

## Practice environmental cost management accounting: The case of Vietnamese brick production companies

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### ABSTRACT

During the past few years, there has been a growing interest in applications of environmental cost management accounting (ECMA) in different manufacturing industries. ECMA is a useful tool for environmental performance improvement and achieving better financial benefits. Nevertheless, ECMA implementation is in early stages in many countries such as Vietnam. Brick industry is one of the most polluted sectors, which has significant impact on the environment. The purpose of this paper is to provide a clear image of ECMA application in Vietnamese brick manufacturing enterprises. Both qualitative and quantitative research methodologies are used to analyze the participants' attitudes, perceptions and concerns about the potential for applying ECMA. The results indicate that the brick industry adopted low level of ECMA and provide some necessary suggestions to promote the enterprises applying ECMA.

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## 1. Introduction

Environmental pollution is becoming a global problem, and business activities that have negative impacts on the environment have generated increasing attention. This leads to increase in environmental costs significantly due to environmental regulations and social needs for sustainable development (Dayana et al., 2010). Therefore, an organization should collect, analysis and report environmental cost accounting systematically to manage and control environmental costs. Environmental cost management accounting (ECMA) is one of useful tools to reach better environment. Although ECMA is an area of accounting, it is expressed as an extended term related to the provision of information on environmental performance. ECMA application in environmental management is becoming more apparent. ECMA has attracted increasing attention and is considered as a useful tool for managing environmental performance. ECMA is no longer a Western phenomenon because it is spreading around the world including developed and developing countries. Recently, ECMA has been applied widely at a rapid pace in Asian countries (Rikhardsson et al., 2005; Bennett & James, 2005). However, ECMA has not been popular in Southeast Asian countries such as Vietnam yet and few ECMA applications in these countries are available (Herzig,

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2012). Brick manufacturers are playing an important role in the development of industrialization and modernization. However, with the current brick production technology, the enterprises have caused negative impacts on the environment. Therefore, we need to set some requirements for the brick production enterprises to reduce the environment effects. In this paper we present an empirical investigation to study the effects of environmental cost management accounting in brick production enterprises in Vietnam. The research objectives not only describe the environmental cost management practices, but also analyze the views, thoughts and interests of managers associated with ECMA application. Then, the ECMA system will be built through the use of modern accounting methods that are appropriate to the actual conditions in order to help the brick production enterprises achieve both economic, environmental and social benefits for the goal of sustainable development.

## **2. Research overview**

The important role of accounting for sustainable development is identified in the 1970s. However, very few studies about ECMA appeared between 1970 and 1989 (Schaltegger et al., 2011). Previous studies provided only limited guidance on ECMA (Parker, 1997). Until 1990 the application of accounting to environmental management became clearer (Mathews, 2000; Chang, 2007). The environmental information was actually connected to management accounting and the potential of the management accounting in environmental cost management was explored. This marks the turning point for the development of ECMA. Studies on ECMA have been conducted and have made important contributions (Herzig, 2012; Rikhardsson et al., 2005; Ditz et al., 1995). Some experiences or initiatives have proven that environmental costs have had significant and increasing trend. Therefore, minimizing these costs through appropriate management activities can increase profitability. The research by the World Resources Institute shows that environmental costs are accounted for nearly 20 percent of the operating costs at the Yorktown Amoco Oil refinery, and more than 19 percent of the total production costs at Ciba Geigy. A case study by Ditz et al. (1995) concluded that environmental costs could go up to 20% of the total costs. A number of European projects in the Netherlands and the United Kingdom also reported similar results and suggested opportunities for cost savings, profit improvement, reductions in environmental impacts, pollution prevention and management (Bartolomeo et al., 1999; Jasch, 2003). In the United State, many initiatives of ECMA have been supported by Environmental Protection Agency (USEPA). The book named "Introduction to Environmental Management Accounting as a Business Management Tool" was published in 1995 to help identify the key concepts and terminologies associated with ECMA and to provide an environmental cost classification scheme. It introduced methods for defining environmental costs as well as clarifying the role of ECMA in cost allocation, product design and budgeting. USEPA develops ECMA research and practices in the industry and successfully application of methods which determine environmental costs such as activity based cost (ABC) and full cost accounting (FCA). (USEPA, 1995a; USEPA, 1996).

In the 21st century, ECMA has received much attention when a series of environmental impacts have created serious financial consequences for organizations. A number of international organizations and professional accounting agencies have spent significant amount of time researching about ECMA. The United Nations Division of Sustainable Development (UNSD) and the International Federation of Accountants (IFAC) published the following document as "Environmental Management Accounting: Procedures and Principles" (UNSD, 2001) and "International Guidance Document: Environmental Management Accounting" (IFAC, 2005) as a guideline for governments and organizations in the world in applying ECMA and understanding the benefits that ECMA system brings. According to UNSD (2001), ECMA is considered as a more comprehensive approach than management accounting. ECMA system not only includes monetary information but also physical information of material, energy, wastes and products. Therefore, UNSD is particularly interested in the method of material flow cost accounting (MFCA). IFAC (2005) points that ECMA consists of monetary environmental management accounting (MEMA) and physical environmental management accounting (PEMA). In addition to the definition, content, benefits and challenges of the ECMA, IFAC focuses on management initiatives which are supported by ECMA such as waste management, supply chain management, environmental reports and give

