FACTORS AFFECTING THE APPLICATION OF ENVIRONMENT MANAGEMENT ACCOUNTING: EVIDENCE FROM MANUFACTURING ENTERPRISES

Thanh Nga Doan [*], Thi Anh Nguyen [**], Huyen Linh Vu [**], Ha Anh Nguyen [**], Hoang Anh Dam [**], Thanh Son Nguyen [**]

[*] *Corresponding author*, School of Accounting and Auditing, National Economics University, Hanoi, Vietnam
Contact details: National Economics University, No. 207, Giai Phong Street, Hai Ba Trung District, Hanoi, Vietnam
[**] National Economics University, Hanoi, Vietnam

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Abstract

This study was conducted to identify and measure the factors affecting the applicability of environmental management accounting (EMA) in Vietnamese manufacturing enterprises. It was based on institution theory, contingency theory, stakeholder theory, and theory of planned behavior. The method used in this research is a mixed research method. The qualitative method was used by consulting 14 experts through a survey to check whether the factors and models established are appropriate in the current context in Vietnam. Then, the quantitative method was used to test the hypotheses developed from the qualitative research results. Data was collected from 238 manufacturing enterprises in Vietnam from July 2022 to November 2022. The results find seven factors affecting the application of EMA in Vietnamese manufacturing enterprises. There are recommendations to help enterprises improve their ability to apply EMA. This study contributes to enriching the previous literature in two ways. First, it extends the strand of research on EMA application in developing countries, such as Vietnam (Alkisher, 2013; Wachira, 2014), highlighting the role of EMA implementation in these countries. Second, it extends the research about the factors affecting the application of EMA in enterprises, especially in manufacturing enterprises (Jalaludin et al., 2011; Nguyen, 2019).

Keywords: Environmental Management Accounting, EMA, Manufacturing Enterprises, Vietnam

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1. INTRODUCTION

The development associated with environmental protection has become a global trend, in which sustainable development is the primary concern. In particular, since the 1992 Earth Summit in Rio de Janeiro, the global business community has increasingly raised awareness of the need to achieve sustainable development and minimize the impact of its business activities on the environment (Mohammed, 2023). Though environmental performance is a growing concern in many nations, traditional management accounting practice has many cognitive limitations related to environmental performance (International Federation of Accountants [IFAC], 2005). This method places more emphasis on financial performance than on a specific assessment of environmental problems and the expenses associated with them (Le, 2019). Therefore, the important role of environmental management accounting (EMA) in environmental management has become more obvious.

EMA is defined as the identification, collection, analysis, and use of physical information about a company's energy, water, and material uses, flows, and sources, as well as financial information on environmental costs and income. Accordingly, businesses can use the information which EMA provides to improve industrial waste treatment, reduce energy consumption, and make their operations environmentally friendly, thereby enhancing the corporate image in the public (Ferreira et al., 2010).

Vietnam is a developing country in Asia. Since its economic reform in 1986, it has become one of the fastest-growing economies by more than doubling its gross domestic product (GDP) from 2010 to 2018. The manufacturing sector contributes the largest share of the country's GDP with nearly 25% in 2022 and has been among the sectors with the highest number of employees (Nguyen, 2023). This is also the largest sector consuming raw materials, using energy, and generating emissions. Wastes from business activities in this sector create serious consequences for the environment so enhancing economic performance with minimizing environmental impact must be prioritized. To tackle these issues, the Vietnamese government issued "The National Action Plan on Sustainable Consumption and Production". In addition, several manufacturing enterprises have implemented management efforts and programs to address environmental issues, but the tracking, calculation, and reporting information have not been examined; and Vietnamese enterprises are also just focusing on financial accounting but have not yet realized the importance of EMA in building an effective accounting information system (Le, 2019). This gap has led to the need to study the EMA in this sector.

While most of the studies on EMA application focus mainly on European countries, the United States (US), and Japan, the research on EMA in developing countries such as Vietnam is still very limited. These studies are only studied within the limits of each country, so they do not give consistent results. In addition, Vietnam's economic, political, and social environments are different from other developed countries, so the results of many foreign studies are not suitable for the conditions in Vietnam (Doan, 2016). There are many studies on the factors influencing the application of EMA but the majority of prior studies' research methodologies were qualitative (Jalaludin et al., 2011). In Vietnam, EMA is a new topic with a limited number of studies. Some studies approach the importance of EMA, or learn EMA applications in developed countries and then draw lessons for Vietnamese businesses. Nevertheless, only a few studies are interested in the factors affecting the application of EMA, especially for manufacturing enterprises — business subjects directly affect the environment. Not surprisingly, therefore, there has been little systematic documentation and analysis of recent efforts to the application of EMA in Vietnamese manufacturing enterprises.

