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The Impact of Ecological Accounting Information on Operational Efficiency: Research at Enterprises in the Coastal Area of Vietnam

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Abstract

The coastal economic region in Vietnam is a unique economic region with extremely rich forest and sea natural resources. To be effective in meeting sustainable development requirements, businesses themselves must always consider economic efficiency along with social efficiency. With the characteristics of the region, ecological accounting information is important to help businesses in the coastal area improve operational efficiency. Eco-accounting makes a company's environmental costs more visible through its accounting and reporting systems. Then,

the company's benefits and costs are recorded according to the best quantitative assessment in both monetary and in-kind measures. The author used quantitative research with the PLS-SEM model at 105 enterprises in the coastal economic region of Vietnam. The results identified two factors: internal ecological accounting information and external ecological accounting information. The external climate has a positive and significant impact on improving the operational efficiency of businesses in the coastal area of Vietnam.

Keywords: Ecological Accounting, Information, Performance

1. Introduction

Walter (1995) ^[8] defined ecological accounting as “a discursive approach to accounting for solving environmental problems within a defined economic system”. It has been a rigorous and integrated approach to environmental assessment through measuring ecosystems and measuring service flows from ecosystems into economic and other human activities. Schatigger (2000) ^[13] argued that ecological measurements (kilograms, energy consumption, etc.) are limited by physical terms, so they need a way to be measured in monetary units. Ecological accounting applies the basic principles of management accounting to environmental information systems through ecological accounting's concern with analyzing and reporting activities and recording activities in an economic system.

Through ecological accounting, information about natural resources will be clarified, and the company's social responsibility requirements will be fulfilled with the aim of preserving resources from depletion. Eco-accounting makes a company's environmental costs more visible through its accounting and reporting systems. Then, the company's benefits and costs are recorded according to the best quantitative assessment in both monetary and in-kind measures. Monetary estimates can inform decision-makers, for example, in economic policy planning, cost-benefit analysis, and raising awareness of the relative importance of nature to society. Companies must reflect the environmental impacts arising from them in their accounting systems based on the requirements of ecologically sustainable development. Eco-accounting begins with incorporating the eco-accounting function into a company's environmental policy and building an appropriate accounting and data collection framework. Ecological accounting identifies the environmental impact to determine the responsibility of environmental impacts from products and production processes. Ecological accounting information is used by managers to analyze the strengths and weaknesses of a company in terms of ecology. This information system functions as a necessary control base for the business. Thanks to ecological accounting information, businesses will operate more effectively and improve their competitiveness in the market.

The coastal economic region in Vietnam is a unique economic region with extremely rich forest and sea natural resources. Businesses in this area are facing a great opportunity: the opportunity for sustainable economic growth and development with a linked model of forming a synchronous industrial production and goods distribution network, focusing on industries with competitive advantages, and making exports, services, and tourism key to the region's strengths. To be effective in meeting sustainable development requirements, businesses themselves must always consider economic efficiency along with

social efficiency. With the characteristics of the region, ecological accounting information is important to help businesses in the coastal area improve operational efficiency.

This article aims to explore the impact of ecological accounting information on business performance at businesses in the coastal area of Vietnam, with the main contents being the theoretical basis of ecological accounting and efficiency activities, research the relationship between ecological accounting information and business performance, and thereby propose recommendations to help businesses in the coastal area of Vietnam use ecological accounting information to enhance business efficiency.

2. Literature Review

2.1 Ecological Accounting

In 2021, the United Nations Statistical Commission adopted an ecological accounting system to provide detailed guidance for measuring the extent and health of ecosystems and quantifying ecological services. An ecological accounting system is a statistical framework that integrates biophysical information about ecosystems, measures ecosystem services, monitors changes in ecosystem size and condition, assesses ecosystem assets and services, and links this information to measures of economic and human activity (United Nations, 2021). According to Maes *et al.* (2016) ^[12], ecological accounting measures the extent to which nature and ecosystems contribute to the development of the economy and society. Ecological accounting is a rapidly growing field, a structured approach to assessing the dependence and impact of economic and human activity on the environment.

Ecological accounting provides information to support economic and environmental policy by emphasizing the importance of ecosystems and ecological services to policymakers. At the macro level, ecological accounting supports policy decision-making by connecting information about many types of ecosystems and many ecosystem services with other macro-level information. At the microlevel, ecological accounting can be used to support decision-making in different local areas and for different environmental areas such as water basins, forest reserves, marine conservation, etc. Hein *et al.* (2020) ^[7] argued that information from ecological accounting is useful information that points out the contributions of ecosystems to the economy, providing information related to natural resource management.

At the corporate level, ecological accounting aims to fulfill the requirements of social responsibility with the goal of conserving natural resources so that they do not become depleted. According to Radneantu *et al.* (2010) ^[14], eco-accounting aims to make the environmental costs of companies more visible through accounting and reporting systems. Companies' benefits and costs are then recorded in a way that allows for the best quantitative assessment in both monetary and physical terms. The goal of eco-accounting is to increase companies' transparency regarding the environment and exercise accountability; minimize the negative impact of traditional accounting on the environment; determine the relationship between the company and society on environmental issues; and bring competitive advantage to businesses.

