

DETERMINANTS INFLUENCING THE APPLICATION OF GREEN ACCOUNTING: THE CASE OF EMERGING MARKET CONSTRUCTIONS FIRMS

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Abstract

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Green and sustainable development is a common trend in the world, in which firms are not only interested in socio-economic development, but also environmental protection and environmental indicators in the production process. Green accounting, an important tool to assess the environmental impact on the economy, is considered a transition towards green and sustainable economic development (Gray, 1992). This study is conducted to assess the impact of all factors on the application of green accounting in Vietnamese construction firms, of which data is collected from 243 survey questionnaires of managers and accountants of Vietnamese construction firms. By using Cronbach's alpha test, exploratory factor analysis (EFA) test, and multiple regression analysis to check and forecast information, there are five determinants affecting the application of green accounting in Vietnamese construction firms as staff levels and resources, legal and regulatory systems, customer demands, legal and educational systems, stakeholder, managers' perceptions, internal resources. Based on the findings, some suggestions are proposed to management businesses and agencies to compensate for the shortcomings in the process of applying green accounting, contributing to making green accounting one of the most effective tools. It is important to appraise the environmental impact on the economy and is acknowledged as a transition towards sustainable development and green economic development.

Keywords: Construction Firms, Green Accounting, Environmental Accounting, Sustainable Development

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1. INTRODUCTION

Natural resources and climate change have been top concerns in the context of environmental degradation caused by economic development,

increased demand for natural resources, and higher volume of waste. In that context, policymakers need to pay attention to the recovery threshold of the ecological environment and ensure a balance between finance and environment, between

economic benefits and social benefits as a trend of sustainable development (Wilcox & Morin, 2022). However, in the traditional accounting system, it is difficult to determine the cost of environmental damage due to the lack of appropriate metrics and accounts. The environmental economic accounting system or green accounting acts as a sustainable accounting system to determine economic losses and natural resource depletion of an economy.

The goal of green accounting is to help firms understand and manage the potential *quid pro quo* between traditional economic goals and environmental goals. Green accounting includes three main goals: collecting and calculating energy-related materials, reporting the use of environmental costs, and providing information on other costs adding to environmental protection. Faced with such a situation, establishing a green or environmental accounting system to prevent pollution or damage is necessary (Asheim, 1997). Asheim (1997) also indicated that the system maintained economic measures having an environmental impact on electricity production and consumption. Because of its high impact on natural resources, the operation of a power plant should be considered and implemented. Regarding the content of green accounting, in the report by Dao (2019), green accounting consists of five main contents: environmental financial accounting, environmental management accounting, environmental finance, environmental law, ethics, and relationships with society. Along with that, Duong (2016) supposed that Vietnam needs to have a sustainable development strategy using green accounting. Green accounting is believed to be both a way and a direction to transform the development, towards a "green economy". This is also a new and long-term approach that will be in line with the general development trend of the global economic system. Research has revealed that applying green accounting in general and environmental accounting, in particular, is a long-term process that requires serious implementation and research investment to create sustainable growth. Green accounting or environmental accounting is a part of green growth, by people, for people, leading to the stability of environmental and social resources for development.

In addition, in recent years, construction has been considered one of the important industries of the economy, and the number of construction firms doing business in the Vietnamese context gradually increases. The increase in the number of construction firms contributes to attracting labor and capital, and also makes an increasing contribution to the state budget, helping to stabilize the socio-political economy. However, in the face of the risk of scarcity and deterioration of natural resources, the construction industry must face difficulties in product quality assurance and construction waste treatment. In addition, the number of construction firms tends to increase, making this problem likely to spread and adversely affect the life quality of the whole society. The application of green accounting is a solution to help firms balance profits and natural resource protection.

Through the collection, review, summary, and comprehensive evaluation of domestic and foreign

studies related to the topic, we realize that green accounting is still a new concept but is receiving more attention in the world. However, it is difficult to apply the results of these foreign studies to practical situations due to differences in habits, business characteristics, and legal systems which make them unsuitable for the conditions of Vietnam. In Vietnam, studies on green accounting are still limited. Studies currently only focus on environmental accounting and its benefits at the firm level without mentioning green accounting and its importance for firms in the context of sustainable development.

The remainder of this research is structured as follows. Section 2 reviews the studies of green accounting. Section 3 describes the data sample collection and methodology employed in the conduct of the research. Section 4 sets out a discussion of key results, while Section 5 shows some key conclusions and implications of the study practice and recommendations.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Green accounting

Green accounting received little attention from researchers and firms at that stage. It was not until a decade later in the 1980s that the term "green accounting" was popularized by economist, Prof. Wood in the 1980s (Schaltegger & Burritt, 2000). After that, many studies on green accounting were published such as Ullmann (1985), Gray (1992), Mathews (1997), Parker (2005), and Owen (2008). In the past three decades, studies on green accounting have mainly focused on the relationship between social performance and the interests of firms and the state; disclosure of social responsibility is related to the information to the public. In 1993, the United Nations first published a handbook on the System of Environmental Economic Accounting (SEEA). In 2014, the United Nations continued to deploy an application program called an "Economic and Environmental Accounting System" (green accounting) and requested countries around the world to apply the environmental accounting system in the business activities of firms.

According to financial experts, green accounting is a modern, comprehensive accounting system to record, summarize and report aspects related to an organization including assets, liabilities, investment capital, sources of revenue, and expenditures for the national green environment.

Green accounting may be defined as an accounting method that uses accounts in the SEEA, focuses on the depletion of scarce natural resources, and convert behaviors with environmental and social impacts into costs/revenues, and profits in monetary units.

Environmental and social issues, in particular, the costs, revenues, and related benefits are increasingly concerned by many countries around the world. However, traditional accounting practices do not provide sufficient information for accountability for sustainable development.

2.2. Green accounting studies

The traditional accounting system cannot provide sufficient information to estimate and convert these arise. Green accounting has overcome this drawback of the traditional accounting system to make it easier to determine the accounting relationship between the economy and the environment (sustainable development goals). Therefore, it is necessary to study green accounting and the factors affecting its application.

