

## Environmental Accounting and Sustainable Development: An Empirical Review

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### ABSTRACT

*The appearance of sustainable development as the complex perception of social and environmental issues which must be addressed growing influence in the accounting practices. The main purpose of this paper is to identify how environmental accounting can be able to contribute for ensuring sustainable development. This construing used existing empirical literature especially it has conducted general search by the name of environmental accounting application in the sustainable development in different online database sources such as Science Direct, Emerald, Springer Link, EBSCO Host, Scopus and Google Scholars, etc. The study summarized from the review findings that proper practices of environmental accounting is a vital issue for sustainable development especially to concentrate on environmental taxes, environmental costs, valuing ecosystem services, costing of carbon dioxide, and cost of water pollution and ensure income sustainability of green products in the way of sustainable development.*

**Keywords:** Environmental Accounting, Green Accounting, Carbon Accounting and Sustainable Development

### 1. INTRODUCTION

Environmental Accounting is a field that identifies resource use, measures and communicates costs of a company's or national economic impact on the environment (Deegan, 2013b). Costs include costs to clean up or remediate contaminated sites, environmental fines, penalties and taxes, purchase of pollution prevention technologies and waste management costs (Deegan, 2013b). An environmental accounting system is consisted of environmentally differentiated conventional accounting and ecological accounting (Zhan &

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Zhang, 2013). Environmentally differentiated accounting measures effects of the natural environment on a company in monetary terms and ecological accounting measures the influence a company has on the environment, but in physical measurements (Zhan & Zhang, 2013).

Environmental accounting emerged in the 1970s as a result of an increase in environmental awareness and concerns about social and environmental wellbeing (Khalid, Lord, & Dixon, 2012). It has three distinct applications: national income accounting, examining macroeconomic measures in a national economic context; financial accounting, including companies' estimation and reporting of environmental concerns to the public; and management accounting, where the context is the use of environmental data in companies' decisions and operations (Khalid, et al., 2012). The financial accounting part of environmental accounting is readily available through annual reports, sustainability reports and other reporting media, and in contrast, management accounting information related to operations is usually considered to be internal and confidential (Weale, 1991).

The concept about "accounts of sustainability" has been drew attention to a global measure during the 1990s (Gray, 2010). No longer were accounts potentially hidebound things, loosely articulated through ill-specified notions of accountability and responsibility – they had become the contested terrain of global planetary desecration of human and other species suffering and of social justice addressed through the language of sustainability, sustainable development and commerce (Gray, 2010). Important though this might be, such concerns do not directly confront us with system-wide threats to do with life and death and yet it is this plus matters as crucial as species extinction; what it is to be human; how it should engage with humanity and responsibility to the planet that these appeals to sustainability and sustainable development raise (Ying, Gao, Liu, Wen, & Song, 2011). The main purpose of this paper is to examine the literature that deals with environmental accounting or green accounting and sustainability. The study also makes an attempt to understand how green accounting has been considered and evaluated by different authors who have done researches in the same field. Based on different studies considered, a procedural model suitable for most of the developing countries is to be selected.

## **2. BACKGROUND INFORMATION**

### **2.1 Historical development of Environmental Accounting**

Environmental accounting started through a period of improbability. The development of environmental accounting in four stages, from 1970 to 1980 is the beginning of the first researches in the area of environmental accounting, which had a more descriptive character, as studies from that period (Vasile & Man, 2012). From 1981 to 1994, there are debates regarding the role of

accounting in the disclosure of information regarding environmental activities (Vasile & Man, 2012). During this period, the interest of researchers for this area increases; the managers and even accountants start to pay more attention to the issue of environmental accounting and about 267 researchers of environmental accounting is also increasing at the expense of researches regarding social accounting (Vasile & Man, 2012).