projects and pilot case studies in countries such as Australia, Japan, Spain, United States, United Kingdom, Philippines, Germany, etc., which guide organizations and other countries practice. It can be said that USEPA (1995b), UNDSO (2001) and IFAC (2005) were considered as the most comprehensive guidelines for the period 1970-2005. These guidelines have become a good starting point for countries to publish ECMA brochures in organizations such as “Environmental Accounting Guidelines” by the Ministry of Environment in South Korea, Japan, Germany, Australia, Malaysia, Czech Republic, Bangladesh (Lee et al., 2005; JMOE, 2005; Schaltegger et al., 2011; Deegan, 2003; Jalaludin et al., 2010; Hyršlová and Hájek, 2005; Mia, 2005). ECMA is still a new concept in both research and practice in Vietnam. Research on management accounting in Vietnam have not focused on the environmental costs connected with management functions. Studies on ECMA do not appear popular. ECMA is not enough to cause debate in the areas of management accounting and the environment. Therefore, the potential for saving costs and increasing economic benefits associated with environmental performance in organizations is being ignored.

On the other hand, there is no study on ECMA in Vietnamese brick manufacturing enterprises. This is the production field that causes many negative impacts on the environment and this leads to an increase on environmental costs. This is also considered as a gap in the previous studies, so research context is one of the factors that make up the novelty of the paper. The main content of the paper is to focus on researching factors affecting ECMA application through quantitative research method. From the results of the study, the authors give some implications on the side of enterprises, the government and community for promoting ECMA application in Vietnamese brick manufacturing enterprises.

### **3. Research methodology**

Although brick production enterprises in Vietnam have provided environmental information in their annual reports, such as environmental impact assessment reports, environmental monitoring reports and environmental protection projects, few enterprises use environmental cost information for internal management purposes. Therefore, both qualitative and quantitative research methodology are used to analyze participants' attitudes, perceptions and concerns about the potential for applying ECMA. Depending on the purpose of research, there are many types of qualitative and quantitative studies, which are combined (Nguyen, 2013). In this study, combining qualitative and quantitative methodology is expressed that:

Qualitative research help explication the quantitative results when quantitative research is difficult to explain for evaluating status about the level of ECMA application in Vietnamese brick production enterprises. Therefore, the qualitative questions related to the research objective are designed to help the study link the meaning of numbers in quantitative research to reality.

#### *3.1. Qualitative methodology*

##### *Data collection*

The study collected qualitative data by using in-depth interview method. Interviewees include chief accountants, environmental managers, directors and deputy directors in size - medium and large companies. The number of managers interviewed are 15 people, including 4 directors, 3 deputy directors, 4 chief accountants and 4 environmental managers. The average length of their job experience is 7.2 years, which varies between 4 to 12 years.

The first interviewees are director and deputy director. They are responsible for management, allocation and use of resources in their enterprise and environmental issues are part of their management operations. The next interviewees are head of management accounting department or equivalent position responsible for collecting, processing and providing information for internal management needs. This is associated with how environmental costs is calculated, aggregated and distributed and whether or not the environmental costs are considered in the business decisions. The fourth interviewees are environmental managers who track and monitor environmental performance, understand environmental policy, environmental regulatory and supply environmental reports. However, not all businesses have their own environmental management department and so related managers will also be selected for alternative interviews.

In addition, some additional individuals suggested by the interviewees are also contacted by phone or email to obtain detailed and necessary information on a number of questions.

Prior to the interviews, an invitation letter and interview questionnaire were sent to managers to facilitate the preparation answers before interviews were conducted. Participants were advised that the interview would take up to 2 hours. The information collected was recorded fully and was considered confidential at the request of the interviewees. Information was used as a basis for next research as an important evidence. When additional data was needed, the authors contacted back by phone or email if the previous answers were unclear or missing. In-depth interviews were not only guided by development proposals from theory, but also the participants were allowed to talk freely in order to discover new perspectives.

### *Process and analyze data*

Participants were encrypted with their own notation, ensuring confidentiality of their information. Qualitative data were analyzed by the following steps (Nguyen, 2013):

Step 1: Synthesize the data into the word file. The answers of 15 respondents were recorded carefully and completely in the word file.

Step 2: Define the keywords. The authors read each quotation in the data file and identify the key phrases that best describe the content of the quote. This is also a step for the authors to find new concepts and views from the data.

Step 3: Create excel file to enter and process interview data. The excel file contains the characteristics of the respondent (name, gender, age, position, work unit, work experience, training) and response content (ECMA, Factors impacting on application of ECMA and selected EC methods). Key words and phrases in the same content were grouped into a research topic to make it easier to compare, analyze and synthesize answers.

## *3.2. Quantitative methodology*

### *Data collection*

Submission of a questionnaire survey is the method used to collect quantitative data to explore the factors that affect the application of ECMA. The collection process of quantitative data involves the following steps:

- Questionnaire design: Authors sent questionnaires to managers in Vietnamese brick manufacturing enterprises. The four respondents participated in the survey including the director, deputy director, chief accountant and environmental manager. Questionnaires were designed based on the Likert's scale. The mean level is from 1 to 5 where 1 represents strongly inapplicable and 5 denotes strongly applicable.