This study combines many of the best features of the previous ones to address the primary objective, which is to find out the factors and measure the degree of their influence on the application of EMA in Vietnamese manufacturing enterprises. This study can also significantly contribute to further research that relates to the adoption of EMA in developing countries, where few studies of EMA have been carried out. The authors have selected the independent variables that affect the dependent variable based on the fundamental theories and inherited the results of previous relevant studies. To determine and measure the influence, the authors use a combination of qualitative and quantitative methods. In addition, the study would give recommendations and suggest policies to enhance the application of EMA in manufacturing enterprises, consequently, improving the reliability of financial information for stakeholders and supporting managers in making decisions toward the goal of sustainable development.

The remainder of this study is organized as follows. Section 2 presents the fundamental theory on which the authors are based. Section 3 deals with the grounded theories of EMA application and builds research hypotheses. Section 4 analyzes the methodology that has been used to conduct empirical research. The results of this study are presented clearly in Section 5. Section 6 discusses and compares the results of this study with previous ones. The study ends with the conclusion and recommendations in Section 7.

2. THEORETICAL FRAMEWORK

2.1. Institution theory

According to DiMaggio and Powell (1983), institution theory comprises three elements: normative, coercive, and simulated. When managers are aware of the benefits of implementing EMA techniques to improve an organization's performance in a competitive environment, the spillover mechanism will motivate the unit to implement EMA. Therefore, institution theory is used to explain the impact of the strictness of the legal system, the perception of managers, and the difficulties in applying EMA in manufacturing enterprises in Vietnam.

2.2. Contingency theory

According to Waterhouse and Tiessen (1978), contingency theory has proven to be effective with operations depending on the context of an organization, showing a link between an organization's ability to adapt to contingencies and its effectiveness in operations. Contingency theory is used to explain the impact of firm size, the environmental sensitivity of the manufacturing sectors, and the clarity of company culture on the application of EMA in Vietnamese manufacturing enterprises.

2.3. Stakeholder theory

Research by Parmar et al. (2010) referred to the theory of stakeholders for the first time as the theory of corporate governance to explain ethical issues and other values in corporate governance. Stakeholder theory can be applied to promote the implementation of EMA (Le et al., 2019) in enterprises by promoting actions of stakeholders to monitor and minimize environmental-related issues. Therefore, stakeholder theory is used to explain the impact of the environmental sensitivity of the manufacturing sectors, the clarity of company culture, and the perception of managers on the application of EMA in Vietnamese manufacturing enterprises.

2.4. Theory of planned behavior

Intention includes motivational factors that influence the behavior of an individual. These factors show the level of willingness and effort that each individual will expend to perform the behavior (Ajzen, 1991). The subjective norm is the perception that influencers will think that the individual should or should not perform the behavior. Usually, the stronger the intention, the more concrete action it will take. Therefore, the theory of planned behavior is used to explain the impact of the perception of managers, the quality of accountants on the application of EMA in Vietnamese manufacturing enterprises.

3. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

3.1. Literature review

The development of management accounting has led to newly developed views and techniques, including EMA (Jalaludin et al., 2011). EMA was formed and developed by and with strong support from many organizations and researchers. In 1992, the United States Environmental Protection Agency (USEPA) executed a voluntary program for EMA development. The European Commission on Climate Change (ECCC) developed yet another EMA initiative in the late 1990s.

Many definitions of EMA have appeared in documents and show the difference in the scope or boundaries of applications. Generally, EMA emphasizes main contents, such as EMA being a part of management accounting and providing environmental information for internal management. EMA, which is the intersection between environmental accounting and management accounting, not only includes monetary information but also physical information (Bennett et al., 2003). It also increases competitive advantage, enhances corporate reputation, and generates social benefits. Emerging environmental concerns call the companies to adopt EMA to align with their environmental, financial, and social goals (Javed, 2023).

Jalaludin et al. (2011) based on institutional theory to explain the relationship between institutional pressure and EMA adoption through interviewing 74 accountants from manufacturing enterprises, including chemicals, automobiles, food, building materials, etc. participated in the survey. The authors show that coercive pressure has some influence on the application of EMA, in which normative pressure is considered the strongest. Conversely, simulation pressure has no effect. Moreover, surveyed accountants all agree that they are under pressure from stakeholders, including the customers, shareholders, and the government on environmental performance.

Christ and Burritt (2013) again use contingency theory to explain the importance of following factors to the application of EMA in Australia: 1) environmental strategy, 2) organizational structure, 3) firm size, and 4) industry characteristics. The survey obtained 108 answers and used a regression model to analyze data. The research results showed factors, including business size, environmental strategy, and characteristics of enterprises. The industry positively impacts the application of EMA, but contrary to expectations, organizational structure factors have no impact.

Wachira (2014) surveyed 30 businesses in different sectors in Kenya to determine the relationship between the following factors: 1) firm size, 2) operation time, 3) technology level, 4) financial performance, and 5) environmental strategy. Wachira (2014) shows a weak correlation between the technology level and the application of EMA in practice. Meanwhile, cost compliance, environmental strategy, and financial performance significantly influence the adoption of EMA practices. In addition, it was found that the hierarchical culture in the enterprise is a factor that prevents enterprises from implementing EMA.

