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An Assessment of the Effectiveness on Environmental Management Accounting (EMA) at Sierra Mineral Holdings Limited in Sierra Leone

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Abstract

This study gives an assessment of the effectiveness of Environmental Management Accounting (EMA) at Sierra Mineral Holdings Limited in Sierra Leone. Specifically, this study focuses on the present environmental management accounting practices that have been adopted by the management and how risk is being assessed. The study made use of probabilistic sampling and uses a research design that caters to both primary and secondary data. The study made use of the mixed methods techniques that were derived from a research paradigm & strategies of inquiry that were adopted by the researcher, and these however justified the research approach. The study adopted the use of descriptive design surveys using well-structured questionnaires and conducted personal interviews to obtain information. This piece of work used mathematical models like Benford's Law and the KNIME Analytics Platform software to analyze and interpret data. The findings of this study revealed that there is a high awareness of environmental management accounting for the various cost categories and in the assessment of environmental risk in Sierra Leone as a developing country. The study uses an imaginary company's income statement to explain the conventional cost as it clearly shows how environmental costs are captured in the notes of the financial statements but then lose their identity in overheads which will prevent management from making informed decisions. Based on the findings of this study, it is prudent that organizations put modalities in place for effective management of environmental management accounting principles.

Subject Areas

Accounting, Environmental Economics, Risk Management

Keywords

Environmental Management Accounting (EMA), Mixed Methods, Benford's Law, KNIME Analytical Platform, Research Paradigm, Strategies of Inquiry

1. Introduction

Environmental awareness stems from the political ideology of environmentalism. (Cohen, 2001) [1]. Most developing countries rely on non-renewable energy using substandard plants & machinery, poor drainages from waste, and lack of site preparation had resulted in serious environmental hazards and degradation.

Environmental Management Accounting (EMA) has been described as a support tool for managers to make informed decisions about their environmental impacts beyond its boundaries. It helps management to identify win-win solutions that improve economic and environmental performance (Burritt, Schaltegger and Christ, 2021) [2].

Over the last few decades, the expanding population and increasing industrial development have led to environmental degradation. Consequently, organizations face increasing pressures from a variety of stakeholders. Such pressure requires management to provide timely information about various aspects of their operations beyond those reflected in traditional financial and cost accounting methods (Khan. M, 2007) [3].

Accordingly, this piece of work intends to discuss environmental management accounting (EMA) whose use has delivered many benefits that outweigh the cost associated with it. This paper aims to give a brief description of the development of environmental management accounting, a basic framework for identifying the various environmental cost categories, and an assessment of the various risks associated with environmental issues.

The piece of work reviewed the annual Financial Statements of a leading mining company to make an assessment of the company's performance and to evaluate how its environmental costs are reported. Furthermore, the researcher noticed that the said company does not have an internal audit department that should have dictated the Internal Audit functions, and finally, a risk assessment was conducted on its environmental management. The health and safety Manager is responsible for Environmental Impact Assessment (EIA) and he was interviewed alongside several informed officers to derive information for this piece of work. Their perceptions serve as a springboard that helps the researcher to make an assessment of the effectiveness of Environmental Management Accounting in Sierra Leone.

2. Aims and Objectives

2.1. Aim

- To establish the increasing role and importance of EMA and to identify if the

various environmental costs are correctly treated.

2.2. Objectives

- To investigate and evaluate the various cost categories of Environmental Management Accounting used.
- To assess the various risks that affect EMA practices.
- To evaluate the role of the Internal Audit Department relating to Environmental Management Accounting.
- Investigate if there are other contingency plans for the closure of future sites and if adequate provisions were made.

3. Environmental Management Accounting Costs

This section discusses the various cost categories of environmental management accounting that are applicable. This piece of work will only focus on conventional and contingent costs.

3.1. Conventional Cost

These costs that are reported by a company's accounting systems in their income statements. These costs are hidden in the notes of the financial statements and can be classified as either operational costs administrative costs or overheads. Examples of such costs include regulatory fines because of non-compliance with environmental laws, and the cost of raw materials and energy used that are being accounted for by their accounting systems as the cost of sales.

The downside of this category of classifying cost is that it will make it difficult for planning and controlling. Overheads like emission costs will be embedded in a note in the financial statements and it will not signal to the director of finance of the dangers it might cause and may possibly lead to regulatory fines. Such fines can cause customer boycotts which will drastically reduce revenue.

3.2. Contingent Cost

An internally generated Microsoft (MS) Excel document examined titled "Provision Decommissioning (Dec. 2020. Revised)", calculates the provisions made from 2013 to 2031 in relation to its decommissioning costs. (VIMETCO SL Ltd, 2021) [4] These costs represent contingencies put in place to account for their decommission cost and site restoration cost. This is shown in **Appendix 1**.

