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### Environmental Accounting in Enterprises in the Context of Digital Transformation: A Study in Vietnam

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#### Abstract

Environmental accounting is important in helping stakeholders understand the actual situation of the enterprise when using environmental resources for production and business activities. From there, environmental accounting provides information to help the management make effective decisions to achieve and maintain reasonable business management. In other words, in implementing environmental protection activities, an enterprise or external organizations can accurately identify and measure the investments and costs related to environmental protection activities. By doing so, it is possible to clearly understand the benefits and potential of these investments and costs, the

company not only improves its operational efficiency but also makes timely and reasonable decisions on environmental issues. Environmental accounting is a part of accounting in enterprises, related to information on environmental activities within the enterprise to collect, process, analyze and provide environmental information for internal and external entities to use for decision making. Furthermore, environmental accounting aims to achieve sustainable development, maintain good relations with the community, and improve the effectiveness of environmental protection activities.

**Keywords:** Environmental Accounting, Business, Digital Transformation

#### 1. Introduction

Environmental protection and environmental accounting (environmental accounting) are topical issues, posing many challenges. Environmental accounting is a necessary tool, not only helping businesses meet environmental protection requirements but also improving business efficiency and enhancing competitiveness. However, environmental accounting is still a new issue in Vietnam. Therefore, understanding the nature, benefits and role of environmental accounting in socio-economic development in general and enterprises in particular is very necessary. The application and development of environmental accounting will contribute to effective cost management, increase profits, towards the goal of sustainable development, creating a solid step for Vietnamese enterprises in the process of economic integration. Environmental accounting is considered from two perspectives: Accounting work and environmental management work. In addition, environmental accounting has many different functions such as supporting internal decision making in business operations of enterprises to improve financial and environmental performance; at the same time, providing information on types of costs related to the environment (direct and indirect, hidden costs and tangible costs...).

In recent years, enterprises, especially those in environmentally sensitive industries in Vietnam, have not paid much attention to environmental accounting, both in terms of financial accounting and management accounting, because Vietnam has not had specific instructions on implementing environmental accounting, making environmental information lack transparency, incompleteness and reliability for information users. The implementation of environmental accounting at enterprises is currently carried out mainly according to environmental legal documents and traditional accounting regulations, so the recording, measurement and provision of environmental information by enterprises have not ensured accuracy and completeness. On the other hand, the awareness of environmental protection of business administrators is still limited. Environmental accounting at enterprises has not received attention and promotion from senior administrators; The implementation of environmental accounting by enterprises is mainly due to coercive pressure from state management

agencies rather than proactive environmental management and integration of environmental information in production and business management. Meanwhile, the development of environmental accounting in the accounting system is very necessary to promote sustainable development in current conditions. Therefore, the research on the topic has scientific significance in both theory and practice.

## 2. Theoretical basis

According to the United States Environmental Protection Agency (USEPA), environmental accounting is one of the strategies for assessing environmental aspects in sustainable development. These strategies differ in the level and comparability of indicators of energy, water, materials and pollutant flows. According to Gauthier *et al.* (1997), environmental accounting in business is a part of accounting related to environmental issues and is inseparable from financial accounting and management accounting; it is an information system that allows data collection, analysis, checking, evaluating performance, making decisions and assigning responsibility to managers for environmental costs and risks.

According to IFAC (2005) [27], environmental accounting is a broad term used in a number of different accounting contexts: Financial accounting and reporting; management accounting; full cost accounting; resource accounting, reporting and national accounting; sustainability accounting. At the organizational level, environmental accounting is divided into management accounting (assessing pollution control equipment and revenues from recycled materials; annual savings from new energy-saving equipment) and financial accounting (assessing and reporting environmental-related liabilities). Although there are some differences in the views on environmental accounting among organizations and individuals, through the above concepts, we can understand that environmental accounting is a part of the accounting system, using a new theoretical framework and accounting methods to record, measure and disclose environmental financial information and environmental non-financial information to support the decision-making of stakeholders inside and outside the enterprise. Environmental accounting is a means to measure the interactions between the environment and the business activities of the enterprise, emphasizing the connection between environmental efficiency and economic efficiency to aim at sustainable development goals. Environmental accounting includes the cost and benefit factors arising in environmental protection during the business activities of the enterprise such as: Research transfer, application of science and technology in the rational use of resources, environmental protection and sustainable development.

**Environmental protection costs:** Investments and costs associated with preventing, minimizing or avoiding environmental impacts, eliminating those impacts, and recovering from natural disasters and other activities.

**Environmental Conservation Benefits [Physical Unit]:** Benefits resulting from preventing, minimizing or avoiding environmental impacts, eliminating impacts, recovering from disasters, and other activities.

**Economic Benefits Related to Environmental Protection Activities [Monetary Value]:** The increased benefits of business profits as a result of environmental protection. In which, environmental costs are considered a major component of environmental accounting. However, there is

currently no unified framework for environmental costs. Environmental costs have many different classifications depending on each organization:

According to the United States Environmental Protection Agency (USEPA), environmental costs are divided into four categories: Traditional costs, Hidden costs, Contingency costs, Image and relationship costs.

According to the United Nations Commission on Sustainable Development (UNSD), environmental costs are divided into four categories: Waste and emissions treatment costs related to non-product outputs, Environmental prevention and management costs, Material costs related to non-product outputs, and Processing costs related to non-product outputs.