Karimi et al. (2017) measured the factors affecting the use of EMA by surveying financial managers of petrochemical companies. The results show that the factors: resistance to change, lack of standards, competition, and culture are related to the relationship with EMA. Except for gender, all personal characteristics of financial managers affect the view of efficiency ratios of several factors in the use of EMA tools. This study has new points in understanding the internal and external factors related to the application of EMA.

Researching manufacturing enterprises in South Vietnam, Nguyen (2019) studied some new factors: 1) awareness of the volatility of the business environment, 2) the complexity of tasks, and 3) environmental quality. The author conducted a linear regression analysis which showed that most of the researched factors positively impact the implementation of EMA but the complexity of tasks factor has the opposite effect. In addition, the enterprises with the highest level of EMA

application are foreign-invested enterprises, and the implementation of EMA in large-scale enterprises is higher than in small and medium enterprises.

3.2. Hypotheses development

Firstly, firm size: Pervan (2012) believes that firm size is one of the most mentioned factors in EMA-related topics. However, the research about the impact of this factor still needs to be clarified. Ferreira et al. (2010) show that the size of the organization does not influence the implementation of EMA while Christ and Burritt (2013) and Nguyen (2019) suggest that the larger the enterprise, the more likely it is to apply EMA. To determine the influence of the scale factor on the application of EMA in the context of manufacturing enterprises in Vietnam, the paper proposes the first hypothesis as follows:

H1: Firm size positively affects the application of EMA in Vietnamese manufacturing enterprises.

Secondly, the environmental sensitivity of the manufacturing sectors: Manufacturing includes many different production areas with different industry characteristics. Differences in the production process, production costs, and market competition will lead to different accounting requirements for each enterprise (Ofoegbu, 2016). Ferreira et al. (2010) pointed out that businesses operating in sensitive manufacturing sectors are limited by regulations and industry restrictions for disclosing environmental information. Therefore, they tend to reveal more legitimate theoretical information to avoid punishment. To clarify the level of application of EMA in enterprises with different production fields, the authors propose the second hypothesis:

H2: The environmental sensitivity of the manufacturing sectors positively affects the application of EMA in Vietnamese manufacturing enterprises.

Thirdly, coercive pressure: For EMA practices, coercive pressure from stakeholders can lead to the adoption of new techniques due to the need to comply with environmental regulations and directly affect the application of EMA (Alkisher, 2013; Jamil et al., 2015). Latif et al. (2020) indicate that when companies face coercive pressures, EMA adoption helps companies to improve environmental performance and garner government support and economic benefits. In the current situation in Vietnam, if the legal regulations of the state agencies are strictly controlled and the threats of losing competitive advantage from the business environment increase, it is likely to promote the manufacturing industry to apply EMA. For the above reasons, the authors hypothesized the following:

H3: Coercive pressure positively affects the application of EMA in Vietnamese manufacturing enterprises.

Fourth, the strictness of the legal system: The government needs to establish a waste management policy to improve environmental problems (Latifah & Soewarno, 2023). Regarding the legal framework for accounting work, Vietnam has neither issued an accounting regime nor has any guiding documents for enterprises in applying EMA. Bui (2019) and Huynh (2019) also pointed out that the application of EMA in Vietnam is currently facing difficulties due to the lack of legal regulations related to the environmental accounting regime. Therefore, the hypothesis is proposed:

H4: The strictness of the legal system positively affects the application of EMA in Vietnamese manufacturing enterprises.

Fifth, the perception of managers: Perception of managers will directly affect the implementation of EMA in enterprises (Gibson & Martin, 2004). Supporting this view, Alkisher (2013) confirmed that the support factor of senior management has a positive influence on the application of EMA in the oil production companies in Libya. On the contrary, the lack of responsibility and support for environmental issues leads to the unwillingness to change and apply EMA (Jamil et al., 2015). The authors clarify the above contradiction by hypothesizing:

H5: The perception of managers positively affects the application of EMA in Vietnamese manufacturing enterprises.

Sixth, the quality of accountants: An accountant's qualifications are reflected in the accountant's knowledge and experience when performing their duties (Chang & Deegan, 2007). Qian and Buritt (2007) and Qian et al. (2015) all concluded that accountants' level of education and understanding of EMA plays an important role in deciding to apply to EMA. In terms of experience, Karimi et al. (2017) showed that all personal characteristics except gender, such as professional work experiences, will affect the performance of accountants. Research by Nguyen (2016) pointed out that training programs in Vietnam have not focused on training EMA. Therefore, the authors hypothesized about the quality of accountants as follows:

H6: The quality of accountants positively affects the application of EMA in Vietnamese manufacturing enterprises.

Seventh, the clarity of company culture: The close relationship between company culture and EMA has been previously demonstrated in the research of Wachira (2014) and Karimi et al. (2017). Le et al. (2019) research has shown the influence of corporate culture on the company's awareness of environmental protection. However, the influence of company culture on the application of EMA has not been clarified by previous research, especially in the context of manufacturing enterprises in Vietnam. Therefore, the authors propose the seventh hypothesis:

H7: The clarity of company culture positively affects the application of EMA in Vietnamese manufacturing enterprises.