The Figures shown in **Appendix 1** give an explicit explanation of how their decommissioning cost is being treated for contingency plans in other to reduce the burden at the end of their site life span. Adequate provisions are made to ensure that at the end of the asset life span, they can easily meet all expected expenditures to close such a site and bring it to a state where the land can be restored to its original state. For the provisions to cover inflation rates and exchange rate issues, an interest of 5% was charged to ensure that the present values take account of the time value of money.

4. Risk Assessment Strategies for Operational Activities in EMA

In other to evaluate risk, the study uses the KNIME analytics platform which gives an assessment of the fire emergency preparedness for the targeted mining company in Sierra Leone.

USING KNIME ANALYTICS PLATFORM TO EVALUATE RISK:

KNIME Analytics Platform is open-source software for creating data science. The KNIME Platform uses nodes to model each step of the data analysis, to control the flow of data (KNIME Platform, 2022) [5]. With the information analyzed, a scattered diagram will be used to cluster analysis.

The aim of using the scatter diagram plot is to show areas in the graph where information is clustered or those that are considered an Outlier. Information in the scatter diagram plots that are clustered together are considered normal transactions and those that fall as outliers require more samples to be collected or more actions to be done. See **Appendix 2** for data and Figure 1 for the diagram.

From the scattered Plot Diagram, the X axes represent the number of years under review while the Y axes represent the total expenses paid to the government of Sierra Leone. We noticed that the plots clustered between the years 2012 to 2016 indicate that expenses paid are normal transactions. This situation is considered a normal situation as the expenses are within the expected range. On the contrary, we also noticed a slight increase in the plots in 2017 and 2019 but there was a significant increase in 2018. If the plots do not follow the general pattern, it is then considered outliers. It is therefore suggested that more samples will be obtained in the years that are considered outliers to ensure that the risk is reduced to a tolerable level.

5. Internal Audit Function-EMA

This section will discuss the internal audit function of EMA to aid compliance

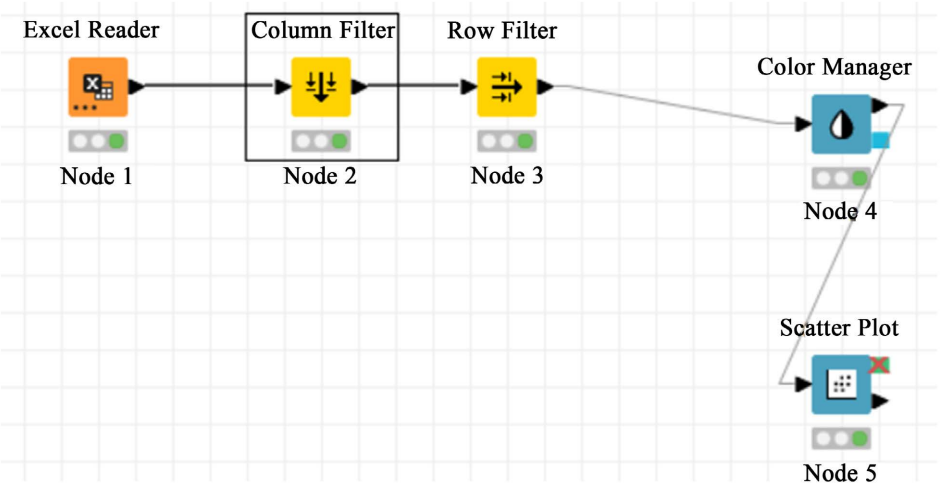

Figure 1. Analysing risk using knime analitics platform.