According to the US Environmental Protection Agency (EPA), environmental costs include 7 types: Business area costs, Upstream/downstream costs, Management costs, R&D costs, Social activity costs, Environmental pollution treatment costs and Other costs.

According to IFAC (2005) [27], environmental costs include two types: External environmental costs and internal environmental costs. In this study, the author uses the EPA classification method based on the relationship between business activities and environmental impacts, fully demonstrating the costs related to environmental accounting including:

**Business Area Costs:** These costs are for activities that aim to reduce the environmental impacts that occur in the business area due to business activities. The business area is the area where the company can directly manage the environmental impacts. Business area costs related to environmental protection are divided into 3 types, pollution prevention costs, global environmental conservation costs and resource recycling costs.

**Upstream/Downstream Costs:** Costs incurred upstream and downstream at the business site, or any costs associated with the purpose of minimizing environmental impacts. Upstream refers to activities prior to the provision of goods or services, including all activities that occur after the product or service has left the business site, to the production and sale of a company's products, as well as consumption, disposal of containers and packaging.

**Management costs:** These costs are defined as those costs incurred in managing environmental protection activities and indirectly contributing to the reduction of environmental impacts resulting from business operations, as well as external communications costs.

**R&D Expenditure:** Expenditure on research and development activities allocated to environmental conservation.

**Social activity costs:** Costs related to environmental conservation activities that a company may carry out as part of its social activities but are not directly related to its business operations.

**Environmental pollution treatment costs:** These potential costs are allocated to restore environmental degradation caused by business activities.

**Other costs:** Some other environmental costs not mentioned above.

In accounting, the System of Environmental Economic Accounting (SEEA) is the first international standard for environmental economic accounting, providing a framework for organizing and presenting environmental statistics and their relationship to the economy. It brings together

economic and environmental information in a set of unified concepts, definitions, classifications, accounting rules and standard tables to produce internationally comparable statistics. SEEA is produced and published under the auspices of the United Nations, the European Commission, the Food and Agriculture Organization of the United Nations, the Organization for Economic Cooperation and Development, the International Monetary Fund and the World Bank Group. Among them, the SEEA Central Framework (SEEA CF) was adopted by the United Nations Statistical Commission as the first international standard for environmental economic accounting in 2012. SEEA CF focuses on “environmental assets”, such as water resources, energy resources, forests, fisheries, etc., their use in the economy and their return to the environment in the form of waste, emissions and water.

Environmental accounting was born with the aim of achieving sustainable development, by maintaining a favorable relationship with the community and pursuing effective environmental conservation activities (Japan Council of Corporate Accountants, 2000). According to this council, accounting procedures enable an organization to determine the costs of environmental protection in the normal course of business, determine the benefits obtained from such activities, provide the best possible quantitative means of measurement, and support the reporting of its results. Here, environmental protection is defined as the prevention, reduction of impacts affecting the environment, elimination of such impacts, recovery after disasters and other activities. Environmental impacts are the burdens on the environment from business or other human activities and potential obstacles that may hinder the preservation of a favorable environment.

According to the International Federation of Accountants IFAC (2005)<sup>[27]</sup>, environmental accounting is a broad term used in a number of different contexts, including:

Evaluation and disclosure of environmental financial information in accounting and financial reporting; evaluation and use of physical and monetary environmental information in the context of environmental management accounting (EMA); estimation of external environmental impacts and costs (environmental costs), commonly known as full cost accounting (FCA); accounting for natural resource stocks and flows in both physical and monetary terms, that is, natural resource accounting (NRA); compilation and reporting of organization-level accounting, natural resource accounting information and other information for accounting purposes; consideration of material and monetary information related to the environment within the broader context of sustainability accounting.

According to the UK Environment Agency (2006), environmental accounting is the collection, analysis and interpretation of data, financial and environmental performance obtained from business management and financial accounting systems. Environmental accounting is the combination of environmental costs and information on various accounting methods (Graff, Reiskin, White, & Bidwell, 1998). Daferighe (2010) stated that environmental accounting involves the identification, aggregation, analysis, use and reporting of environmental liabilities and financial documents. Environmental accounting can be used in any industry, regardless of the size of the company, small or large. According to the US EPA (1995), environmental

accounting is defined as the identification and measurement of the costs of environmental materials, activities and the use of information for environmental management decisions. The aim is to recognise and seek to minimise the negative environmental impacts of activities and systems. Environmental accounting makes the problems, if any, visible to the organisation and to society. It enables the organisation to set its environmental performance targets and to orient them accordingly.

Environmental accounting also enables an organization to identify environmental issues within the organization, by providing an accurate and detailed picture of environmental concerns. Environmental accounting is a general term used, to integrate environmental issues at the macro or micro level. Mohamed (2002) states that environmental accounting at the micro level means the entire field of accounting for the environment which includes financial accounting, reporting and auditing and environmental management accounting. Kayode (2011) states that environmental accounting is the reporting by the directors of an organization, attempting to quantify the costs and benefits of the organization’s activities in relation to the environment. He further explains that environmental accounting is not just about calculating environmental costs and benefits. It is taking into account any costs and benefits arising from changes to a company’s products or processes, where the change also involves a change in environmental impacts.

