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Factors Affecting the Implementation of Environmental Management Accounting: A Case Study in Manufacturing Enterprises in Danang City

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Abstract: Sustainable development is an inevitable development trend of modern society, that is, a development that can meet the needs of the present without affecting the ability of future generations to meet their own needs. Therefore, in the 70s, environmental management accounting (EMA) has increasingly received the attention of authorities, enterprises, and researchers because this is a means for enterprises to balance business management and environmental sustainability. Thus, this study surveyed 321 chief accountants and managers working for 200 manufacturing enterprises in Da Nang, Vietnam. The study aims to determine the factors affecting EMA implementation and measure the influence of the factors on the implementation of EMA in manufacturing enterprises in Da Nang. This research uses a combination of qualitative research methods to identify influencing factors and quantitative research to measure the influence of factors on EMA implementation. Research results show five factors affecting EMA implementation: technology level, enterprise characteristics; performance pressure; accounting staff qualifications, and managers' awareness. Research on EMA in Vietnam is relatively new and has not been studied much. At the same time, there is currently no research on EMA in manufacturing enterprises in Da Nang city. Therefore, the study also contributes to the theoretical basis of the factors affecting EMA implementation.

Keywords: environmental management accounting, environmental accounting, environmental management, Da Nang city.

影响环境管理会计实施的因素——以岘港市制造企业为例

摘要：可持续发展是现代社会的必然发展趋势，即既能满足当代人的需要，又不影响后代人满足自身需要能力的发展。因此，在70年代，环境管理会计越来越受到当局、企业和研究人员的重视，因为这是企业平衡经营管理和环境可持续性的一种手段。因此，本研究调查了越南岘港200家制造企业的321名总会计师和经理。本研究旨在确定影响环境管理会计实施的因素，并衡量这些因素对岘港制造企业环境管理会计实施的影响。本研究采用定性研究方法识别影响因素和定量研究相结合的方法来衡量因素对环境管理会计实施的影响。研究结果表明影响环境管理会计实施的五个因素：技术水平、企业特征；绩效压力；会计人员的资质和管理人员的意识。越南的环境管理会计研究相对较新，研究较少。同时，岘港市目前还没有关于制造企业环境管理会计的研究。因此，本研究也有助于为影响环境管理会计实施的因素提供理论依据。

关键词：环境管理会计，环境会计，环境管理，岘港市。

1. Introduction

Da Nang is the 4th largest city in Vietnam after Ho Chi Minh City, Hanoi, and Hai Phong regarding urbanization and socio-economic development.

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Located on the coast of the East Sea, Da Nang is one of the port cities with a strategic location in Central Vietnam and one of the five cities directly under the Central Government. Over the past years, Da Nang has had a strong, relatively comprehensive development, becoming a dynamic and creative coastal city, using its potential and strengths well. As a result, the city's economy maintains a relatively high growth rate, occupying the leading position in the central key economic region.

Manufacturing enterprises in Da Nang city and manufacturing enterprises in Vietnam, in general, want their businesses to develop sustainably and have high competitiveness. Therefore, they need to balance 3 factors: economy, environment, and social responsibility, towards a green economy - ensuring long-term development for future generations starting from the awareness of environmental protection with the goal of sustainable development. In order to achieve a healthy economy with sustainable development, businesses must have commitments and measures to fulfill those commitments, including commitments to the environment and environmental protection to identify environmental costs associated with the production value chain. Manufacturing enterprises play an important role in the economic development of agro-forestry-fishery of the whole city. Recently, manufacturing enterprises have paid more attention to the application of cleaner production solutions in the processing industry, but most have not yet boldly applied and fully implemented. Therefore, the operation of manufacturing enterprises in the area still has many problems related to the environment that need to be considered and resolved.

From an enterprise perspective, environmental accounting plays an extremely important role in improving the quality and effectiveness of environmental management, having a very effective tool - Environmental Management Accounting (EMA). EMA is comprehended as the administration of financial, quantitative, and qualitative evidence regarding a firm's ecological effects and the economic significance of ecologically driven organizational practices. Their information aids managerial decision-making and the firm's environmental responsibility [1, 2]. However, up to now, in Vietnam, there are no regulations, circulars, or standards in the field of accounting to guide the organization and practice of managing assets, liabilities, income, and environmental costs. Therefore, the reality of Vietnamese enterprises shows that environmental costs have not been accurately or fully reflected, leading to incorrect identification of income, costs, and selling prices of products and services. That indirectly affects the competitiveness of enterprises. In addition, it has not supported managers to make the right management decisions based on measuring, evaluating, and recording the achieved results in an organization. Therefore, an enterprise's environmental accounting information (EA) has important implications for business administration and management as well as providing information to other related groups.

