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Study on Environmental Management Accounting (EMA) Implementation: Case at PT Semen Indonesia

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Abstract.
The purpose of this research is to explore the practice of Environment Management Accounting (EMA) in PT Semen Indonesia (PT. SI) as an effort to assess Eco-efficiency. The research was conducted by using qualitative method to ensure in depth understanding of the topic researched. The data collected consists of: (1) interview transcript, (2) supporting documents, and (3) direct observation. This research revealed that PT SI incentives in maintaining Eco-efficiency are mainly due to stakeholders' demand, especially government, foreign shareholders, and surrounding community. PT SI's focus of data monitoring is still mainly on physical information from non-accounting department (PEMA), while the company record monetary information (MEMA) in separated recording. The cost allocation for environmental costs are still buried inside overhead costs, therefore, it lowers the accuracy and extensiveness of financial information provided through MEMA. Since qualitative research is used, then the research limitation relates to the methodological issues which is the research results cannot be generalized but it might be transferred to other company. Perhaps in the future the need for more advanced environmental costs tracing will emerge and thus PT. SI will begin to optimize to use both PEMA and MEMA to help them to identify their environmental costs more accurately. This paper contributes to the empirical research on environmental and performance management by integrating these two issues, and also illustrates that forces are dynamic rather than static.

Keywords: *Environmental Management Accounting, Physical Environmental Management Accounting (PEMA), Monetary Environmental Management Accounting (MEMA)*

I. Introduction

Environmental issues are currently on the spotlight ever since they were first emerged in the last two decades. The citizens, both nationally and internationally, had started to pay more attention towards current environmental problem such as pollution, global warming and the degradation of ozone sphere [1]. These increasing concerns for environment had further pushed the need to maintain environmental sustainability. The effort to increase international awareness in regards to sustainability had already started even much prior to 1992 Earth Summit in Rio de Janeiro and further escalated with the implementation of Kyoto Protocol since February 16th, 2005 [2,3]. From business perspective, the effort to maintain sustainability was solidified since 1991 through the introduction of Eco-efficiency. World Business Council for Sustainable Development (WBCSD) describes Eco-efficiency as a creation of "more goods

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and services with ever less use of resources, waste, and pollution" [3]. Environmental concern is also affecting the interest of stakeholders. This new concern of stakeholders had created a new need for proper reporting.To fulfil the stakeholders' needs for information, an accounting system was expected to provide more information in regards to environmental and sustainability aspect of business; that is environmental accounting.

Environmental accounting is a concept that was born to incorporate the need for environmental-related information in the business. The need for environmental-related information, moreover, was rooted from the increasing environmental awareness, which eventually established the need to maintain sustainability. Furthermore, it was also mentioned that sustainability brought forth a management goal known as Eco-efficiency. Therefore, studying the implementation environmental accounting implementation will eventually lead to understand the extent of the company's effort on maintaining its Eco-efficiency. Previous research by Basuki [4] found that PT SI has interpreted the Eco-efficiency concept very well, and it have been implemented even though the company did not mention it as an implementation of Eco-efficiency. PT SI also adopts some concepts of modern manufacturing technologies that requires companies not only to think about profit, but also prevent people and the planet from environmental damage.

Indonesia was among developing countries which formally committed in the implementation of the Kyoto Protocol through deforestation. As the host for UN Climate Meeting in December 2007, Indonesian government continuously paid more attention for climate change issue. On G20 Meeting in Pittsburgh in September 2009, Indonesia became the first nation to announce its willingness to reduce GHG emission up to 26% (or 41% with the full support of developed nations) by the end of 2020 [5]. Ironically, the government's enthusiasm was not shared among Indonesian citizens. In fact, Indonesia was currently facing similar problems with other nations in regards of its citizens' low environmental awareness [2].

Moreover, many companies in South-East Asia, including Indonesia, has been experiencing in implementing Environmental Management Accounting (EMA). Herzig, et al., [6] studied the implementation of EMA in Indonesia, the Philippines, Thailand, and Vietnam companies. They concluded that EMA "provides a set of opportunities and possibilities to support management in achieving their goals" and "… the implication provides useful insights and new ideas for researchers and practitioners beyond the South-East Asia region to reveal the actual and potential contribution EMA can make sustainable development" [6].