Environmental accounting can be traced back to the “Rig Veda”, according to Hindu Philosophy. The Rig Veda states that the environment should be treated like a child. Companies can be the pacemakers of green design, by implementing green reporting in their companies and also encouraging other companies to do so, for environmental sustainability. By implementing green accounting at all levels of the organization, advanced environmental responsibility can be achieved. The benefits of green reporting are acknowledged to be the tendency to regulate and create receptivity, regarding environmental related costs. Hence, it helps in identifying methods to reduce and eliminate those costs.

According to general definitions, environmental accounting is the measurement of sustainability along with human development, that is, economic, social and environmental. Therefore, environmental development can be measured in the following three aspects: Economic impact can be the impact on local people's jobs and livelihoods; social impact can include changes in the terms and conditions of work of employees or projects in the community; environmental impact can include the quality of wastewater discharged into the environment or greenhouse gas emissions, from industrial activities.

Currently, environmental accounting is still a voluntary activity. However, companies are increasingly concerned with aspects of social development and environmental impact.

The necessity of environmental accounting for businesses

Environmental accounting provides a useful tool: To identify, assess and manage social and environmental risks, by identifying resource efficiencies and cost savings, linking improvements in social and environmental issues to financial opportunities. It also enables, compares and evaluates performance and identifies best practice.

Environmental accounting helps avoid greenwashing: Greenwashing is a term used to describe a situation where

an organization spends more time and money advertising itself as being environmentally friendly than it actually does, in order to minimize its environmental impact and deceive consumers. Organizations can use a number of tactics to deceive or convince the public that their products, goals, and policies are designed to promote a sustainable environment and society. Sustainability accounting has emerged to reduce greenwashing. Sustainability accounting ensures that organizations will actually take the environmental actions they claim to take. Sustainability accounting provides an opportunity for organizations to report the exact steps or actions they are taking or have taken to promote the environment.

Organizations committed to environmental development look beyond immediate profits to achieve profitability and value. This can be achieved over many years and in ways that are linked to environmental and social issues. In some studies, to identify direct and indirect costs. Environmental accounts can be used to: Collect information about the environment and its implications for the financial benefits of the business; show how external environmental and social costs can be reduced over time with a commitment to sustainability; highlight social and environmental risks associated with current financial performance and aid risk management; identify which stakeholder relationships have sustainability risks and benefits.

Encourage partnerships between relevant organizations

**Industry pressure:** Another driving force for sustainability accounting is industry pressure. There is a global shift towards sustainability, in almost every industry. Some industries have started to incorporate sustainability considerations into their practices. This is driven by the vision of business leaders and consumer awareness. Consumer awareness of sustainability is increasing, and they are more likely to favor companies and businesses that are environmentally conscious. Therefore, businesses today tend to communicate and compete, by promoting sustainability.

**Legislative pressure:** Another driver for sustainability accounting is legislative pressure. Legislative pressure occurs when laws are passed that require organizations to comply with certain sustainability reporting and disclosure requirements (Guia Arraiano *et al.*, 2017). In some countries, sustainability reporting is supported by law, through the Securities and Exchange Commission in the United Kingdom, the United States, China, and India. In other countries, sustainability reporting is not supported by law, as it is difficult to legislate what sustainability information is decisionally useful to investors at each point in time, as the usefulness of sustainability information is time-dependent. For example, environmental disclosure may become highly decisionally useful during the climate crisis and less useful in a stable climate. Therefore, imposing laws on sustainability reporting may result in the disclosure of information that investors do not find useful.

**Stakeholder pressure and gaining legitimacy:** Another driver for sustainability accounting is stakeholder pressure and legitimacy. Environmentally conscious stakeholders can exert pressure on organisations to move from traditional accounting to sustainability accounting. Moving from traditional accounting to sustainability accounting will help organisations reassert their legitimacy in the eyes of the environment and society. It will ensure that sustainability accounting takes into account economic, social and environmental considerations.

Therefore, if we want to calculate the real costs in the process of calculating national income and measuring the development of a country, we cannot ignore the environmental costs. Although these costs may not be directly related to monetary costs, they affect the development of that country, so they must be accounted for and considered.

### 3. Tools of environmental accounting – Environmental costs

Environmental costs are the costs that organizations incur to prevent, control, and report environmental impacts. The US EPA (1995) identifies five levels of environmental costs, namely: Normal costs; hidden costs; contingency costs; image costs, and social costs. These costs are divided into two: Business costs and social costs. Business costs are paid by businesses; while social costs are borne by society.

**Ordinary costs:** Are the capital costs of equipment, raw materials, and supplies. The costs of using raw materials, utilities, capital goods, and supplies, which are often addressed in cost accounting and capital budgeting, are not usually considered environmental costs. However, reduced use and less waste of raw materials, utilities, capital goods, and supplies are more environmentally friendly, reducing both environmental degradation and natural resource consumption.

**Hidden costs:** Are costs that are easily overlooked when allocating environmental costs. There are several types of environmental costs that can be hidden from managers: The first are upfront environmental costs, which are incurred before a process, system or facility is put into operation. These can include costs associated with designing appropriate products or processes to avoid environmental impacts, qualification of suppliers, evaluation of alternative pollution control equipment, etc. Whether classified as overhead or separate costs, these costs can be easily overlooked when managers and analysts focus on the operating costs of processes, systems and facilities.

**Contingency costs:** Are environmental costs that are not certain to occur in the future, but depend on events that may occur in the future. They are a cost that may or may not occur at some point in the future.

