

ASSESSING THE USE OF ENVIRONMENTAL MANAGEMENT ACCOUNTING AS A TOOL TO CALCULATE ENVIRONMENTAL COSTS AND THEIR IMPACT ON A COMPANY'S ENVIRONMENTAL PERFORMANCE

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The aim of this study was to investigate the use of Environmental Management Accounting (EMA) and identify environmental costs and their impact on environmental performance. Over the last two decades, EMA has emerged as an important approach by organizations wanting to improve their environmental and economic performance. However, despite the many pilot projects conducted that demonstrated the positive impact that EMA has on an organization, EMA implementation remains slow and lagging behind in South Africa. EMA is an environmental management tool that traces environmental costs directly to the processes and products that are responsible for those costs, thereby highlighting problem areas that need to be prioritized when considering the adoption of cleaner production. Previous research identified that traditional costing systems did not adequately account for the actual environmental costs incurred by companies as much of these costs were hidden under overhead accounts. Hence, production costs were high, resulting in incorrect profit margins being set and ultimately impacting on company profitability. This paper is based on a case study of a paper manufacturing company in KwaZulu-Natal. The scope of this study was limited to the steam generation process and focused mainly on the efficiency of the current coal-fired boilers used in the boiler plant. The research methodology used in the study was both quantitative and qualitative involving triangulation. The results of the study show that EMA can improve environmental and economic performance of an organization by providing managers with more accurate values of their environmental costs.

Keywords: Environmental Management Accounting (EMA), Sustainable Development (SD), Cleaner Production (CP), Efficiency, Environmental Performance

INTRODUCTION

In many developing countries, an increase in industrial activity, electricity demand and

transportation results in emissions and poor air quality has become a major issue (Stringer, 2010). Higher energy and raw material prices are

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causing cleaner production to grow in relevance and importance. Cleaner Production (CP) focuses on improved productivity and reduced impact as the result of design over the life of products, processes and services (National Cleaner Production Strategy, 2004; Lakhani, 2007). The amount of waste to landfill is increasing steadily.

Many companies are using inefficient processes and technologies that are obsolete instead of state-of-the-art processes, resulting in higher production costs, which, in turn, affect their profitability and competitiveness (Schaltegger *et al.*, 2010). Managers of paper mills perceive investments in pollution abatement technologies as 'unproductive' because they have 'no marketable and quantifiable effect in terms of productivity' (Bras *et al.*, 2004), resulting in the omission of the use of cleaner production opportunities (Baas, 2007). Large savings potential and opportunities for CP to address environmental issues successfully are not easily identified by companies since there is no monitoring and data collection in place.

The benefits of using Environmental Management Accounting (EMA) in practice, as an environmental and sustainability tool to collect, evaluate and interpret the information needed to estimate the potential for cleaner production saving with particular emphasis on non-product output costs and to make decisions to choose the right CP options, have been established in several business cases.

However, the level of implementation of EMA in practice is low because of the significant gap in academic knowledge concerning EMA and its role in identifying inefficiencies in a production process and benchmarking environmental costs

to yield superior environmental and economic performance (Ferreira *et al.*, 2010; Burritt *et al.*, 2009; Christ and Burritt, 2013; Schaltegger *et al.*, 2010; Thant and Charmondusit, 2010; Chius and Leung, 2002; Van, 2012).

PROBLEM STATEMENT

The paper and pulp manufacturing process of the company, on which the case study is based, consumes large amounts of natural resources and also generates excessive waste. The rising costs of input resources and increasing environmental costs had a negative impact on the companies' profitability (Cost Accountant, 2013).

The company has invested large amounts of money on end-of-pipe technologies and the wastewater treatment plant to reduce the negative impact of their production processes on the environment. This investment has, however, not solved their environmental issues nor has it reduced their resource use in production. The technology used in the steam production process is outdated and obsolete and generates between 20 to 60 tons of unburned coal ash as hazardous solid waste daily (Environmental Manager, 2013).

