



## **Overview of Ecological Accounting with Particular Reference to Internal Ecological Accounting**

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### **ABSTRACT**

This paper examined ecological accounting as a branch of environmental accounting. It looks at the definitions of environmental accounting. It also explains the components of environmental accounting i.e. conventional and ecological accounting. An overview of ecological accounting was carried out with particular reference to internal ecological accounting. Research progress of ecological accounting in major countries was undertaken in this work. It was observed that why Western Countries have conducted extensive theoretical research on ecological accounting and some specific theories have risen to the level of practical guidance. Developing countries like Nigeria, Ghana, China among others are still in the embryonic stage of research hence they have to rely on the ideas and experience of developed countries.

**Keywords:** Ecological Accounting, Environmental Accounting, Internal Ecological Accounting

### **INTRODUCTION**

Chatfield (1974) stated that accounting mainly refers to a period of commercial development and is closely related to economic development. According to Schaltegger, Benneth and Burritt (2006), developing along with social progress, accounting plays an important role that should not be underestimated. Like other disciplines, accounting must be combined with related subjects and evolve toward becoming an interdisciplinary science in order to meet the needs of social development. Alver and Alver (2009), opined that under the economic and social forms of self-sufficiency, as well as under the conditions of a simple commodity exchange barter, accounting records the production, consumption and resulting balance of goods and is an important part of economic management.

Reyes (1995), stated that accounting provides important information for internal and external stakeholders in an economic system. As the allocation of social resources improves and a market economy emerges, the available accounting content continues to expand, and the importance of the role of accounting also continues to expand. Crises in capitalist economic systems were the impetus for the development of social accounting starting on an historical stage. According to Jain, Sen, Khan and Bala (2007), the rising status of social accounting is inevitable, and social accounting has gradually become understood and accepted by theoretical accountants. Subsequently, after hundreds of years of the development of a capitalist market economy, some business enterprises have come to regard the pursuit of profit as the only guide to their decision making, ignoring the public interest, including factors such as consumer interest and ecological and environmental pollution. Thus, social responsibility accounting has emerged in order to prevent, eliminate and compensate for these risks.

Lone, Nyborg and Aaheim (1993), opined that some developed countries, such as the United States, Germany and the United Kingdom, set off a wave of research on social responsibility accounting. Due to the worldwide acceptance of sustainable development strategy, many accounting scholars and experts have begun to think about the relationship between resources and accounting. Resource accounting has

absorbed the principles and method of resource economics, ecological economics, sustainable development economics and other disciplines.

According to Uno and Bartelmus (1998), at present, resource accounting has gradually subdivided into new branches, such as forest resource accounting and marine accounting. Since the late 1980s, population, resources, environment and development have become four major problems faced by the international community. In order to meet the urgent and important needs of accounting in the economic society, the accounting of the economic activities of enterprises has extended its focus to the environment systems associated with enterprises to form a new branch called environmental accounting. Environmental accounting identifies and measures environmental costs, environmental liability and environmental benefits.

Common and Norton (1994), stated that after decades of development, environmental accounting has become divided into environmental financial accounting and environmental management accounting. Its theoretical research has been applied in practice to promote the sustainable development of enterprise. With the unrestrained exploitation and utilization of natural resources by humans, natural resources, the environment and ecosystem have been severely affected. Environmental accounting has being unable to fully measure the outside impact of human activity, thus some scholars have put forward the concept of ecological accounting.

Lei, Zhou and Wang (2014) stated that ecological accounting is not a new concept, and it developed slowly over nearly ten years. However, it is a new field and discipline. Social accounting and social responsibility accounting, resource accounting and environment accounting have an inherent relationship with ecological accounting. Relatively speaking, the perspective of ecological accounting is more open; it is not limited to environmental pollution, and it considers the collective relationship among resources, environment and economic performance. Although the development and application of accounting among commercial enterprises still has many shortcomings and deficiencies, the related principles and methods form important theoretical support for ecological accounting.

### **Objectives of the Paper**

The objectives of this study are:

- i. to examine ecological accounting with particular reference to internal ecological accounting
- ii. to assess research progress of ecological accounting in some major countries.