**Image costs:** These are less visible costs, as they are incurred to influence the subjective perceptions of management, customers, employees, communities and regulators. This category may include costs of community engagement activities, annual environmental reporting and costs voluntarily spent on environmental activities (KASNEB, 2014).

**Social costs:** Are the costs that a business pays to people who suffer from the negative environmental impacts of its business. For example, damage to a river from the discharge of polluted wastewater; or to ecosystems from solid waste disposal; or to asthma. Because emissions of air pollutants are all examples of external costs, which an industry often cannot compensate for (Uwaloma, 2011).

**Non-financial indicators:** According to Karambu and Joseph (2016), non-financial information is information related to environmental objectives, management, policies and other forms that can broadcast environmental performance in non-financial information. The disclosure requirements under the Global Reporting Initiative on non-financial information, related to environmental objectives are:

**Compliance:** The monetary value of significant fines and the total number of non-monetary sanctions, for non-compliance with environmental laws and regulations.

**Environmental performance indicators (water, air, land):** These indicators, published by the Global Reporting Initiative and other organizations. The disclosure requirements under the Global Reporting Initiative, included in the environmental performance indicators are:

**Water:** Water resources significantly affected by withdrawals; percentage and total volume of water recycled and reused.

**Biodiversity:** Location and extent of land owned, leased, managed or adjacent to protected areas and areas of relatively high biological value outside protected areas. Description of significant impacts of activities, products and services on biodiversity within protected areas and areas of relatively high biological value outside protected areas; areas of habitat protected or restored; strategies, current actions and future plans to manage impacts on biodiversity; number of IUCN Red List and national conservation list species with habitats in areas affected by activities, by level of extinction risk.

**Emissions, effluents and waste:** Total direct and indirect greenhouse gas emissions by weight; other related indirect greenhouse gas emissions by weight; GHG emission reduction initiatives and reductions achieved; emissions of ozone depleting substances by weight; NO, SO and other significant emissions by type and weight; total weight of waste by type and method of disposal; total number and volume of significant spills; weight of transported, imported, exported or treated waste considered hazardous, under the provisions of the Basel Convention, Annexes I, II, III, VIII and concentrations of transported waste, transported internationally; identity, size, protected status and biodiversity values of waters and associated habitats significantly affected, by the reporting organisation's discharges and flows (Karambu & Joseph (2016).

**Products and services:** Initiatives to reduce the environmental impact of products and services and the extent to which they are reduced; Percentage of products sold and their packaging materials, recovered by category.

**Materials:** Percentage of materials used that are recycled input materials.

**Energy:** Direct energy consumption by primary energy sources; indirect energy consumption by primary sources; energy saved through efficiency and conservation improvements, initiatives to provide renewable energy-based or energy-efficient products and services and reductions in energy requirements resulting from these initiatives; initiatives to reduce indirect energy consumption and reductions achieved.

#### 4. Environmental accounting and the value of the enterprise

##### *Environmental financial indicators and corporate value*

Charles, John and Umeoduagu (2017) examined environmental accounting disclosures, in relation to financial performance (ROE, ROCE, NPM) of food and beverage companies in Nigeria. The results showed that there was a significant correlation between environmental accounting disclosures and return on equity of the selected companies. Based on the results, the study suggests that, companies should adopt uniform reporting and disclosure standards on environmental practices. This, will enhance

performance monitoring and measurement. The study also advocates that, companies (especially small and medium sized companies), should be encouraged to report their environmental activities in their annual reports, to enhance their competitiveness. This, in turn, leads to higher corporate performance.

Mohammad, Fakhrol and Rezaur (2016) assessed the relationship between corporate profitability and the clarity of environmental accounting reporting, in the annual reports of the companies. For this study, the environmental accounting reporting index (EARDI) was developed which covers 21 major environmental accounting reports. Return on assets (ROA) was used, which indicates the profitability of the company. To obtain the EARDI score, content analysis is being used and statistical techniques such as frequency, mean, standard deviation, to obtain the research results. Arong, Ezugwu and Egber, (2014) determined, the impact of environmental cost management on the profitability of the petroleum industry in Nigeria, from 2004 to 2013. The data was obtained and analyzed using multiple regression techniques. The results showed that there is a significant relationship between environmental cost management and profitability of the oil and gas industry in Nigeria. It was also found that there are established standards in Nigeria that guide environmental cost management in the oil and gas sector in Nigeria.

Makori and Jagongo (2013) analyzed, whether there is any significant relationship between environmental accounting and profitability of selected listed companies in India? Using multiple regression analysis, they found that, there is a significant negative association between environmental accounting and return on equity (ROCE) and earnings per share (EPS). Daniel and Ambrose (2013) determined, whether there is any significant relationship between environmental accounting and profitability of quoted Indian companies? The data for the study was collected through annual reports and accounts of 14 randomly selected quoted companies at the Bom Bay Stock Exchange in India. The data was analyzed, using multiple regression models. The results indicate that there is a significant negative correlation between environmental accounting and return on capital employed (ROCE), earnings per share (EPS) and a significant positive correlation between environmental accounting and net profit margin and dividend per share. The study suggests that the Government should allow tax credits for organizations that comply with its environmental laws and that environmental reuse should be made mandatory in India, to improve the performance of organizations and the nation as a whole.