To ensure their future sustainability and competitiveness, management needs to consider adopting Cleaner Production (CP) techniques and technologies which will address waste issues at its source. According to the CP philosophy, which focuses on resources and resource flows, any reduction in material and energy used will result in fewer emissions (Christ and Burritt, 2013). CP is perceived by management as a costly strategy that requires innovation with no financial returns to the company in the short-term. The company's management is unaware of the magnitude of their

environmental costs are, since the company uses conventional accounting methods to allocate costs. EMA) can be used as a tool to systematically trace and accurately reallocate environmental costs to the relevant processes and products to enable managers to identify opportunities for implementing CP and thus improve their environmental and economic performance. Information needed to estimate the potential for cleaner production savings was facilitated by making use of material flow analysis, a tool of EMA to allocate environmental and material flow costs (Jasch, 2008).

AIM AND OBJECTIVES

Aim

- To demonstrate the role and importance of EMA in sustainable development and to investigate the use of EMA in identifying environmental costs.

Objectives

- To demonstrate the role and importance of EMA in sustainable development; and
- To assess the company's current environmental performance by identifying environmental costs using EMA instead of conventional costing systems currently being used by the company.

Within the scope of this study, the following research questions were posed to achieve the objectives. They are listed as follows:

1. Are specific types of the major environmental costs separately identified and measured? If yes, what are they? If not, why not?
2. How are the major environmental costs, both physical and monetary, being captured (if at all) within the current accounting systems?
3. Are environmental costs regularly measured and monitored against technological standards to ensure that technology is functioning optimally?
4. Are environmental costs reflected as production costs and hidden under general overhead costs in financial statements?
5. What are the barriers to the adoption of an EMA system and to invest in cleaner production technologies?
6. Are there regular communication and exchange of information between the accounting department, production department, technical managers and the environmental team?
7. How old is the technology used in the production process?
8. Are non-product output cost calculated using principles of EMA and recorded separately or are they included as production costs?
9. Are managers aware of the potential benefits of CP implementation?

The questions listed above informed the research and guided the data collection.

RESEARCH METHODS

The study is based on a case study following a multi-method approach, that is, method triangulation. The researcher will implement both qualitative and quantitative data analysis methods during the study.

Since managers are the only respondents who can provide the required data for this study, the researcher elected to conduct a census study. The census included all members of the management team including top management,

middle-level managers and frontline managers.

Qualitative methodology comprised of interviews, and observation, and quantitative methodology involved the use of questionnaires and quantified input and output material flows using mass flow balance. It was suggested by Yin (2009) that the triangulation approach to data collection enhances accuracy as it involves a combination of three approaches, use of questionnaires, interviews and systematic observation. Triangulation method increases confidence in research data and establishes validity.

DATA ANALYSIS

In order to analyze the quantitative information, the researcher used a number of tools such as tables, figures, models and charts. The statistical package for social sciences, SPSS 22 – was used for descriptive and inferential statistics data analysis. Inferential techniques used in the study include the use of correlations and chi square test values; which were interpreted using the p-values. Interviews were analyzed using relevant statistical methods.

Reliability of primary data was also established by using questionnaires to collect data on the company's current level of environmental performance and economic impact. The Cronbach's Alpha Coefficient was used to measure the reliability of the questionnaires in this study. The overall reliability score of each section exceeded the recommended value of 0.70. Hence, it would seem that the case study is reliable (Quinlan, 2011). Reliability of the case study was established by using multiple sources of evidence.

Some of these secondary data used in the

study was found in the company's internal documents. Environmental management costs were assessed from annual reports complemented with information extracted from the firm's environmental manager and a member of the Financial Accounting and Cost Accounting Department (Management Accountant, 2013).

The two most important aspects of precision are reliability and validity. Reliability is computed by taking several measurements on the same subjects. A reliability coefficient of 0.70 or higher is considered as "acceptable".

Table 1 reflects the Cronbach's alpha score for all the items that constituted the questionnaire.

The overall reliability score of each section exceeds the recommended value of 0.70. This indicates a high (overall) degree of acceptable, consistent scoring for the research.

All of the themes (sub-sections) have values that exceed the acceptable standard.

Questions 3 and 4 are scalar in nature. Cronbach's alpha was not determined.

RESULTS AND DISCUSSION

The results are first presented using summarized percentages for the variables that constitute each section.

Results are then further analyzed according to the importance of the statements.

Q1. Corporate Environmental Strategy of the Organization

This section deals with management's perception of the extent to which environmental issues are integrated into the organization's corporate strategies.