**Table 1**  
Observed variables reflecting the level of ECMA application

Observed variables	Source
Use monetary information to measure environmental costs	Hyršlová and Hájek (2005); Jami et al. (2015); Ramli & Ismail (2013)
Use physical information to measure environmental costs	Hyršlová and Hájek (2005); Ramli and Ismail (2013); Jamil et al. (2015); Jinadu et al. (2015)
Track environmental costs by detailed accounts	Venturelli and Pilisi (2005); Lee et al. (2005), Kokubu and Nashioka (2005); Jasch and Danse (2005); Hyršlová and Hájek (2005); Collison et al. (2003); Ramli and Ismail (2013); Doorasamy (2014); Jinadu et al (2015)
Determine environmental costs by modern method	Venturelli and Pilisi (2005); Lee et al. (2005); Kokubu and Nashioka (2005); Jasch and Danse (2005); Hyršlová and Hájek (2005); Jalaludin et al. (2011); Collison et al. (2003); Ramli and Ismail (2013); Doorasamy (2014); Jinadu et al. (2015)
Estimate environmental costs	Kokubu and Nashioka (2005); Jalaludin et al. (2011)
Estimate environmental cost report	Collison et al. (2003); Jinadu et al. (2015)
Develop environmental performance indicators	Kokubu and Nashioka (2005); Ramli and Ismail (2013); Doorasamy (2014); Jinadu et al. (2015)
Integrate environmental costs into business decisions	Lee et al. (2005); Kokubu and Nashioka (2005); Jalaludin et al. (2011); Collison et al. (2003); Doorasamy (2014); Jinadu et al (2015)

- Survey sample selection: The questionnaire was designed for 4 respondents (Directors, Deputy directors, Environmental Managers and Chief Accountant) in Vietnamese Brick manufacturing enterprises. The study selected sampling methods and completely ensured representativeness, typical for the whole. Brick production enterprises selected for this study differ in scale to reflect diversity and have more complete evaluation.

- How to send and collect questionnaires: Questionnaires were sent to managers in 150 Vietnamese brick manufacturing enterprises during the period 2016 - 2017. How to send and collect questionnaires:

Option 1: The authors sent survey forms directly to the managers in brick production enterprises and collected them directly after completion.

Option 2: Online survey forms designed by the Google Docs tool were sent to managers by email. Online questionnaires were automatically updated to the summary sheet.

#### *Data process*

The number of enterprises participating in the survey were 72 brick enterprises, representing 48% of the sample size and 33.8% of the total. There were 238 respondents answered the questionnaire. Questionnaires collected were retested to eliminate invalid questionnaires. There were 6 invalid votes eliminated. 232 valid votes were numbered and entered into SPSS 22.0 software. Questionnaires were processed by SPSS software through tools such as reliability testing, descriptive statistics, relationship testing and difference testing.

## **4. Results and discussions**

### *4.1. Quantitative research about the level of ECMA application in Vietnamese brick production enterprises*

#### *Verifying the reliability of observed variables on the ECMA application level*

When we verified the reliability of the observed variables reflecting the level of ECMA application, the results showed that the Cronbach's Alpha coefficient was equal to  $0.911 > 0.6$ . In addition, Corrected Item-Total Correlation was greater than 0.3 and Cronbach's Alpha when some items were deleted was greater than 0.6. There was no case of rejection for any observable variable that could cause Cronbach's Alpha greater than 0.911. It was proved that the observed variables were reliable (See in Table 2).

**Table 2**

Verifying the reliability of observed variables on the level of ECMA application

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Using monetary information to measure environmental costs	.751	.896
Using physical information to measure environmental costs	.655	.904
Tracking environmental costs by detailed accounts	.646	.904
Determine environmental costs by modern method	.795	.892
Estimating environmental costs	.620	.907
Estimating environmental cost report	.761	.895
Developing environmental performance indicators	.809	.890
Integrating environmental costs into business decisions	.653	.904

#### *Descriptive statistics about observed variables that reflect the level of ECMA application*

Table 3 shows the values of Skewness and Kurtosis of the observed variables in  $[-1; 1]$  which show that the observed variables follow standard distribution (Hair et al., 2010). In eight observed variables, the variables including "Using monetary information to measure environmental costs", "Integrating environmental costs into business decisions" and "Developing environmental performance indicators" have the largest mean values of 2.68, 2.34, 2.32, respectively. The variables such as "Tracking environmental costs by detailed accounts", "Estimating environmental costs"; "Establishing environmental cost report" have the lowest mean values. On the other hand, mean values of all observed variables are in the range

of 1.97 to 2.68, mode value is equal to 2, except that the observer “Using monetary information to measure environmental costs” which has a value of 3. As a result, it reflects the fact that most brick production enterprises apply ECMA system in a low level.

**Table 3**

Descriptive statistics about observed variables

	Mean	Median	Mode	Skewness	Kurtosis
Using monetary information to measure environmental costs	2.68	3.00	3	-.160	-.946
Using physical information to measure environmental costs	2.21	2.00	2	.344	-.750
Tracking environmental costs by detailed accounts	1.97	2.00	2	.566	-.372
Determine environmental costs by modern method	2.31	2.00	2	.211	-.760
Estimating environmental costs	2.11	2.00	2	.420	-.550
Establishing environmental cost report	2.19	2.00	2	.217	-.529
Developing environmental performance indicators	2.32	2.00	2	.255	-.711
Integrating environmental costs into business decisions	2.34	2.00	2	.108	-.652

*Verifying relationship between the level of ECMA application and operation scale (by number of employees)*

Table 4 shows that small sized enterprises (less than 100 people) absolutely did not apply ECMA. There are 45% enterprises from 100 to fewer than 200 employees with no ECMA implementation. Enterprises from 200 to fewer than 300 people mainly applied ECMA in “inapplicable” level and they were accounted for 46,9% while large sized enterprises with more than 300 employees applied ECMA primarily in “normal” level of 61.1%. It seems that the larger the size of enterprises is, the higher the level of ECMA application is. To confirm this, the study examines the relationship between the level of ECMA application and the number of employees.

