

## FULL COST ACCOUNTING AND SOCIAL ENVIRONMENTAL EFFECTS ON GLOBAL WARMING PHENOMENON

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### ABSTRACT

*The purpose of this research is a critical analysis of current knowledge in the field of accounting recognition policies and procedures as well as social and environmental reporting, leading to a conceptual clarification of externalities induced by global warming effects. We propose a review of FCA – Full Cost Accounting literature that allows the conventional costing model to expand to an eco-costing model able to generate costs that are compatible with the sustainable development objectives. The study represents a fundamental inductive research, using qualitative methods to identify the theoretical and practical difficulties of externalities recognition in social and environmental accounting. Thus, a pertinent knowledge base on externalities will emerge, in order to incorporate external costs into the conventional accounting model.*



*Global warming, externalities, full cost accounting, social and environmental accounting model, stakeholders*

### INTRODUCTION

The present global economy is governed by market forces that do not generally uphold ecological principles. Prices include accounting information designed as an expression of economic reality, ignoring the environmental impact and therefore generating decisions that are in total dissonance with the planetary ecosystem.

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Climate change, having global warming as a main component, is first in place in the top ten environmental issues (Esty & Winston, 2006: 287), along with the energy crisis, water quality, biodiversity and land use, deforestation, water and air pollution.

In the case of Romania, having a future in close connection with that of the European Union, a policy without a clear environmental orientation is unconceivable. The negotiation process for European integration included environmental protection policies in Chapter 22 *Environmental protection* (2001). The Treaty of Accession of Romania to the European Union, ratified by the 157/2005 law, establishes the implementation of EU acquis for environmental protection until the date of accession, with a few exceptions that were granted a transitional period (e.g. waste management – until 2017). Romania has defined and finalized its strategies regarding the management of environmental protection and has started the process for the harmonization of environmental legislation, based on EU requirements and integrated with global policy.

In the new context, the joint efforts of specialists and researchers in all fields are convergent with sustainable development. The accounting literature has demonstrated an important concern for sustainability issues and for the role of accounting, justifying the alleged belief in the sustainability of business operations, and also challenging that belief and developing alternative accounting technologies which may offer different meaning structures of *nature*, *society* and *business success* (Bebbington & Thomson, 1996; Stone, 1995; Canadian Institute of Chartered Accountants 1993).

A thorough study of related literature reveals four main accounting approaches (Bebbington & Gray, 2001: 561): (1) accounting is well away from nature, ecology and sustainability, since it can offer pernicious quantitative information that can only alter the preciousness of life (Mauders & Burritt, 1991; Cooper, 1992); (2) accounting recognizes sustainable, ecological and environmental issues, in the reducing form of contingent liabilities, provisions and impaired assets (Canadian Institute of Chartered Accountants, 1993; Federation des Experts Comptables Europeens, 1993); (3) environmental accounting and management show the way to sustainability in an absolute manner, with no flexibility from adaptable and complex value judgements (Gray, 1990; Gray *et al.*, 1993; Stone, 1995; Bennet & James, 1998 a, b); (4) accounting may be able to support the sustainable development objectives, but the practical way to achieve such objectives is a challenge for the accounting scientific community (Bebbington, 1997; Owen *et al.*, 1997).

This paper proposes a contribution to the development of sustainability accounting knowledge, as part of the fourth approach described above.