## **LITERATURE REVIEW**

### **Meaning of Environmental Accounting**

Uno and Bartelmus (1998) stated that environmental accounting identifies and measures environment costs, environmental liability and environmental benefits. In other words, environmental accounting means to identify and measure environmental costs, environmental liabilities and environmental benefits.

The Ministry of Environment, Environmental Accounting Guidance (2002), also defined Environmental Accounting as aims at achieving sustainable development, maintaining a favourable relationship with the community and pursuing effective and efficient environment conservation activities.

It went further to say that the accounting procedures allow a company to identify the cost of environmental conservation during normal course of business, identify benefits gained from such activities, provide the best possible means of quantitative measurement (in monetary value or physical units) and support the communication of its results. Environmental conservation is further defined as the prevention, reduction and avoidance of environmental impact, removal of such impact, restoration following the occurrence of disaster and other activities.

### **Environmental Accounting Framework**

According to Josiah (2017), environmental accounting deals with conventional and ecological accounting. Conventional accounting is further divided into three accounting systems: Management accounting, financial accounting and other accounting.

### **Management Accounting**

Management accounting (also called managerial accounting or cost accounting) is central tool and basis for most internal management decision and it is not usually directly available to external stakeholders.

They deal with how environmental costs are treated and traced, how environmental accountants are responsible.

### **Financial Accounting**

Financial accounting is typically designed to satisfy the information requirements of external stakeholders of firms with respect to financial impacts.

They deal with how environmentally induced outlays are capitalized or expensed. How the standards and guidelines exist concerning disclosure of environmental liabilities and assets are treated. Also, how the environmental assets are measured.

### **Other Accounting**

Other accounting is tax accounting and bank regulatory accounting. Tax accounting is mandatory for all businesses as government tax agencies require tax report. Bank regulatory agencies for example have special accounting and reporting requirement. Each of those accounting systems considers different aspects of how environmental issues influence organizations. They deal with how the effect of subsidies on pollution abatement devices, possibilities and impacts. How the cost for remediation of landfills can be deducted from taxes. The effect of accelerated depreciation and cleaner production technologies and the consequences of various environmental taxes.

### **Ecological Accounting**

This measure the ecological impact a company has on the environment. Its measures are in physical terms (kilograms). Ecological accounting can be divided into three systems:

1. **Internal Ecological Accounting:** This is designed to collect information expressed in terms of physical units, about ecological system for internal used by management. Methods of measuring the impacts of a company's product and process on the natural environment are necessary foundation for good management decision. Various ways of examining pollution discharge and damage to ecological capital have been developed over the past decade. Whether sophisticated or not, internal ecological accounting is necessary for any environmental input system.
2. **External Ecological Accounting:** Here the data for external stakeholders interested in environmental funds, non-governmental organizations (NGO) and pressure groups are collected and disclosed. Over the past ten years, hundreds of firms have public stock-taking of their environmental impacts. Many of these reports are produced annually and contain extensive data on discharge of pollution.
3. **Other Accounting:** Other ecological accounting systems which also measure data in physical unit provide a means for regulators to control compliance with regulations. Also, these accounting system are necessary for computation of environmental taxes such as CO<sub>2</sub>, emission tax, discharge tax. Without information about discharge levels, environmental tax rates cannot be multiplied by the volume of release of pollution to derive a future for total tax drive.  
Apart from tax agencies and environmental agencies which are primarily interested in a specific information on discharge of specific pollutants, an increase number of stakeholders such as Banks and Insurance companies require reliable information on the ecological impact of companies as part of the risk assessment process.

### **Internal Ecological Accounting**

According to Josiah (2017), this system of accounting is designed to provide information for decision made by internal stakeholders, primarily managers. Internal ecological accounting is voluntary and not specifically under taken to satisfy the demand of external stakeholder.

Ideally, internal ecological system should like the conventional management accounting system lay the foundation for external and all other ecological system. It provides therefore the starting point for discussion of ecological accounting system, including those designed for external purpose.

Comprehensive internal ecological accounting provides user information for all managers, regardless of their responsibilities and hierarchical level. Typically, different managers have different perspectives and

place emphasis and different aspect of information. Also, the degree of details required by managers of different level varies; with top management requiring more aggregate information than operations management.