**Table 4**

Relationship between the level of ECMA application and number of employees

		The level of ECMA application					Total	
		Strongly Inapplicable	Inapplicable	Normal	Applicable	Strongly Applicable		
Number of employees	<100	Number of respondents	8	0	0	0	0	8
		Percentage of respondents	100%	0%	0%	0%	0%	100%
	100-200	Number of respondents	9	11	0	0	0	20
		Percentage of respondents	45.0%	55.0%	0%	0%	0%	100%
	200-300	Number of respondents	43	45	7	1	0	96
		Percentage of respondents	44.8%	46.9%	7.3%	1.0%	0%	100%
	From 300 people more than	Number of respondents	5	30	66	7	0	108
		Percentage of respondents	4.6%	27.8%	61.1%	6.5%	0%	100%
	Total	Number of respondents	65	86	73	8	0	232
		Percentage of respondents	28%	37.1%	31.5%	3.4%	0%	100%

Chi-Square test for Sig = 0.000 < 0.05.

There is a relationship between the level of ECMA application and the number of employees. In addition, values of Somers'd, Kendall-tau, and Gammar tests are belong to [-1; 1] and Sig value = 0.000, which indicate that the results are statistically significant. On the other hand, the value of test is positive meaning that the number of employees with the applicable level of ECMA is positively correlated. This shows that the higher the number of employees, the higher the level of ECMA application.

*Verifying difference between the level of ECMA application and operation scale (by number of employees)*

Test of Homogeneity of Variances has Sig value of 0.026 (<0.05) so that there was a difference in variance. The result is statistically significant. Table 5 demonstrates that there was a difference between the level of ECMA application and operation scale (number of employees), except for between enterprises with 100-200 employees and enterprises with 200-300 employees are not statistically different.

**Table 5**  
Verifying difference between the level of ECMA application and number of employees

Multiple Comparisons							
Dependent Variable: The level of ECMA application							
(I) Number of employees	(J) Number of employees	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval		
					Lower Bound	Upper Bound	
Bonferroni test	< 100	100-200	-.66250*	.20886	.010	-1.2184	-.1066
		200-300	-.71484*	.18373	.001	-1.2038	-.2259
		>300	-1.62037*	.18294	.000	-2.1073	-1.1335
	100-200	<100	.66250*	.20886	.010	.1066	1.2184
		200-300	-.05234	.12272	1.000	-.3790	.2743
		>300	-.95787*	.12154	.000	-1.2813	-.6344
	200-300	<100	.71484*	.18373	.001	.2259	1.2038
		100-200	.05234	.12272	1.000	-.2743	.3790
		>300	-.90553*	.07003	.000	-1.0919	-.7191
>300	<100	1.62037*	.18294	.000	1.1335	2.1073	
	100-200	.95787*	.12154	.000	.6344	1.2813	
	200-300	.90553*	.07003	.000	.7191	1.0919	

*Verifying relationship between the level of ECMA application and operation scale (by total capital)*

Table 6 shows that 100% of small sized enterprises, with less than VND 20 billion market value, never applied ECMA. For medium-sized enterprises, 47.6% of them did not apply ECMA, 8.7% of them applied in “normal” level, and 2.4% selected “apply” level. Large sized enterprises focused on the level “normal” of 66.0%. (Chi-Square test for Sig = 0.000 < 0.05). There is a relationship between the level of ECMA application and total capital. In addition, the results are statistically significant. Moreover, Value of tests has a positive value, which means that the total capital has positive relationship with the level of ECMA application. The greater the total capital, the higher the level of ECMA application and vice versa.

**Table 6**  
Relationship between the level of ECMA application and total capital

		The level of ECMA application					Total	
		Strongly Inapplicable	Inapplicable	Normal	Applicable	Strongly Applicable		
Total capital	Less than 20 billion VND	Number of respondents	12	0	0	0	0	12
		Percentage of respondents	100%	0%	0%	0%	0%	100%
	From 20 to 100 billion VND	Number of respondents	52	60	11	3	0	126
		Percentage of respondents	41.3%	47.6%	8.7%	2.4%	0%	100%
	More than 100 billion VND	Number of respondents	1	26	62	5	0	94
		Percentage of respondents	1.1%	27.7%	66.0%	5.3%	0%	100%
Total	Number of respondents	65	86	73	8	0	8	
	Percentage of respondents	28.0%	37.1%	31.5%	3.4%	0%	100%	

*Verifying difference between the level of ECMA application and operation scale (by total capital)*

The results indicate a difference in variance so that the test result has statistical significance. In addition, the ANOVA test has Sig. = 0.000 (< 0.05) so that there was a difference between the level of ECMA application and total capital.

**Table 7**  
Verifying difference between the level of ECMA application and total capital

Multiple Comparisons							
Dependent Variable: The level of ECMA application							
(I) Total capital	(J) Total capital	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval		
					Lower Bound	Upper Bound	
Bonferroni test	Less than 20 billion VND	From 20 to 100 billion VND	-.76835*	.15060	.000	-1.1315	-.4052
		More than 100 billion VND	-1.65137*	.15281	.000	-2.0199	-1.2828
	From 20 to 100 billion VND	Less than 20 billion VND	.76835*	.15060	.000	.4052	1.1315
		More than 100 billion VND	-.88302*	.06794	.000	-1.0469	-.7192
	More than 100 billion VND	Less than 20 billion VND	1.65137*	.15281	.000	1.2828	2.0199
		From 20 to 100 billion VND	.88302*	.06794	.000	.7192	1.0469

According to Table 7, there is a difference between the level of ECMA application and total capital. Therefore, when the operation scale (total capital) is different, the level of ECMA application is different. From verifying the relationship and the difference between the level of ECMA application and the size of enterprises in terms of the number of employees and the total capital, we realize that the larger operation scale is, the higher the level of ECMA application is. This is also the evidence to suggest that the application of ECMA should start with medium and large sized enterprises.