## **1. GLOBAL WARMING: LITERATURE REVIEW AND RESEARCH HYPOTHESES**

Environmental issues are manifest at a planetary level; the solutions are global and have environmental protection as a main objective. In this meaning, the Environment Conference that took place in Stockholm – 1972 and the Environment and Sustainability Conference in Rio de Janeiro – 1992 have emphasized the importance of environmental protection at a global level and the need for cohesive actions, controlled and harmonized. The Kyoto Protocol (Environment Conference Kyoto, 1997) has created policies for reducing gas emissions in order to diminish the explosive growth of global warming. Consequently, at a European level, the environmental policy has been defined for the first time by the Single European Act, establishing that actions in one country must not cause environmental impairments in another. Therefore, the EU Member States must take joint action and endorse a coherent global policy for environmental protection. In addition, there has to be a correlation between the undertaken actions and the type of pollution for certain geographic areas. In 2007, the United Nations Intergovernmental Panel on Climate Change – IPCC, reuniting experts from around the Globe, has formulated the fourth report regarding the impact of global warming on humankind and Earth. The Report draws attention upon the damages of global warming being larger and more rapidly increasing than originally estimated.

### **1.1 Literature Review on Global Warming Phenomenon**

The industrial processes and the use of superior fossil fuels lead to the atmospheric diffusion of different materials and particles, with different and measurable negative effects. The present concern is represented by the indirect effects associated with such polluters and their more important consequences for the future of our planet. The human, scientific, business or domestic society undertake a strong debate regarding gas emissions with greenhouse effects and the global climate change, even if there is widespread recognition, knowledge and convergent opinions on the nature and possible consequences of such a change. The climate change is a slow and gradual process, but some of its effects can emerge suddenly and over a short period of time, if some climatic parameters rise above certain threshold values that are scientifically recognized and demonstrated. Such unexpected effects are even more dangerous if the context is not understood properly (Tsur & Zemel, 1996).

A large amount of economic literature agrees upon the climate change phenomenon, its impact on Earth and the costs generated by the attempts to moderate the process (Nordhaus, 1979, 1991; Edmonds & Reilly, 1983; Pearce, 1991; Cline, 1992; Schmalensee, 1993; Weyant, 1994). Determinist authors, recognized in the field, are considering that humankind induces climate change

in the context of the consumption-pollution compromise (Plourde, 1972; Smith, 1972; Keeler *et al.*, 1972; Forster, 1975). Subsequently, the stochastic aspects of the problem have been recognized and described (Cropper, 1976; Heal, 1984, 1990; Clarke & Reed, 1994; Plourde & Yeung, 1989; Conrad, 1992 quoted by Tsur & Zemel, 1996: 1290). Some of these papers find as uncertain the timeframe for a certain event to take place that will affect all life on Earth, others place the uncertainty among the variables flow (e.g., permanent pollution) that generate chain destructions.

Worldwide, efforts are made to reduce the environmental impact by implementing clean technologies, products and services. In Europe, the BATNEEC (Best Available Techniques Not Entailing Excessive Costs) studies have evaluated the current manufacturing processes and have researched potential improvements to reduce their environmental impact (Dijkmans, 2000). All of these green procedures generate costs that are an expression of economic consumption (the so-called conventional or usual costs) as well as additional expenditures that measure the environmental impact and are recognized as eco-costs (Kawai & Tazawa, 2000).

In the paper *Estimating the hidden costs of environmental regulation*, Joshi *et al.* (2001) examine the extent to which accounting systems independently identify all costs involved by the environmental protection regulations. Based on an empirical study, the authors suggest that the insufficient identification of entities' eco-costs (approximately 90% of total costs are hidden costs) has a major impact in the social, economic and environmental disclosures required by law.

The trajectories of transdisciplinary strategies combine economic, social and environmental aspects, towards sustainable development in the context of global warming, a major objective of FP 7 (The Seventh Framework Programme).

The experience of some countries such as Japan and Australia, that do not have a generous natural environment, shows that a sustainable economy works only in the context of ecological equilibrium. The business community experiences the effects of the "green wave" propelled by two fundamental forces: (1) environmental stress and (2) the pressure enforced upon companies by the society as a stakeholder for social and environmental accountability. These drivers are transforming market dynamics, rendering old business practices obsolete, for large, multinational, as well as small family businesses (Esty & Winston, 2006: 288).