Non-financial environmental indicators and corporate value  
Karambu and Joseph (2016) assessed the impact of corporate environmental disclosure on the financial performance of listed companies on the Nairobi Stock Exchange, Kenya. Content analysis of sampled listed companies' annual reports was conducted to examine environmental disclosure practices. A causal research design was used to determine the cause-effect relationship between corporate environmental accounting reporting and financial performance. A linear regression model was used to determine the causal relationship between environmental disclosure and financial performance. The overall model was found to be significant. Firm size and leverage did not influence environmental accounting reporting. The results showed that environmental disclosure has a significant

positive impact on average financial performance. The study suggests that firms should engage in environmental disclosure as it leads to increased financial performance.

Oraka and Egbunike (2016) examined the impact of environmental disclosure theme on total asset turnover, cash flow ratio, current ratio, return on equity and return on assets of Nigerian consumer goods manufacturing firms. A descriptive research design was adopted. The study found that, there was a significant difference in the environmental disclosure theme of consumer goods manufacturing firms. In addition, there was a significant effect of environmental disclosure on total asset turnover and return on equity. However, no significant impact was found, on cash flow ratio, current ratio and return on assets of manufacturing firms. The study found that, a detailed, well-spelled and evidenced environmental disclosure theme must be established, to provide a solid foundation for corporate social and environmental disclosure among firms. In addition, there is a need for standard setting bodies, to establish guidelines or principles or other accounting standards, to improve financial and non-financial disclosures of companies in Nigeria. Ndukwe and John (2015) identified, the determinants of environmental disclosure on performance in 15 Nigerian oil and gas companies. The performance indicators were firm size, profitability, leverage and type of audit firm on environmental disclosure. A cross-sectional research design was used, to conduct the study spanning 2008 – 2013, while binary regression was used as the data analysis method. The results showed that, there is a significant correlation between firm size and environmental disclosures. In addition, there is no significant correlation between profitability and corporate social responsibility that is certain. Furthermore, there is no significant correlation between leverage and corporate environmental disclosures. Finally, there was no significant relationship between the type of audit firm and corporate environmental disclosure. The study concluded that, the voluntary stance of environmental reporting is often used as a cliché, for companies to under-report their impact on the environment and this is responsible for the negligence of some corporate entities, regarding corporate social and environmental reporting. The study found that, incentives are given to promote disclosure. There was no evidence of diagnostic testing in the study of Ndukwe and John (2015) which is not appropriate, as there may be multivariate problems in the data.

Hughes, Anderson, and Golden (2001) determined the environmental accounting disclosures made by US manufacturing companies in 1992–1993, using the modified Wiseman Index, which measures disclosures in the presidential letters, MD&A, and annual notes and CEP rankings, to represent environmental performance. It was found that companies rated as poor by CEP often disclosed the most. The recommendation from the study may not be valid, as in 2001, because the research variables and data are from 1992 and 1993. The study period is far from the period in which the study was conducted. Therefore, Hughes, Anderson, and Golden (2001) may have extended the period to 1999 or 2000.

Environmental performance indicators and corporate value  
Musa, Peter and Bukar (2015) analyzed the environmental accounting reporting practices of Nigerian companies, cited and examined how it varied from company to company, as there were no mandatory disclosure guidelines. A sample of

8 companies, selected from 19 consumer goods companies on the Nigerian stock exchange. Content analysis was used to obtain data from the annual reports published in 2013 of the selected companies. The data collected was analyzed using one-way analysis of variance, to test the hypotheses. It was found that, accounting standards do not significantly influence environmental accounting reporting, the absence of standards leads to lack of uniformity in disclosure and variations were obtained in the hypothesis testing. It has been argued that, given the pressures on companies to disclose all information about their operations, it would be appropriate for international accounting standard-setting bodies to set a uniform standard for how companies should disclose their environmental accounting information.

Akinlo and Iredele (2014) determined the impact of environmental disclosure on the market value of 50 quoted companies in Nigeria, spanning from 2003 – 2011. The aggregate and individual impacts of environmental disclosure by company E (CED) were regressed to market value (Tobin's Q). While, firm size was treated as an irrelevant variable. The results indicated that, CED had a significant positive impact on market value when considered in aggregate. In turn, considering the impact of each variable: Energy Policy (ENP) Impact on Biodiversity (BIO); Awards received for installing environmental management systems (AWR) had an insignificant positive impact on market value, except for Environmental Research and Development Costs (ERD). In addition, Environmental Pollution and Control Policy (EPC); Waste Management Costs (WSM) and Compliance with Environmental Laws (CEL) have a negative impact on market value. The study suggests that firms should invest in areas where environmental activities negatively impact firm value and also in areas where they enhance firm value.

Toukabri and Faouzi (2014) evaluated the impact of corporate environmental disclosure, on the cost of equity, for a sample of Tunisian firms, over the period 2003 – 2011. Using a dividend-increment approach, to estimate the cost of equity of the firms. It was found that firms with better environmental disclosure scores exhibited cheaper equity financing. In particular, the findings suggest that investing in corporate environmental disclosure practices, contributed significantly to reducing the cost of equity of the firms. Toukabri and Faouzi (2014) may have extended the time period to 2012 or 2013, since the study was conducted in 2014.