A study by Chenhall and Langfield-Smith (1998) showed that large-scale manufacturing firms (organizational scale, management structure) would apply cost management accounting as well as green accounting. The increase in organizational scale will make the management mechanism more complex and require the application of more complex cost management methods. According to Wu and Boateng (2010), the scale of foreign firms, partners, and the qualifications of managers and accountants will positively affect the application of environmental cost management accounting in foreign joint ventures. Next, Wachira (2014) said that it was the concern about environmental protection that encouraged firms to apply environmental cost management accounting, the level of production technology, operating time, and environmental strategy had a certain influence on the application of environmental management accounting in manufacturing firms in Nairobi. The firms only apply when they are aware of the benefits of environmental cost management or are under some pressure (Khalid et al., 2012). When applying institutional theory, Jalalludin et al. (2011) found a series of internal and external factors affecting the use of green accounting by firms, such as pressure from professional organizations, environmental organizations/groups; pressure from accounting-auditing organizations that pay much attention to training and application of environmental costs, etc. Not only institutional theory but also contingency theory has shown that the selection of an appropriate management accounting system must depend on the characteristics as well as the environment of each firm (Christ & Burritt, 2017). Besides, another factor affecting the application of environmental management accounting is pressure from external or internal stakeholders. Laws and regulations are the major barriers preventing the activities of green accounting as well as environmental management accounting in Nigeria (Iredele & Ogunleye, 2018). Rounaghi (2019) set out that green accounting indicators (gross domestic product, GDP) can be used in policy formulation and evaluation. The calculation of green GDP can lead to raising awareness of sustainability concerns among governments or national policymakers, who tend to focus on rapid economic development. Rounaghi (2019) also revealed that environmental accounting can be applied to large and small firms in different business lines as well as in the manufacturing or service sectors. Environmental accounting can be applied on both a large scale and on a smaller one with mandatory bases. Andrian and Pangestu (2022), analyze the effects of green accounting, chief executive officer (CEO) power, gender diversity, and nationality diversity on social responsibility disclosure. This

study uses ISO 26000 to assess social responsibility disclosure to measure and report social responsibility policies and practices to provide new perspectives for business people. They use a quantitative approach and panel data regression on 102 financial sector companies listed on the Indonesia Stock Exchange (IDX) for the 2018-2020 period. The results reveal that green accounting, CEO power, and gender diversity of the board of commissioners do not affect social responsibility disclosure.

Not only in the world but also in Vietnam, there are many studies on the factors affecting the application of green accounting. Nguyen (2016) pointed out the factors influencing environmental cost management accounting, coercive pressure, internal communication, and the role of the management accounting department. Nguyen et al. (2019) explore the influencing factors and assess the extent of their influence on information disclosure in each accounting environment. Data were collected from 57 mining firms listed on the Vietnamese Stock Exchange from 2013 to 2017. The results illustrate that the level of environmental accounting disclosure is influenced by the factors of profitability, financial leverage, firm size, number of listings, and independent audit. Lam (2019) also investigate factors affecting the disclosure of environmental accounting information (EAI) in Vietnamese seafood firms. The findings of the exploratory factor analysis (EFA), which extracted six determinants and the multivariable regression method, have shown the degree of influence on the disclosure of environmental accounting information in seafood firms, including legal and regulatory systems; knowledge of environmental accounting of accountants; management awareness; guidelines for the implementation of environmental assessment; pressure from the government, importers, investors, financial institutions, the community about environmental information; and benefits. Nguyen et al. (2021) look into issues hypothesizing green accounting and the relationship between green accounting and the sustainable development of firms, the current application trend of green accounting, thereby offering some recommendations on how to claim green accounting towards sustainable development in Vietnam. Nguyen (2022) pointed out that seven determinants have a positive and statistically significant impact on environmental accounting in firms in the textile and garment industry in Vietnam, including legal regulations, accounting staff qualifications, firm size, related parties, awareness of business leaders on the environment, environmental accounting, characteristics of the textile and garment manufacturing industry that affect the business's environment, and financial resources. In addition, they have a significant influence on the application of environmental accounting in Vietnamese textile and garment firms. Based on specific standardized weights, Nguyen (2022) asserts that these factors have a positive and statistically significant impact on environmental accounting.

A summary of variables, attributes, relevant grounded theories, and impacts is illustrated in Appendix, Table A.1.

Through an overview of the theory and practice of applying green accounting in Vietnamese construction firms, we propose nine hypotheses as follows:

Firm size: This factor is determined based on business capital, number of staff, etc. Based on contingency theory and referenced studies, this factor is expected to have a positive impact on the application of green accounting (Chenhall & Langfield-Smith, 1998; Christ & Burritt, 2017; Wachira, 2014; van de Burgwal & Vieira, 2014; Nguyen et al., 2019; Nguyen, 2022).

H1: Firm size has a positive impact on the application of green accounting in Vietnamese construction firms.

Management awareness: It will affect business strategies and firm development plans. Based on the contingency theory, this determinant is expected to have a positive impact on the application of green accounting (Wu & Boateng, 2010; Lam, 2019; Nguyen, 2022).

H2: Management awareness has a positive impact on the application of green accounting in Vietnamese construction firms.

Stakeholder: Stakeholders include government, investors, customers, etc. This factor is expected to have a positive impact on the application of green accounting based on stakeholder theory and institutional theory (Khalid et al., 2012; Iredele & Ogunleye, 2018).

H3: Stakeholders' opinions have a positive impact on the application of green accounting in Vietnamese construction firms.

Financial resource: This factor represents the firm's ability to pay and maintain operations. According to the contingency theory, this factor is expected to have a positive impact on the application of green accounting (Khalid et al., 2012; Christ & Burritt, 2017; Iredele & Ogunleye, 2018).

H4: Financial resources of firms have a positive impact on the application of green accounting in Vietnamese construction firms.