Governments and trans-national organizations (the United Nations – UN, the United Nations Environmental Programme – UNEP, the European Union – UE, etc.) have formulated strategies as a response to the threat posed by global climate change, based on the development of related scientific knowledge, looking to outline public policies that offer feedbacks for adapting in the confrontation with

the global climate change. These policies include both the society and the economic environment and aim to:

- Create and develop environmentally aware behaviour, such as: the modal shift in transport, washing clothes at lower temperature, turning off appliances on standby;
- Support the energy-efficient measures in domestic and business environment;
- Provide information about the relative carbon impacts of consumer choices regarding the whole range of commodities, from automobiles to chips; or
- Use fiscal and economic levers: taxes on conventional fuels, alternative renewable energy production and the development of adequate capacities.

Creating markets where carbon may be traded is a manifestation of the application of policies designed to reduce the effects of global warming, directly and immediately affecting corporations, as market partners. In particular, this is a process of translating ecological concerns into economical problems, which will then impact upon accounting policies and practices (Bebbington & Larrinaga-González, 2008: 698).

Researchers have identified a direct connection between greenhouse gases generated by human activities and the uncontrolled rise in temperature (IPCC, 2001; Stern, 2006). *Global warming* is used to describe how the increased concentration of greenhouse gases – GHCs generates effects that are too quick for the Earth's eco-system to adapt to and will affect the human population significantly. The attempts to limit the temperature increases to 2°C (currently the planet has warmed by approximately 0,6°C) are based on this alarming hypothesis, 2°C representing the breaking point of controllable environmental effects. The darkest consequences anticipated by some beyond this point are: the extinction of iconic species or loss of entire eco-systems, the loss of human cultures, water resource threats and substantial increases in mortality levels (Schellnhuber, 2006: 12). There are also other potential adverse effects in all economic sectors. Stern's (2006) significant contribution was the estimation of economic losses if humankind does not act to prevent global warming. In 2008, during the annual meeting of American Economic Association, he stated that the decrease of GHCs emissions as opposed to the actual trend would generate costs in the amount of 1% of GDP, which can be assumed without affecting global prosperity (Stern, 2008). In the absence of any measures, Nicholas Stern estimates losses between 5 and 20% of global GDP, with effects similar to those of the World Wars and the economic depression at the beginning of the 20th century. In the current conditions, the effects will be difficult or impossible to reverse (Bebbington & Larrinaga-González, 2008: 700, quoting Stern).

The key aspect of ecological footprint is that the increase in GHCs concentration will intensify climate change, inducing adverse ecological, social and economic effects (Bebbington & Larrinaga-González, 2008: 701).

## 1.2 Research Hypotheses and Methodology

The study represents a fundamental inductive research, using qualitative methods to identify the theoretical and practical difficulties of externalities recognition in social and environmental accounting. Thus, a pertinent knowledge base on externalities will emerge, in order to incorporate external costs into the conventional accounting model.

The research is based on a literature review joint with an archival study. Using this methodology, we aimed to emphasize the adaptive practice of management accounting on its eco-costing side. Our research intends to move beyond customized opinions, assumptions or models for recognition of global warming effects in social environmental accounting with the goal to examine the recognition of theoretical concepts towards the social environmental accounting practices of externalities information.

The scientific approach explores the possibilities to merge socio-economic and environmental objectives in the context of global warming, pursuing several research directions, systematically defined below.

*H1: Approaching global warming effects from an accounting recognition policies and procedures perspective.*

Global warming, as a consequence of uncontrolled economic progress, is the most important factor of the exponential degradation of the planetary eco-system. The epistemic approach of concepts essential to the assimilation of global warming impact in socio-economic sciences, as well as the study of international accounting recognition practices create the foundations for sustainable performance measurement. From this point of view, the identification of global warming effects at a macro and microeconomic level provides the opportunity to outline specific accounting policies and choices, well suited for their idiosyncrasies.