From 1995 to 2001, the period was the maturation stage of environmental accounting. Environmental information is starting to be taken into consideration and also, environmental audit is launched. Moreover, the environmental accounting were discussed both way theoretically and practically especially in developed countries (Vasile & Man, 2012). The studies from this period are starting to grow, this period being named the “cornerstone” of environmental accounting and the researchers of this area are starting to pay increased attention to this field, the number of studies is beginning to grow considerably, and the environmental reports remain the main sub-field approached by researchers and this sub- field is starting to gain interest due to the implementation of standards regarding environmental management, standards that also include a part of audit or verification (Vasile & Man, 2012)

Furthermore, from 2002 to till date, guided regarding the reporting of environmental information and regulations about environmental accounting was issued (Vasile & Man, 2012). The number and quality of articles about environmental accounting continue to grow and the studies in this field are more numerous, ample, and bring important contributions to the development of this research area (Vasile & Man, 2012). The assumptions that may be drawn is that researches in environmental accounting have grown considerably due to the importance that environmental issues started to have over entities and over society. New sub-fields of environmental accounting are developing, namely environmental audit and environmental management accounting.

## **2.2 Basic concept of Environmental Accounting**

Environmental accounting as a subsection of accounting that addresses activities, methods and systems as well as recording, analysis and reporting of environmentally persuaded financial impacts and ecological impacts of a defined economic system also emphasize two sides of environmental accounting, the non-monetary and monetary aspects (Burritt, et al., 2002 ). Monetary data encompass the material costs of product and non-product outputs, waste and emission control costs, prevention and other environmental management costs, research and development costs, and less tangible costs, in contrast, environmental or physical data consist of information about material inputs (reward auxiliary materials, packaging materials, merchandise, operating materials, water, and energy) and outputs (product and nonproductive output, such as solid waste, hazardous waste, wastewater and air emissions) (Sumiani,

Haslinda, & Lehman, 2007). In summary, both an internal and an external perspective can be identified at the organizational scale (Fig. 1).

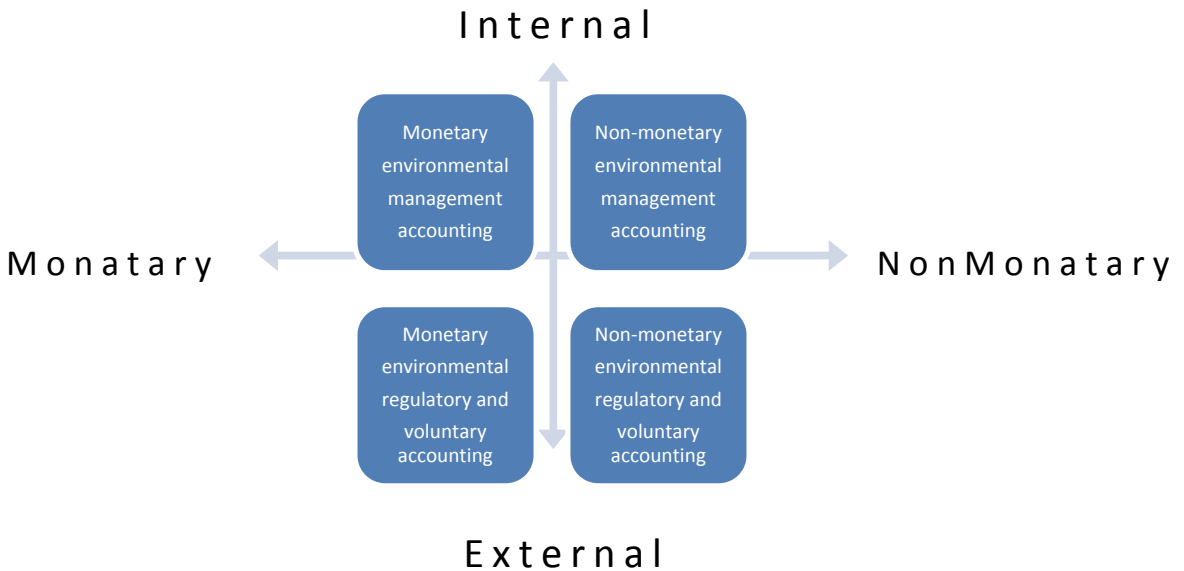


Figure 1: Environmental Accounting

Sources: (Bartolomeo *et al.*, 2000) & (Burritt, Hahn, & Schaltegger, 2002)