Table 2 represents the corporate

Table 1: Cronbach Scores

		Number of Items	Cronbach's Alpha
Q1	Corporate environmental strategy of the organisation	4 of 4	.878
Q2	Environmental related activities	12 of 12	.978
Q3	Reasons for the promotion of clean production by industries	-	-
Q4	Cause of pollution/waste generation	-	-
Q5	Perspectives of environmental management accounting	5 of 5	.922
Q6	Environmental audit assessments	5 of 5	.884

environmental strategy of the organization.

The average level of importance for this section was 75.71%.

The first two statements average 91.43% with the last statement lowering the overall average, with only half of the respondents agreeing (51.43%). Even though the level of agreement is reasonably high, the statements relating to environmental issues are always considered during new product development and environmental objectives being linked with the company's corporate goals, scores lower than the rest.

It is interesting to note that although all four statements are considered a part of corporate environmental strategy, the response to the last two statements varied significantly as compared to the first two statements. The most important levels of agreement were for the first two statements.

The uncertainty to this question is evidenced by the large number respondents indicating a neutral view on the last two statements, with 31.43% for statement three and 45.71% for statement four. According to Gil *et al.* (2007) management commitment has a substantial influence on corporate environmental strategy

and that management's awareness of the responsibility to the environment during strategic decision making is important to reflect this commitment inside and outside the organization.

Lack of clear environmental goals is one of the obstacles to environmental performance measurement (Mohr-Swart, 2008).

To determine whether the differences were significant, chi-square tests were done by variable (statement). The null hypothesis tested the claim that there were no differences in the scoring options per statement. The results are shown in Table 3.

Since all but one of the sig. values (p-values) are less than 0.05 (the level of significance), it implies that the distributions were not even. That is, the differences between the levels of agreement were significant. Similar scoring patterns were observed for statement 3 ($p = 0.690$).

Differences in the level of agreement clearly indicate that managers have limited knowledge on the organization's corporate environmental strategy, more especially in areas concerning environmental objectives and new product development.

Q2 Environmental Related Activities

Table 2: Corporate environmental strategy of the organisation

Question 1	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Integrated environmental issues are incorporated into the company's strategic planning process	0.00	0.00	8.57	60.00	31.43
Reducing the environmental impact of products and processes forms part of the Total Quality Management (TQM) policy	0.00	0.00	8.57	65.71	25.71
Environmental objectives are linked with the company's corporate goals	0.00	0.00	31.43	40.00	28.57
During the development of new products, environmental issues are always considered	0.00	2.86	45.71	28.57	22.86

Table 3: Test Statistics

	Integrated environmental issues are incorporated into the company's strategic planning process	Reducing the environmental impact of products and processes forms part of the Total Quality Management (TQM) policy	Environmental objectives are linked with the company's corporate goals	During the development of new products, environmental issues are always considered
Chi-Square	13.943 ^a	18.057 ^a	.743 ^a	13.114 ^b
df	2	2	2	3
Asymp. Sig.	.001	.000	.690	.004

This section deals with environmental-related activities that have been practiced in the company to implement environmental management.

The average level of respondents indicating that environmental activities are *regularly done* for this section is 39.76%. There are three levels of *agreement patterns*.

The highest ranked statement is "Identification of environmental related-costs" (82.86%).

A single second important statement was for statement 2 which related to the estimation of environmental-related contingent liabilities (68.57%).

The remaining statements all had agreements for *regularly done* of no more than 40%. The

corresponding negative scoring level (*Being done to some extent or never done*)

The results revealed that to some extent, the respondents perceived their organization had conducted appropriate environmental-related activities. It was apparent that 'Identification of environmental related-costs' activity was ranked the highest suggesting a common activity within the organization. This was followed by 'Estimation of environmental-related contingent liabilities.' Surprisingly, an average of 45.7% of the respondents indicated that the following environmental related activities were 'never done': Allocation of environmental-related costs to production processes and products, product improvement analysis and assessment of

potential environmental impacts associated with capital investment decisions.

Literature suggests that an EMA system be implemented in order to overcome the limitation of conventional management accounting which is unable to detect hidden environmental related costs that affects business performance (Schaltegger *et al.*, 2010). In addition, Qian *et al.* (2011) emphasize the incompleteness of conventional management accounting approaches that only takes into consideration the operational cost of waste management during decision making. Product improvement analysis should also be done in order to identify new opportunities within organizations.