*H2: Identifying the demand and supply of accounting information regarding externalities and eco-costs from a socio-economic and environmental perspective.*

The identification of the current financial and non-financial information portfolio for the measurement of externalities generated by global warming contributes to the correct evaluation of accounting supply and to the objective estimation of the degree of correlation with the demand for such information in the context of eco-performance measurement for an eco-balanced corporate management.

The attainment of such an objective allows for a relevant knowledge base to be built in the field of externalities and eco-costs. This entails a complex knowledge of regional and national specifics of eco-costs integration within the conventional accounting model for a reliable foundation of socio-economic and environmental policies.

*H3: A transdisciplinary study regarding eco-efficiency as a method for measuring global warming impact on the environment.*

The scientific demarche pursues the concept of sustainable development by creating a coherent system for the recognition and economic integration of global warming effects, which is also self-adjusting due to its components, correlating for the realization of the assumed objectives. The research regarding the concepts, the regional, national and international eco-efficient policies and procedures and the identification of national responsibilities lead to the emergence of a framework for eco-efficiency implementation, based on studies integrating accounting, economic analysis and statistics with social and environmental issues.

*H4: Complex modelling of eco-costs and eco-efficiency.*

An eco-efficient costing model is needed in order to provide comprehensive cost information, from a socio-economic and environmental point of view. A thorough knowledge of global warming eco-costs measurement models and of eco-costs integration within conventional costing models, correlated with the outcomes of a more extended research work having as a first phase the present paper, constitute the prerequisites for the design of the eco-efficient model through borderline research.

## **2. THEORETICAL FRAMEWORK REGARDING EXTERNALITIES**

The increase in general social welfare, generated by the marketplace mechanisms is nothing but the sum of net advantages measured as the producers and consumers surplus. Such reasoning originates in the hypothesis that prices accurately measure *social values* of goods, as well as the increase or decrease of potential community welfare, generated by the production or use of such goods. The price system manifests itself as a common denominator for the aggregated agent interactions that allows for the measurement of community welfare, as long as the decisions made by entities are based on such a system and they are enforced in accordance with the rules of a free market economy. The conclusion is that, under perfect competition conditions, the price system favours decisions that lead to the efficient use of available resources.

A real-world analysis reveals the existence of numerous cases where the price system fails to perform its functions as defined by the perfect competition, costs and social advantages theory. There are various situations where an entity's decision to consume or to produce impacts upon other entities' profit or satisfaction level, but the marketplace mechanisms make no evaluation of such influences and consequently no remuneration or sanction is applied (for example, through additional costs), that accounts for the positive or negative nature of the influence exercised by the emitting agent. As a result, there are external effects or externalities.

The existence of externalities makes the pricing system unable to induce optimal social decisions, thus generating various forms of ineffective management of production and manufacturing activities.

Externalities represent consequences or effects affecting human life and activities, including the natural environment (Alfsen & Greaker, 2007). They are materialized through costs and benefits that, regardless of their occurrence, are not recognized as entities' expenses and/or results. Externalities arise in situations where market prices reflect neither costs, nor benefits associated with manufacturing or consumption activities and represent a part of costs and benefits that are external in relation with the main stakeholders, and are associated with third parties. An externality is characterized by the fact that:

- it derives from the activity of other entities than the one directly supporting costs;
- their effects being induced, externalities are not directly recognized on the market, and, as a consequence, they have no influence over the competition equilibrium.

In the case of externalities, the production or consumption of a commodity by an entity changes the balance between public and private interests by generating private costs or benefits (conventional, internal or individual), on one hand, and social costs or benefits, on the other hand. Externalities arise mainly because resource ownership is either insufficiently protected, or incompletely defined. For example, the resource *air* has no owner, and pollution is the most common case of externality (Azar & Schneider, 2002).

*Social cost* represents the aggregated expenditures and sacrificed chances, materialized as costs sustained by community members as a result of the organization and development of a certain activity (Coase, 1960). *Private cost* encompasses only expenditures sustained directly by the entities involved in the organization and development of such an activity.