World research on the factors affecting EMA application is still modest, and most approaches are either theoretical or case studies [3, 4]. However, research on guiding the application of EMA in organizations plays an important role in developing an understanding of the concept and knowledge of EMA. It is also necessary to supplement the factors affecting the application of EMA to extend current knowledge of EMA in practice and increase the generalizability of the research problem [4-7]. However, especially in developing countries, this line of research is still limited and in its infancy, such as Burritt [4-6].

This study contributes to a cleaner environment and complements the literature on EMA by studying the factors affecting EMA implementation in manufacturing enterprises in Da Nang city. The study was conducted selectively but without duplicates in order to contribute to providing more information on the factors affecting the implementation of EA in manufacturing enterprises in Da Nang.

2. Literature Review and Hypotheses Development

2.1. Environmental Management Accounting (EMA)

Management accounting has been developed over the years to focus on resource management and waste minimization to increase value. The development of management accounting has led to newly developed views and techniques, including EMA [2]. Environmental management accounting is an approach to management accounting with particular emphasis on the cost associated with environmental issues and wasted raw materials. Its objective is to influence an organization's environmental and financial performance [8]. Reference [8] developed a working definition for EMA as a tool for transforming physical and financial measures of environmental data into information for decision-making to judge environmental performance. Reference [9] showed that EMA is used to identify, collect and analyze physical and monetary information for internal decision-making.

Physical information comprises data on the use and flows of energy, water, and materials, including waste. In contrast, financial information is based on environment-related costs, savings and earnings, and environmental costs that are generally hidden under overheads. As per reference [10], EMA is defined as developing and implementing environment-related systems and practices to manage environmental and

economic performance [8]. Furthermore, reference [11] suggests that, in a contemporary world, EMA should be used in the strategic development process to create a balancing interaction between economic, social, and technological factors to ensure a sustainable environment.

EMA can accurately identify, estimate, allocate and reduce expenditure and manage the use and flow of energy and materials, thereby supporting cost-effective programs to improve environmental balance. Therefore, EMA is useful for applying preventative environmental activities such as cleaner production [12].

Research on EMA focuses on two main directions: (i) research on environmental management accounting to explain the approach and development of EMA in units and organizations; (ii) Research on factors affecting the application of EMA. First, this study explains the factors affecting EMA in manufacturing enterprises in Da Nang, including enterprise characteristics, technology level, manager's perception of accounting staff qualifications, and performance pressure. In addition, this study established hypotheses about factors affecting the application of EMA based on four theories, including contingency, institutional, stakeholder, and legitimacy.

2.2. Business Characteristics (CHARA)

According to the stochastic and legal framework, the business characteristics of the enterprise are a very important factor and have a positive relationship with EMA performance.

Reference [13] is the empirical research on manufacturing enterprises with environmentally sensitive industries. Accordingly, these companies will often apply the EMA process more than less environmentally sensitive industry groups. Companies in environmentally sensitive industries make environmental information reports consistent with previous studies. Environmentally sensitive businesses will have a greater impact on the environment so that they will incur greater environmental-related costs and a higher awareness of them. Regulations impose on these enterprises, so there is a significant difference in environmental audits between these enterprises and those less environmentally sensitive enterprises.

Reference [14] investigates the relationship between enterprise characteristics and the application of EMA, empirical research in listed companies in Malaysia. Reference [14] raised the following hypotheses: environmental sensitivity of industry, firm size, ownership status, recognized environmental management system, and the ratio of non-executive directors. Companies seem to focus on environmental cost performance rather than measuring and integrating environmental information. The companies are more focused on complying with environmental regulations than incorporating EMA information into management, operational control, and reporting. EMA information is also useful for reporting economic, social, and environmental indicators in the Global Initiatives Report (GRI) guidelines. One of the reasons why many companies are not profit-oriented towards sustainability is because there are many concerns about ensuring their legitimacy. That may explain why most Malaysian listed companies insist on meeting regulatory requirements, as it will help them find legitimacy to ensure the company's survival and continue doing business [15].