Q3 Reasons for the Promotion of Clean Production by Industries

This section investigates the manager's perception of factors that promote the adoption of cleaner production in industries.

Table 5 is the average rank score of the factors, ranked from the highest to the lowest levels of importance.

The most important factor is identified as being uncertainty regarding business sustainability.

The results indicate that external factors have a more significant impact on whether or not an organization will adopt cleaner production than internal factors. The first three factors are external while the last two factors, rated as less important are internal factors. The contingency theory could be used to explain why managers have identified uncertainty regarding business sustainability as the most important factor. It can be inferred from Qian *et al.* (2011) that there is no single best approach to sustainability since the external business environment is characterized by

uncertainty. They concur that the optimal course of action will depend on factors such as company's environment, technology and culture.

According to the Institute of Environmental Engineering and the UNEP, internal barriers to CP implementation within a company are: low commitment from management, lack of environmental awareness, poor communication links and financial obstacles. Therefore, the last two constructs have been rated as less important. Fore and Mbohwa (2010) identified barriers to cleaner technology adoption as: less stringent government regulations and policies, resource unavailability and lack of financial initiative. This supports the respondents' view to a certain extent that external factors, such as market pressures, strict legislation and, most importantly, uncertainty of the businesses future sustainability, are the driving forces of CP implementation.

Q4 Cause of Pollution/Waste Generation

This section is concerned with the most important causes of waste/pollution in the company.

Table 6 ranks the causes in order of being most important to least important.

The results reveal that the most important cause of pollution is input and raw material waste, followed by poor manufacturing and inadequate input, product and equipment specification. No planning for production, purchasing and sales was rated the least important cause of pollution or waste. Literature supports this view that the most significant share of total environmental costs is usually non-product output costs (Domil *et al.*, 2010). Material costs make up the highest portion of costs (about 50%) in a manufacturing company. According to Sygulla *et al.* (2011), by

Question 2	Never done	Being done to some extent	Neutral	Regularly done	Always done
Identification of environmental related-costs	0.00	0.00	17.14	48.57	34.29
Estimation of environmental-related contingent liabilities	0.00	11.43	20.00	42.86	25.71
Classification of environment-related costs	0.00	57.14	8.57	11.43	22.86
Allocation of environment-related costs to production processes	40.00	14.29	11.43	17.14	17.14
Improvements to environment-related cost management	2.86	54.29	8.57	14.29	20.00
Allocation to environment-related costs to production products	48.57	8.57	11.43	11.43	20.00
Creation and use of environment-related cost accounts	0.00	54.29	5.71	20.00	20.00
Development and use of environment-related key performance indicators (KPIs)	0.00	51.43	17.14	11.43	20.00
Product life-cycle cost assessment	2.86	54.29	14.29	8.57	20.00
Product impact analysis	0.00	57.14	11.43	11.43	20.00
Product improvement analysis	45.71	11.43	11.43	11.43	20.00
Assessment of potential environmental impacts associated with capital investment decision	48.57	11.43	11.43	8.57	20.00

	Mean
The fear for business sustainability in the future and its uncertainties	4.54
The market pressures for cleaner products and processes	3.97
Strict legislation and environmental crime law	3.80
The greater business managers' awareness and commitments to the environmental aspects	2.94
Many emotional aspects connected with environment and the company's productive activity	2.43

reducing material usage, the amount of waste generated will also decrease. Schmidt and Nakajima (2013) claim that by implementing Material Flow Cost Accounting, a tool of EMA, material losses can be evaluated in monetary terms making it possible for managers to identify environmental and economic benefits of adopting cleaner production techniques and technologies. Jonall (2008) states that wasted raw material is

a sign of inefficient production processes or poor manufacturing. In many cases, this was generally caused by old technologies used. He added that polluting companies actually pay three times for non-product output and need to take this cost saving potential into consideration when making decisions regarding investment in cleaner production technologies. Other causes of waste are improper material handling, poor

Table 6: Causes of Pollution	
	Mean
Input and raw material waste	7.14
Poor manufacturing	5.83
Inadequate input, product and equipment specification	4.94
Improper material handling	4.80
No suitable maintenance	4.03
Improper use of technologies	3.71
Insufficient operator training and commitment	3.37
No planning for production, purchasing and sales	2.51

maintenance, improper use of technology and insufficient operator training, but are considered less important.