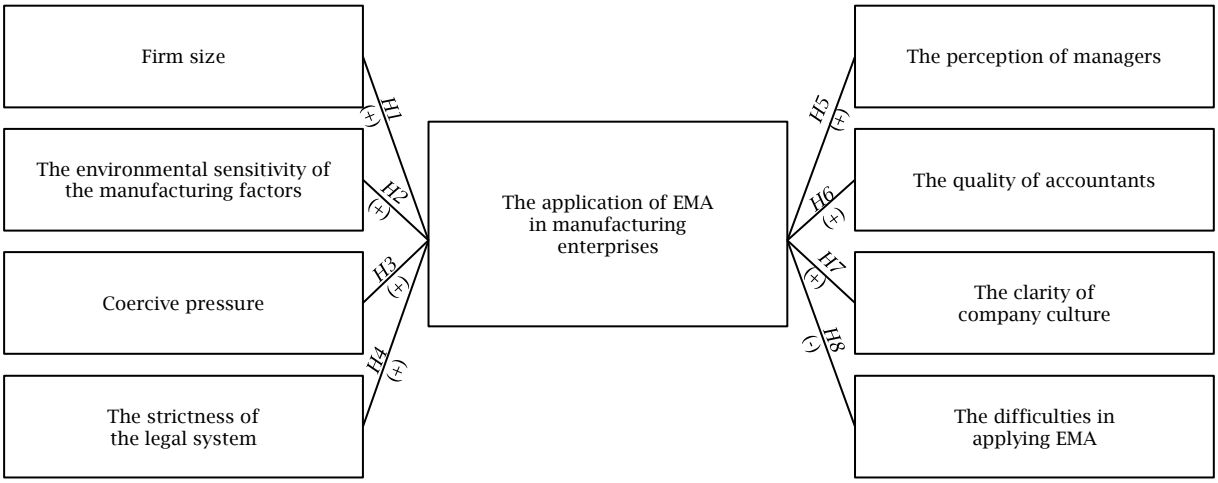
Eighth, the difficulties in applying EMA: Jamil et al. (2015) provides five barriers that prevent enterprises from applying EMA, including barriers related to cognition, finance, information, institutional, and management. The studies by Setthasakko (2010) also showed that the lack of guidance on EMA causes difficulties in collecting, identifying, analyzing, and evaluating data related to the environment. In addition, Trinh (2010) believes that the lack of cooperation and communication between departments in organization has led to difficulties in environmental management. From

previous studies and the situation in Vietnam, the paper proposes the eighth hypothesis as following:

H8: The difficulties in applying EMA negatively affect the application of EMA in Vietnamese manufacturing enterprises.

Inheriting the results from previous study on the application of EMA, the authors built a research model with eight factors affecting the application of EMA in manufacturing enterprises. The model is shown in detail in Figure 1.

Figure 1. Research model



Source: Results from the authors' study.

4. RESEARCH METHODOLOGY

After reviewing the previous studies related to factors affecting the application of EMA, authors decided to use a mixed research method, which combines qualitative research methods and quantitative research methods.

Qualitative research method: This was carried out by studying previous studies in combination with the theoretical basis, and then consulting experts in the field of EMA to complete the questionnaire. The survey was discussed by 14 experts on online and paper platforms, including lecturers majoring in Accounting — Auditing at universities and management accountants in large manufacturing enterprises in Vietnam. Through in-depth interviews, the authors want to prove that the statements made are consistent with the actual circumstances; find out and complete the relevant factors; then eliminate duplicate or unrelated variables and add other variables (see Appendix).

Quantitative research method: The sample is selected from the prestigious website in Vietnam (http://finance.vietstock.vn). The authors select the enterprises that are the clients of the independent audit. The sample selected to send the questionnaire through Google Forms was 565 of 1,284, accounting for 44% of the total listed Vietnamese manufacturing enterprises as of June 30, 2022. The survey period was from July 2022 to November 2022. The 322 responses were collected, and the number of valid responses was 238. For the exploratory factor analysis (EFA), the minimum sample size is five times the number of observed variables (44). Therefore, the sample size is 220 (Hair et al., 2021). For multivariate regression analysis, it is calculated by the equation:

$$n = 50 + 8 * m \quad (1)$$

where, n is the sample size, m is the number of independent variables. The $m = 8$, so the sample size is $n = 114$. From the above results, the minimum sample size chosen was 220. Therefore, 238 responses are valid.

Before conducting the research, the authors also proposed an alternative research method in case the results obtained from the mixed research method are not valid: *case study method*. Case study is a type of research in the social sciences in which the researcher learns about an object functioning in its natural circumstances mainly through qualitative methods such as observation, interview, collect and analyze evidence relevant to a particular case.