*Social benefit* represents a monetary representation of all the utilities available to community members as a result of the organization and development of a certain activity. *Private benefit* includes only direct advantages acquired by the entities involved in the organization and development of such an activity.



Depending on the beneficial or destructive nature of induced effects, the external results/consequences of a certain activity may be positive or negative. From the symbiotic entity – environment perspective, the typology is relative in nature, because a negative environmental externality may be a positive one for society. Thus, an entity generates negative external effects by pollution, but the development of polluting manufacturing may increase the number of workplaces. This is the reason why the classification of externalities is based upon the prevailing character of external effects.

We compare the two types of externalities, following five different characteristics, in Table 1:

*Table 1. Positive externalities vs. Negative externalities*

	<b>POSITIVE EXTERNALITY</b>	<b>NEGATIVE EXTERNALITY</b>
<b>Concept</b>	Action by an entity generating benefits for third parties	Action by an entity generating costs for third parties
<b>Symptom</b>	Production and consumption levels are inferior to those characterising efficient resource allocation	Production and consumption levels are superior to those characterising efficient resource allocation
<b>Effects</b>	Private benefits are lower than social benefits	Private costs are lower than social costs, that include external costs sustained by third parties
<b>Supporting activity</b>	<ul style="list-style-type: none"> <li>• generates positive external effects (beneficial);</li> <li>• insures a quantity of goods and services lower than the demand;</li> <li>• generates a decrease in demand if social costs are recognized</li> </ul>	<ul style="list-style-type: none"> <li>• generates negative external effects (destructive);</li> <li>• insures a quantity of goods and services higher than the demand;</li> <li>• generates an increase in demand when costs are assumed by parties through compromises meant to balance situations with external effects</li> </ul>
<b>Corrections</b>	Political involvement in subsidizing producers' private costs	Integration of external costs in market prices

The political decision to reduce negative externalities favours cost minimization, considering the economic arguments of cost-benefit analysis. The decisions to minimize negative effects have a double connotation: economical and ethical. Pollution, as a direct cause of global warming, can be manipulated through specific cost generating decisions:

- Reducing production levels involves a cost for pollution reduction that includes the value of cut-off production plus restructuring costs;

- Modifying the manufacturing process generates a cost for pollution reduction that includes the additional costs imposed by a new and less polluting technology;
- Using less polluting equipments generates a cost of pollution minimization in the sum of expenses for replacing older equipments and for the new form of polluters, less destructive, generated by the new activity;
- Changing the placement of the pollution generator in a reduced impact zone. The cost of pollution in this case is represented by the relocation and replacement expenses, including the new pollution expenses (Steinemann *et al.*, 2005).

Negative externalities require the involvement of authorities for monitoring and correcting negative effects. There are, however, situations where governmental intervention can be avoided. By clearly and rigorously stating ownership rights and concurrently creating a institutional mechanism for the enforcement and guarantee of such rights and contractual transactional stipulations, some economic problems regarding externalities integration in conventional costs can be solved without governmental involvement.

The experience accumulated in countries with a free market economy show that there are no incompatibilities between the stated solutions for internalization through the state's correcting intervention on free markets and those realized through direct transactions.

In a free market economy, costs constitute extremely useful economic tools for substantiating and adopting resource allocation decisions, as well as other decisions regarding production volume and structure, supply expansion or contraction, technological innovations, etc. If the effects or results of different projects converge, the lowest cost is the criterion for identifying the optimal choice. At the same time, there is a tendency to measure different costs for different structures; not only manufacturing costs, but also distribution costs, labour costs, education costs, health, information, administration, time, debt (loan), life, inflation, unemployment, crisis, economic reform, crime fighting, arrest and condemnation, punishment, ecological, negative externalities costs etc. (Dascalu *et al.*, 2008).