#### *4.2. Qualitative research about the level of ECMA application in Vietnamese brick production enterprises*

The qualitative results show that there are many similar views about adopting ECMA in the enterprises which reflects the common situation in brick production enterprises, detail:

##### *Accounting information tends to the monetary measure*

The environmental information in the accounting system primarily includes monetary information. Because accounting systems in most enterprises are governed by accounting regulations disclosing information to external audiences. The accounting system also provides physical information for planning, inventory management and quality control. However, Vietnamese brick production enterprises do not consider physical information specific and clear.

Although physical information plays a key role in environmental management, the accounting system that combines information for managing environment is not popular for most brick production enterprises. The importance of physical environmental information is ignored. Physical information about energy, water and especially waste are not available in the current accounting system in most brick production enterprises. The costs of materials creating waste is considered as one of the most important costs in enterprises and they are closely linked to other environmental costs including waste disposal costs, waste prevention and management costs. However they are not properly calculated in current accounting system.

##### *Environmental costs are collected in overhead accounts*

The fact shows that accounting system in most brick production enterprises have had many important environmental costs hidden in the overhead accounts. The overhead accounts are used to collect costs but they are difficult to be classified and allocate to processes or to the products. In general, in current accounting system, environmental costs are linked with non-environmental costs. As a result, managers does not know where to find environmental costs and the extent of them. The environmental costs such as costs of waste control and treatment; costs of polluted prevention and management are collected to cost of business management and cost of general production. In most enterprises, cost of general production is allocated while cost of business management is not. Besides, the value of the materials and processing costs that generate wastes are gathered in production cost. For examples, a management accountant states:

*All environment costs in our company are tracked in overhead accounts. Actually, we do not pay much attention in environmental costs, therefore we do not trace these costs. But this may be a problem that we need to consider carefully because environmental management increasing plays an important role in our business operations.*

##### *Allocating environmental costs according to traditional methods*

Because environmental costs are hidden in overhead accounts, this will limit the collection and allocation of environmental cost to determine production costs. In addition, environmental costs are allocated to cost centers (products, production processes) through the use of a common allocation criteria. Allocation criteria often consist of production volume, working hours, machine hours, production norms, etc. As a result, environmental costs are separated by the products and activities which created them. Therefore, managers do not recognize the actual costs of the products because the costs are out of their control. For example, the cost of waste disposal which is quite high for fired bricks but relatively low for unfired



bricks. If this cost is allocated to two types of bricks according to the volume of products, it will be unsuitable and can make wrong decisions for product prices and even ignore the opportunities to cut down the costs.

Enterprises often use traditional methods to allocate environmental costs. Even when the costs is allocated to the products based on activity, it is not for environmental purposes but for economic purposes. Although enterprises are setting a goal of cost savings, a suitable approach measuring environmental costs should be considered. Because then brick production enterprises will achieve many benefits including not only increasing profits but also improving environmental efficiency.

#### *Limitations in the estimation of environmental costs*

The current accounting system only contains information on the quantity of raw materials, electricity and coal used for production without reflecting the amount of raw materials and energy losses. Moreover, due to the low level of environmental cost integration into business decisions, almost brick production enterprises do not estimate environmental costs. Therefore, the fluctuation analysis between actual costs and estimated costs is not considered and the causes of the fluctuations are not detected.

Estimation of some environmental cost items such as budget estimation for environmental monitoring programs, estimation of waste prevention and management costs are only shown in the environmental management program, environmental impact assessment reports or environmental protection commitment scheme but they are not reflected in the accounting system. As explained earlier, environmental costs in most Vietnamese brick production enterprises are contained in overhead accounts. Therefore, management accountants are unaware about the environmental costs and do not know how to estimate the environmental costs, precisely.

#### *Limitations in reporting environmental costs and assessing environmental performance*

There is an increasing number of brick production enterprises implementing some form of voluntary environmental management such as providing environmental initiatives to improve resources efficiency and reduce wastes. Moreover, according to regulations, enterprises must provide environmental reports such as environmental impact assessment reports, environmental monitoring reports, environmental management programs, environmental commitments to demonstrate their actions towards environmental responsibility. However, very few brick enterprises pay enough attention to environmental cost reports. This is easily explained that environmental costs are not tracked and monitored regularly by managers. There are a number of large-scale enterprises creating environmental reports but they only report on monetary environmental information and mainly reflect costs of waste treatment, costs of polluted prevention and management. Environmental report on physical environmental information is rarely applied. Besides, environmental performance assessment through environmental performance indicators (EPI) is not focused. Indicators of environmental performance are usually a number of absolute criteria such as the type of materials used, volume of waste water, dust, emissions and solid waste generated, volume of solid waste to be recycled, etc. or monetary indicators (costs of waste treatment, costs of pollution management).