Q5 Perspectives of Environmental Management Accounting

This section is concerned with manager’s perception of environmental management accounting practices within the organization.

The average level of agreement is 44.00%.

The level of agreement is fairly consistent except for statement 4 which relates to the undertaking environmental impact audits culminating in the company’s activities (74.29%). Two of the statements show high levels of neutrality whilst the remaining statements indicate higher levels of disagreement.

This finding suggests that most of the environmental management accounting practices are not being implemented within the organization except for environmental impact audits. Since the organization is ISO 14001 accredited, environmental impact audits are mandatory. The company uses a traditional cost accounting system which is inadequate in incorporating environmental information into general

management accounting information.

Findings in question two above related to environmental activities also suggest that EMA system is not being implemented by the company. According to Benette *et al.* (2013), EMA is a tool that tracks and traces environment-related costs that are generally hidden under overheads to assist managers in decision making. Recent developments in EMA emphasize the greater need for accounting information when making decisions regarding environmental projects (Qian and Burritt, 2008). Previous research by Jasch and Schnitzer (2002) showed a lack of communication between the environmental manager and cost accountant in companies. The environmental manager has limited access to actual cost accounting documents and although the cost controller has most of the information, they lack the ability to separate the environmental part without proper guidance.

EMA is a combined approach to bridge this communication gap and provide for the transition of data from cost accounting and financial accounting to reduce the environmental impact by increasing material efficiency. Hence, it was implied that, in order to enable the sharing of

environmental information needed to stimulate management accounting practices, formal and informal interactions between different functions are required.

Environmental reporting and environmental audit is based on the ‘stakeholder theory’ which implies that a company needs to conduct their business operations in a way that is socially acceptable by the community. It can be inferred from Shaltegger *et al.* (2011) that some firms place greater emphasis on stakeholders as they believe that this is critical to the firms’ success and to ensure future sustainability. This could explain the reason for the high level of agreement for statement 4.

Q6 Environmental Audit Assessments

This section looks at annual environment impact and other audit assessments and whether the organization was currently practicing these.

The average level of agreement regarding usage was 94.86%.

Respondents, in general, agree that their organization does conduct regular environmental

audit assessments. Research suggests that audits in EMS are used to validate the implementation of the management system and to check compliance with legislation, but do not measure actual environmental performance (Lundberg, 2009). A basic commitment of EMS, according to ISO 14001 standardization, is continuous improvement to achieve environmental performance that is consistent with the organization’s environmental policy.

CORRELATIONS

Bivariate correlation was also performed on the (ordinal) data. The results indicate the following patterns:

The correlation value for Business factors between “Integrated environmental issues are incorporated into the company’s strategic planning process” and “Environmental objectives are linked with the company’s corporate goals” is 0.721. This is a directly related proportionality. Respondents agree that the more integrated environmental issues are incorporated into the company’s strategic planning processes, the more likely the environmental objectives are linked

Table 7: Perspectives of Environmental Management Accounting

Question 1	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Inclusion of environmental information in the present management accounting information system	0.00	45.71	8.57	22.86	22.86
Availability of formal accounting procedures when dealing with specific environmental issues	0.00	2.86	65.71	14.29	17.14
Implementing cost-benefit analysis that also takes into consideration any environmental issues when dealing with viability of projects, course of actions	0.00	48.57	14.29	20.00	17.14
Undertaking environmental impact audits culminating company's activities	0.00	0.00	25.71	57.14	17.14
Reporting environmental information to external stakeholders	0.00	5.71	62.86	8.57	22.86

with the company’s corporate goals, and vice versa.

Respondents also agree that the allocation of environmental-related costs to production processes and classification of environmental-related costs results in improvements to environment-related cost management (correlation of 0.880 and 0.978, respectively).

Further analysis shows that assessments of environmental impact issues during capital investment decisions demonstrate greater commitment and awareness of environmental issues by the business managers (positive correlation of 0.748). Input and raw material waste seems to be positively related to poor manufacturing.