With this method, the authors will:

- select and collect data from a specific business or group of businesses;
- use diverse sources of evidence, including personal explanations of individuals in the business;
- research events and objects in the natural operating situation of that business;
- draw conclusions about the current situation of EMA application and factors or barriers that directly affect the application of EMA in that enterprise and limit them to only that enterprise.

The research sample is summarized in Table 1. It shows that the respondents to the question are accountants, general accountants, and CFOs, who have worked, on average, for five years and more. They might well understand financial and accounting activities at the business, so their answers are believed to be reliable.

Table 1. Descriptive statistics

Criterion		*Frequency*	*Percent (%)*
Position	Accountants/General accountants	155	65.1
	Chief accountants	38	16
	Other	45	18.9
	Total	238	100
Years of working	Below 5 years	69	29
	5–10 years	131	55
	Above 10 years	38	16
	Total	238	100
Manufacturing sectors	Manufacturing industry	106	44.5
	Processing industry	87	36.6
	Mining industry	18	7.6
	Other	27	11.3
	Total	238	100

Source: Results from the authors' study.

Regression analysis was used to evaluate the influence of the variables on the application of EMA in manufacturing enterprises. Here is an example of a regression model:

$$AD = \varepsilon + \beta_1 * QM + \beta_2 * LV + \beta_3 * AL + \beta_4 * PL + \beta_5 * QL + \beta_6 * TD + \beta_7 * VH + \beta_8 * KK + eY \quad (2)$$

where, *AD* is the application of EMA, *QM* is the firm size, *LV* is the environmental sensitivity of the manufacturing sectors, *AL* is the coercive pressures, *PL* is the strictness of the legal system, *QL* is the perception of managers, *TD* is the quality of accountants, *VH* is the clarity of company culture, *KK* is the difficulties in applying EMA, ε is the constant of the equation, *eY* is the error.

The researchers designed a questionnaire with 44 observations including one dependent variable and eight independent variables, using the 5-level Likert scale (1: Absolutely disagree, 5: Absolutely agree). The dependent variable is *the application of EMA* (*AD*).

Independent variables are variables that affect the dependent variable, in other words, the dependent variable is determined by the independent variable. In this research, there are eight variables considered eight factors that are *QM*, *LV*, *AL*, *PL*, *QL*, *TD*, *VH,* and *KK*. The scales of the variable are inherited from previous studies.

5. RESULTS

5.1. Result of Cronbach's alpha test

The test was carried out on nine scales with 44 observed variables. The results showed that the reliability of the scales satisfied Cronbach's alpha standard (each scale > 0.6), and item-total correlations > 0.3. The variable *AL6* of the scale coercive pressure has an item-total correlation equal to 0.153 and the variable *QL3* of the scale *the perception of managers* has an item-total correlation equal to -0.035, both less than 0.3, thus they are excluded from the model. The remaining 42 variables continued to be included in the EFA. The result of Cronbach's alpha test is shown in Table 2 below:

Table 2. The result of Cronbach's alpha test

Factors	*Number of observations*	*Number of valid observations*	*Cronbach's alpha*	*Corrected item-total correlation*
Firm size	5	5	0.852	0.664
The environmental sensitivity of the manufacturing sectors	3	3	0.756	0.585
Coercive pressure	6	5	0.772	0.545
The strictness of the legal system	4	4	0.787	0.595
The perception of managers	5	4	0.787	0.595
The quality of accountants	4	4	0.799	0.611
The clarity of company culture	4	4	0.777	0.581
The difficulties in applying EMA	4	4	0.856	0.700
The application of EMA	9	9	0.915	0.684

Source: Results from the authors' study.

5.2. Exploratory factor analysis

With the independent variables, the *KMO* = 0.794, KMO > 0.5, and Sig. = 0.000 < 0.05, so the variables are correlated with each other and satisfy the conditions for factor analysis. The value of eigenvalues coefficients is all greater than 1 with the 8th factor having the lowest eigenvalues of 1.075 (> 1), so the authors divided the original 42 observed variables into 9 main groups. The total value of variance extracted is 63.53% (> 50%), so it can be concluded that these eight factors explain 63.53% of the variation of the data. At the same time, the factor loading coefficients are all greater than 0.5, showing that all variables have an influence on the factor that the variable represents.

For the dependent variable, *KMO* = 0.907 > 0.5 and Sig. = 0.000 < 0.05, so the above variables are correlated and are eligible to perform exploratory factor analysis. With the extracted variance = 60.475% > 0% and eigenvalues = 5.443 > 1, the nine observed variables above converged on one factor and this group of factors explained 60.475% of the variation of the data. The result of EFA is shown in Table 3 below:

Table 3. The result of exploratory factor analysis (EFA)

Observed variables	*Factors*							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
QM5	0.800							
QM1	0.761							
QM2	0.749							
QM4	0.740							
QM3	0.714							
KK4		0.861						
KK1		0.807						
KK2		0.803						
KK3		0.745						
AL3			0.769					
AL4			0.713					
AL2			0.683					
AL1			0.654					
AL5			0.608					
TD1				0.822				
TD2				0.765				
TD4				0.720				
TD3				0.714				
QL1					0.822			
QL4					0.768			
QL5					0.749			
QL2					0.686			
PL3						0.789		
PL2						0.779		
PL1						0.752		
PL4						0.730		
VH2							0.810	
VH4							0.802	
VH3							0.746	
VH1							0.656	
LV1								0.747
LV2								0.724
LV3								0.714

Source: Results from the authors' study.