Monetary and non-monetary information are included in both perspectives. Hence, the internal perspective encompasses monetary environmental management accounting and physical or non-monetary environmental management accounting, in contrast, from the external perspective, it is possible to differentiate monetary environmental regulatory from environmental accounting and physical or non-monetary environmental regulatory from environmental accounting (Bartolomeo, *et al.*, 2000). However, it do not combine these two areas into financial accounting because this term is typically used in monetary terms and the differentiation between regulatory and environmental accounting originates from a time when external accounting was initiated by regulatory authorities (Bartolomeo, *et al.*, 2000). Currently, organizations also account for monetary and physical information voluntarily to inform their stakeholders and it is clear that environmental accounting can be realized not only at an organizational scale but also at the firm, plant, regional and national scales (Bartolomeo, *et al.*, 2000).

### **2.3 Basic Concept of Sustainable Development**

“Sustainability” comes to be synonymous with other notions such as “social responsibility” or “environmental management” and, most especially, becomes a term that offers no threat to corporate attitudes and activity (Thornton, 2013). Sustainable development has been defined by the World Commission on Environment and Development as the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs (Thornton, 2013). However, due to the vagueness in the widely quoted definition of ‘sustainable development’, it has been accorded a wider meaning to encompass a myriad of ideas, so much that it has been likened to a Trojan horse of words, a term quite sufficiently empty that it can be filled at will by different users to hold their own meaning and intentions (Thornton, 2013).

Sustainability emerges as planetary, morally engaged and as involving human arrangements and their impact on a natural and social environment and the resulting in justice and its concerns life, death, species, suffering and oppression (Stechemesser & Guenther, 2012a). How demanding the achievement of sustainability might be, what price might be worth paying for it and where we currently stand in relation to the desirable state of sustainability are matters of considerable debate – some of which it shall need to address in this essay (Stanojević, Vraneš, & Gökalp, 2010). Firstly, sustainability is both an ecological and societal concept which will only rarely, if at all, coincide with corporate or organizational boundaries, that is may speak of justice within societies and ecological carrying capacities at a global or even a regional level, their translation to a corporate level is fraught, in a number of particular ways, not be sensible.

Secondly, sustainability itself relates to a state, a way of being (Staniskis & Stasiskiene, 2006). As already suggested, there is not a single sustainable position and it potentially can be achieved by as many practicable solutions our imaginations can produce and there is no single place at which to arrive and so there is no way of saying that it have or have not arrived at that place politics, preferences, knowledge, religion and spirituality, understanding of the planetary ecology, morality and so on are all ingredients in any sustainable solution such that a chosen notion of sustainability is a collective outcome of all of these personal value judgments and finally, any foreseeable sustainable state will be the result of interactions between organizations, individuals, societies and states (Solomon & Thomson, 2009). It is possible to imagine, for example, that one organization may be clearly behaving in an unsustainable manner but it is doing so within a sustainable system that consciously and deliberately compensates for this extraction in some way or other, thus it is possible to imagine a world wherein all entities do not have to be sustainable in their own right (Schaltegger & Csutora, 2012). Equally, it could also imagine situations in which an organization undertakes some actions which may be thought to be contributing to

sustainability for, example, getting water to drought ridden people, in some unsustainable manner for example, using motor transport (Gray, 2010). The net effect of these might be sustainable by some societal calculus. Consequently to require all entities to be so sustainable is unnecessary and probably unduly restrictive (Saravia-Cortez, Herva, García-Diéguez, & Roca, 2013).