## **5. Environmental accounting and the role of environmental accounting in enterprises**

Environmental accounting (environmental accounting) can be understood as a part of business accounting (enterprise), with the task of collecting, processing, analyzing and providing information on the economy and environment of the enterprise (enterprise) to serve the purpose of making business decisions. Environmental financial accounting provides information and financial reports on transactions and events related to the environment of the enterprise that have an impact or are likely to impact the operating results of that enterprise; the users of the report are subjects outside the enterprise.

In relation to the perspective of business management accounting, in 1998, the International Federation of Accountants (IFAC) introduced the concept of environmental management accounting as: "The effective

management of economic performance and environmental performance through the process of implementing and developing appropriate accounting systems and methods related to the environment. This process may include reporting and auditing activities at some units. Environmental management accounting is often associated with product life cycle cost assessment, accounting for determining product manufacturing costs, determining profits and strategic planning for environmental management”.

In 2001, the United Nations Sustainable Development Committee (UNSD) emphasized the role of environmental management accounting in providing information for internal business decision-making. Therefore, UNSD defined environmental management accounting as the work of identifying, collecting, analyzing and using two types of information for internal decision-making, including: (1) Mechanical information (non-monetary) on the use, circulation and disposal of energy, water and raw materials (including waste), (2) Monetary information on costs, income and savings related to the environment. This concept has been recognized by more than 30 countries and was used by the International Federation of Accountants (IFAC) in its Environmental Management Accounting guidelines in 2005.

Thus, environmental accounting is a part of accounting in enterprises, related to information on environmental activities within the enterprise to collect, process, analyze and provide information on the environment for internal and external users to make decisions. Furthermore, environmental accounting aims to achieve sustainable development, maintain good relations with the community, improve the effectiveness of environmental protection activities. Environmental accounting methods allow enterprises to identify environmental costs, identify income and expenses and provide the most appropriate ways to measure indicators (monetary and physical) and support environmental performance reports.

Environmental income is the result obtained from the implementation of environmental activities in the enterprise, such as: income from subsidizing the consumption of products from environmental protection activities, income from transferring emission reduction certificates (CERs), income from selling scrap and waste products with usable value created from production and business activities. Information related to environmental income from recycling waste into useful products, improving environmental quality will help investors and stakeholders have an overview and evaluate the social responsibility of an enterprise.

There are many types of environmental costs with different characteristics. Enterprises can apply popular methods in the world such as: Material flow cost accounting (MFCA) method, activity-based environmental cost determination method (ABC). According to IFAC, environmental costs are divided into the following 6 types: Material costs included in product output; Material costs not included in product output; Waste and emission treatment and control costs; Pollution prevention costs and other environmental management costs; Research and development costs; Environmental costs with little tangible existence.

An enterprise is an economic organization with its own name, assets, and a stable transaction office, registered for business in accordance with the provisions of law to carry out business activities. According to the 2005 Enterprise

Law, business is the continuous implementation of one, several, or all stages of the investment process, from production to consumption of products or provision of services on the market for the purpose of making a profit. Thus, an enterprise is a for-profit economic organization, although in reality some business organizations have activities that are not entirely aimed at profit. For each different type of enterprise, the organization of the accounting apparatus plays a decisive role in the effectiveness and quality of accounting work at each unit. Therefore, building a compact, scientific, reasonable, highly effective accounting organization model that is suitable for each enterprise is extremely important.

In the context of Vietnam promoting the transformation of the growth model, aiming at developing a green economy, the application of environmental accounting in enterprises is very necessary, playing an important role in the sustainable development of enterprises in particular and the economy in general. Currently, most enterprises in Vietnam have been implementing environmental accounting. Research on transfer, application of science and technology in the rational use of resources, environmental protection, sustainable development and considering environmental accounting as an inseparable part of the accounting system. Quantitative information in environmental accounting is presented relatively fully. However, we do not have a specific, effective tool in environmental accounting. It is very difficult to do environmental accounting while not yet building a national environmental data bank as a basis for accounting. These enterprises also do not have detailed tracking books or make estimates.

In addition, we do not have guidelines for implementing environmental accounting and environmental accounting standards, which makes environmental information lacking in completeness and transparency. The current method of implementing environmental accounting is mainly based on environmental legal documents and traditional accounting regulations, so the recording, measurement and provision of environmental information by these enterprises is not accurate and complete. In addition, most enterprises do not have proper attention to environmental accounting information and environmental non-financial information (environmental policies, commitments to comply with environmental regulations, environmental goals), environmental physical information (waste volume, material flow, etc.). This leads to limited identification and analysis of environmental performance indicators due to the lack of linkage between environmental physical information and environmental monetary information, so businesses cannot properly assess ecological and economic performance (according to Le Thi Tam (2017) <sup>[24]</sup>, Nguyen Thi Nga (2017) <sup>[23]</sup>, environmental cost reports have not been prepared at manufacturing enterprises in Vietnam).

The implementation of environmental accounting in enterprises today is mainly based on compliance with environmental regulations, not on proactiveness, exploration, and creativity in solutions for effective and practical implementation of environmental accounting. Therefore, environmental reports and information provided to the outside are not presented in a focused manner, lacking accuracy, causing difficulties for information users.

Environmental accounting is a field that has been of interest and research in the world for many decades. Environmental accounting is a bridge between business - society and

sustainable development by recording, processing and providing environmental information to relevant subjects, increasing awareness and reducing negative impacts on the environment. In the world, many documents on different aspects in the process of processing information to providing information on environmental accounting have been published. However, in Vietnam, environmental accounting is still a fairly new topic and research works are limited. Some previous studies in Vietnam have not covered all aspects of information processing, mentioning environmental accounting mainly from the perspective of environmental cost management without assessing the factors affecting the implementation of environmental accounting as well as not showing a comprehensive and focused environmental accounting framework.