Research by reference [16] concludes that senior managers' environmental awareness, business characteristics, and qualifications of accountants have a significant influence on EA.

In Vietnam, environmental issues are currently very concerned, including the issue of environmental impacts from the activities of manufacturing enterprises. Manufacturing enterprises are one of the industries that greatly impact the environment. With their sensitive characteristics to the environment, production and business activities will also have more impact on the environment. Therefore, to ensure their prestige, reputation, position, and production and business activities, manufacturing enterprises in Da Nang produce the products that impact the environment and are more likely to implement EA.

Thus, the characteristics of manufacturing enterprises can be expected to affect EMA implementation, and the hypothesis about the relationship between the characteristics of manufacturing enterprises and EMA implementation is proposed as follows:

Hypothesis H1: enterprises' business characteristics positively impact EMA implementation in manufacturing enterprises in Da Nang.

2.3. Level of Technology (TECH)

According to the stochastic framework, information technology affects EA implementation. Information technology is an important factor in successfully applying EA because if the accountants in particular and the business, in general, do not have the information capacity to apply information technology to their work. It is very difficult for accountants to make EMA applicable to businesses.

The technological capacity of a country (industry or institution) is the ability to deploy existing technologies effectively and cope with major technological changes. There are two levels of technology development activities, which are also two bases for analyzing technology capabilities: effective use of available technology and successful implementation of technological innovation.

The study by reference [16] sought to identify potential threats that could hinder the effective

operation of environmental accounting information systems (EAIS) and show conclusions through the linear structural model that information technology capacity significantly influences EA in Indonesia. This study also calls out the need to maintain the quality of information technology by ensuring sophisticated infrastructure and a highly-skilled workforce to capture the true nature of IT expertise in EA.

Research by reference [17] concludes that using information technology causes significant changes in accounting practice. The results show: Information technology helps users improve their performance. Information technology enables users to perform their tasks with greater efficiency. People who use information technology say it helps them focus and feel good about their work. Accountants can no longer simply copy and evaluate financial data as the basis for making future decisions. With knowledge of information technology and the ability to use technology as a strength in the 21st century, the accounting profession needs to be well prepared for the advent of the information age.

Research by reference [4] concludes that through career involvement, EA can be enhanced and possibly cost savings on actual investments in equipment. Environmental treatment, when implemented into Industry 4.0 infrastructure designed to digitize business operations. Industry 4.0 can be used to leverage environmental, financial, and environmental management accounting. A proposed new academic research program aims to establish how Industry 4.0 can facilitate more accurate, high-quality, real-time environmental management accounting and reporting. External environment reporting in related areas, company size, across different management roles and communal facilities, and supply and value chains. Industry 4.0 to create a foundation for improvements in corporate sustainability through greater uptake of environmental accounting.

Therefore, information technology will influence EA implementation in manufacturing enterprises. The relationship between technology proficiency and EMA performance in manufacturing firms is suggested in the following hypothesis:

Hypothesis H2: Technology level positively impacts EMA implementation in manufacturing enterprises in Da Nang.

2.4. Perception of Manager (PERC)

According to the stochastic theoretical framework, the manager's perception is a factor affecting EMA implementation. Manager's awareness is an important factor in being able to implement EMA.

According to reference [13], environmentally sensitive businesses will have a greater environmental impact, thus incurring greater environmental-related costs and awareness of the environment's higher environmental costs.

Research by reference [18] suggests that in addition to the increasing demand for environmental information from supply chains, it may encourage the application of EMA tools to collect environmental information. Institutional pressure and awareness of the development of the EMA are positive drivers of the development of the EMA. Another important barrier to developing an EMA concerns managers' perceptions. Increased investment and increased environmental education and training, especially for many production managers and workers, are needed to improve environmental awareness and their skills. With such support, managers feel their Chinese businesses will solve environmental problems.

Research by reference [19] on factors related to strategic forecasting of the corporate environment; confirm the role of the EA system and the manager's perception. Organizational context is thought to influence managers' perception of environmental problems, including three factors: the legitimacy of the problem, discretionary indulgence, and employee incentive system. Problem legitimacy measures the degree to which environmental concerns are embedded in corporate identity and, therefore, how legitimized organizational actors are to adopt a behavior consciously about the environment. Consistent with the strategic problem management literature, management's interpretation of an environmental problem is expressed in terms of perception of opportunity or perception of threat.