5.3. Pearson correlation analysis

From the results of Pearson correlation analysis, the authors found that the independent factors were strongly correlated with the dependent factors, and the correlation coefficients were statistically significant (Sig. < 0.01). The correlation relationship between the mean variable *the application of EMA* with all independent variables is 0.000. Thus, it is perfectly appropriate to use the above data to include in the linear regression analysis.

5.4. Regression analysis

To analyze the impact of every factor on the application of EMA in Vietnamese manufacturing enterprises, the authors use regression analysis to determine the affection of independent variables on dependent variables. The result of the regression analysis is shown in Table 4 below:

Table 4. Result of regression analysis

Model	*Unstandardized coefficients*		*Standardized coefficients*	*t*	*Sig.*	*Collinearity statistics*	
	B	*Std. error*	*Beta*			*Tolerance*	*VIF*
Constant	-0.097	0.345		-0.281	0.779		
QM	0.107	0.049	0.102	2.201	0.029	0.698	1.434
LV	0.179	0.047	0.184	3.848	0.000	0.647	1.546
AL	0.331	0.051	0.295	6.461	0.000	0.712	1.404
PL	0.162	0.044	0.152	3.717	0.000	0.892	1.121
TD	0.119	0.042	0.121	2.816	0.005	0.811	1.234
VH	0.057	0.041	0.057	1.374	0.171	0.878	1.139
KK	-0.223	0.039	-0.249	-5.739	0.000	0.790	1.266
QL	0.241	0.044	0.230	5.450	0.000	0.837	1.195

Source: Results from the authors' study.

The value of adjusted R-squared is 0.647, so about 64.7% of the independent variables included in the regression effect the change of the dependent variable *the application of EMA*.

From Table 4, it can be seen that the model has statistical significance for independent variables *QM*, *LV*, *AL*, *PL*, *TD*, *KK*, and *QL* as p-value (Sig.) is less than the significance level of 0.05. Particularly, *VH* has a value of Sig. = 0.171 (> 0.05) so it is not significant in the model. Thus, *the clarity of company culture* does not affect the application of EMA in manufacturing enterprises.

The sign of the regression coefficients reflects the impact of independent variables on the dependent variable. Only variance *KK* has a negative β_i value, meaning that it negatively affects *AD*. Otherwise, the values of β_i of other variances

have positive signs, indicating that these factors have a positive impact on *AD*.

The VIF coefficients of the independent variables are all less than 2 and the tolerance coefficients are in the range (0.5, 1). This proves that in the research model, there is no multicollinearity phenomenon. The regression equation of the *AD*:

$$AD = 0.102 * QM + 0.184 * LV + 0.295 * AL + 0.152 * PL + 0.121 * TD - 0.249 * KK + 0.230 * QL \quad (3)$$

Therefore, the degree of influence of factors on the application of EMA in manufacturing enterprises in descending order: *the coercive pressures*, *the difficulties in applying EMA*, *the perception of managers*, *the environmental sensitivity of the manufacturing sectors*, *the strictness of the legal system*, *the quality of accountants and firm size*.

6. DISCUSSION

The authors have identified seven factors affecting the applicability of EMA in manufacturing enterprises in the following order:

First, *the coercive pressure* has the strongest impact on the application of EMA. Therefore, hypothesis *H3* is accepted. This result is consistent with Jalaludin et al. (2011), Asiri et al. (2020), and Nguyen (2019). It shows that pressure from stakeholders will promote the application of EMA. It is completely suitable with the fact that the social community plays an important role in encouraging businesses to be more socially responsible because they can mobilize opinions from the public to combat the activities of an enterprise. Therefore, these stakeholders need to put pressure on businesses to comply with environmental policies and regulations to avoid violating actions that negatively affect the environment.

Second, *the difficulties in applying EMA* has the second strongest impact on the application of EMA. This is the only factor that has a negative impact. Therefore, hypothesis *H8* is accepted. The results are quite similar to previous studies by Jamil et al. (2015) and Setthasakko (2010). When researching Vietnamese enterprises, Trinh (2010) said that the lack of cooperation and communication between departments has led to difficulties in the application of EMA. Besides, the collection, processing, and allocation of costs related to the environment also cause obstacles for businesses. In addition, the cost of applying EMA is quite high, so businesses must consider the benefits received and the investment costs when applying EMA. Therefore, the application of EMA in manufacturing enterprises in Vietnam is still limited.