Staff level: This determinant refers to the professional skills and practical experience of the staff. The development plan of a firm must be suitable to the current level of the staff. Based on the contingency theory, this factor is expected to have a positive impact on the application of green accounting (Qian et al., 2015; Lam, 2019; Nguyen, 2022).

H5: Staff level has a positive impact on the application of green accounting in Vietnamese construction firms.

Legal and regulatory system: This factor refers to a system of specific laws and regulations related to firms. According to legitimacy theory and institutional theory, this factor is expected to have a positive impact on the application of green accounting (Deegan & Gordon, 1996; Lam, 2019; Nguyen, 2022).

H6: The legal and regulatory systems have a positive impact on the application of green accounting in Vietnamese construction firms.

Business lines: This factor influences the disclosure of non-financial information of firms. According to the legitimacy theory, this determinant is expected to have a positive impact on the application of green accounting (Ferreira et al., 2010; van de Burgwal & Vieira, 2014; Rounaghi, 2019).

H7: Business lines have a positive impact on the application of green accounting in Vietnamese construction firms.

Competition: Green accounting is used as a tool to control costs and minimize waste due to environmental problems, thereby improving business efficiency and creating competitive advantages for firms. According to the stakeholder theory, this factor is expected to have a positive impact on the application of green accounting (Khalid et al., 2012; Nguyen, 2016; Nguyen, 2022).

H8: Competitiveness has a positive impact on the application of green accounting in Vietnamese construction firms.

The education and training system: Alkisher (2013) showed that education is one of the factors affecting the intention of firms to apply green accounting. Insufficient knowledge and skills also limit the integration of environmental issues into the accounting system at construction firms.

H9: The education and training system has a positive impact on the application of green accounting in Vietnamese construction firms.

3. RESEARCH METHODOLOGY

Based on the literature review and grounded theories, we have gathered the determinants affecting the application of green accounting. We conduct in-depth interviews to redefine factors and find new determinants from 12 experts who are experienced and knowledgeable about green accounting in construction firms. Then test the factors and models developed from the data collected through studies around the world to determine if they are really appropriate in the current context. Then, we use quantitative research methods and questionnaire surveys to test hypotheses and models about factors affecting the application of green accounting in Vietnamese construction firms for sustainable development.

The questionnaire survey for the study is divided into three parts:

Part 1: Introduction to the topic;

Part 2: Overview of the firm and respondents;

Part 3: Questions related to determinants influencing the application of green accounting in Vietnamese construction firms.

Survey subjects are firm managers, chief accountants, accountants, and people with responsibilities for environmental and social issues, 125 construction firms in Vietnam with 243 questionnaire surveys were collected.

After obtaining data from the questionnaire surveys, the research team will eliminate the unsatisfactory questionnaire surveys, then perform data entry for analysis:

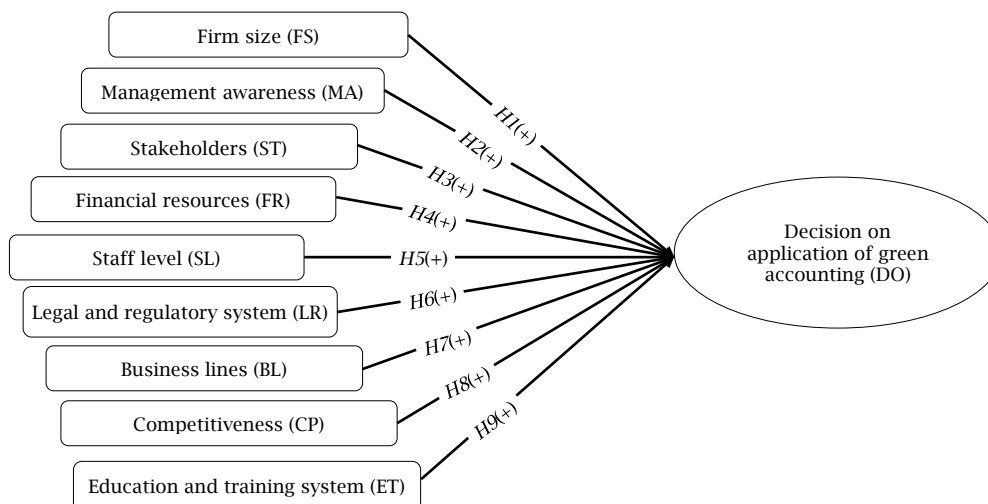
Step 1: Test the scale using Cronbach's alpha (CR);

Step 2: Use exploratory factor analysis (EFA) to summarize and reduce the scale;

Step 3: Use the regression method. The linear regression model aims to regress and predict information to see how the dependent variables are based on the independent variables (the explanatory variables).

The research model has been designed in Figure 1 below.

Figure 1. Research model proposed



4. RESULTS AND DISCUSSION

We analyzed 243 satisfactory surveys, of which 183 surveys (75.3%) were surveyed at firms in the central region and 60 surveys (24.7%) were surveyed at firms in the north. In terms of ownership, private firms accounted for 59.4%, and state-owned firms accounted for 40.6%. There were no complete surveys for foreign direct investment (FDI) firms. The group of firms with average revenue of more than VND 200 billion accounted for 6.9%, the group of firms with an average revenue of VND 50–200 billion accounted for 22.8%, the group of firms with an average revenue of VND 3–50 billion accounted for 58.4%, the group of firms with average revenue of less than VND 3 billion accounted for 11.9%.

The surveys were concentrated in medium-sized firms (58.4%), which was higher than the other groups. Most of the business activities of the surveyed firms have an impact on the environment (229 “yes” and 14 “no”). The proportion of firms with environment-related assets is much different from the proportion of firms without environmental-related assets, the difference is 147 surveys, equivalent to 60.49%. The proportion of firms with environmental costs is 84.16%, much different from the proportion of firms without environmental costs (15.84%). The number of firms that have not yet implemented green accounting accounts for nearly one-third of the surveyed firms, equivalent to 32.67%. Sixty-seven point thirty-three percent (67.33%) of firms have implemented green accounting: 26.73% of firms do it to gain business profits; 15.84% of firms do it for environmental protection; 24.76% of firms have not fully implemented it. The variables in the model are shown through the following factors.