Therefore, managers' perceptions will affect the implementation of EMA in manufacturing enterprises. The relationship between managers' perception and EMA performance in manufacturing enterprises is proposed in the following hypothesis:

Hypothesis H3: Manager's perception positively impacts EMA implementation in manufacturing enterprises in Da Nang.

2.5. Accountant Qualifications (QUAL)

According to the stochastic framework, the employee's qualification is the factor affecting EMA implementation. Therefore, the qualifications of employees are considered an important factor in being able to successfully apply to EMA because if the employees do not master the knowledge and skills, it is difficult for EMA to apply to the business.

Research [20] has shown that education level is one factor affecting the company's intention to apply to EMA.

Reference [21] concludes that the presence of professional accountants in small and medium-sized enterprises helps promote the application of managerial accounting in that enterprise.

Research by reference [8] examines and models the factors influencing the use of EMA tools from the

perspective of financial managers and those working in refineries and petrochemicals. The study results show that from the point of view of financial managers, the changing pressures and methods of gathering and allocating environmental costs, standards, competitive environment, and socio-cultural in Dealing with environmental issues are factors that influence the use of EMA tools. The results of the fifth hypothesis test show that except for gender, all personal characteristics of managers and accountants, such as professional work experience, the field of study, education, and age, enjoy the implementation of EMA.

Manufacturing enterprises in Da Nang city are mainly small and medium enterprises with low competitiveness. Most new enterprises have just joined some stages of the global production network and value chain, but there are not many key products with national and international brands. At the same time, production workers have not been trained or guided in the knowledge of environmental issues, and accountants have not been trained in EMA, which will be an obstacle to the implementation of EMA in enterprises.

Therefore, staff qualifications are more likely to influence EMA implementation in manufacturing enterprises. The relationship between employee qualifications and EMA performance in manufacturing firms is suggested in the following hypothesis:

Hypothesis H4: Employee qualifications positively impact EMA implementation in manufacturing enterprises in Da Nang.

2.6. Stakeholder Pressures (PRES)

According to the institutional framework and stakeholder theory, institutional pressure and stakeholder influence affect the implementation of EMA in manufacturing enterprises. Performance pressures stem from legal regulations of state agencies (pressure from government, regulatory agencies) and threats of losing competitive advantage from the business environment (pressure from the business environment). There is also pressure from customers, suppliers, investors, media, etc.

Reference [22] studied the relationship between institutional pressure and EMA use in Malaysian manufacturing firms. The authors surveyed 74 accountants from manufacturing companies in Malaysia. Regression analysis was used to examine institutional pressure (coercive peer pressure, normative pressure, and mimetic processes) versus EMA acceptance. The findings of this study suggest some effects of institutional pressure on EMA adoption. However, research results also show that accountants agree that their education level determines their work [23, 24].

Reference [25] used a survey questionnaire and OLS linear regression to analyze the factors affecting EMA implementation. The authors consider institutional pressure as an important factor influencing an organization's decision to implement EMA.

Therefore, implementation pressure is more likely to affect EMA implementation in manufacturing enterprises. The relationship between performance pressure and EMA performance in manufacturing firms is proposed in the following hypothesis:

Hypothesis H5: Implementation pressure positively impacts the implementation of environmental management accounting in production enterprises in Da Nang.

Therefore, the research model of the proposed paper includes five independent variables: (1) Business Characteristics; (2) Level of Technology; (3) Perception of Manager; (4) Accountant Qualifications; (5) Stakeholder Pressures.