#### *Making business decision based on inadequate environmental information*

Decisions such as selecting green materials, producing environmentally friendly products, designing green production processes or investing in polluted prevention systems may be affected if the environmental cost information is not supplied accurately. The lack of correct information about environmental costs increases uncertainty about decisions. For examples, an enterprise may not choose to invest in environmentally friendly technology instead of accepting waste disposal cost higher. As director of a company states:

*I think I would not be willing to invest a large amount of money unless I find that money can be saved by using cleaner production technology.*

Many managers do not fully consider environmental costs to make investment decision. Because environmental costs are not collected completely and often distorted in internal management decisions for performance improvement or cost savings. Environmental protection projects that aim to prevent wastes by using more efficient raw materials are unrecognized. Managers are often unaware that environmental costs such as the cost of materials which produce wastes are greater than the cost of processing them, so this cost is not considered important information for decision-making. Some costs are ignored in decisions such as material flow costs, recovery costs, unforeseen cost, cost of prestige, relationship and image of the business. These costs are difficult to estimate but they can have a significant impact on the financial health of enterprises.

Brick production enterprises will develop methods for collecting and measuring environmental costs and integrating environmental cost information into decisions only when the costs are considered significant and the scope and extent of environmental costs are highly appreciated. Therefore, if managers are unaware the importance of the environmental costs, this becomes a barrier in making management decisions regarding waste prevention, cost savings.

*Managers have a low priority on environmental costs*

The application of ECMA in brick production enterprises is low because it does not appear voluntary by managers to fully identify a proactive environmental management program. As a result, management accounting department is under pressure to adopt new methods in ECMA (Le, 2018; Le & Nguyen, 2018).

Environmental costs are incorporated as part of overhead account which suggests that managers consider a low priority on environmental costs. Although some environmental costs can be easily identified, such as depreciation of polluted treatment of equipment, environmental monitoring costs, costs of fire prevention, costs for planting trees, costs of reconstruction and environmental improvement after exploitation. However, these costs which are only reflected in the environmental impact assessment report, the environmental protection project, environmental rehabilitation and restoration project, environmental management program are not monitored in details by management accountants. On the other hand, when they are asked about environmental costs, managers primarily indicate that environmental costs are costs of waste treatment, cost of pollution prevention and management. Meanwhile, waste losses, processing costs that generate wastes are not properly considered even in large-scale enterprises.

ECMA pays little attention from managers because the main purpose of most brick production enterprises is economics benefits in short-term rather than sustainable development. The survey found that nearly 83% of managers indicated that the goal of their enterprises are to combine financial benefits and environmental benefits with greater focus on financial benefits, while just over 17 % of managers show that their enterprises focus on environmental benefits. More emphasis on economic benefits will be the main reason behind the pursuit of an ECMA system. This creates delays in integrating environmental issues into accounting practice. At the same time, it can limit opportunities to prevent pollution and reduce the ability of detecting environmental risks (Le, 2018; Le & Nguyen, 2018).

In addition, management accounting department is restricted to the framework of the current accounts. The response of management accountants in environmental problems is unclear, they often do not consider environmental cost information in their expertise. Therefore, environmental costs are not a priority for them. In addition, the environmental managers who are responsible for environmental control and management argues that environmental costs can be significant but calculation of the costs is difficult because of limited access to cost accounting system. Therefore, an environmental cost information system to departments is not strong enough to calculate environmental costs and the monitoring and management of these costs can hardly be solved. Managers underestimate the role of ECMA as follows:

*We provide accounting information to the director board. If they do not request information, we will not collect and record it. In fact, we have a low interest in environmental cost accounting. It is a new field and is out of our understanding. Therefore, it is a difficult task to collect and provide this information. (Chief management accountant)*

*We understand clearly about manufacturing process and the environmental performance that is taking place in the factory. We provide the environmental reports to the Director twice a year. Environmental costs are primarily the cost of treating wastes and they actually account for a small proportion of the total operating costs. (Environmental manager)*

It seems that managers have no incentive to adopt ECMA in sustainable development. Therefore, many enterprises still use traditional cost accounting systems and it is difficult to make strategic decisions for cleaner production.

## **5. Solutions**

By evaluating the status of ECMA application in Vietnamese brick production enterprises, the study shows that current management accounting system did not collect necessary environmental cost information to help managers control and manage environmental costs. Therefore, management accounting system of Vietnamese brick production enterprises should be adjusted to meet the internal management needs toward sustainable development (Le, 2018; Le & Nguyen, 2018).

The current management accounting practice of the brick enterprises does not cause significant surprise because it becomes popular in most enterprises. However, ECMA is a new field in Vietnamese brick production enterprises, therefore to apply ECMA, management accounting system needs to be improved to integrate environmental costs into the accounting system (Le, 2018; Le & Nguyen, 2018). Jasch (2003) argues that changing the existing accounting system with a focus on environmental cost information is the prerequisite for achieving sustainability. ECMA system will allow enterprises to track environmental cost information clearly and fully and help to identify better opportunities related to resource savings. It is also used to generate environmental cost reports and is a good starting point for measuring environmental performance, improving economy and environmental efficiency. In order to practice ECMA the best, accounting system in brick production enterprise in Vietnam needs to be improved including design of separate accounts for environmental information, classify environmental costs, develop method to determine environmental costs, make environmental cost reports and build environmental performance indicators (Le, 2018; Le & Nguyen, 2018). The above solutions do not require a “revolution” for the current management accounting system but it will require renewal and innovation. A minor adjustment in the system would also lead to significant improvements in the supplement of environmental costs. In addition, the proposals for modifying management accounting system are merely the introduction of accounting techniques related to the field of environmental management so that it will not create too many challenges for enterprises to implement.