Firm size (FS): Most of the surveyed firms are interested in green accounting. Business activities of private firms have more impact on the environment than state-owned firms. However, the level of interest in green accounting of state-owned firms is higher than that of private firms. It shows that environmental issues have not been a concern by the group of firms that have a greater impact on the environment. This requires measures to raise the awareness of private firms towards the

environment. At variable of whether larger firms have bigger impact on the environment than smaller ones do, the level of agreement in the two groups of firms is different (no opinion in state-owned firms and agreement in private firms), which is also the group with high disagreement (standard deviation > 1).

Management awareness (MA): Firms in the two groups both express unclear opinions with the observed variable of green accounting information not affecting business decision-making, which can be explained when the concepts of green accounting and environmental accounting are still new to many people (MA1, MA2). The level of agreement with the observed variable “Applying green accounting in firms is a sustainable development orientation” is high.

Stakeholder (ST): In recent years, the government and agencies have constantly enhanced the importance of the environment in the development of the country. All the surveyed firms agree with customers/investors on the disclosure of their environmental information (ST3) based on the requirements for disclosure of environmental issues.

Financial resource (FR): The application of green accounting in private firms depends more on financial resources than on state-owned firms. Besides, private firms are easier to raise capital than state-owned firms.

Staff level (SL): Most of the survey opinions highly appreciate the importance of accountants’ level in applying green accounting in firms. Statistics show that the proportion of staff who graduated from vocational schools and courses in state-owned firms is higher than in private firms. However, the proportion of accountants with international certificates (ACCA, FIA, etc.) in private firms is higher than in state-owned firms.

Legal and regulatory system (LR): Surveys show that the need for detailed guidelines on the implementation of green accounting as well as legal documents regulating, encouraging, and disclosing relevant green accounting information at private firms are higher than at state-owned firms. The results also show that private firms will pay more attention to environmental issues when the sanction mechanism is strengthened. In addition, there should be regulations on the presentation of

non-financial information prescribed by laws promulgated by the National Assembly and the Government's decrees to help firms implement green accounting.

Business line (BL): State-owned firms and private firms agree that "Construction is an industry that uses a lot of natural resources". However, the opinions on the importance of environmental information disclosure for construction firms are not clear.

Competitiveness (CP): The agreement of both groups of firms concerning the variables in the group of competitiveness factors is at a high level. The level of agreement in the group of private firms is higher than that of the group of state-owned firms at observed variables *CP1* and *CP2*. In the observed variable, "International firms increasingly attach importance to environmental issues", the level of agreement in the group of private firms is lower than that in the group of state firms.

Education and training system (ET): Most of the surveyed firms acknowledge that the Vietnamese

education system has not emphasized the importance of environmental protection and widely taught knowledge about green accounting. There is no big difference in the level of agreement between state-owned firms and private firms.

Decision (DO): Most of the firms in the two surveyed groups agree with the statement "The application of green accounting is necessary for firms" and "Applying green accounting in firms is a sustainable development orientation". Although green accounting is still quite new to many firms, the application of green accounting in firms is expected to be more popular in the future.

4.1. Checking the reliability of the scale

Table 1 illustrates Cronbach's alpha of the measurements is greater than 0.6. The total adjusted correlation of all observed variables is greater than 0.3. Unreliable observational scales have been eliminated.

Table 1. Reliability analysis with Cronbach's alpha

Variables	No. of variables	Cronbach's alpha	No. of variables remaining
Firm size	4	0.622	2
Management awareness	6	0.633	2
Stakeholders	6	0.695	6
Legal and regulatory system	7	0.703	6
Competitiveness	4	0.635	3
Business lines	4	0.632	2
Education and training system	4	0.732	2
Financial resources	4	0.792	2
Staff level	5	0.696	1

4.2. Exploratory factor analysis (EFA)

EFA on the independent variables shows that among other predicted exploratory factors, 20/24 observed variables have a load factor greater than the allowable standard (> 0.5). Bartlett's test shows that the Kaiser-Meyer-Olkin (KMO) coefficient of 0.725 is greater than 0.5, indicating that the factor analysis is appropriate. Bartlett's test is statistically significant at the 5% level of significance, showing that the observed variables are correlated with each other in the population. At the same time, the load factors of the factors are greater than 0.5, indicating the close association between the factors. If eigenvalue > 1 , there are seven factors drawn and these determinants explain 63.074% of the variation of the data. However, several measures of the same scale are loaded with different factors, showing that

some of the original statements have no significant relationship with them. Therefore, explore four new factors of *staff level and firm resource factors (SF)*; *customer demand factors (CD)*; *legal and education system factors (LE)*; *internal resource factors (IR)*, and *preserve management awareness factors (MA)*.

4.3. Explanation of the model

Through the regression results in Table 2, we have Adjusted R-square = 0.444 (F-test, sig. ≤ 0.05) showing that independent variables *SF*, *LR*, scientific research, *LE*, *ST*, *MA*, *IR* explains 44.4% of the variation of dependent variable *DO* and is significant at the 95% confidence level. The remaining 55.6% is explained by out-of-model variables and random errors.

Table 2. The regression coefficient of the research model

Model	R	R ²	Adjusted R ²	Std. Error of the estimate	Change statistics					Watson
					R ² change	F change	df1	df2	Sig. F change	
1	0.695 ^a	0.483	0.444	0.46447	0.483	12.402	7	93	0.000	2.027

Note: a. Predictor: (constant), *DO* mean.

4.4. Suitability of the model

The research team tests the hypothesis pair:

H_0 (null hypothesis): The independent variables do not have a linear relationship with the dependent variable *DO*.