Third, it is the factor *the perception of managers*. The larger this factor, the greater the ability of enterprises to apply EMA. Therefore, hypothesis *H5* is accepted. This result is quite similar to the results of previous studies by Chang and Deegan (2007) and Alkisher (2013). Therefore, if managers are the perception of the benefits and appreciate the usefulness of EMA technical tools, they will be interested in and plan to apply EMA to implement the proactive environment strategy, provide much environmental information. However, many managers in Vietnam are often interested in financial accounting to provide financial information to stakeholders, so most businesses have not paid much attention to EMA's tools and techniques to support the management and administration process. Furthermore, many enterprise managers and executives make operational decisions based on emotional elements or experience rather than principles, skills, management expertise, or other information offered by EMA.

Fourth, the factor *the environmental sensitivity of the manufacturing sectors* has the same effect on the ability to apply EMA. Therefore, hypothesis *H2* is accepted. Similar to the results of this study, Ferreira et al. (2010) has demonstrated that companies with sensitive business sectors such as chemical, mining, and metallurgical industries are more likely to apply EMA. It shows that the more environmentally sensitive businesses have, the more they need to apply EMA because these businesses often incur risks of adverse impacts on the environment, causing businesses to face many costs incurred, affecting the profit earned.

Fifth, *the strictness of the legal system* has a positive impact on the ability to use EMA. Therefore, hypothesis *H4* is accepted. Domestic studies by Bui (2019), Huynh (2019); Nguyen (2016) also pointed out that the application of EMA in Vietnam is currently facing difficulties due to the lack of relevant legal regulations. Vietnam has not yet promulgated accounting standards related to EMA and still does not have effective environmental management tools such as natural resource tax, and pollution fees. Besides, legal documents and standards on the environment in the operation of enterprises are still lacking and inconsistent.

Sixth, it is the factor *the quality of accountants*. Hypothesis *H6* is accepted. This is consistent with Alkisher (2013), Qian and Burritt (2007). This study explains why businesses with highly skilled and experienced accountants will aid in the smoother implementation of EMA. Therefore, in order to properly implement accounting in the organization and lay the groundwork for the use of EMA, these accountants must possess the credentials, expertise, and experience in accounting. The majority of financial accounting training programs are the emphasis of accounting and auditing training institutes in Vietnam; few management accounting training programs, particularly EMA, are offered. Many businesses are still rather new to even the idea of EMA.

Finally, the *firm size* has the least impact on EMA application. Hypothesis *H1* is accepted. This result is similar to the research results of Christ and Burritt (2013), and Nguyen (2019). However, Ferreira et al. (2010) show that the application of EMA is not influenced by the size of the organization, some other authors indicate that this effect is very small or insignificant. The results of the authors are completely consistent with the current situation of Vietnamese enterprises when the number of small and medium enterprises accounts for the majority, leading to the application of EMA still facing many difficulties.

In addition to the above seven factors, the authors also found that the factor *the clarity of company culture* has no impact on the ability to

apply EMA. Therefore, hypothesis *H7* is not accepted. Many previous works have studied the relationship between company culture and EMA, however, the influence of company culture on the application of EMA in manufacturing enterprises has not been clarified.

7. CONCLUSION

The results show that the application of EMA by Vietnamese manufacturing enterprises is moderate (3.21 on the Likert scale) so they have only applied EMA at a simple level, in which environmental information is recorded without further analysis. Therefore, it is necessary to accelerate the application of EMA in those enterprises toward sustainable development goals.

The study highlights the importance of EMA for the sustainable development of enterprises and determines the level of influence of seven main factors on the application of EMA in Vietnamese manufacturing enterprises today: Coercive pressures, the difficulties in applying EMA, the perception of managers, the environmental sensitivity of the manufacturing sectors, the strictness of the legal system, the quality of accountants and firm size. The study has contributed to diversifying survey studies on the application of. First, it extends the strand of research on EMA application in developing countries which are being strongly affected by climate change, pollution, and environmental degradation, which has affected the economy as well as the quality of life of the people. In particular, the main object of environmental degradation is businesses such as Vietnam, Malaysia, and Lybia, highlighting the role of EMA implementation in these countries. Second, it extends the research about the factors affecting the application of EMA in enterprises, especially in manufacturing enterprises. The findings from this study provide a theoretical framework to help explain the implementation of EMA. Thereby, this research work can serve as a reference for future academic studies or support organizations, enterprises, professional associations, etc. in the process of EMA application and dissemination.

Based on research and practice, the authors make several recommendations to assist Vietnamese manufacturing enterprises in successfully applying. The Government and the relevant agencies should soon accomplish the legal system, synchronize environmental standards, and issue specific guidelines to create a basis in the process of applying EMA. Meanwhile, managers and senior staff need to actively participate in, or even set up forums to exchange knowledge and experience in applying EMA among enterprises in the same industry to inherit and develop the EMA system. Based on those practices, they can build the route to apply EMA appropriately and effectively. In addition, stakeholders can put pressure on enterprises to apply EMA, such as strongly condemning businesses that violate, pollute, and destroy the environment. Last but not least, EMA should be considered to add as a course at economic universities, especially in accounting and auditing majors, or in environmental accounting training programs to train a team of qualified accountants.