Based on this logical assumption, the problem for this research can be stated as follows: "Why and how does PT Semen Indonesia implement the Environmental Management Accounting?". The reasons for choosing PT SI as the most suitable research site are: (a). As the big industrial player in cement market and a chemical-based industry, PT SI consumes high electricity, water, and releases high amount of carbons, and other chemical substances which potentially harmful to the surrounding environment. (b). The company received a Gold PROPER in 2012-2013, the highest rank given to the company in

Indonesia from the annual assessment of environmental performance held by the Ministry of Environment, Republic of Indonesia.

II. Literature Review

Sustainable Development is the effort that "meets the needs of the present without compromising the ability of future generations to meet their own needs" [7]. Hence, to be sustainable, development must bring no negative environmental impact. Sustainable development is about taking action, changing policy and practice at all levels, from the individual to the international level [8]. The concept of sustainable development binds together three key factors: People, Planet, and Profit [9]. One of the most promising policy concepts for moving towards sustainability is Eco-efficiency.

Eco-efficiency basically is a management philosophy that encourages business to search for environmental improvements which yield parallel economic benefits [3]. In other words, it encourages the companies to become more environmentally responsible and profitable. Hansen and Mowen [10] mentioned six causes and incentives for a company to maintain Eco-efficiency, they are: Customer demand for cleaner product; Better employees and greater productivity; Lower cost of capital and lower insurance; Significant social benefit leading to improved image; Innovation and new opportunities; Cost reduction and competitive advantage. Moreover, another important thing about Eco-efficiency is related to how it is conducted. WBCSD has identified seven elements that can be used to improve Eco-efficiency, such as: reduce material intensity; reduce energy intensity; reduce dispersion of toxic substances; enhance recycle ability; maximize the use of renewable; extend product durability; and increase service intensity [3].

2.1. Environmental Management Accounting (EMA)

EMA is broadly defined to be "the identification, collection, analysis and use of two types of information for internal decision making: (1) physical information on the use, flows and destinies of energy, water, wastes, and materials (PEMA), and (2) monetary information on environment-related costs, earnings and savings (MEMA)" [11]. Moreover, Jasch [12] mentioned that EMA represents "a combined approach which provide for the transition of data from financial accounting, cost accounting, and material flow balances to increase material efficiency, reduce environmental impact and risk, and reduce cost of environmental protection". To assess environmental costs correctly, an organization must collect not only monetary data, but also non-monetary data on material use, personnel hours, and other cost drivers [11]. According to IFAC, the inputs and outputs information that can be collected in PEMA perspective includes: material inputs (raw and auxiliary materials, packaging materials, merchandise, operating materials, water, and energy), product outputs: (products, by-products), and non-product outputs: (solid waste, hazardous waste, waste water, and air emissions). Furthermore, in MEMA perspective some environmental related cost categories must be collected include: material costs of product; material costs of non-product; waste and emission control costs; prevention and other environmental management costs; research and development costs; and less tangible

costs. EMA provides an excellent base for informing decisions made by managers in the many areas, such as, the need of cleaner production, pollution prevention, environmental management systems, corporate planning and assessment, benchmark, as well as performance evaluation. Reyes [13] concluded in her research done in the Philippines that EMA must be introduced to the community through in Accounting Education.

III. Research Method

Qualitative research is used to deeply explore a problem while mainly emphasizing on the process itself, accordingly, the use of case study research design is most suitable. Even though there are six sources of evidence in case study research, this research focus mainly on three sources of data: (1) interviews, (2) documents, and (3) direct observations. Some interviewees have been chosen based on their expertise to provide financial information, such as, Mr. JB. Trijono Ari Purnawan, (the Head of Financial Accounting and Reporting Bureau), Mrs. Tri Cicik Wijayanti (Knowledge Management Bureau), Mr. Tri Eddy Susanto (Senior Manager of R&D's Product Application Department) who was highly familiar with the company's product innovation, Mr. Rahadi Mahardika (Head of Energy and Environmental Section in R&D Department), and Mr. Guntoro (Cost Accounting Section). To maintain the data validity, especially the interview data, interview data must be validated through triangulation [14] and this research relied on the data, and methodological triangulation.