H_a (alternative hypothesis): There is at least one independent variable that has a linear relationship with the dependent variable *DO*.

In Table 2, we see that the regression model has Sig. = 0.000 ≤ 0.05 . From there, we accept H_a ; i.e., the independent variables are linearly correlated with the dependent variables and the linear regression model is suitable.

Cronbach's alpha test reveals that the scale factor does not influence the application of green accounting. Then, conduct EFA and identify some old influencing factors and detect and replace some

new factors to be more suitable to the research. The factors are summarized through EFA: *staff level and firm resources (SF)*, *legal and regulatory systems (LR)*, *customer demands (CD)*, *legal and education systems (LE)*, *stakeholders (ST)*, *management awareness (MA)*, and *internal resources (IR)*. After conducting EFA, use multiple regression analysis to test and predict how dependent variable information

is based on independent variables. The linear regression model shows that the factors of *SF*, *LR*, *ST*, *MA*, and *IR* are statistically significant with the dependent variable *DO*, two variables of *CD* and *LE* are not statistically significant. Based on the survey results, Table 3 on the influence of factors affecting green accounting is as follows:

Table 3. The influence of factors influencing the green accounting

<i>Determinants</i>	<i>Regression coefficient</i>	<i>Contribution level</i>
<i>Staff level and firm resources</i>	0.093	18.20%
<i>Legal and regulatory system</i>	0.019	3.72%
<i>Stakeholders</i>	0.122	23.87%
<i>Management awareness</i>	0.246	48.14%
<i>Internal resources</i>	0.031	6.07%

Note: The meanings of the influencing factors are shown below.

Staff level and firm resources: Green accounting will be applied more and better in firms if the accountants have high professional qualifications and obtain international certificates in accounting (CPA, ACCA, etc.) Because the accountant is the person who directly performs accounting activities in the firm, if the accountant's capacity is still low and inexperienced, he/she will sometimes make mistakes in measuring environmental costs in currency units. The disclosure of non-financial information is even more necessary, especially for the construction industry, which has a great impact on the environment due to using a lot of natural resources. In addition, building an environmentally friendly corporate image will help firms gain more sympathy from partners, customers, and consumers, and improve their competitiveness.

Legal and regulatory system: If the state or the government promulgates legal documents or regulations on the disclosure of green accounting information, socio-economic and environmental information about construction firms, regulations on penalties, charters, etc., green accounting will be more convenient and guaranteed. In other words, green accounting is still a fairly new concept in Vietnamese construction firms in particular and Vietnamese firms in general, so its application is not feasible or suitable without relevant guidelines, regulations, and penalties.

Stakeholder (customers, investors, governments, suppliers, creditors, and government agencies) play an important role in determining the impact on economic, social, and environmental activities in construction firms in Vietnam. If the customer has a demand for corporate information, the investor requests such information be published, and the government shall closely monitor the related issues. Other stakeholders will accordingly collect information and monitor green accounting activities in construction firms so that they can make specific decisions. Therefore, construction firms must provide enough information to stakeholders to create and maintain better relationships, ensure business efficiency and maintain long-term and sustainable development for construction firms.

Management awareness of green accounting: Green accounting provides environmental cost information that cannot be achieved by traditional accounting. Compared with environmental accounting, green accounting is still new to managers. Green accounting can help firms save costs in many ways such as saving production costs

and reducing pollution. If managers understand green accounting, environmental information, environmental protection, and sustainable development, they can make more accurate decisions for the long-term strategies of their firms.

Internal resource: As the construction industry is an industry that uses a lot of natural resources and has a strong impact on the environment, the need to provide non-financial information, especially on environmental costs becomes more and more necessary than industries with less environmental impact. However, to provide environmental information in a standardized way, we must use green accounting as a necessary accounting tool. However, to effectively apply green accounting, in addition to good staff level, and high management awareness, good financial issues are also very important. If the construction firm has a large amount of cash and capital available, high solvency, good financial independence, and funding from creditors, financial institutions or the government, or other organizations, it will be easier and more convenient for the firm to apply for green accounting thanks to the effective support from many parties. But in a business environment under high pressure from different competitors, green accounting or other activities of the firm will be difficult due to a lack of financial resources.

5. CONCLUSION

Management agencies should be properly aware of the development and application of green accounting in current practice as well as the importance of its application in sustainable development in Vietnam as the application and development are essential to the growth of firms now and in the future. In line with the Party and State's policy of sustainable and green economic development, management agencies need to realize that the application of green accounting in general and environmental accounting, in particular, is a mandatory requirement that requires a reasonable long-term roadmap. In addition, agencies should continue to supplement and improve regulations on green accounting, and strengthen sanctions or regulations on tax policies, environmental fees, environmental responsibilities, and environmental protection. Actively praise, encourage, and apply good remuneration policies for firms that have been implementing green accounting, and performing well in economic, social, and environmental

responsibilities. In addition, motivate firms to strive more and more to follow the trend of green development and spread this positive business model to other firms to learn and follow.

The first concern is the continuance of supplementing and perfecting the legal system related to green accounting. The current accounting system is not qualified for firms to conduct environmental accounting. The system of accounts, books, and accounting vouchers does not separately record environmental information. Regarding accounting accounts, it is necessary to record significant environmental costs such as the cost of repair, compensation, cost of troubleshooting, and cost of cleaning up and handling the destruction of the ecological environment, and living environment. The cost factor "environmental" and the income brought by the "environment" not in a common account, but in a separate, specific account of the accounting should be taken into consideration. The second is to strengthen sanctions, well implement environmental tax policies for businesses, thereby helping businesses raise awareness as well as fulfill their responsibilities towards the environment and environmental protection. On the contrary, there are also regimes to reward, encourage and reward businesses that perform their social responsibilities well. Thirdly, a modern and scientific information management system for businesses should be built to put accounting software into the accounting activities of firms. With today's modern and scientific information technology, the government needs to research and utilize blockchain technology and augmented reality for information management of the whole enterprise. Fourthly, the Government should issue many regulations to limit the over-exploitation of natural resources for economic and social development, minimize violations and damages toward the environment as well as causes of environmental pollution. Green accounting is considered a crucial tool to scrutinize the impact of the natural environment on the economy and a transition to sustainable development, towards the development of a green economy that Vietnam is heading.