Despite the accomplishment of the findings and remarks, this study still has limitations. Firstly, the surveys were created using a URL connection and sent to all of the participants via email. Therefore, it was hard to assist responders in completing the survey and describing unclear questions, and avoiding unreliable answers. Secondly, the regression model explains 64.7% of the variation of the dependent variable, implying that there are other factors that affect the application of EMA. The model has not been generalized yet.

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APPENDIX

Table A.1. Describe the variables in the study (Part 1)

No.	*Survey criteria*	*Level of agreement*				
		1	*2*	*3*	*4*	*5*
Firm size						
1	The larger the revenue, the more motivation for your enterprise to apply EMA.					
2	The more employees, the more motivation for your enterprises to apply EMA.					
3	The larger the total assets, the more motivation for your enterprise to apply EMA.					
4	The more factories, machines, etc., the more motivation for your enterprise to apply EMA.					
5	The more departments, branches, etc., the more motivation for your enterprise to apply EMA.					
The environmental sensitivity of the manufacturing sectors						
1	The more sensitive the manufacturing sector, the more motivation for your enterprise to apply EMA.					
2	The more sensitive the manufacturing sector, the more environmental protection costs are likely to incur in your enterprise.					
3	The more sensitive the manufacturing sector, the more unexpected risks arise in your enterprise, affecting the environment.					
Coercive pressure						
1	Environmental management activities in your enterprise are under pressure from shareholders and investors, requiring institutional compliance to achieve the best performance or avoid damage to the environment.					
2	Environmental management activities in your enterprise are under pressure from customers.					
3	Your enterprises are under pressure to comply with the laws, policies, regulations, and standards on pollution established by the Government.					
4	The media is increasingly interested in environmental issues, putting pressure on your enterprises to improve their efficiency.					
5	Environmental management activities in your enterprise are under pressure from the surrounding population or the general community.					
6	Environmental management activities in your enterprise are under pressure from professional organizations, such as trade unions, financial institutions, professional associations, and environmental organizations/groups.					
The strictness of the legal system						
1	Vietnam has not yet issued an accounting regime related to the application of EMA.					
2	Vietnam has not issued specific guidelines on how to account for environmental information arising.					
3	Legal documents and environmental standards in the operation of enterprises are lacking and inconsistent.					
4	The Government has not had documents to support enterprises to access information about the model of EMA system successfully applied in the world.					
The perception of managers						
1	Managers in your enterprise have an understanding of EMA.					
2	Managers in your enterprise appreciate the usefulness of EMA.					
3	Managers in your enterprise are aware of the complexity of applying EMA					
4	Managers in your enterprise accept the costs incurred when applying EMA.					
5	Managers in your enterprise need to use the information provided by EMA.					
The quality of accountants						
1	The knowledge of accountants in your enterprise about EMA is still limited.					
2	Accountants in your enterprise with long-term working experience make the application of EMA easier.					
3	Accountants in your enterprise having international certificates (ICAEW, ACA, ACCA, CIA, CPA, etc.) make the application for EMA easier.					
4	Accountants in your enterprise have the spirit of learning and absorbing knowledge about the application of EMA from developed countries in the world.					

Table A.1. Describe the variables in the study (Part 2)

No.	*Survey criteria*	*Level of agreement*				
		1	*2*	*3*	*4*	*5*
The clarity of company culture						
1	Your company culture demonstrates the application of EMA through having rules and regulations on saving energy, raw materials, and environmental protection.					
2	Your company culture demonstrates the application of EMA through propaganda actions about saving energy, raw materials, and environmental protection.					
3	Your company culture demonstrates the application of EMA through employees' saving energy, raw materials, and environmental protection.					
4	Your company culture demonstrates the application of EMA through having a clear reward and punishment policy related to compliance in saving energy, raw materials, and environmental protection.					
The difficulties in applying EMA						
1	The process of applying EMA in your enterprise faces difficulties in collecting and allocating costs related to the environment.					
2	The process of applying EMA in your enterprise faces difficulties in considering the financial benefits brought about by the high cost of implementing EMA.					
3	The process of applying EMA in your enterprise faces difficulties in the lack of practical experience and documentation.					
4	The process of applying EMA in your enterprise faces difficulties in the lack of cooperation and communication between departments in terms of organization and application.					
The application of EMA						
1	Your enterprise determines costs related to the environment.					
2	Your enterprise classifies costs related to the environment.					
3	Your enterprise determines income related to the environment.					
4	Your enterprise allocates environment-related costs to products.					
5	Your enterprise analyzes product lifecycle analysis (consider a product's costs and revenues over its entire life cycle).					
6	Your enterprise analyzes the cost of raw materials.					
7	Your enterprise analyzes the material flow					
8	Your enterprise analyzes the efficiency of environmental operations.					
9	Your enterprise makes internal reports related to the environment.					