The role of environmental accounting

Researching, applying and perfecting environmental accounting in enterprises brings the following benefits:

One is to contribute to saving and reducing general costs for the entire enterprise.

One of the functions of environmental accounting is to identify, manage, research and reduce environmental costs in the enterprise. For example, environmental accounting conducts research to find alternative materials that are environmentally friendly and cost-effective; researches waste treatment systems, finds sources of recycling, and ensures efficiency in the overall operations of the enterprise. In fact, when enterprises accept to spend research costs to combine production with sustainable development with the environment, they can create greater values in the future.

Second, enhance the competitive advantage of the business.

For businesses that are at the forefront of strategy and trading in products associated with environmental protection, it always makes a big difference in consumer awareness, especially in the context of increasing environmental pollution and every global citizen is aware of the responsibility to protect the environment. Thus, practicing environmental accounting helps businesses build their image and reputation with customers and the market, thereby enhancing their competitive advantage.

Third, strengthen and satisfy relationships.

State agencies and environmental organizations are always concerned with economic development combined with environmental protection. Enterprises that fulfill their responsibilities to the community, society and environment will receive much support and incentives from state agencies and environmental organizations.

### **Challenges in implementing environmental accounting**

In reality, the implementation of environmental accounting practice programs in enterprises, in some aspects, if ineffective, will affect the interests of stakeholders as well as the management solutions of business administrators. In other words, these issues are related to both financial accounting and environmental management accounting, because environmental financial accounting mainly serves to provide information to external parties, associated with the interests of many stakeholders; while environmental management accounting focuses on providing information to support decision making by administrators. The basic challenges associated with environmental accounting information include:

Uncertainty about the appropriateness of cost measurement solutions, coefficients, and environmental indicators.

The availability of environmental accounting information for decision making is limited.

The information disclosed and the environmental accounting solutions may be distorted and misrepresented. For example, the enterprise, in addition to having the sole discretion to decide whether to measure and provide information (in the absence of specific legal regulations), will have the ability to choose the assessment method and model, and may influence the published results. Similarly, environmental performance may be encouraged to be under-rated when the enterprise is concerned about an adverse stock market reaction.

Environmental management accounting practices increase operating costs, affecting the economic benefits of the business.

If the environmental cost management information system is ineffective and lacks uniformity, it will lead to errors in collecting and analyzing information on environmental costs.

From the above analysis, it can be seen that, in order to overcome the problems in environmental accounting practices, enterprises need to innovate or upgrade the technological infrastructure to control costs and operations in the context of digital transformation and application of the industrial revolution (digital transformation). Thereby, the process of collecting and providing information on environmental management accounting will be more effective and reliable.

### **Promoting the application of Digital Transformation in environmental accounting**

One of the challenges that businesses face when implementing environmental management accounting is the timeliness, completeness and quality of accounting information. On the other hand, information on environmental issues can be "manipulated" due to the pressure of economic interests of businesses. Therefore, researching and investing in information infrastructure systems to serve digital transformation in businesses will support improving the quality of environmental management accounting (Roger Burritt and Katherine Christ, 2016)<sup>[18]</sup>. In addition, building a strategic vision for developing information systems in businesses associated with digital transformation combined with environmental management accounting systems is a step to help businesses save investment costs for digital transformation.

Many research projects around the world have been proposed and implemented with the aim of establishing a digital transformation program and applying digital transformation in enterprises, thereby creating more favorable conditions for environmental management accounting to provide more accurate information in real time to relevant subjects (including business administrators and external subjects such as investors, management agencies, etc.).

Digital transformation can be used to improve environmental management accounting initiatives in a number of ways:

Multidimensional information systems enable previously unobtainable data to be rendered: Digital transformation applications enable the visualization of invisible and poor-quality data on environmental impact and operating costs as the basis for decisions made automatically on smart machines.



Improve data quality through greater accuracy and detail for environmental, efficiency, data assurance, and other decision-making purposes.

Improved data transfer for control functions: Data to support transfers between different departments or between parties in the supply chain will be available from networked digital information and communications technology infrastructure investments.

Common set of data mining and filtering conditions for all types of decisions, governance objects and all objects of control: When applying digital transformation, human decision making will be informed by a common database that is accessible to all relevant groups, especially cross-industry strategic groups. If the digital connectivity provided by the Internet of Things is combined with environmental managers and Virtual Reality Systems, internal environmental lawyers and accountants will have access to shared data on the environmental aspects of business operations. From there, there are many opportunities for groups to work together to use real-time environmental management accounting data and, at the same time, make decisions on a collaborative basis for environmentally effective actions.

- Take advantage of existing production facilities and information infrastructure to limit investment costs: The quality of accounting data for managers can be improved in the existing advanced but digitized production environment, leading to improved productivity and work efficiency.