IV. Result Discussion and Analysis

4.1. Causes and Incentives for Eco-efficiency

The six causes and incentives mentioned by Hansen and Mowen [10] are used as a basis to determine PT SI's drive force in maintaining environmental efficiency.

4.1.1. Customer demand for cleaner product

In PT SI, the demand for cleaner products from customers is considered minimum. However, the incentive for PT. SI to become "green industry" came from different stakeholders. From government, there is a regulation issued by the Ministry of Industry No. 12/2012 to ensure the reduction of CO_2 emission by 5% in 2020 for cement industry. More specifically this regulation demands for "…a reduction of CO_2 emission specifically from 2009's baseline as much as (a) 2%, voluntarily, from the period of 2011-2015, and (b) 3%, mandatory for the period of 2016-2020" (*Peraturan Menteri Perindustrian* or The Ministry of Industrial Affairs Decree No.12/M-IND/PER/1/2012, page 3). Accordingly, PT. SI has to comply by making some efforts to reduce its emission, then increasing efficiency in environmental aspects. Another strong incentive came from the shareholders, when majority of the shares owned by foreign institutions, their involvement in PT SI ownership eventually pushed the top management to be more environmental-oriented in formulating company's policies.

4.1.2. Better employees and greater productivity

The second incentive come from the employees. It is said that in labour market of

developed countries, Japan for example, employers with higher concern on environment may find it easier to gain employees' loyalty, meanwhile, greater productivity will be achieved through cleaner and safer working environment which eventually attract good workers into the company. Basuki [4] revealed that in PT SI the employees have high adaptability of worse environment. So even though their environment was highly polluted (like significant amount of dust from production process), they would easily adapt to this dusty environment and did not consider to file any complaint to management. That is why according to Tri and Rahadi, the commitment to have cleaner and safer working environment in PT SI initially came from the top management. The company's commitment to become a cleaner company also increases productivity by providing a more comfortable working space for the employees.

4.1.3. Lower cost of capital and lower insurance

The benefit of lower insurance cost for PT SI most likely came from fewer claims by the society regarding the environmental problems resulted from firm's production process or the products itself. PT SI had always tightly maintained their product quality, hence any alteration in the production process (including the use of toxic waste in the mix) was carefully planned so it would not harm the quality of their finished goods as well the environment.

4.1.4. Significant social benefits leading to improved image

It is an undeniable fact that having a good company image in the eyes of stakeholders is very crucial. Better image in the eyes of shareholder will be positively rewarding for the management while good image in the eyes of society may lead to higher brand recognition and eventually, better market capitalization. PT SI, just as other business practitioners, are highly concerned on how to make continuous improvement, or to maintain good image. Any social benefit is simply a positive impact resulted from PT SI's attempt to improve their company image by maintaining sustainability.

4.1.5. Innovation and new opportunities

For PT SI, innovation is "an effort to increase competitiveness to achieve sustainable development", that is why innovation plays an important role in a process of continuous improvement. Innovation by innovation is created and communicated by this department to the management before it is implemented and eventually creates efficiency. By focusing on this new environmental perspective, PT SI saw more potential objects to be optimized through innovation, such as the discovery of alternative energy source, alternative materials, waste recycling and so on.

4.1.6. Cost reduction and competitive advantage

The final incentive is cost reduction which also leads to competitive advantage. Energy consumption use alternative energy sources as a substitute for coal fuel in the burner. The costs of alternative energy sources, biomasses for example, are relatively low, especially compared to the price of coals that increasing overtime. The company utilizes non-degradable material such as paper, plastic, fabric, wood, used tire, and Styrofoam as energy sources. To save the electrical energy consumption for third party (PTPLN),

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PT SI established WHRPG (Waste Heat Recovery Power Generator). This project makes the use of exhaust gas (heat) from cement combustion process.

4.2. The Implementation of EMA in Assessing Eco-efficiency in PT Semen Indonesia

The World Business Council for Sustainable Development (WBCSD) has identified three broad objectives when it comes to Eco-efficiency: the reduction of resources consumption, the reduction of negative environmental impact, and the improvement in products or service quality. These three objectives can be divided further into seven elements in a business that can be used to improve their Eco-efficiency. These seven aspects will be used as a guide to explore the EMA implementation in PT SI.