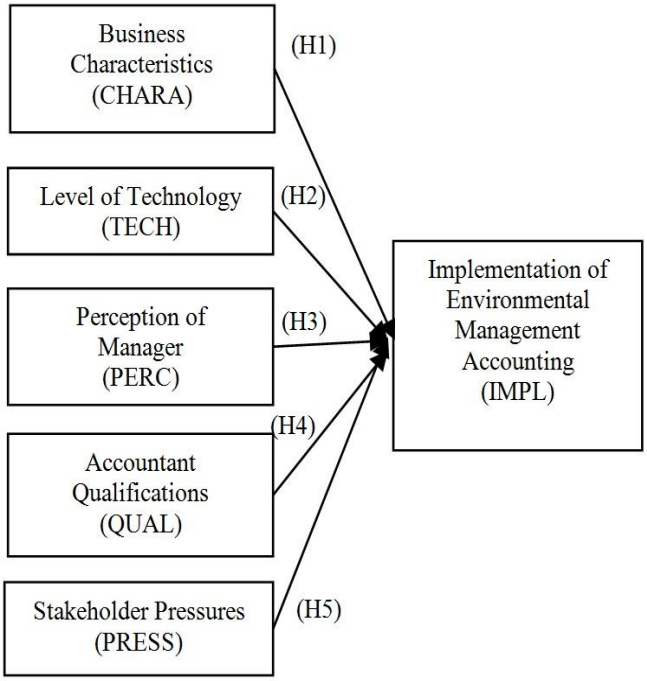

Fig. 1 A research model for Factors affecting the implementation of environmental management accounting in manufacturing enterprises in Da Nang

3. Methods of Research

The author uses a mixed research method. The research process includes 2 main steps: (1) general and (2) detailed research. In the general research step, the author uses the qualitative research method.

(1) In the qualitative research method, the author uses the systematic approach, synthesizes documents, analyzes to determine the factors affecting EMA implementation, then compares the differences in EMA implementation in Vietnam and internationally. From there, the author selects relevant factors that can affect the implementation of EMA in manufacturing enterprises in Da Nang city.

(2) In the quantitative research method, the author collects information from the questionnaire about the factors affecting EMA implementation. The sample of

this analysis includes manufacturing companies in Danang city, Vietnam. Danang city was chosen as the location due to serious environmental issues. Data were collected through a questionnaire distributed to respond directly. The respondents were management and accountant in 200 manufacturing companies. Each company received two to three questionnaires submitted directly to it. The total questionnaires distributed numbered 350, but the number of returned questionnaires was 321 from 200 companies.

The data found that only 321 sets of data could be analyzed because many answered did not answer the questionnaire completely.

The scale used in the study is based on relevant research and background theories. These scales are adjusted and supplemented to suit the actual characteristics of manufacturing enterprises in Da Nang. In this study, EMA is measured with an instrument developed by reference [4, 11]. Respondents' responses were measured using a Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Quantitative research methods are applied in the process of synthesizing observed variables. For the scale evaluation, the testing was performed using Cronbach's Alpha and EFA, respectively, applied PCA (principal components analysis) with varimax matrix rotation. Observed variables with a correlation coefficient between variable and total (item-total correlation) below 0.3 will be removed. KMO coefficient (Kaiser-Meyer-Olkin) is an index used to consider the appropriateness of factor analysis. The value of KMO must reach a value of 0.5 or more ($0.5 \leq KMO \leq 1$), which is a sufficient condition for factor analysis to be appropriate [24]. Bartlett's test of sphericity is used to see whether the observed variables in the factor are correlated. Bartlett's test has statistical significance (sig Bartlett's Test < 0.05), showing that observed variables are correlated with each other in the factor. The eigenvalue is a commonly used criterion to determine the number of factors in EFA analysis. Only factors with Eigenvalue ≥ 1 are kept in the analytical model with this criterion. Total Variance Explained ≥ 50% shows that the EFA model is suitable [25]. Factor Loading, also known as factor weight, represents the relationship between the observed variable and the factor. The higher the factor loading coefficient, the greater the correlation between that observed variable and the factor and vice versa [24].

Table 1 Summary of research scales

Factors	Scale source
H1: Characteristics of enterprises	Senn & Giordano-Spring [13] Mokhtar et al. [14] Nguyen [15]
H2: Level of technology	Susanto et al. [16] Jasim & Raewf [17] Burritt & Christ [5]
H3: Perception of manager	Senn & Giordano-Spring [13] Falih Chichan et al. [18] Romagnoli (2016) [19]
H4: Qualification of accountants	Alkisher (2013) [20] Álvarez Jaramillo et al. [21] Karimi et al. [8]
H5: Stakeholder Pressures	Fuzi [22] Mohamed & Jamil [23]
H6: Implementation of environmental management accounting	Thoradeniya et al. [3] Schaltegger & Burritt [2] Mokhtar et al. [14]

4. Results

In this study, the authors proposed a model consisting of 5 independent variables and 1 dependent variable. Independent variables include: Characteristics of the enterprise_CHARA (characteristics); Technology level_TECH (technology level); Manager's awareness_PERC (perception);Accounting staff qualification_QUAL (qualification); Performance pressure_PRES (enforcement pressure); Dependent variable: implementation of environmental management accounting (IMPL).