## 6. References

1. Alkisher A. Factor affecting environmental management accounting adoption in oil and manufacturing firm in Libya, Thesis of doctor Utara Malaysia University, 2013.
2. Burritt RL, Hahn T, Schaltegger S. Towards a comprehensive framework for environmental management accounting e links between business actors and environmental management accounting tools, *Aust. Accounting Rev.* 2002; 12(27).
3. Chang H, Deegan C. Exploring factors influencing environmental Management Accounting adoption at RMIT University, Sixth Asia Pacific Interdisciplinary Research in Accounting (APIRA) conference, Sydney, Australia, 2010.
4. Christ KL, Burritt RL. Environmental management accounting: the significance of contingency variables for adoption. *Journal of Cleaner Production.* 2013; 41(0):163-173.
5. Deegan C. The accountant will have a central role in saving the planet really? A reflection on 'green accounting and green eyeshades twenty years later. *Critical Perspectives on Accounting.* 2013; 24(6):448-458. Doi: <http://dx.doi.org/10.1016/j.cpa.2013.04.004>.
6. Jamil CZM, Mohamed R, Muhammad F, Ali A. Environmental management accounting practices in small medium manufacturing firms. *Procedia-Social and Behavioral Sciences.* 2015; 172:619-626.
7. Ferreira A, Moulang C, Hendro B. Environmental management accounting and innovation: An exploratory analysis. *Accounting, Auditing & Accountability Journal.* 2010; 23(7):920-948.
8. Gadenne DL, Kennedy J, McKeiver C. An Empirical Study of Environmental Awareness and Practices in SMEs. *Journal of Business Ethics.* 2009; 84(1):45-63.
9. Gauthier Y, Leblanc M, Farley L, Martel L. *Introductory Guide to Environmental Accounting*, KPMG, Montreal, 1997.
10. Hair JF, Anderson RE, Tatham RL, Black WC. *Multivariate data analysis (5th ed.)*, Englewood Cliffs, NJ: Pren-tice-Hall International, Inc, 1998.
11. Nurul Huda Y. Determinants of environmental reporting in Malaysia for industrial product sector, Doctoral thesis, Universiti Utara Malaysia, 2015.
12. Ofoegbu GN, Megbuluba A. Corporate environmental accounting information disclosure in the Nigerian manufacturing firms. *International Journal of Management Sciences and Business Research.* 2016; 5(12):208-220.
13. Sumiani Y, Haslinda Y, Lehman G. Environmental reporting in a developing country: A case study on status and implementation in Malaysia. *Journal of Cleaner Production.* 2007; 15(10):895-901. Doi: <http://dx.doi.org/10.1016/j.jclepro.2006.01.012>.
14. Hung Yen Provincial People's Committee. Decision No. 28/2017/QD-UBND, dated December 5, 2017, promulgating regulations on environmental protection of Hung Yen province, 2017.
15. Vuong QH, Nguyen MH. Better Economics for the Earth: A Lesson from Quantum and Information Theories. *AISDL*, 2024.
16. Wachira MM. Factors applying the adoption of environmental management accounting practices among firms in Nairobi, Kenya, Masters Thesis, University of Nairobi, 2014. Retrieved from: <https://su-plus.strathmore.edu/handle/11071/4270>.
17. Bui To Quyen. Environmental accounting and practical experience from some corporations in the world, 2019. [https://mof.gov.vn/webcenter/portal/ttp/tpc/pages\\_r/l/chitiet-tin-ttp/tpc?dDocName=MOFUCM236681](https://mof.gov.vn/webcenter/portal/ttp/tpc/pages_r/l/chitiet-tin-ttp/tpc?dDocName=MOFUCM236681);
18. Roger Burritt and Katherine Christ. Industry 4.0 and environmental accounting: A new revolution? *Asian Journal of Sustainability and Social Responsibility.* 2016; 1(1):23-38.
19. Burritt RL, Hahn T, Schaltegger S. Towards a comprehensive framework for environmental management accounting-Links between business actors and environmental management accounting tools, *Aust Account Rev.* 2002; 12(27):39-50.
20. Deloitte. Industry 4.0. Challenges and solutions for the digital transformation and use of exponential technologies, 2015.
21. PwC. Industry 4.0, 2016. <http://www.pwc.com/gx/en/industries/industry-4.0.html> Accessed 21 July 2016.
22. Pham Hoai Nam. Perfecting the organization of environmental accounting work in manufacturing enterprises. Research on transferring and applying science and technology in rational use of resources, environmental protection and sustainable development 430 in Quang Ngai province. Doctoral thesis in economics, Academy of Finance, 2016.
23. Nguyen Thi Nga. Environmental cost management accounting in steel manufacturing enterprises in Vietnam. Doctoral thesis in economics, National Economics University, 2017.
24. Le Thi Tam. Research on environmental cost management accounting in brick manufacturing

- enterprises in Vietnam. Doctoral thesis in economics, National Economics University, Hanoi, 2017.
25. Nguyen Thi Kim Tuyen. Environmental accounting at mineral exploitation enterprises in Binh Dinh province. PhD thesis in economics, Academy of Finance, Hanoi, 2020.
  26. Gauthier Y, Leblanc M, Farley L, Martel L. Introductory guide to environmental accounting. KPMG, Montreal, 1997.
  27. IFAC. International Guidance Document: Environmental management accounting. New York, USA, 2005.
  28. Science of the Total Environment 473 - 474. Environmental reporting and accounting in Australia: Progress, prospects and research priorities. Australian National University, 2014.
  29. SEEA. United Nations, the European Commission, the Food and Agriculture Organization of the United Nations, the Organization for Economic Co-operation and Development. International Monetary Fund, the World Bank Group, 2012.