4.2.1. Reduction of material intensity

The production process in cement industry is highly dependable on natural sources for materials and energy. To maintain their sustainability, PT SI has to manage these resources thoroughly. In order to be a green cement company, PT SI gradually tries to reduce the material usage relatively to the volume of cement produced. To be more cost efficient, PT SI increase the utilization of recycled material including industrial wastes that fall into the category of hazardous and toxic waste (B3), such as spent earth, filter aid, EAF dust, resin, aluminium dust, paper sludge, steel slag, copper slag, gypsum purified. During the high-temperature combustion process in the kiln burner, these wastes will be decomposed into oxide compounds that can improve the cement qualities without harming the environment. In 2013, the use of recycled material already covered approximately 5.34% of total material usage (see table 1, below).

Table 1. Material Used and Recycled Material

Material	Description	IDR
Limestone	Raw-materials, non-renewable	12,395,870
Clay		2,829,604
Limestone filler		196,832
Silica sand	Associated process materials, non-renewable	42,473
Iron sand		27,701
Trass		1,198,092
Copper slag & steel slag	Associated process materials, recycled materials	202,466
Gypsum		351,014
Fly ash		170,652
Bottom ash, spent earth, dust EAF, etc		79,512
Return dust		128,146
Total material consumption		**17,621,733**
Total recycled material		**940,790**
Percentage of recycled material used		**5.34**

PT SI also produces blended cement product such as Portland Pozzolan Cement (PPC), Special Blended Cement (SBC), and Portland Composite Cement (PCC) to reduce the use of non-renewable natural resources such as limestone, clay, iron sand, etc. According to Try Eddy, by switching to blended cement, the

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company can significantly reduce the material and energy consumption.

4.2.2 Reduction of energy intensity

To save energy, both electricity and heat, PT SI has made several efforts including mass production of PPC. The production of PPC, which is partially mixed with pozzolanic material that only needs to be milled before being added into finished cement product, will reduce the need for energy in kiln. Another effort to reduce the cost of energy consumption in PT SI is by optimizing the utilization of alternative sources of energy, including biomasses and other synthetic fuel. In 2013, the portion of alternative energy use has reached 5-8% of total energy requirement (of coal consumption, see table 2). PT SI utilizes the excessive heat produced from combustion in kiln in Waste Heat Recovery Power Generation system to produce electricity.

Table 2. Energy Consumption 2009-2013

Details	Unit	2009	2010	2011	2012	2013
Clinker produced	(-,000) ton	7,666	6,661	7,617	7,609	7,339
Cement produced	(-,000) ton	8,615	8,203	8,985	9,280	9,291
Coals	(-,000) ton	1,105	1,138	1,213	996	1,361
IDO	kliter	3,368	7,521	6,613	9,036	2,729
Biomass	ton	4,538	21,641	61,356	65,234	124,397
Electricity	MWh	869,285	817,998	864,960	838,311	827,161
Coal calories value	Kcal/kg	5,600	5,200	4,900	4,500	4,200
Biomass calories value	Kcal/kg	3,400	3,400	3,400	3,400	3,400
Calories Index		0.607	0.654	0.694	0.756	0.810
Coal Substitution	**ton**	2,755	14,150	42,574	49,288	100,702
	%	**0.25%**	**1.24%**	**3.51%**	**4.95%**	**7.40%**
Thermal energy usage	GJoule	26,919	23,336	24,698	25,376	24,226
Electrical energy usage	GJoule	3,129	2,945	3,114	3,018	2,978
Specific Thermal Energy Consumption	**GJ/ton semen**	3.125	2.845	2.749	2.734	2.608
Specific Electrical Energy Consumption	**GJ/ton semen**	0.363	0.359	0.347	0.325	0.321
% Thermal Energy Efficiency	**%**		**9.0%**	**12.0%**	**12.5%**	**16.5%**
% Electrical Energy Efficiency	**%**		**1.2%**	**4.6%**	**10.5%**	**11.77%**