At the same time, the government ought to focus and be thorough in the process of modernization and development of Vietnam's Industry 4.0. Industry 4.0 has been creating fundamental changes in management, production, distribution, and consumption in society. However, due to the specificity of the business line, the level of technical equipment, people, etc., the impact of Industry 4.0 on each business is not the same. The implementation of Industry 4.0 in accounting in general and environmental accounting in particular in each enterprise requires to be about other departments in the whole enterprise.

Promoting the power of Industry 4.0 to apply to green accounting is a topical issue for all other professions along with all aspects of society. Theoretical and practical research has discovered the great roles of Industry 4.0 in boosting green accounting data for either decision-making or control of economic and environmental activities in firms towards sustainable development. Industry 4.0 can be employed to enhance green accounting information, namely:

- Through the system of big data with the augmented reality used in technology 4.0, it is possible to help accountants collect and connect economic and environmental data promptly with greater accuracy and timeliness — data that was previously difficult to fully access and effectively link or big data helps generate relevant statistics for multiple sets of data division, multiple accounting periods allows to improve the analysis of green accounting information.

- Blockchain technology in 4.0, which enables multiple departments to collect data from a common data system and use of the data for different purposes allows effective use of the joint information system of the enterprise.

- Another improvement can be noticed in data transfer for management planning and control in supply and value chains. Industry 4.0 encourages data transfer between departments and components in the supply chain, based on existing information infrastructure and telecommunications technology. Linking physical and monetary data from planning, production, accounting, and environment to facilitate planning, control, and evaluation of production, environmental and financial plans effectively.

- Industry 4.0 increases the reliability and coherence of reporting through self-control systems, self-audit, and personal calculating demands. Technically, real-time digitization of data collection and reporting reduces instances of inaccurate reporting (inflating or downplaying information) and makes it easier for stakeholders to access information systems available to serve their own purposes.

For the business community, first, it is crucial to change awareness of the application of green accounting in trading and manufacturing activities. Presently, businesses themselves are aware of the meaning and benefits of neither environment-protecting activities in general nor the implementation of green accounting in particular. Most businesses have not yet calculated environmental costs whereas their managers have not clearly calculated the costs of environmental issues. Business managers have to assess more about the environmental aspects of costs incurred in business agreements, to make appropriate business investment decisions.

- Raising awareness of the application of green accounting in trading and manufacturing activities is a matter of fact. At present, businesses themselves are not aware of the meaning and benefits of either environmental protection activities in general or the application of green accounting in particular. Most businesses in Vietnam have not yet carried out environmental cost calculations. In addition, many business managers are not aware that the cost to calculate environmental costs is much smaller than the total cost incurred when they pay taxes, fees, or fines for harmful acts toward the environment.

- There should be truly meaningful articles, essays, etc. to spread positive messages about green accounting or live forums with businesses in different regions to discuss the importance of green accounting. A firm belief is built on that from good awareness, there will be effective implementation methods, and sustainable development goals will be accomplished.

Second, paying attention to the build-up and prosperity of qualified human resources, it is

necessary to supplement a broader coverage with green accounting. Therefore, in the near future, businesses had better pay attention to searching, training, and building an accounting department with capacity and experience in green accounting. Specifically:

- Pay attention to the build-up and development of qualified human resources. Currently, because green accounting has not been popular in firms, the accounting department has almost no accountants with knowledge of environmental accounting as well as specialized environmental accountants.

- Focus on the growing level of employees in the company because technology is only a tool to support people. Since the application of technology can only achieve optimal efficiency when we have knowledge and master technology, it is essential to have a comprehensive understanding of the production process, along with environmental factors. For employees in the enterprise, it is essential to have seminars and discussions for ideas and knowledge exchange, learning professional knowledge, and training in the application of information technology.

- Improve the efficiency of information management and analysis in the enterprise. For accounting, businesses need to have a comprehensive analysis and assessment of the business's operation situation, influencing factors of the natural and economic environment on the dynamic situation of the business, and make plans, forecasts, and operational orientations for the next business cycle.

Third, for internal resources, investing to grow the efficiency of management and information analysis in the enterprise should be focused.

With the growing level of the modern information science system today, it is necessary to promote the role of financial resources to enhance the power of Industry 4.0 in information system management and the operation of economic and environmental activities in firms. As Industry 4.0 has brought great efficiency and benefits in improving the quality of economic and environmental information, thereby helping administrators make the right decisions in the management and operation of economic and environmental activities in firms.

Fourth, with stakeholders such as customers, investors, suppliers, etc., it is necessary to strengthen the monitoring of activities of related businesses to be able to limit unfriendly behaviors towards the environment of that business. Periodically, stakeholders can inquire firms to explain their environmental-related expenses to demonstrate the transparency of the business as well as to recognize the behavior and attitude of the business related to the environment, thereby making the right decisions, and restricting the negative actions of the business.

However, this study has some limitations such as 1) the number of samples collected and studied is not large enough, due to limited time and means of communication as well as expenses, and access to all types of firms, especially foreign firms; and nationwide is not possible; 2) the group has only studied the factors affecting the application of green accounting in construction firms, not in other industries, so there may be many differences with those in other industries and other professions; 3) green accounting is relatively new content and has not been studied much in Vietnam, so the questions of measurement incurred can confuse managers and accountants in the businesses that are following traditional accounting form and not yet updating new knowledge.

To overcome the above limitations and develop future research, we propose some directions as follows.

First, conduct the experiment on a larger scale in terms of the number of samples and especially the implementation space, expand the research to firms in specific regions, which are in different provinces, or expand the study area. Research of other professions can see a clearer difference in mind about green accounting.