For example, product manager has different information needs from those of site or divisional manager. This is why an internal ecological accounting needs to be able to distinguish between;

1. Site-oriented accounting
2. Product-oriented accounting
3. Business, Company-oriented accounting.

Production managers have to take into account of the contribution made by their own production activities. They will for instance, want to know their share of the environmental interventions released by joint used clean-up facilities.

Sewage plants and numerators usually treat the waste of several production process and products. Therefore, emissions released by these facilities have to be allocated to respective process and product. Production managers have to ask sewage plant manager to promote information on how much their production activities have contributed to the emissions of sewage plant.

Site manager want to be informed about the impact of their plant whereas divisional managers need to know about the environmental interventions of all sites and product of the division for which they are responsible.

Business unit, divisional managers request information at the level of an organization strategist, demand is for environmental information that is strategic and aggregated, rather than operational and disaggregated and depending on the analytical focus, also has a site or product orientation.

The top management and divisional management require an overall picture by using consolidated information about the whole company or division including all sites and products.

### **The Research Progress of Ecological Accounting in Major Countries**

According to Uno and Bartelmus (1998), since the 1990's, a large amount of literature has emerged about "resource accounting" and "environmental accounting." Many enterprises also have participated in the practice of this accounting. Common and Norton (1994), opined that resource and environmental accounting have made significant achievements in the theory and practice. However, many complex problems in areas including resources, the environment and ecological health have emerged that have prompted scholars to widen the study of environmental pollution accounting to the entire ecological field. At present, these studies of ecological accounting are still underway, and no unified viewpoint has yet been formed.

#### **Progress in the United States and Canada**

Birkin and Woodward (1997), stated that the analysis of enterprise environmental problems using the environment cost method is the original concept of ecological accounting. So far, scholars generally have four kinds of understanding about the concept of ecological accounting. Frank Birkin thinks ecological accounting is based on the integration of ecological and economic concepts, measurement methods, and values, providing performance evaluation, control, and information for decision making and reporting purposes, and for taking the meaning of ecological accounting. According to Smith and Lairs (1993), in some literature, ecological accounting reflects the meaning of accounting or ecological statistics. Lei, Zhou and Wang (2014), stated that some scholar regard ecological accounting as an information system that describe, calculates and measure the information related with the ecological environment.

Klopffer (1997), opined that some scholars think that ecological accounting is an alias for life cycle assessment. According to Birkin and Woodward (1997), in addition to the concept of no uniform identification standard, there are also different views about theoretical model study. Birkin proposed a burden-based model and pointed out that most of the assets and economic activities have been included in the "burden-based" relationship and that people measure these basic functions with "load capacity". Also, Birkin and Ranghieri developed an ecological accounting system model called the "Overpass" model, which included conceptual framework and a matrix containing the EU-funded project known as "the

sustainable development of tourism environment protection system.”

Bradley and Jakes (1995), stated that there are many scholars interested in the background. Some economists have expressed a new understanding of the economic system, and they tried to expand their cost basis to include social and environmental costs, as well as the design of monetary and welfare measures. Isenmann and Marx-Gomez (2004), opined that some accountants and scholars have advocated a new idea and application of the enterprise environmental report and environmental management accounting, and have confirmed corporate environmental costs and liabilities in published reports. According to Birkin (2003), ecological accounting is an embryonic development based on ecological philosophy and economic values.

Rees (1992), stated that with the in-depth research of ecological accounting, many scholars have paid more attention to the ecological footprint. Canadian ecological economist Rees first proposed the ecological footprint concept, and his doctoral student M. Wackemagel explained it from different angles. Ewing and Goldfinger (2010), opined that the ecological footprint is a ratio of measuring human use of resources and the influence of this usage on ecosystems. People’s need for natural capital varies with their different levels of societal development, cultural practices, and wealth; thus, it is difficult to calculate an average ecological footprint across the entire human race.

### **Progress in the European Union**

According to Wackemagel, Monfreda and Ebr (2004), wide- ranging research on the environmental and ecological aspects of the EU has been important for many years, including queries about such things as eco-taxes. Adjusting and innovating the existing tax distortions, and introducing eco-taxes, can achieve green tax reform, and the reform of eco-taxes can promote environmental quality. If the energy tax rate is lower than the rate of labor, the reform of eco-taxes can promote employment. Schneider (2015), opined that many members considered eco-taxes as an environmental policy tool that produced good results. Eco-taxes cover a wide spectrum, as EU members have imposed taxes on fuel, products and actions that endanger the environment, such as when Sweden imposed taxes on natural gas and carbon, and Germany began levying a water pollution tax.