The sample size selected in study 321 is to satisfy the conditions on the sample to perform the tests.

Table 2 Research results

Factor name	Items	Factor loading	Eigenvalue	Mean	Std. Deviation
Characteristics	CHARA1	0.833	1.862	3.353	0.601
	CHARA2	0.816			
	CHARA3	0.753			
	CHARA4	0.781			
Technology	TECH1	0.772	5.387	3.115	0.571
	TECH2	0.812			
	TECH3	0.810			
	TECH4	0.742			
	TECH5	0.820			
Perception	PERC1	0.788	2.428	3.238	0.582
	PERC2	0.783			
	PERC3	0.825			
	PERC4	0.823			
Qualification	QUAL1	0.747	2.176	3.375	0.606
	QUAL2	0.818			
	QUAL3	0.803			
	QUAL4	0.811			
Enforcement pressure	PRES1	0.737	2.581	3.348	0.577

Continuation of Table 2

	PRES2	0.737			
	PRES3	0.722			
	PRES4	0.785			
	PRES5	0.813			
KMO	0.832				
p-value	0.000				
Cumulative	65.611				
Implementation	IMPL1	0.859	2.741	3.358	0.653
	IMPL2	0.800			
	IMPL3	0.858			
	IMPL4	0.792			
KMO	0.816				
p-value	0.000				
Cumulative	68.527				

Table 3 Model summary

Model	R	R2	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.723[a]	0.522	0.515	0.45460	2.211

The results show that the regression model gives relatively consistent results at the significance level of 0.05. The adjusted R-squared coefficient = 0.515 means a 51.5% variation of the dependent variable IMPL – the implementation of EMA is explained by the variation of the independent variables: Characteristics of the enterprise; Level of technology; Perception of manager; Qualifications of accountants; Stakeholder Pressures. The remaining 48.5% variation of EMA implementation is explained by other factors not considered in the model (such as implementation cost, enterprise size, corporate culture, etc.).

Table 4 Regression coefficient results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant	-0.951	0.236		-4.031	0.000		
CHARA	0.261	0.044	0.240	5.909	0.000	0.916	1.092
TECH	0.340	0.048	0.297	7.142	0.000	0.877	1.140
PERC	0.234	0.046	0.209	5.079	0.000	0.897	1.115
QUAL	0.231	0.046	0.214	4.983	0.000	0.820	1.220
PRES	0.251	0.047	0.222	5.340	0.000	0.880	1.137

4.1. Unnormalized Regression Equation

The implementation of EMA (IMPL) = -0.951 + 0.261CHARA + 0.340TECH + 0.234PERC + 0.231QUAL + 0.251PRES.

Table 5 Summary of research results

Hypothesis	Independent variables	Normalized regression coefficient	Significance level (Sig.)	Result
1	CHARA – Characteristics of enterprises	0.240	0.000	Accepted
2	TECH – Level of technology	0.297	0.000	Accepted
3	PERC – Perception of manager	0.209	0.000	Accepted
4	QUAL – Qualification of accountants	0.214	0.000	Accepted
5	PRES – Stakeholder Pressures	0.222	0.000	Accepted

That is also a table of normalized regression coefficients and the order of impact of independent factors on EMA performance.

The level of impact of the independent variables on the dependent variable IMPL is as follows:

The TECH variable has the strongest impact on the dependent variable IPML, with 25.11%.

The CHARA variable has the second strongest effect on the dependent variable IMPL, with 20.34%.

The PRES variable has the third strongest effect on the IMPL dependent variable, with 18.75%.

The QUAL variable has the fourth-strongest impact on the dependent variable IMPL, with 18.13%.

The PERC variable has the 5th strongest impact on the dependent variable IMPL, with 17.66%.