Negative values, as identified in the correlation

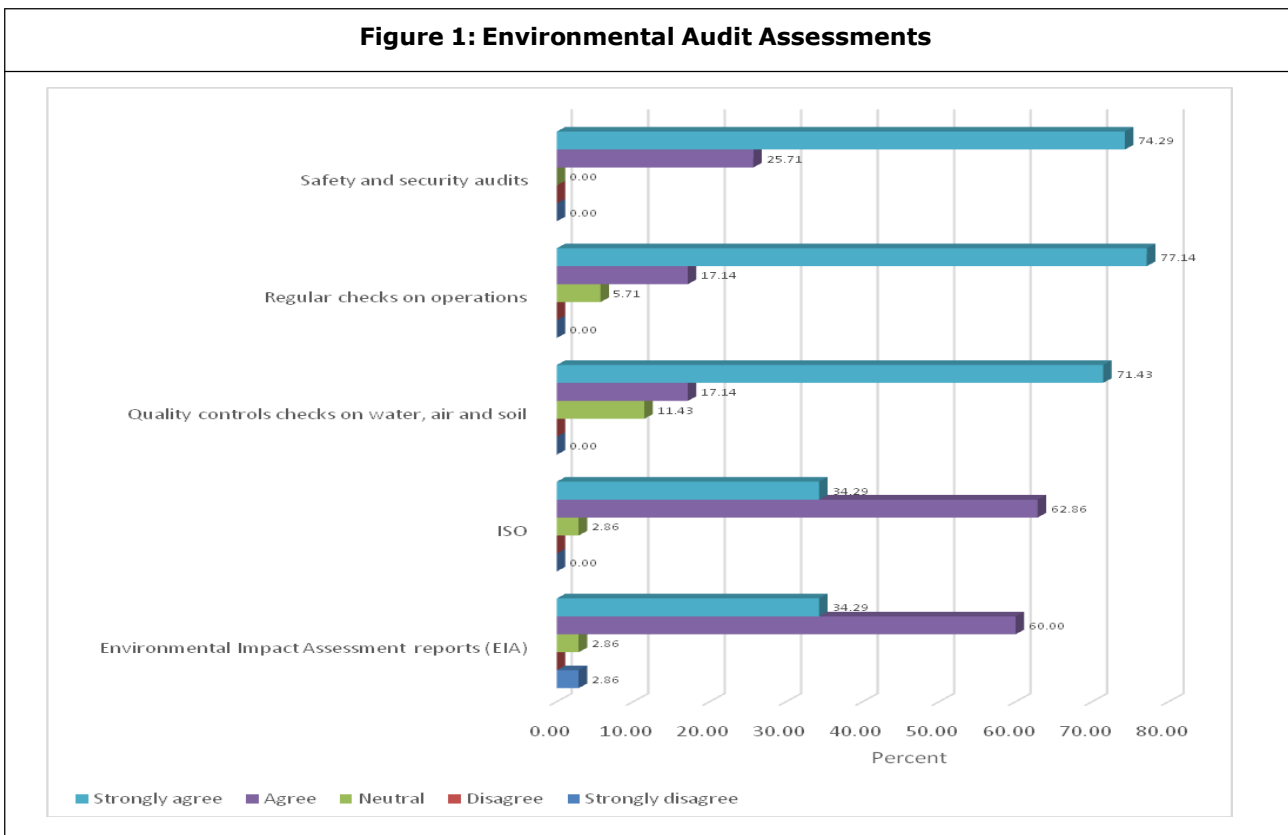
results, imply an inverse relationship. That is, the variables have an opposite effect on each other. Analysis on negative coefficients for certain variables was interpreted as follows:

The coefficient between “The fear for business sustainability in the future and its uncertainties” and “Classification of environment-related costs” is -0.664 .

This finding indicates that the greater the environmental business costs, the less sustainable businesses may become, and vice versa.

Interestingly, a negative correlation exists between inclusion of environmental information in the present management accounting information system and input and raw material waste. This means that input and raw material waste decreases when environmental issues are

Figure 1: Environmental Audit Assessments



incorporated into the company's management accounting system (-0.656). This trend indicates an inverse relation between environmental management activities practised and input and raw material waste generated.