According to Chan, Wangi and Raffoni (2014), the implementation of eco-taxes made a significant reduction in gas emissions for the ecological environment, and to a certain extent, promoted the innovation of environmental technology. In terms of social practice, members of the EU instituted ecological initiatives; for example, eco- industrial parks and the establishment of an ecological compensation mechanism. Allen (2014), opined that beginning in the 1990s, in response to the great loss caused by various ecological disasters, EU members actively developed ecological industry in the form of eco-industrial parks that varied from the establishment of Holland’s Amsterdam Park to the expansion of Denmark Fort. Owing to the institution of various ecological compensation mechanisms, agriculture and forest in the EU have recovered to a remarkable degree. In 2005, the EU Council adopted its 1698th/2005 article which regarded an auction as a tool for the payment of agricultural eco - environmental protection. The EU imposed ecological agriculture production-related subsidies by enacting the “Common Agriculture Policy, CAP.” Regardless of how a system was constructed or put into practice, the EU’s forest ecological compensation is advanced. Through a combination of eco-labeling and sustainable forest management, the European Union has formed a relatively complete system of forest ecological compensation.

### **Progress in Japan**

Unlike the United States and the European Union’s eco-environmental protection campaign, Japan—one of the earliest countries to develop a circular economy—considered the actual situation of a limited land area and the scarcity of natural resources and put forward the developmental mode of the circular economy. The idea of a circular economy’s development concurs with the connotation of ecological accounting. The mode of circular economy promoted the development of ecological accounting in Japan to a certain extent.

Haxhimoto and Moriguchi (2004) stated that at the macro level, researchers focused on eco-industrial parks or social material circulation problems from the perspective of the recycling industry. In addition, another type of study aimed at a certain special material in the loop of the society. For example, Seiji

Hashimoto described the six indicators of the socio-metabolism material cycle from the perspective of material flow analysis. Using Japanese wood as an example, and Yuichi Morgachi described the six material circulation indices of the social metabolism.

According to Masao (1998), studies of ecological accounting in Japan can be traced back to the 1970's, when Professor Kiyoshi Kurosawa proposed the idea of eco-accounting in his close study of numerous environmental pollution problems caused by the destruction of the environment, and first used the term of ecological accounting. Based on this foundation, Kawano Masao and others considered the problem from three viewpoints, including the economic aspect of environmental accounting, the enterprise level of environmental accounting, and resource accounting studied from the perspective of ecological accounting. Masao (2006), opined that after nearly ten years of researches, they expanded and modified the research content of ecological accounting, incorporating environmental and sustainability reporting, as well as environmental accounting.

Miyazaki (2006), stated that the Ministry of the environment put forward the construction of ecological accounting for studying social, economic and environmental problems. Subsequently, they conducted a survey which covered many social problems, such as the rationalization of water projects and the way that businesses balances the water resource cost burden against the maintenance of waterway facilities and environmental capital. Kawano Masao studied economic problems such as the burden of costs and capital maintenance caused by the supply of rivers, and developed in-depth research on economic, social and environmental issues according to the principles of ecological accounting.

#### **Progress in Australia**

According to Schaltegger and Burritt (2000), in the area of the research and practice of ecological accounting, Australia is loath to lag behind. Stefan Schaltegger and Roger Burritt built a systematic and complete framework of the micro-environmental accounting in a book titled "Contemporary environmental accounting: issues, concepts and practice" in 1992. In this framework, micro environmental accounting is divided into two parts, including the differences in environmental accounting and ecological accounting. The authors thought that following the principle and method of traditional accounting, ecological accounting was the process that used biological and physical units to collect, classify, analyze and transfer environmental information. Cho and Patten (2013), stated that based on the above theory, ecological accounting is a subsystem of environmental accounting, and the most obvious distinction between it and environmental management accounting is manifested in recording, tracking and measuring the environmental impact by physical unit. In 1992, Australia signed an important document called "the Australian government environmental agreement" which signified that Australia has entered a new stage of integrating economic, environmental, eco-logical and sustainable management. In the promulgation of the "Financial information quality characteristics," the Australia Accounting Standards Board asked enterprise to measure and to disclose the relevant and reliable environmental impact.