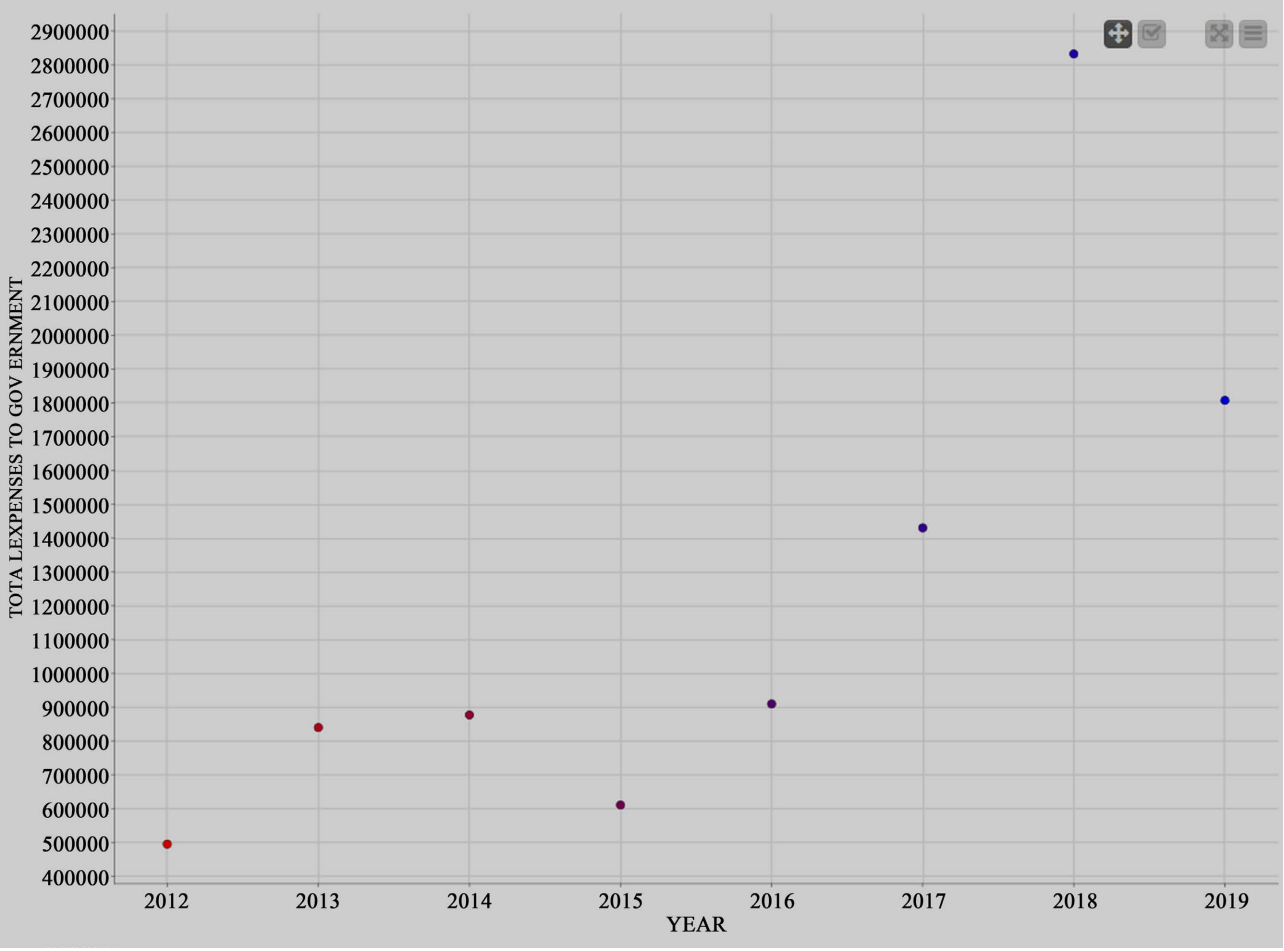

Figure 2. Scattered diagram plot.

and give assurance on the internal control processes.

USING BENFORD'S LAW TO AID COMPLIANCE WITHIN VIMETCO SL LIMITED: Benford's law is also called the 'first-digits law. This law also predicts the occurrence of digits in large sets of data. Its formula is Log 10 (1/X + 1). Where X is assumed to be in cell A4 to cell A12 for the first nine digits *i.e.* (1 - 9) (Monnik, 2021) [6].

Since the formula has been established, an analysis will be done on the cost by a mining company paid to the government to determine areas that are riskier from which more samples should be collected. This study developed a table that will analyze from 2012 to 2020 and give an illustration of how Benford's law can be used by the internal audit.

In other to have the first digit, we use the" @ left" function which is shown on the third column or column C in the MS Excel table above. The fourth column or column D in the excel sheet contains the first nine digits that are from 1 – 9. Column E gives the actual frequency which was derived by using the Excel formula count if which gives a total frequency of 8, this formula can be used to check for control totals and completeness of a transaction for the period under review. The Actual % (percentage) was derived by dividing the actual frequency

and the total and multiplying by 100; while Benford's law percentage, uses the stated formula. The difference or variance in column H was calculated by deducting the Actual % from Benford's law %.

These variances do not mean fraud, but it highlights areas that require more audit work and samples. From Table 1, we can safely predict that 2012, 2014, and 2015 show higher percentages that require more samples and audit procedures for the internal audit department to achieve its desired goals.