Hence, by incorporating environmental management activities into daily business operations, input and raw material waste generated can be reduced and manufacturing can be improved.

SUMMARIZED OVERVIEW OF QUANTITATIVE FINDINGS

Analysis of the results of procedures to measure environmental performance showed that the EMS is a separate and isolated management procedure, mainly used by the environmental manager and environmental administrators. It is separate and detached from general management and, consequently, the EMS has no real management function on an overall organizational level. It is also not linked to the cost accounting system to provide monetary values of environmental impact and environmental costs are not accurately traced back to the products or processes responsible for those costs. Hence, inefficient production processes cannot be identified and considered in strategic decision making. Production costs include non-product output costs as environmental aspects are not excluded in financial reporting. This results in understated environmental costs and the overstatement of production costs.

In addition, findings also reveal that not all environmental aspects are quantified, and limited quantified data make it difficult to monitor environmental performance and identify possible environmental improvements.

The objectives in the strategic plan of the organization correspond to the national environmental quality objectives. This implies that environmental issues are incorporated into the long-term goals of the organization which requires a strategic work plan to be implemented and budgeted for. There is a need to increase pressure on business managers to include environmental objectives in the operational planning, which seems to be currently lacking in the company. Operational activities need to be aligned to strategic objectives.

The effectiveness of the company's current system from an environmental point of view is questionable since it is difficult to assess the extent to which environmental objectives are fulfilled. Environmental objectives in terms of targets and improvement measures are not clearly connected to the strategic objectives and absent from general management system. Research suggests that even though a company may have well-formulated objectives and suitable indicators measuring progress towards achieving objectives, actual improvements are unlikely to be achieved unless employees are committed and motivated to work towards improving environmental performance (Lundberg, 2009).

Managers in the company are unaware of the company's progress and performance to environmental objectives due to a lack of feedback and unclear structures.

SUMMARY OF EMPIRICAL FINDINGS

The study yielded the following results:

The researcher, during the interview with the

cost accountant of the company, discovered that the environmental costs are perceived to be insignificant and only accounted for annually using a traditional accounting system.

Current Accounting Practices For Managing Environmental Cost Of The Company

Standard accounting information system is used for both financial and management accounting. Environmental costs are recognized for waste treatment and waste disposal under overhead expenses for the whole company. Only monetary information is provided for environmental costs. For the steam generation process, no environmental costs were included. Production costs for the process included raw material (coal), electricity, water and fixed cost. All coal purchased was included as part of production costs. Raw material lost during production was not calculated and measured in monetary and physical terms. The non-product output is an environmental cost to the company as this loss represents waste which is a sign of inefficiency in production. Depreciation, including that of environmental equipment like ESP's or cyclones used to reduce environmental impact of pollution and hazardous waste, forms part of fixed cost.

This cost allocation is incorrect as depreciation of environmental equipment should be recognized as part of environmental costs and not fixed overhead costs. Labor cost of handling and disposal of waste including the salary of the environmental manager should be allocated to environmental cost. However, this is not being done by the company. Environmental costs are allocated to overhead accounts and key managers are not held liable for these costs. This tends to discourage managers from actively

managing environmental costs. There is limited environmental accountability.

Based on the above information regarding accounting practices for managing environmental cost, it can be concluded, that, due to the inadequacies of the company's current accounting systems, environmental costs reported by the company are significantly underestimated.

The environmental costs included in financial statements are not a true and accurate reflection of the actual environmental costs.

There seems to be poor communication between the management accountant and the environmental manager. Management accountants tend to be constrained to thinking within the existing chart of accounts, and pay less attention to environmental costs (Chang, 2007). Due to this break in communication, opportunities for reducing environmental costs remain unidentified. In order to build a link between physical and monetary information systems and improve environmental and economic performance, it is essential that there be regular interaction and information sharing between the environmental and accounting departments. In terms of the management of major environmental costs:

- A monthly management report is produced by the Finance department in order to review current operations and assess performance against the budget. Hence, major environmental costs are allocated as per budget;
- A detailed breakdown of the costs are not provided and, therefore, due to incomplete information, management of environmental costs are not prioritized; and

- The problem stems from the fact that there was no prior focus on environmental cost management. The fact that senior managers feel that the environmental costs are insignificant, means that they do not know the extent of environmental costs.