#### **Progress in China**

According to Zhang and Zhang (2011), with the further development of accounting theory, some scholars have noted defects in the current accounting system with regard to sustainable development. Because of the government's demand for accounting information about the ecology, economic stakeholders and environmental stakeholders, the appearance of ecological accounting has become possible and necessary. Yu (2014), opined that in addition, some scholars have expounded the possibility and necessity of the generation of ecological accounting standards in the national macro strategic perspective. Lin and Xiao (2006), stated that sustainable development requires ecological accounting and can construct ecological accounting according to environmental accounting experience.

According to Shen and Liao (2014), sustainable development put forward the new request and challenge on ecological accounting from the three levels: governments, businesses and society. Under certain conditions, ecological accounting is related to the development of the current accounting theory and requires the support of a specific background.

Geng and Cao (2007), stated that domestic research is still at the preliminary stage. Ecological accounting reflects the exchange of material and energy between the main body of accounting and the

natural environment; it also must meet the information needs of the accounting system. Some scholars have put forward the framework of ecological accounting measured by goals, elements, and assumptions. A review of the research literature at home and abroad finds two main perspectives: theory and practical application, and three levels: macro view, middle and micro view. Among them, American and Canadian theory on ecological accounting ranges widely, and some specific aspects of the theory have been developed. However, most American and Canadian ecological accounting is the representative of the meaning of accounting that differs from the proposed ecological accounting in this paper. In the macro and middle view of the practice of ecological accounting, the EU has obtained many achievements; for example, compared with United States and Japan, the construction of the eco-industrial park is richer, and the names have more variety.

In contrast, Japan's research of ecological accounting began earlier and formed a systemic and complete theoretical system that progressed the development of environmental accounting. As an ecological power, the ecological concept of Australia reflected all aspects, such as city traffic construction and education and the water resource accounting. Due to the guidance of national policy in recent years in China, ecological accounting has become a hot spot in academic research, but problems such as a relatively weak theoretical foundation and slow progress have meant that most research is still in the conceptual and exploratory stage.

## CONCLUSION

Western countries have conducted extensive theoretical research on ecological accounting, and some specific theories have risen to the level of practical guidance. Developing countries like China, Nigeria, Ghana etc learn from the ideas and experience of developed countries. On the one hand, foreign institutions, whether they are governmental, institutional, or scholarly, have expounded theoretical research about ecological accounting from multiple perspectives. This discussion has provided a theoretical basis for the practice of micro market strategies by companies and organizations that are actively involved in implementing new ideas; this practical activity has in turn become a reference for academic research, which has generated new theories to be tested in practice, and so on and so on, in an interlocking cycle.

On the other hand, the study of ecological accounting in developing countries lags behind. Most scholars tend to study the western literature without considering the breakthroughs and innovations occurring in the developing world; thus their research is unable to meet the current need for economic transition in developing countries. Due to the considerations of cost benefit, the domestic industrial subject does not actively participate in the practical application of new concepts, making it difficult for academics to study the structural framework of ecological accounting in developing countries such as China, Nigeria, Ghana etc.

In general, ecological accounting in various countries has been developing rapidly and extensively, but it has some deficiencies and defects; namely, it lacks a specific theoretical framework, and it lacks systems for accounting, evaluation, optimization and control, and simplistic research. In order to break through the current research difficulties and provide more support for sustainable development, this paper suggests the following:

- 1) Construct a specific theoretical framework. Various aspects of ecological accounting have come a long way, but the lack of a framework may hinder their use in practice. A specific theoretical framework can provide broad guidelines that can be applied to specific objects.
- 2) Further improvement of the system so that it contains functions like accounting, evaluation, optimization and control. Ecological accounting derives from environmental accounting, which is formed by combining accounting with environmental management, environmental economics and other disciplines into a complex system. Improving a system so that it includes functions like accounting, evaluation, optimization and control can provide theoretical and practical support for sustainable accounting management.
- 3) Enriching the related research methods and increasing the variety of empirical study. Currently, domestic research is largely empirical; this limits the usefulness of related ecological accounting

research and hampers further research. Using mature statistical methods and measurement methods, such as structural equation modeling, may allow research to break through the current limitations of ecological accounting research.

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