### *Design separate accounts for environmental information*

It is found that when environmental costs are contained in overhead accounts, it makes it difficult to identify, quantify and evaluate the environmental costs. As a result, managers look for a distorted picture of environmental costs. The first solution is to establish accounts clearly. Developing accounts for environmental management accounting help management accountants easier to collect, measure and monitor environmental costs. Besides, it facilitates for environmental costs calculation and analysis, in particular physical EMA accounts. Because physical EMA accounts will provide benefits for monitoring resource consumption, calculating environmental costs and supplying environmental report. ECMA is a very flexible system, so depending on the production characteristics, the size and the management needs, enterprises can design detailed accounts to serve internal management.

### *Identify environmental costs*

Although environmental costs grows and appears in all activities of enterprises but many brick production enterprises are not fully aware of environmental costs and their importance in decision making (Le, 2018; Le & Nguyen, 2018). For this reason, classifying of environmental costs plays an important role in helping businesses to fully and accurately identify environmental costs. Enterprises can classify environmental costs according to the content and use of costs. By this way, managers capture the utility and

content of environmental costs and determine material loss for internal management purposes. Accordingly, environmental costs include: Material costs of non – product outputs; energy costs; system costs; cost of waste treatment and management.

*Material costs of non – product outputs:* these costs include the purchase costs of materials inputs converted into non – product outputs: raw materials (clay, coal, sand, ...), additional materials (yeast, chemicals), packaging, operating materials.

*Energy costs:* including electricity, fuel oil and gas used to produce bricks and coal used as fuel in a kiln.

*Costs of waste treatment and management:* cost of waste treatment and control, cost of waste prevention and management. This includes cost of waste treatment and control which is the cost of handling, treatment and disposing of the waste; remediation and compensation costs related to environmental damage; and regulatory compliance costs related to waste control such as: depreciation of waste treatment facilities; internal staff expenses, cost of operating materials, environmental taxes, charges and fees; environmental insurance; cost for remedying consequences and compensation.

*Costs of waste management and prevention:* the cost for affording to prevent waste and implement environmental management activities. First, it includes the cost of environmental prevention activities such as ecosystem management, recycling, cleaner production, and environmental management of supply chain. It also includes costs for environmental management activities such as: establishment of the environmental management system; environmental measurement; including monitoring, performance audit, performance appraisal; environmental communication, which includes reporting, community group meetings, government lobbying and other related activities (e.g. financial support for community environmental projects).

*System costs:* Including direct labor costs (such as lost time due to inefficient production) and general production costs to make non-product outputs.

#### *Development a method for determining environmental costs*

Most current accounting systems in Vietnamese brick production enterprises do not directly trace the origin of environmental costs. Instead, environmental costs are allocated into products or production process by simple criteria. If environmental costs are low, this allocation is not serious problem. However, when the environmental costs are high and have increasing trend and when different departments in enterprises contribute unevenly, traditional allocations can send false signals to managers and affect decision making. Designing an appropriate method for determining environmental costs is an important task for the enterprise to calculate the exact amount of the environmental costs. Moreover, it is the basis for determining production costs and pricing products and encouraging cleaner production. An improvement in accounting methods can provide incentives for significant improvements in finance and the environment. When surveying managers on the method that their enterprises should apply, the results show that the majority of them choose material flow cost accounting method - MFCA (accounted for 83.3%). In brick production enterprises, material costs are accounted for a large proportion of the total costs. Therefore, the MFCA method has also been evaluated as a very useful technique for determining material losses at each stage of production. The application of this method will help managers take measures to effectively use materials and save resources. Once the material losses are reduced, the costs of treating waste and managing pollution will decrease. At the same time, the study also conducted in-depth interviews with managers to consider their viewpoints in the application of MFCA method. The result shows that managers supported highly about the method.

*Material flow cost accounting is a method used commonly for determining material losses. We are particularly interested in the efficient use of resources so we think it is suitable for our managerial requirement. (Director)*

*I suppose that we should apply MFCA method. This method is not difficult to implement because we know clearly the production process in enterprise. Therefore the material losses in each stage of production can be determined. (Deputy director)*

### *Make environmental cost reports*

The environmental management system (EMS) in Vietnamese brick production enterprises has not been completed yet. The new system only provides simply environmental reports. The reports can be considered as a starting point to develop sustainability reports because they help to assess economics and environmental performance of an enterprise.

Depending on the purpose of using and providing information, environmental cost reports are presented in different formats. The data in environmental cost reports may include monetary information and/or physical information. Monetary information looks for different cost aspects of environmental issues affecting business operations while physical information helps to provide tools to ensure compliance with specific regulations.

ECMA supplies environmental cost information and generates environmental reports. The information in the reports can be used to make management decisions and demonstrates environmental responsibility in brick production enterprises. They help managers set environmental goals, integrate accountability into environmental performance and improve financial and environmental efficiency.

In addition, the environmental cost reports are the basis for Vietnamese brick production enterprises to estimate environmental costs. This is necessary for managers to evaluate plans and to take corrective measures for controlling costs, reducing negative environmental impacts, and improving financial efficiency. Indicators in budget tables can be designed based on the template of environmental cost reports.

### *Build environmental performance indicators*

Evaluating environmental performance helps to provide the background information of environmental activities in the enterprises. Brick production enterprises must show environmental impacts that they are caused and operations that they make to reduce the impacts as a necessary requirements for sustainable development.