### **3. METHODOLOGY**

This is the review study which has examined the determinants of sustainable development and environmental accounting from the flow of existing literature. This study conducted general search by the name of environmental accounting application in the sustainable development in different online database sources such as Science Direct, Emerald, Springer Link, Scopus and Google Scholars, etc. From this search identified the number of journal articles, conference and other generic work, which have been delivered to determine which articles needed to be included in the review of this paper. After reading thoroughly most relevant articles have collected those were found as the best fit within objectives of the present issues about environmental accounting as well as sustainability developments. The review have examined on the basis of objectives, methods and findings accordingly of the all collected empirical studies.

### **4. EMPIRICAL EVALUATION OF ENVIRONMENTAL ACCOUNTING AND SUSTAINABLE DEVELOPMENT**

This section examines various studies that are dealt at international and national levels with respect to environmental or green accounting and sustainable development. R. Gray in 2010 tried to initiate an auto-critique of accounting for sustainability via an examination of meanings and contradictions in sustainable development which, in turn, leads towards a suggestion for the development of multiple and conditional narratives that whilst no longer realist or totalising, explicitly challenge the hegemonic claims of business movements in the arena of sustainability and sustainable development (Gray, 2010). Moreover, Deegan, C. in 2013 claims that organisations should provide accounts of not only their financial performance, but also of their social and environmental performance. Likewise, the authors dismiss the traditional financial reporting frameworks suggestions. Also, highlights the apparent absurdity of using market-based mechanisms, such as cap and trade systems for pollutants to solve social and environmental problems that were effectively caused by the market. The author having questioning the role of accounting and business educators in instilling some form of personal social responsibility in the minds of students (Deegan, 2013a).

Again, R. Gray in 2013 tried to explore whether mainstream financial accounting when it appears to genuflect to the environment actually has anything substantive

do with or to say about the natural world. The author argues that conventional financial accounting is a predominantly economic and not very internally logical practice which has no substantive conceptual space for environmental or social matters per se and it has no space for what Tiedemann calls 'market alien values values such as environmental concern. The author also re-examines why environmental and social issues can be potentially very important indeed, what seems clear is that whilst any account that sought to reflect environmental and social exigencies might choose to use the technologies of accounting (Gray, 2013).

On the other hand, K. Herbohn in 2005 investigated in a full cost environmental accounting (FCEA). The author examined a reporting experiment using FCEA valuation techniques that was undertaken by an Australian Government Department managing publicly owned forests. The implementation experiences of the department including the reactions of its managers and stakeholders provide an opportunity to critically reflect on the experimental outcomes to extend the current empirical knowledge of corporate social responsibility reporting (Herbohn, 2005).

However, M. J. Jones in 2010 developed a multi-layered theoretical model to underpin environmental accounting and reporting these were severe environmental dangers; corporate responsibility; new relationship between industry and environment; measure industry's impact, and disclose and report impact stakeholders. The author developed several implications from the acceptance of this theoretical model for organisations and accountants. First, at the general level, given the severity of the environmental problems, it would seem prudent for managers and accountants to take immediate action to address these threats. Second, the traditional accounting paradigm with its narrow focus on accounting numbers does not capture the environmental consequences of organisational activity. Third, as part of innovation and experimentation there is a continued need to explore potential alternative monetary and non-monetary valuation systems. Finally, the theoretical framework implies that as part of their discharge of their stewardship function organisations should disclose their environmental performance to stakeholders (Jones, 2010).

Moreover, F. M. Khalid et al. in 2012 investigated the level of Environmental Management Accounting (EMA) implementation in companies within environmentally sensitive industries in Malaysia, as well as gaining insights into pressures for implementation. The authors found that the elements of environmental-related management accounting within some of the organizations in which interviews were conducted. Implementation was driven by a motivation to reduce costs rather than environmental conservation. Apart from that, companies reactions to environmental issues stem from pressures from customers who demand environmentally sensitive workplaces, procedures and processes in the companies with which they are in business (Khalid, et al., 2012).