Table 6 Order by percent influence of factors

Rating	Factor	Normalized correlation coefficient	% impact
1	TECH – Level of technology	0.297	25.11
2	CHARA – Characteristics of enterprises	0.240	20.34
3	PRES – Stakeholder Pressures	0.222	18.75
4	QUAL – Qualification of accountants	0.214	18.13
5	PERC – Perception of manager	0.209	17.66
	Total		100%

Fig. 2 shows the results of the regression coefficient and the % impact of each factor on the implementation of EMA

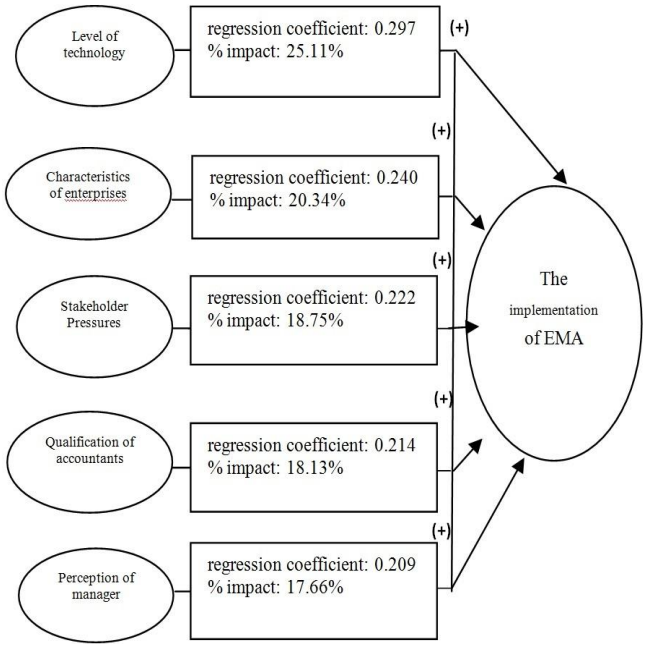

Fig. 2 Summary results

Research results show that:

If the level of technology in manufacturing enterprises increases by 100%, the implementation of the EMA will increase by 25.11%, assuming other factors are constant;

If manufacturing firms with business characteristics strongly related to the environment increase by 100%, the implementation of the EMA will increase by 20.34%, assuming other factors are constant;

If the stakeholder pressure in manufacturing enterprises increases by 100%, the EMA implementation will increase by 18.75%, assuming other factors are constant;

If the qualification of accountants in manufacturing enterprises increases by 100%, the implementation of EMA will increase by 18.13%, assuming other factors are constant;

If the manager's perception of manufacturing enterprises increases by 100%, the implementation of EMA will increase by 17.66%, assuming other factors are constant.

5. Conclusion

5.1. Conclusion

Based on the synthesis of documents, theoretical overview analysis, and previous studies, the authors presented the basic contents of EMA. Combined with the findings of the qualitative research phase, contingency theory, institutional theory, stakeholder theory, and legitimacy theory, it can explain EMA implementation in enterprises. They were made in Da Nang. The purpose of the quantitative research phase is to analyze the implementation of EMA in manufacturing enterprises and determine the influence level of factors belonging to random theory (CHARA, QUAL, PERC, TECH), theory institutional (PRES), legitimacy theory (CHARA), and stakeholder theory (PRES) impact on EMA implementation in manufacturing enterprises in Da Nang. Finally, based on related studies, the author confirms the importance of using EMA as an effective management technique to help managers make more accurate decisions.

Analyzing the factors affecting the implementation of EMA in manufacturing enterprises in Da Nang are: characteristics of enterprises (CHARA); technology (TECH); manager's awareness (PERC); accounting staff qualification (QUAL); performance pressure (PRES). Regression results and hypothesis testing show that all 5 factors affect EMA performance statistically significantly. The strongest influence belongs to the technology factor (TECH) (normalized $\beta = 0.297$), followed by the influence of characteristics of enterprises (CHARA), performance pressure (PRES), and accounting staff qualification (QUAL). The weakest effect belongs to the PERC factor (normalized $\beta = 0.209$). All factors have a positive influence on the implementation of environmental management accounting. The authors have identified and analyzed the factors affecting the implementation of environmental management accounting in manufacturing enterprises in Da Nang.

The factor of technology level has the most significance and impact on EMA implementation. This result is completely consistent in practice. In the 4.0 technology era, if businesses can apply technology effectively and invest in tools to support accounting work, it will increase the level of EMA implementation in businesses. In a developing country like Vietnam, Da Nang businesses need good enough technology infrastructure to serve accounting work. EMA's implementation needs software and support technology to implement EMA successfully.