Second, learn and add new factors to the model in addition to the factors affecting green accounting that have been studied in previous studies, thus, analyzing the impact of green accounting factors on business performance or the sustainable development of firms. Therefore, other mediating determinants can be employed to determine the influence when utilizing green accounting in firms.

REFERENCES

1. Alkisher, A. O. (2013). *Factors influencing environmental management accounting adoption in oil and manufacturing firms in Libya* [PhD Thesis, Universiti Utara Malaysia]. https://etd.uum.edu.my/4315/13/s92483_abstract.pdf
2. Andrian, T., & Pangestu, A. (2022). Social responsibility disclosure: Do green accounting, CEO power, board gender, and nationality diversity matter? *Corporate Governance and Organizational Behavior Review*, 6(4), 110-121. <https://doi.org/10.22495/cgobrv6i4p10>
3. Asheim, G. B. (1997). Adjusting green NNP to measure sustainability. *The Scandinavian Journal of Economics*, 99(3), 355-370. <https://doi.org/10.1111/1467-9442.00068>
4. Chenhall, R., & Langfield-Smith, K. (1998). Factors influencing the role of management accounting in the development of performance measures within organizational change programs. *Management Accounting Research*, 9(4), 361-386. <https://doi.org/10.1006/mare.1998.0080>
5. Christ, K. L., & Burritt, R. L. (2017). Water management accounting: A framework for corporate practice. *Journal of Cleaner Production*, 152, 379-386. <https://doi.org/10.1016/j.jclepro.2017.03.147>
6. Dao, T. T. H. (2019). Green accounting application in Vietnam and some problems. *Financial Review*, 1.
7. Deegan, C., & Gordon, B. (1996). A study of the environmental disclosure practices of Australian corporations. *Accounting and Business Research*, 26(3), 187-199. <https://doi.org/10.1080/00014788.1996.9729510>
8. Duong, T. T. H. (2016). Green accounting and environmental accounting — Some modern perspectives. *Journal of Accounting and Auditing*, 4, 35-42.
9. Ferreira, A., Moulang, C., & Hendro, B. (2010). Environmental management accounting and innovation: An exploratory analysis. *Accounting, Auditing & Accountability Journal*, 23(7), 920-948. <https://doi.org/10.1108/09513571011080180>

10. Gray, R. (1992). Accounting and environmentalism: An exploration of the challenge of gently accounting for accountability, transparency, and sustainability. *Accounting, Organizations and Society*, 17(5), 399-425. [https://doi.org/10.1016/0361-3682\(92\)90038-T](https://doi.org/10.1016/0361-3682(92)90038-T)
11. Iredele, O. O., & Ogunleye, O. J. (2018). An evaluation of environmental management accounting (EMA) practices and barriers to its implementation: a comparative study of Nigeria and South Africa. *Crawford Journal of Business and Social Sciences*, 13(1), 96-113. University of Lagos Library. <https://ir.unilag.edu.ng/items/2e8159b8-193b-4db7-984c-ef5c6bfcbbfc>
12. Jalalludin, D., Sulaiman, M., & Ahmad, N. N. N. (2011). Understanding environmental management accounting (EMA) adoption: A new institutional sociology perspective. *Social Responsibility Journal*, 7(4), 540-557. <https://doi.org/10.1108/174711111111175128>
13. Khalid, S., Irshad, M. Z., & Mahmood, B. (2012). Job satisfaction among academic staff: A comparative analysis between public and private sector universities of Punjab, Pakistan. *International Journal of Business and Management*, 7(1), 126. <https://doi.org/10.5539/ijbm.v7n1p126>
14. Lam, T. T. L. (2019). *Factors affecting disclosure of environmental accounting information in Vietnamese aquaculture enterprises* [PhD Thesis, University of Economics].
15. Mathews, M. R. (1997). Twenty-five years of social and environmental accounting research: is there a silver jubilee to celebrate? *Accounting, Auditing & Accountability Journal*, 10(4), 481-531. <https://doi.org/10.1108/EUM000000004417>
16. Nguyen, L. S., Nguyen, T. K. H., & Tran, T. T. H. (2019). Factors affecting the level of disclosure of environmental accounting information: A case study at mining companies listed on the Vietnamese stock market. *Journal of Economics and Development*, 261, 81-90.
17. Nguyen, T. M. P., Thai, T. K. A., Le, T. L. U., Tran, T. V. O., Nguyen, Q. H., & Pham, T. T. L. (2021). Green accounting: The desideratum of development in Vietnamese enterprises. In *Proceeding of 4th International Conference on Finance, Accounting and Auditing* (pp. 239-254).
18. Nguyen, T. N. (2016). Building a research model of factors affecting the application of environmental cost management accounting in Vietnamese steel manufacturing enterprises. *Journal of Accounting and Auditing*, 8(155), 34-37.
19. Nguyen, T. T. (2022). Research impact of environmental accounting on the performance of textile and garment enterprise in Vietnam. *Journal of Science and Technology*, 56(2), 45-58. <https://doi.org/10.46242/jstuih.v56i02.4344>
20. Owen, D. (2008). Chronicles of wasted time? A personal reflection on the current state of, and future prospects for, social and environmental accounting research. *Accounting, Auditing & Accountability Journal*, 21(2), 240-267. <https://doi.org/10.1108/09513570810854428>
21. Parker, L. D. (2005). Social and environmental accountability research: A view from the commentary box. *Accounting, Auditing & Accountability Journal*, 18(6), 842-860. <https://doi.org/10.1108/09513570510627739>
22. Qian, W., Burritt, R., & Chen, J. (2015). The potential for environmental management accounting development in China. *Journal of Accounting & Organizational Change*, 11(3), 406-428. <https://doi.org/10.1108/JAOC-11-2013-0092>
23. Rounaghi, M. M. (2019). Economic analysis of using green accounting and environmental accounting to identify environmental costs and sustainability indicators. *International Journal of Ethics and Systems*, 35(4), 504-512. <https://doi.org/10.1108/IJOES-03-2019-0056>
24. Schaltegger, S., & Burritt, R. (2000). *Contemporary environmental accounting: Issues, concept and practice*. Routledge. <https://doi.org/10.4324/9781351282529>
25. Ullmann, A. A. (1985). Data in search of a theory: A critical examination of the relationships among social performance, social disclosure, and economic performance of U.S. firms. *The Academy of Management Review*, 10(3), 540-557. <https://doi.org/10.2307/258135>
26. United Nations (UN). (1993). *Handbook of national accounting: Integrated environmental and economic accounting*. <https://seea.un.org/content/handbook-national-accounting-integrated-environmental-and-economic-accounting>
27. van de Burgwal, D., & Vieira, R. J. O. (2014). Environmental disclosure determinants in Dutch listed companies. *Revista Contabilidade & Finanças*, 25(64), 60-78. <https://www.scielo.br/j/rcf/a/sYqkPmpzyP3g8DDTCC4BCtz/?format=pdf&lang=en>
28. Wachira, M. M. (2014). *Factor influencing the adoption of environmental management accounting (EMA) practices among manufacturing firms in Nairobi, Kenya* [PhD Thesis, University of Nairobi]. <https://splus.strathmore.edu/items/f1b9822d-71c8-47bb-ad96-4634c71cd1c>
29. Willox, S., & Morin, J. (2022). Economic and environmental benefits of performance management controls in human service transportation planning. *Corporate Governance and Sustainability Review*, 6(4), 44-53. <https://doi.org/10.22495/cgsrv6i4p4>
30. Wu, J., & Boateng, A. (2010). Factors influencing changes in Chinese management accounting practices. *Journal of Change Management*, 10(3), 315-329. <https://doi.org/10.1080/14697017.2010.493303>