6. Conclusions

The role of the management accountant has increased over the years, especially in environmental preparedness and suitability. Projections up to 2035 in relation to its decommissioning cost/contingent cost are a plus on their side but the researcher was keen to find out if there are other contingency plans for the closure of future sites and if adequate provisions were made. The researcher is satisfied with the provisions made on the decommissioning cost as shown in **Appendix 1**. Using conventional costs has been very risky as the overheads were only explained in the notes in the financial statements. There have been adverse consequences of reporting these costs as administrative/operating costs such as paying huge regulatory fines and customer boycotts.

This study introduced KNIME Analytics as a tool to assess risk management on the simple theories of clustering and outliers and uses a scattered diagram to explain the nodes analyzed. It should be noted that items that are outside the clustering range do not signify fraud, but it is rather justifying that more samples should be collected to make informed judgements.

To aid compliance, this study used Benford's Law to determine areas that the scope of the audit and areas that require adequate concentration.

Table 1. Benford's law analysis.

Year	Annual Cost to Government (Input) (B)	Use first Digit (@ Left)	Digits (1 - 9)	Actual Frequency (Count if)	Actual %	Benford's Law % (Log10 (1/D1 + 1)	Difference (Actual % minus Benford's Law) %
2012	2,020,355.00	2	1	1	12.50%	30.10%	−17.60%
2013	2,839,490.00	2	2	2	5.00%	17.61%	7.39%
2014	4,449,914.00	4	3	0	0.00%	12.49%	−12.49%
2015	4,306,354.00	4	4	2	25.00%	9.69%	15.31%
2016	5,887,686.00	5	5	1	12.50%	7.92%	4.58%
2017	8,545,922.00	8	6	0	0.00%	6.69%	−6.69%
2018	10,562,373.00	1	7	1	12.50%	5.80%	6.70%
2019	7,698,693.00	7	8	1	12.50%	5.12%	7.38%
2020	0.00	0	9	0	0.00%	4.58%	−4.58%
Total				**8**			

If these policies are adopted, it will lead to a successful reporting structure in environmental management accounting within Sierra Mineral Holdings Limited in Sierra Leone.

The limitation of the research is that it was focused on Sierra Mineral Holdings Limited in Sierra Leone, a better insight would have been proffered if a comparative analysis would have been made between different mineral companies in the countries to gain an understating of the effectiveness of environmental management accounting treatments and provisions. In addition, Sierra Leone has been the member of the West African Reginal Body an extended study the on effectiveness of environmental management accounting of similar companies in the sub region would be helpful to provide an insight into the accounting treatment and provision of companies in different countries. We recommend based on these limitations for future research.

The tools used in this study were selected to answer the research objectives and aim. However, similar tool can be used to answer different research questions in another research on environmental management accounting. This is a general limitation in the use environmental accounting tools. Although in some cases different analytical tools are applied to similar problems and delimitations.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix 1. Decommissioning Costs

Decommissioning Cost 2013-2031					
			5%		
No	Year	Provision opening balance	Interest	Provision ending balance	Date
1	2013	-	-	-	31.1.2013
2	2014	2,358,103	111,401	2,469,504	31.12.2014
3	2015	2,469,504	116,664	2,586,168	31.12.2015
4	2016	2,586,168	122,175	2,708,343	31.12.2016
5	2017	2,708,343	127,947	2,836,290	31.12.2017
6	2018	2,836,290	133,991	2,970,282	31.12.2018
7	2019	2,970,282	140,321	3,110,603	31.12.2019
8	2020	3,110,603	146,951	3,257,554	31.12.2020
9	2021	3,257,554	153,105	3,410,659	31.12.2021
10	2022	3,410,659	160,301	3,570,960	31.12.2022
11	2023	3,570,960	167,835	3,738,795	31.12.2023
12	2024	3,738,795	175,723	3,914,519	31.12.2024
13	2025	3,914,519	183,982	4,098,501	31.12.2025
14	2026	4,098,501	192,630	4,291,131	31.12.2026
15	2027	4,291,131	201,683	4,492,814	31.12.2027
16	2028	4,492,814	211,162	4,703,976	31.12.2028
17	2029	4,703,976	221,087	4,925,063	31.12.2029
18	2030	4,925,063	231,478	5,156,541	31.12.2030
19	2031	5,156,541	242,357	5,398,898	31.12.2031

(Source: Internally generated document from Sierra Mineral Holdings Limited, March 2021).

Appendix 2. Total Expenses Paid to the Government

Year	Total Expenses to Government ($)
2012	494,789.14
2013	839,620.73
2014	876,978.15
2015	610,463.86
2016	909,496.63
2017	1,430,472.71
2018	2,832,570.27
2019	1,807,510.74

(Source: Internally generated document from Sierra Mineral Holdings Limited, March 2021).