The factor of firm characteristics is significant when the enterprise is large and related to the group of environmentally sensitive industries, which will increase EMA implementation in manufacturing enterprises in Da Nang.

The factor of stakeholder pressure is significant as the government promulgates many environmental and environmental accounting regulations, which will help increase the application of EMA in manufacturing enterprises in Da Nang. In addition, the greater the pressure related to environmental issues from investors and customers, the higher the implementation of EMAs in these businesses will be.

The factor of accounting staff qualification is significant when accountants with high qualifications, experience, understanding of the accounting regime,

and high awareness of the environment will increase the level of application of EMA in manufacturing enterprises in Da Nang.

The factor of managers' awareness is meaningful when managers are interested in environmental accounting activities, use environmental accounting information to make decisions, appreciate the usefulness of tools EMA technology, and have demand for EMA application in their business. That will increase the implementation of EMA in manufacturing enterprises in Da Nang.

5.2. Management Implications

The results of the research model help measure the level of EMA implementation, thereby providing solutions and recommendations to help manufacturing enterprises have an overview of the benefits of EMA implementation. Not only that, the research will be the basis to raise managers' awareness at Da Nang in manufacturing enterprises about the role and benefits of EMA implementation. Therefore, this study has contributed to promoting EMA implementation in manufacturing enterprises in Da Nang, aiming to increase economic benefits, protect the environment and develop sustainably.

Professional agencies and educational institutions should step up their role in increasing enforcement pressure to promote EMA implementation in manufacturing enterprises in Danang. In addition, higher education institutions and professional associations such as the Vietnam Association of Accountants, Vietnam Federation of Accountants, and Auditors need to help businesses realize the importance and benefits of implementing EMA so that businesses will voluntarily comply with professional rules, standards, and ethics.

In the future, accountants need to be trained so that, on the one hand, they are strong in their expertise and capable of implementing EMA or implementing an accounting system that focuses on environmental sustainability. Nevertheless, on the other hand, they must be trained to improve their performance.

5.3. Awareness of Professional and Ethical Standards

According to [26], to ensure the role of accountants in implementing EMA, it is necessary to equip accountants with professional knowledge and ethics. In other words, education plays an important role in implementing EMA.

Should raise awareness of administrators and interested parties to EMA. This approach can, over time, enable EMA concepts and methods to be generalized across member units within the same organizational area. Therefore, the business community can play an active role in promoting its members to implement the EMA through the organization of awards for green production and sustainable production. That will incentivize businesses to stimulate each other's activities, including EMA implementation.

Manufacturing enterprises should focus their financial resources on investing in accounting machines and software to support the implementation of accounting and internal management. The successful application of management tools and information technology is an important condition for EMA implementation. Especially in controlling environmental costs, if complex methods such as material flow cost accounting (MFCA) or balanced scorecard (BSC) methods are considered, businesses need to have a good and modern information technology system.

Reducing the complexity of EMA implementation is required to increase EMA implementation. First of all, the authorities need to issue documents guiding EMA implementation as soon as possible. In addition, because EMA requires multidisciplinary knowledge, to reduce the difficulty in quantifying environmental impacts, it is necessary to provide accounting knowledge for those working in the field of environment. In addition, it is necessary to expand the knowledge of the environment for accountants and integrate programs for processing and analyzing environmental information into accounting software. All of these will maximize EMA's implementation to reduce accountants' time and effort.

The research was carried out through two stages, including a qualitative research stage and a quantitative research stage. In which the quantitative research stage is the main focus. This phase gave stronger conclusions than the qualitative research phase, and the results of the analysis of survey data helped to measure the influence of factors on EMA implementation in manufacturing enterprises in Da Nang city.

This study is one of the few studies analyzing the factors affecting EMA implementation. At the same time, there is currently no research on EMA in manufacturing enterprises in Da Nang city. The study also contributes to the theoretical basis of the factors affecting EMA implementation. The study has provided the solutions and recommendations to help the manufacturing enterprises overview the benefits of EMA implementation.

However, the new research model only explains 51.5% of the factors affecting the implementation of EMA in manufacturing enterprises in Da Nang city. The method of sampling is convenient, so the accuracy is not high. The scope of the study is still narrow, so it is possible to expand the scope to a wider area. In addition, the following studies can continue to analyze the confirmatory factor CFA to retest the model. At the same time, the implementation of EMA can be studied extensively with more factors affecting other scales.

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