The limitations mentioned above are not specific to this case study, but could be common to many other organizations, as discussed in the literature review. These limitations do, however, impact negatively on the company's environmental and economic performance.

CONCLUSION

The aim of this research was not only to identify environmental costs of the production process, but also to highlight scope for potential savings. During initial analysis, the focus was on what the company identified as environmental costs and also what other costs are environmental but concealed in other accounts.

- *The objective of the study was to assess the company's current environmental performance.*

In order to assess the company's current environmental performance, various procedures and policies were investigated. The empirical results were as follows:

According to the results of the survey questionnaire, the company's current environmental performance could be rated as average considering that paper and pulp production is resource intensive and generates a lot of waste. Environmental data is collected by the company. However, not much is said about how well they manage such data and the availability of information also seems to be a

hurdle to the effective management of the environment. Environmental data collection is poorly coordinated within the company.

The company does not have an environmental management accounting component. Therefore financial criteria were not taken into account when identifying environmental issues. Environmental costs were accumulated in overheads and these costs were being allocated in a manner that did not necessarily reflect their actual use and waste costs were understated as NPO costs were not considered. Waste costs typically reflected the amount paid to subcontractors to remove the waste. Hence, opportunities for improved financial performance had been overlooked because of inaccurate measurement of environmental costs. Furthermore, the organization is unaware of the true value of their internal environmental costs of their operational activities. The general knowledge in the company about different environmental cost and the identification and allocation of environmental costs is limited although the general environmental awareness is good.

Environmental-Related Activities

Environmental-related costs and estimation of contingent liabilities are considered by the company. However, environmental costs are not systematically traced back to production processes and products.

The following weaknesses in the company's current system in calculating environmental costs were identified:

Costs of waste disposal were not consistently gathered and evaluated and the cost of handling of waste within the organization was seldom taken into account. It had also been found that environmental and technical managers have

insufficient information about the magnitude of operational costs. Only accountants were exposed to this kind of information. Furthermore, comprehensive cost statements for environmental costs were not available.

Therefore, it can be deduced that the environmental costs reflected in the company records are incorrect as most of the costs that should be included in the cost calculation are omitted. The reason for this is strongly attributed to the conventional accounting system being used by the company.

Lack of resources had been reported as most challenging in implementing environmental management systems. Difficulty in motivating staff has also been identified as a major challenge. Sinclair-Desgagne (2004) suggests that all business units need to be involved in environmental goal-setting and implementation in order to successfully achieve environmental objectives.

Communication Between Accounting Department And Environmental Department

The environmental manager is the only individual involved in handling environmental issues and, at times, environmental issues are outsourced to an environmental specialist. Poor inter-departmental communication is evident. There is also no link between systems for collecting financial and non-financial data.

RECOMMENDATIONS

Recommendation 1

To adopt an EMA system rather than a conventional accounting system

An improvement of the current accounting system by adopting an EMA has been suggested as this will bring about environmental benefits and ensure environmental reporting according to legislative requirements by focusing on both physical and monetary environmental cost information. Reduction of material and energy loss values is necessary to improve environmental and economic performance. Increased transparency of environmental costs and greater accuracy in calculating these costs are needed.

A general recommendation for the improvement of the data collection of environmental costs and material flow costs is also suggested. Written procedures must be developed for distribution of costs to the correct cost categories.

In addition, costs allocated for personnel expenses of the environmental team and costs incurred for environmental communication must be clearly and uniformly recorded.

Recommendation 2

To adopt cleaner production techniques or technologies

Short-term measures

Investment in CPT is expensive. However, in order to improve environmental and economic performance, the organization needs to adopt a CP strategy. Therefore, it is advisable that, in the shorter-term, the company must ensure that their current technology is operating efficiently and according to technological standards. In the short-term, waste cannot be totally eliminated and, according to technological specifications, the loss of coal is estimated to be approximately 10%. By proper housekeeping and regular

maintenance of their current boilers, the company would be able to save on loss of raw material usage (coal). Excess carbon present in the waste, indicate poor operational practices. The company would also reduce the cost of disposal of ash to landfill and since disposal of carbon to landfill is prohibited, this would ease off the environmental burden to the company.

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