Conversly, K. Stechemesser and E. Guenther in 2012 attempted to derive a definition of carbon accounting by means of a systematic literature review that includes different perspectives and research streams. Based on this review and the use of computer-assisted qualitative data analysis software, the 129 identified and investigated literature sources were divided into four sections: carbon accounting at the national scale, at the project scale, at the organizational scale and at the product scale. Additionally, at each scale, they differentiated between non-monetary and monetary aspects and explained the purpose of the study. Based on these findings, a definition of carbon accounting is proposed that can be used by academics to operationalize research questions. However, the legislators delimited obligatory and voluntary accounting and by practitioners to establish carbon accounting in companies (Stechemesser & Guenther, 2012b).

Though, H. Ahrens and J. Kantelhardt in 2009 presented the models' results concerning the ranking of the different land-use options and discuss the implications for agro-environmental policies and rural development plans. The authors drew attention to three points based on a case study occurs on environmental planning for an ecologically very valuable agricultural landscape in Germany, the Bayerisches Donauried. In agricultural production, ecologically sensitive areas (ecological sites) are used to acquire that farmers environmental requirements adaptation by production responses outside the ecological site. Then, in order to identify the socially most desirable land-use responses, it is necessary to supplement the above-mentioned environmental objectives by socio-economic. In appropriate model for multi-criteria decision analysis, substitutability question between criteria is of utmost importance decision (Ahrens & Kantelhardt, 2009).

Additionally, J. Andrew and C. Cortese in 2011 explored the dominant environmental discourses that can influence and shape carbon disclosure regulation. Carbon-related disclosures have increased significantly in the last five years, and many of these disclosures remain voluntary. The paper considered both the construction of self-regulated carbon disclosure practices and the role that this kind of carbon information may have in climate change-related decision making. The authors focused on the Carbon Disclosure Project (CDP) and the use of the Greenhouse Gas (GHG) Protocol as a reporting model within it (Andrew & Cortese, 2011).

Nevertheless, R. P. Anex and J. D. Englehardt in 2001 used a predictive Bayesian model confirmed for the assessment of highly uncertain environmental and contingent costs. In environmental accounting methods often ignore or inadequately represent large but highly uncertain environmental costs and costs conditioned by specific prior events. The predictive Bayesian approach presented generates probability distributions for the quantity of interest rather than parameters thereof. A spread sheet implementation of a previously proposed predictive Bayesian model, extended to represent contingent costs, was described



and used to evaluate whether a firm should undertake an accelerated phase-out of PCB containing transformers. Model results are compared using several different risk measures. Also, use of the model for incorporation of environmental risk management into a company's overall risk management strategy is discussed (Anex & Englehardt, 2001).

Before, T. Aronsson and K.-G. Löfgren in 1999 are concerned with social accounting at the state of pollution escalate the external consumption . The purpose of the paper is to reconcile the technique of willingness to pay as a means of collecting information, put forward in earlier studies, with the growth theoretical approach to social accounting. This is accomplished by designing approximations of Pigouvian emission taxes on the basis of currently available willingness to pay information. The paper analysed the welfare effects of these taxes as well as to the extent that can be used to measure the value of depletion of environmental capital in the national accounts (Aronsson & Löfgren, 1999).

However, F. Ascui and H. Lovell in 2012 have examined the competency in carbon accounting as been defined and claimed by different actors and communities. Specifically, it focused on the role of the accountancy profession in carbon accounting, charting its engagement over time and its relationship with other communities involved in carbon accounting. The paper built on recent work showing that multiple framings and activities were associated with carbon accounting, leading to conflicting views on what it means, how it should be done, and who should be involved. The authors found that, accountants have undisputed authority in the field of financial reporting of rights and liabilities created under emissions trading schemes in financial carbon accounting. (Ascui & Lovell, 2012)

Most importantly, F. Asdrubali, A. Presciutti, et al. in 2013 emphasised on local actions are essential to impact global mitigation of greenhouse gases (GHG) emissions “think globally, act locally”. However, in order to plan and implement effective, sustainable actions, local authorities need detailed information on their GHG emissions and their sources. The authors presented the work that led to the development of a GIS-based tool for local GHG accounting, which provides data for local decision-makers in an innovative manner different from traditional GHG inventories (Asdrubali, Presciutti, & Scrucca, 2013). Conversely, A Ball in 2007 drawing on a case study of a Canadian City Council. The author argued that the utility of a social movements in organizations perspective in environmental accounting research and also, proves that the environmental accounting is used by employees to build an organizational response to environmental issues. The findings raise questions on the process to evaluate environmental accounting interventions, and about a role for research in helping environmental movement adherents on the inside of organizations to stay engaged and avoid premature capture (Ball, 2007).