4.2.3. Reduction on dispersion of toxic substances

In cement manufacturing process, the most common particulate polluter is its excessive dust. In order to eliminate these dusts, PT SI installed a mechanism on some locations where dusts tend to be overwhelming. The main function of EP is to recapture the flying dust and return it back into production process. That way, PT SI can minimize the amount of dust particles floating in the air. As for the current treatment for hazardous and toxic wastes, Rahadi added that:

"Internally, the amount of hazardous and toxic waste in cement industry is very low. These substances came from the utilization of

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used-batteries and old lamps. To prevent the dispersion of these substances, PT SI created a partnership with waste collector and processor companies, among them is PPLI (Prasarana Pemusnah Limbah Indonesia), an accredited waste-processor company. Every 3 months we transport our B3 wastes to Bogor to be eliminated. On the other hand, we offered help to eliminate external hazardous and toxic waste. Our kiln has the ability to decompose B3 wastes and mix them together with our cement product, hence the zero waste." (Rahadi)

4.2.4. Enhancement of recycle ability

PT SI use of recycled material, especially the toxic substances to be mixed with the cement product as additional raw material is one example. The percentage of usage is still around 5-7%, but gradually the company aims to increase this number while at the same time maintaining the quality of the finished products (see table 3). Another example is PT SI utilization of excess oils, non-renewable garbage, and oil-stained clothes as alternative fuel for burner instead of disposing them all the way. By using these materials as additional fuel, the company can reduce the consumption of coal bit by bit. This is also a way to save the cost for obtaining coals, which according to the internal sources are gradually increasing. Aside from cost efficiency, utilizing unused oil-stained stuffs also helps the company to eliminate and reduce their waste.

Table 3. PT SI Internal B3/Non B3 Waste Management

Waste Type	Unit	Year				
		2008	2009	2010	2011	2012
Hazardous Waste						
Used oil	Kg	-	-	220,000	239,400	227,550
Used batteries	Kg	-	-	50	1,310	4,580
Used majun	Kg	-	-	1,080	1,310	1,190
Used oil filter	Kg	-	-	1,110	2,120	1,920
3R on Hazardous Waste						
Used oil	Kg	-	-	215,000	210,200	254,600
Used batteries	Kg	-	-	1,320	1,360	4,580
Used majun	Kg	-	-	1,090	1,300	1,190
Used oil filter	Kg	-	-	1,110	2,120	1,920
Solid, Non-Hazardous Waste (non-B3)						
Total solid waste	ton	41,530	37,165	32,600	31,109	27.505
Solid waste reduction	ton	*Baseline*	2,911	5,560	10,691	15,664
Solid waste recycle	ton		28,030	24,950	27,858	25,157
	%		75%	77%	90%	91%

Table 4. PT SI Water Conservation Data

Water Conservation Data		Unit	Year			
			2009	2010	2011	2012
Water Source	Ground water	k.liter	702,491	620,022	564,607	490,000
	Recycle water	k.liter	628,690	757,610	772,987	876,290
Total water source		k.liter	1,331,181	1,377,632	1,337,594	1,366,290
Usage	Cooling	k.liter	18,491	13,776	13,376	18,997
	Sanitation	k.liter	1,312,690	1,363,856	1,337,594	1,347,293

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Total water use	k.liter	1,331,181	1,377,632	1,337,594	1,366,290
Recycle Ratio	**%**	**47%**	**55%**	**58%**	**64%**

4.2.5. Maximization of the use of renewable

In PT SI, the raw materials to produce cement are all non-renewable. The clay, limestone, iron sand, and trash are all non-renewable (see table 5.3). However, to conserve the non-renewable materials so that it will remain sustainable, the company prefers to utilize the recycled materials as additional elements in production process. In the long run, the company will always aim to reduce the amount of non-renewable materials used in the production process and uses more renewable ones as either substitute or additional materials.

4.2.6. Extension of product durability

Durability and quality improvement has always been the main goal for PT SI research and development team, with or without the additional philosophy of Eco-efficiency.