The eco-accounting process starts from incorporating eco-accounting functions into the company's environmental

policy and continues to define the appropriate accounting and data collection framework. The first step is to collect, record, and combine with assessment the relative impact of data related to the environment. The next step is to explain the environmental impacts to determine responsibility for the environmental impact arising from the product manufacturing process. Eco-accounting must be integrated with traditional accounting and environmental management systems to ensure positive and effective continuous improvement.

Schaltegger *et al.* (2000) ^[13] identified the ecological accounting system including: internal ecological accounting, external ecological accounting and other ecological accounting. Internal ecological accounting is the collection of information related to the ecological system with the purpose of providing internal information to managers. Methods of measuring the impact of a business's products and production processes on the environment are a necessary and important factor in management decisions. External ecological accounting provides data to shareholders and external parties on environmental issues. Through external ecological accounting, companies' environmental reports are made public. Other ecological accounting provides information to regulatory agencies for the purpose of checking compliance with regulations, while also measuring data in physical units.

2.2 Business performance

A summary of a company's or department's accomplishments is referred to as corporate performance. A system of measurement indicators expresses how well a company is doing financially. Drury (2018) ^[3] thinks that measurement techniques, both financial and non-financial, are frequently employed to assess company performance. Financial metrics like ROI, EVA, and revenue growth rate are frequently utilized. Non-financial metrics, such as those linked to market share and quality, are frequently employed as indicators to measure stakeholder satisfaction.

Kaplan (1998) ^[4] noted that because financial figures are convenient and objective, many studies use them to indicate business performance. Accounting data is used to generate financial outcomes, which adhere to the standards of objectivity, reasonableness, and validity. Customers' pleasure, employee productivity, or internal business procedures, rather than financial metrics, frequently represent a company's survival and growth. As a result, non-financial outcomes are more frequently utilized to assess corporate performance. Combining financial and non-financial performance will enable organizations to function more successfully and steadily over time in a highly competitive environment.

2.3 The Impact of Ecological Accounting on Business Performance

Cholily *et al.* (2019) ^[2] argued that the role of ecological accounting is very important because it is the way that organizations react to and cope with environmental changes to increase competitiveness and organizational performance. Previously, in a 2015 study, Lee *et al.* also pointed out the contribution of ecological accounting information in improving operational efficiency through emissions reduction.

Hojnik *et al.* (2016) ^[10] studied companies in Slovenia to examine the relationship between ecological accounting and

performance. The results showed that ecological accounting has a positive relationship with company performance and competitive benefits. With similar results, in a study of businesses in China, Li (2018) also examined the relationship between ecological accounting and the company's economic performance. Research results have shown that there is a positive relationship between ecological accounting and business performance.

Inheriting from previous studies, the author hypothesizes:

H1: Internal ecological accounting information has a positive impact on the performance of businesses in the coastal area of Vietnam.

H2: External ecological accounting information has a positive impact on the performance of businesses in the coastal area of Vietnam.

3. Research Method

The author employs quantitative research with the PLS-SEM model to investigate the effect of ecological accounting data on the performance of enterprises in the coastal region of Vietnam. Henseler & Chin (2010) assert that while using PLS-SEM, the research model is assessed in two stages: the structural model is assessed first, followed by the measurement model. By examining the measurement ideas in the model's reliability, convergent validity, and discriminant validity, the measurement model is evaluated. The structural model is then assessed using the route coefficient, or R2, the determination coefficient. The bootstrapping test method, according to Schumaker and Lomax (1996), is an appropriate way to gauge the accuracy of estimates in linear structural model analysis.

Data for the study was collected within 3 months, from January 1, 2023, to March 31, 2023. The study then began to classify and clean the data. In the end, 105 survey forms were retained, while invalid survey forms were eliminated.

The study used the probability sampling method when collecting survey questionnaire data distributed directly and indirectly through personal relationships. To ensure the reliability of the collected data, the author selected survey respondents, including senior managers such as the General Director, Director, Deputy Director, and Financial Director; middle managers such as the Chief Accountant, Head, and Deputy Head of Finance Department; and management accounting and general accounting specialists of the enterprise. Each individual will represent the business they are working for.

Based on various studies conducted previously, several variables were applied in this study to measure the impact of ecological accounting information on performance. Internal ecological accounting information was accepted as an independent variable with three observed variables (Lee and Min, 2015) [11]. External ecological accounting information was accepted as an independent variable with three observed variables (Lee and Min, 2015) [11]. Operational efficiency is the dependent variable with 4 observed variables (Zhu *et al.* (2016) [15].