The environmental cost information is used for decision making, but it also helps us measure results and gives environment initiatives. The enterprises can evaluate environmental performance in monetary indicators (monetary EPI) such as total costs of treating wastes, total costs of environmental prevention and management and costs of material losses. The monetary information is used to reflect the level of environmental impacts by business operations and the efforts of polluted prevention and management. Therefore, monetary information is highly persuasive to trigger actions for saving costs as well as reducing environmental impacts. Additionally, physical information support for monetary information to measure and evaluate environmental performance. The physical information play an important role to reflect resource efficiency, the efforts of waste reduction, compliance with environmental regulations and environmental risks such as total wastes gathered; total wastes recycled, total wastes reused, total water saving, number of environmental initiatives; number of environmental incident.

The enterprise evaluates environmental performance through the absolute and relative indicators. The absolute indicators reflect magnitude of the phenomenon in a certain period while the relative indicators show the relationship between the two absolute indicators. Relative indicators allow an organization to compare changes in environmental performance and changes in business activities such as Total environmental costs on volume of products; Volume of wastes per added value; Environmental costs on total costs. Therefore, to determine environmental performance fully and deeply, it is necessary to consider absolute and relative indicators.

## **6. Suggestions**

The study proposes some suggestions to promote Vietnamese brick companies to apply ECMA. Specifically:

*On the side of Vietnamese brick production companies*

*Education and professional development for management accounting (MA) department and environmental management department*

Education and professional development not only provide the knowledge and skills to fully implement business operation but also ensure that the value of the organization is integrated into the thinking of the members. With the function of collecting, analyzing and providing environmental cost information, MA plays a very important role in deciding the success of enterprises. MA system can help to improve both financial and environmental performance. However, it is pointed out that the lack of active participation of accountants in the management of environmental activities led environmental costs not to collect and provide sufficiently and detailed. This can be explained by the limited knowledge and skills of ECMA.

Raising awareness and understanding for the management accounting department on environmental management is a very important mechanism for developing ECMA in brick production enterprises. Therefore, a standard definition of environmental costs as well as the ECMA standard framework should be clearly understood from management accountants' point of view. They also need to consider non-traditional activities such as research on manufacturing processes and activities of treating and managing wastes in the factories. Educational and professional development not only creates opportunities for interaction among members of management accounting but also facilitates the exchange of knowledge with other departments and increases the understanding of the importance of sustainable development.

To help ECMA application succeed, departments also have a common understanding of importance and usefulness of ECMA. Therefore, at the first stage of ECMA project, training programs for all members in companies should be prioritized to help them better understand the link between business growths with environmental efficiency and establish a more detailed plan for ECMA practice.

*Improve the connection between accounting and environmental management department*

Findings show that the more closely accounting department and environmental management department are connected, the higher ECMA application in Vietnamese brick production companies is. Therefore, a team of professionals should be established that includes environmental managers and management accountants, cost controllers to get a complete picture of environmental performance and related environmental costs. In fact, environmental staff have good knowledge about environmental issues such as the flow of materials, information related to treating, handling and controlling environment. However, they have little knowledge of how to reflect those issues into the accounting system. In contrast, management accounting department plays an important role in accessing and analyzing data, but they often have little understanding of the environmental issues that organizations are facing. As a result, management accountants do not often provide environmental information for decision-making fully. Moreover, it is clear that a closely linked relationship between management accounting and environmental management department is essential to track, to calculate and to report environmental costs accurately and completely.

*Raise awareness of environmental managers about environmental information*

The fact show that managers maintained a low priority for ECMA practice. Because they are only responsible for environmental activities within a certain range and they are limited by traditional management accounting systems that leads to discouraging individuals in organization to enhance their environmental responsibility. However, their attitudes and perspectives may be altered whether or not environmental costs are set in the broader context that is in development of environmental concerns from managers. Awareness of environmental information (environmental regulations, green competition, environmental concerns, clean technology, etc.) from managers is a factor which motivates ECMA application for internal management functions.

It is explained that when managers raise environmental awareness, they will focus on cleaner production decisions or measures to improve environmental performance and therefore environmental cost information must be collected, measured and processed. Increased awareness of managers about environmental information is a problem that needs to be addressed early because introduction of ECMA application are proposed by managers especially management accountants and environmental managers.

### *On the side of the government*

Government's action program can be seen as a good starting point for enterprises to assist board of directors, chief accountants, environmental managers in overcoming barriers related to value and professional practice of ECMA. The government should:

- Develop general framework of ECMA, establish a mandatory environmental accounting standard, built ECMA principles for enterprises in the sector; unify environmental cost forms, environmental reports and specific guidelines for each enterprise; use environmental reports to manage and make sustainable decisions for the industry.
- Integrate ECMA into standards and guidelines of Environmental Management System such as ISO 14001, EMAS;
- Develop and set up ECMA theoretical bases for companies in general and brick production companies in particular, such as classifying environmental costs, establishing methods to determine environmental costs, preparing environmental reports, developing criteria to assess environmental performance; providing case studies for application of ECMA;
- Provide environmental reports and specific guidance on how environmental information should be presented in reports;
- Formulate scientific projects in the direction of saving resources, making use of waste, designing new technologies and raising economic efficiency and environmental protection;
- Support researches related to ECMA and environmental reports, environmental management systems and national environmental accounting.
- Exchange information with other countries in design and development of policies to motivate ECMA in enterprises.

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