Conversely, P. Bartelmus in 1992 analysed accountability of socio-economic policies for environmental impacts at the heart of sustainable development. Integrated economic-environmental accounting assesses certain aspects of the sustainability of economic growth in terms of produced and natural capital maintenance. Comprehensive development analysis comprised further non-economic objectives that do not lend themselves to monetary valuation. Social evaluation of these objectives by means of norms, standards, and targets is required for integrated development (Bartelmus, 1992). Again in 2013 the author also described the concepts and methods of environmental accounting at the national level and addresses the role of energy in accounting and sustainability analysis (Bartelmus, 2013).

Besides those studies, H. Böttcher, W. A. Kurz, et al. in 2008 examined on the contributions to forest biomass carbon stock changes of past (pre-1990) disturbances harvest and recent (post-1990) changes in forest management can be differentiated in present and future observable carbon dynamics in managed forest ecosystems. The authors also calculated the consequences of different accounting rules for the magnitude and direction of accountable stock changes in European countries in the period 2013–2017 (Böttcher, Kurz, & Freibauer, 2008). Conversely, R. D. Cairns and P. Lasserre in 2006 presented a carbon accounting method for forests that is implementable in the sense that it made use of observable information. The valuation of the effects of carbon dioxide is based on asset values rather than rental values. They also presented a discussion of the process to implement the scheme in the face of uncertainty. (Cairns & Lasserre, 2006)

On the other hand, K. L. Christ and R. L. Burritt in 2013 aimed to extend current knowledge by investigating whether organisational context could be used to develop a greater understanding of EMA used by Australian organisations. Drawing on contingency theory, a research framework was developed that sought to identify the circumstances under which organisations were more likely to engage with EMA activities, both now and in the future. In order to test this framework a web-based survey of Australian accountants in business was conducted. The data suggested present and future EMA use was associated with environmental strategy, organisational size and environmentally-sensitive industries. Contrary to expectation organisational structure was not found to be associated with accountants' perceptions of EMA used in their organisations. The findings support the potential of contingency-based research to further current knowledge and understanding of the reasons behind EMA development (Christ & Burritt, 2013).

Yet, P. de Beer and F. Friend in 2006 conducted a case study on the life cycle assessment of a functional unit of one million cigarettes by using the EEGECOST model to promote environmental accounting in South Africa. The model identifies records and allocates internal and external environmental costs

to five identified cost types, categorised into several environmental media groups. It also assists in the capital budgeting process for alternative investments (de Beer & Friend, 2006). Moreover, C. Deegan in 2013 struggled to improve the concept of traditional monetary reports frameworks and tried to solve social and environmental problems that were effectively caused by the markets. Having questioned the role of the accounting profession in contributing to broad-based corporate accountability, the paper concludes by questioning the role of accounting and the business educators in instilling some form of personal social responsibility (Deegan, 2013b).

Yet again, S. Dietz and E. Neumayer in 2007 explained on the latest international handbook on environmental accounting, the System of Integrated Environmental and Economic Accounting or SEEA (United Nations, European Commission, International Monetary Fund, Organization for Economic Co-operation & Development and World Bank. The Handbook of National Accounting can be used to measure weak and strong sustainability. The authors emphasized the importance of understanding the conceptual differences between weak and strong sustainability. Then outline consider being current best practice in measurement, all the time flagging the relationship between discussion and that of the SEEA (Dietz & Neumayer, 2007). However, J. Dillard, D. Brown, et al. in 2005 considered a framework useful for developing environmentally enlightening management and accounting information systems that take into account alternative environmental perspectives. The framework can be used to develop prototypes representing different levels of environmental enlightenment, and as such, can provide general guidance for moving collectives and organizations toward a more environmentally responsible posture (Dillard, Brown, & Marshall, 2005).