Table 1: Scale description table

S. No	Factor	Code	No. Variables
1	Internal ecological accounting information	IEA	3
2	External ecological accounting information	EEA	3
3	Business performance	EF	4

4. Results

4.1 Measurement Model Analysis

According to Hair *et al.* (2014), the quality-related observed variable requires an outer loading factor of at least 0.7. Ten observed variables had loadings of higher than 0.7, hence all ten observed variables were deemed to be of high quality based on the survey's findings.

Table 2: Outer Loadings

	EEA	EF	IEA
EEA1	0.875		
EEA2	0.808		
EEA3	0.925		
EF1		0.712	
EF2		0.719	
EF3		0.865	
EF4		0.802	
IEA1			0.751
IEA2			0.725
IEA3			0.903

The author then assesses the reliability of the scale after ensuring the quality of the observed variables. Cronbach's Alpha and Composite Reliability are the two basic metrics used to assess the reliability of the measurement model's variables. Numerous academics, including Hair *et al.* (2010) and Bagozzi & Yi (1988) [1], concur that 0.7 is a suitable assessment criterion. In this study, internal ecological accounting information, external ecological accounting information, and enterprise performance all have Cronbach's Alpha and Composite Reliability values that are higher than 0.7. The measurement scales used in the study, then, guarantee validity.

Table 3: Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
EEA	0.841	0.865	0.904	0.758
EF	0.724	0.754	0.830	0.556
IEA	0.721	0.827	0.838	0.635

The average variance extracted index (AVE) is used by the author to assess convergence. According to Hock and Ringle (2010) [9], if the AVE is 0.5 or greater, the scale exhibits convergent validity. The circular economy model and management accounting system all have AVE values that are more than 0.5, according to an analysis of the measurement model (Table 3). As a result, the variables' convergence is acknowledged.

Besides, the author used the Fornell-Larcker criterion to test the discriminant validity of all measurement models. Fornell and Larcker (1981) [5] recommend that discrimination is assured when the square root of the AVE for each latent variable is higher than all correlations between the latent variables. Table 4 shows that the square roots of the AVE values of all variables are more important than the correlation values between their constructs.

Table 4: Discriminant Validity Fornell-Larcker Criterion

	EEA	EF	IEA
EEA	0.871		
EF	0.453	0.745	
IEA	0.273	0.531	0.797

Henseler and colleagues (2015) [6] presented the HTMT index, which states that discriminant validity is assured if this value is less than 0.9. All of the HTMT indexes are less than 0.9, as seen in Table 5. All variables therefore have discriminant values.

Table 5: Heterotrait-Monotrait Ratio (HTMT)

	EEA	EF	IEA
EEA			
EF	0.555		
IEA	0.368	0.678	

4.2 Analyze Structural Models

According to Hair *et al.* (2019), the model has a very high likelihood of multicollinearity if the VIF is 3 or greater. According to the analysis's findings, the resulting VIF coefficients are all less than 3, indicating that multicollinearity is not present in the model.

Table 6: Inner VIF Values

	EEA	EF	IEA
EEA		1.081	
EF			
IEA		1.081	

The author first checked and assessed the phenomena of multicollinearity among the latent variables before doing structural model analysis. According to the findings of the structural model study, each and every one of the impacts has a P-Value of 0.000 0.05, making them all statistically significant. Particularly, the outcomes of PLS-Sem support hypothesis H1 by demonstrating that internal ecological accounting information has a favorable impact on business performance in coastal areas of Vietnam (=0.333, P0.050). Meanwhile, PLS-Sem's findings corroborate hypothesis H2 by showing that external ecological accounting information improves business performance in Vietnam's coastal regions (=0.440, P0.050).

Table 7: Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
EEA - > EF	0.333	0.343	0.070	4.769	0.000
IEA -> EF	0.440	0.444	0.059	7.473	0.000

The adjusted R-squared index is used by the author to assess how one or more independent variables affect a dependent variable in a SEM model. The independent factors that influence it, such as IEA and EEA, account for 37.3% of the variation (variance) of the EF variable, according to the adjusted R-squared of EF, which is 0.373.

Table 8: R Square

	R Square	R Square Adjusted
EF	0.385	0.373

5. Conclusion

The results of the partial least squares structural equation model identified two factors: internal ecological accounting information and external ecological accounting information, that have a positive and significant impact on enhancing the

operational efficiency of enterprises in coastal areas of Vietnam. Internal ecological accounting information provides internal enterprise information to managers by collecting information related to the ecological system. Methods of measuring the impact of a business's products and production processes on the environment are a necessary and important factor in management decisions. External ecological accounting information provides data to shareholders and external parties on issues related to the environment. Both of these information flows are important and have a positive influence on business performance. According to the survey results, business managers in coastal areas of Vietnam need to pay attention to ecological accounting information. This will then be the basis for increasing companies' transparency on environmental issues and implementing accountability, thereby minimizing the negative impact of traditional accounting on the environment and determining the relationship between the company and society on environmental issues. With the provided ecological accounting information, business administrators will create a competitive advantage for the business.

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