wastewater, 80% = Solid waster 20%	