APPENDIX

Table A.1. Summary of variables and attributes, relevant theories, and impacts

Variables	Sources	Grounded theory	Impacts
Firm size (FS)			
Large-scale firms (revenue, capital) will be more interested in green accounting than small firms.	Chenhall and Langfield-Smith (1998), Christ and Burritt (2017), Wachira (2014), van de Burgwal and Vieira (2014), Nguyen et al. (2019), Nguyen (2022)	Contingency theory	+
The business activities of large firms will have more impact on the environment than small firms.			
The environmental costs of large firms will be higher.			
Large firms gain more benefits from the environment than small firms.			
Management awareness (MA)			
Firms have not learned about green accounting.	Wu and Boateng (2010), Lam (2019), Nguyen (2022)	Contingency theory	+
Firms are well aware of green accounting.			
Applying green accounting in firms is a sustainable development orientation.			
Disclosure of non-financial information is as important as disclosure of financial information.			
The application of green accounting is necessary for firms.			
Stakeholders (ST)			
Customers/investors, etc. will be interested in disclosing information about the firm environment.	Khalid et al. (2012), Christ and Burritt (2017), Iredele and Ogunleye (2018)	Stakeholder theory; Institutional theory	+
The application of green accounting (environmental disclosure) will help firms gain the trust of investors.			
State agencies encourage firms to apply green accounting (environmental disclosure).			
Customers will give priority to the use of "green products".			
Green buildings/urban areas will attract more investors/customers.			
Other stakeholders have a demand for using environmental, economic, and social information from firms.			
Financial resources (FR)			
The application of green accounting in firms depends on their financial resources.	Wachira (2014)	Contingency theory	+
There is financial support from organizations, units, individuals, etc.			
Companies without financial resources are less interested in green accounting.			
Companies with financial resources will be more willing to adopt green accounting.			
Staff level (SL)			
If a company owns highly qualified accountants, it will be easier to apply for green accounting.	Qian et al. (2015), Lam (2019), Nguyen (2022)	Contingency theory	+
All corporate accountants have a bachelor's degree.			
Construction workers all graduated from vocational schools and courses.			
Accountants of construction firms have international certificates (ACCA, FIA, etc.).			
Firms often make mistakes in accounting for payable expenses and taxes.			
Legal and regulatory system (LR)			
There should be detailed guidelines for implementing green accounting.	Deegan and Gordon (1996), Lam (2019), Nguyen (2022)	Institutional theory; Legitimacy theory	+
There should be legal documents regulating, encouraging, and disclosing information related to green accounting.			
Firms will pay more attention to environmental issues when the sanction mechanism is strengthened.			
There should be regulations on the presentation of non-financial information (environmental and social information) for firms listed in the annual report.			
Regulations on green accounting should be regulated by Laws promulgated by the National Assembly.			
Regulations on green accounting should be regulated by Decrees promulgated by the National Assembly.			
Regulations on green accounting should be regulated by Circulars promulgated by the Ministry of Finance.			
Business lines (BL)			
Construction is an industry that uses a lot of natural resources.	Ferreira et al. (2010), van de Burgwal and Vieira (2014), Rounaghi (2019)	Legitimacy theory	+
The construction industry needs to disclose more environmental information than other industries.			
Construction activities cause much environmental pollution (air, water, etc.).			
The construction industry has a positive impact on sustainable development (creating facilities for people).			
Competitiveness (CP)			
Building an environmentally friendly corporate image helps firms receive a great deal of sympathy from customers, partners, etc.	Wabuyi (2009), Khalid et al. (2012), Nguyen (2016), Nguyen (2022)	Stakeholder theory	+
Implementing green accounting helps firms reduce costs due to environmental impacts.			
International firms increasingly attach importance to environmental issues.			
Implementing green accounting helps firms integrate into the world.			
Education and training system (ET)			
The Vietnamese education system has not emphasized the importance of environmental protection.	Alkisher (2013)	Contingency theory	+
Knowledge of green accounting has not been widely taught.			
Green accounting has been taught in education and training programs.			
Teaching green accounting contributes to sustainable development.			
Decision on the application of green accounting (DO)			
The application of green accounting is necessary for construction firms.			
Applying green accounting in firms is a sustainable development orientation.			