Additionally, B. Edens and L. Hein in 2013 identified four key methodological challenges in developing ecosystem accounts, such as, the definition of ecosystem services in the context of accounting, allocation to institutional sectors, the treatment of degradation and rehabilitation, and valuing ecosystem services consistent with SNA principles. The authors analysed the different perspectives taken on these challenges and present a number of proposals to deal with the challenges in developing ecosystem accounts. These proposals comprise several novel aspects, including presenting an accounting approach that recognizes most ecosystems are strongly influenced by people and the ecosystem services depend on natural processes as well as human ecosystem management. Recording ecosystem services as either contributions of a private land owner or as generated by a sector 'Ecosystems', depending on the type of ecosystem service. This study also presented a consistent approach for recording degradation and for applying monetary valuation approaches in the context of accounting (Edens & Hein, 2013).

Therefore, S. El Serafy in 1997 attempted to capturing all environmental changes and the national accounts are far more useful economically than environmentally. The author argued that green accounting can only ensure income (sometimes called weak) sustainability, which should be considered as a step leading ultimately to an ecological (or stronger) sustainability (El Serafy, 1997). Again, D. Ellison, M. Lundblad, et al. in 2011 tried to sets cost effective strategies for climate change mitigation and the efficient and balanced use of forest resources at its centre. The authors recommend paying far greater attention to the troika of competing but potentially compatible interests surrounding the promotion of standing forests as well as in particular for the purposes of carbon sequestration, biodiversity protection and ecosystem promotion or preservation, harvested wood products (HWP) and bioenergy use. The data suggested that the benefits of such a broadly based carbon accounting strategy and the inclusion of national and international accounting and emission trading mechanisms far outweigh potential disadvantages (Ellison, Lundblad, & Petersson, 2011).

On the other hand, Figueroa B, E., C. Orihuela R, et al. in 2010 has been examined green accounting and sustainability of the Peruvian metal mining sector. The authors have used model of green economic income as measurement tools. The results showed that the total loss of natural capital represents between 31% and 51% of the metal mining GDP and between 2% and 4.9% of Peru's GDP. Moreover, correcting the usual GDP measure produced by the traditional National Account System (NAS) for the total loss of natural capital caused by mining activities showed that the GDP traditional measure overestimated by 51–64% the true economic income generated by Peruvian's metal mining sector during the period 1992–2006 (Figueroa B, Orihuela R, & Calfucura T, 2010).

## 5. CONCLUSION

As the main purpose of the study is to know how environmental or green accounting can be able to contribute for ensuring sustainable development. Scholars agreed on developing of ecosystem accounts by explaining of definition of ecosystem services in the context of accounting, allocation to institutional sectors; the treatment of degradation and rehabilitation, and valuing ecosystem services. It is also highlighted from the summary of literature for valuation of the effects of carbon dioxide is based on asset values rather than rental values. The study also found that the environmental accounting and sustainability are correlated and raise questions about how to evaluate environmental accounting interventions and emission trading mechanisms are essentials. Moreover, it has suggested that the development of multiple and conditional narratives no longer realist or totalizing, explicitly challenge the hegemonic claims of business movements in the arena of sustainability and sustainable development.

This study also revealed that most of the organizations often ignore or inadequately represent large but highly uncertain environmental costs and costs conditioned and it has agreed by the scholar's that the proper practice of green accounting promotes income sustainability. It has also noted that the accountants have undisputed authority in the field of financial reporting of rights and liabilities created under emissions trading schemes in financial carbon accounting. Finally, overall findings summarized from the review findings that proper practice of environmental accounting is a vital issue for sustainable development especially to concentrate on environmental taxes, environmental costs, valuing ecosystem services, costing of carbon dioxide, cost of water pollution and ensure income sustainability of leading in the way of sustainable development.

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