4.2.7. The increase in service intensity

To maximize the service quality for customers, PT SI created a specific Customer Service team whose jobs are to answer and follow up any complain directed to the company in regards of its products. Another form of service improvement for PT SI is related to the availability of packing plants in several different strategic locations to ensure the availability of products for customer all over Indonesia. By doing this, PT SI can significantly reduce the distribution cost. This reduction of distribution cost will dramatically reduce the price of cement per sack in remote locations in Indonesia, hence the availability of packing plants can be considered as PT SI's effort to be more cost efficient while increasing customer satisfaction.

Overall, PT SI's implementation on EMA has been quite detailed. Author assumes the extensive practice of EMA is due to PT SI nature as a manufacturing company therefore it has a very high concern in recording its material flows during production process. With the existence of some governmental regulations as well as the newly adopted environmental management system, their recording of environmental items becomes something semi-mandatory. That is why the monitoring of physical items in EMA in PT SI is quite extensive. Surprisingly, the extensiveness of EMA recording seems to be lacking from the monetary side. According to Guntoro from Accounting Department:

"In accounting manner, there is no distinction whether a cost or an expense is meant for environment, AMDAL, or anything. So if we are talking about cost, then we are talking about what it is for. If the cost is related to material, then we categorize it as material cost. If it is related to maintenance, then we categorize it as maintenance cost. However, environmental activities may contain costs of consultation, or perhaps the cost of providing chemical material, or also cost of maintenance. Specifically we don't separate those costs. But each of unit in our company has its own responsibilities. These costs usually will be reflected in each of the related unit.".

Based on statement, clearly that PT.SI is still yet to distinguish the cost according to its purpose as either environmental costs or non-environmental costs. In the sustainability report itself, the information regarding environmental costs are relatively minimum (see table 5). Most likely, the recording of these

costs can be more noticeable on unit-level reporting.

Table 5. PT SI Environmental Costs 2013

ıponent	Value
te Management	00,000
ssion Management	025,000
rnal Services for Environmental Management	720,000
l	**0,345,000**

This is interesting fact while in PROPER assessment, in which PT SI excelled by achieving gold rank, there is yet a criterion that emphasize the use of MEMA. That is why even though PT SI monitors its environmental items very well through PEMA, its implementation on MEMA is still not appropriate.. However, it should be noted that the main purpose of management accounting is to serve the internal need for information in the respective company. Most likely the current practice of EMA for PT SI has already suffices their need for environmental information. Perhaps in the future the need for more advanced environmental costs tracing will emerge (just like the government's regulation regarding the use of EMA in Japan) and thus PT SI will begin to optimize their use on both PEMA and MEMA to help them identify their environmental costs more accurately.

V. Conclusion and Recommendation

This research is aimed to explore the extent of how much and how well PT SI implements the principles and practice of Environmental Management Accounting to assess its Eco-efficiency as well as its incentives to do so. The execution is quite extensive that the company has managed to obtain Gold PROPER award and so many environmental-regarding awards various environmental institutions. It reflects that PT.SI has a high concern for environmental sustainability.

The reasons for increasing concern on Eco-efficiency, PT SI was highly encouraged by the paradigm shift among the stakeholders. These stakeholders are the Indonesian government through the issuance of environmental-based regulations and the establishment of environmental assessment program, and foreign shareholder which are mostly foreign institutions. The fact that there is higher environmental awareness in their countries has caused higher demand for PT SI to present their environmental information more extensively.

In terms of how it implements their EMA, overall PT SI has already monitored a good detail on physical aspect of EMA (PEMA). They already recorded the physical values of the input materials, energy, water, up to their products, by-products, even waste and emissions. This is possibly due to the requirement from the existing government assessment program or regulations which demanded PT SI to constantly monitoring their environmental items. However, PT SI is yet to distinguish their environmental costs as extensively as their physical environmental

information. There are still some rooms for improvement in this area. By separating environmental and non-environmental in more detailed way, the company will earn more accurate information in regards of environmental items and will be able to optimize the efficiency from each post available.

VI. Recommendation

For PT SI, this research hopefully can give a perspective about the importance of maintaining both PEMA and MEMA to obtain more accurate environmental information, especially the financial ones. The more accurate information on environmental costs, the more benefit will be earned through the use of this information on the decision making.

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