### **3. EXTERNALITIES-INTEGRATED COSTS THROUGH FULL COST ACCOUNTING (FCA)**

Communicating information through the accounting language is based on the idea of *resource allocation* for a certain goal or objective. The term *resource* encompasses financial, technical and human resources. Resources are administered by a manager deciding their *allocation* and *use*, and requiring information as to the consequences of allocations for the optimization of *used resources – results* ratio.

The information also refer to the need to compare real and anticipated/forecasted allocations, real and forecasted consequences (Caraiani *et al.*, 2005), real and efficient allocation and consumption of public goods in the context of sustainable development. The source of such information is social and environmental accounting – a communication interface for the efficient management of entities in the public and private sectors.

The conceptual debate regarding the recognition of externalities in managerial analysis and decisions in different operating environments represents a current challenge for managerial systems of economic entities. The key components of the managerial system have individualized functionalities that raise a series of questions when exercised correctly: What to measure? How can a department establish what is its contribution in the realization of corporate objectives? The top management must identify the targets for success through strategic planning, operational policies and controlling, assisting the manager to implement measures at any organizational level. Thus, the use of measures to realize the mission, vision and value estimated by the entity is ensured at all organizational levels, allowing for the elimination of non-efficient bases that are no longer convergent with sustainable development, in the context of reducing destructive external effects.

In addition to the statement of long-term objectives (15 to 20 years), harmonized with medium and short-term objectives, the strategic management of sustainable development involves the implementation of a *set of principles*, efficiently validated at an international level (Zaman & Gherasim, 2007). A considerable part imprints the three-dimensional accounting reasoning, including the social, economic and environmental dimensions, specific to an accounting model for sustainable development:

- *The polluter pays principle* or the marginal external costs integration principle implies the use of market mechanisms to ensure that polluters sustain the full amount of social and environmental costs generated by their activities, directly impacting the prices and tariffs for goods and services;
- *Internalization of positive externalities* (marginal external benefits) refers to the use of a corrective subventions system, stimulating activities that generate marginal benefits for third parties that do not pay (research and development, environmental protection, education, regional development, small and medium-sized enterprises etc.);
- *Public participation* implies the unrestricted access to the information regarding the environment and its resources, with some justified exceptions (confidential business information), the public right to take part in environmental and natural resources allocation decisions and to consider their consequences, the possibility for civil society members reaction, the right to be aware of possible environmental risks and their impact on resources;

- *The governing principle* states that authorities and state institutions should act transparently, efficiently and honestly, in preventing and penalizing pollution and promoting environmental protection;
- *The private – public and public – private partnerships* are based on direct, inter and intra institutional cooperation, between the interested stakeholders represented by the authorities and public institutions, NGOs, industrial companies and groups, networks and businessmen, that can achieve, by cumulating their own expertise and efficiency, a higher value-added for the sustainable development at a micro and macro economic level.

The models for sustainability measurement are based on an interdisciplinary approach that recognizes the need for accounting, meant to lead towards advanced forms of decision and accountability. Sustainable economy is achieved through the interaction of social, economic and environmental areas and it is characterized by eco-performance, as the best possible positioning from a financial and environmental perspective. The exploration of a larger area of decision situations in public and private organizations from highly developed countries involves paying special attention to stakeholders' (including consumers') needs of accounting information (Bebbington, Brown & Frame, 2007).

### 3.1 Stakeholders & Externalities & Environmental Audit

Stakeholders can be defined as “any group or individual who can affect or is affected by the achievement of the firm's objectives” (Freeman, 1984: 46). In support of this concept, Freeman (1984) refines the idea that entities produce externalities that affect several internal or external sectors of an organization.

Externalities often motivate stakeholders to increase their influence over the organizations, in order to reduce the negative impacts in favour of positive ones. The stakeholder theory, initially formulated by R.E. Freeman (1984), represents a corporate management and business ethics tool that allows the harmonization of an entity's interests with those of its stakeholders. Generally, there are two groups of stakeholders impacting organizations: internal and external stakeholders. The pragmatic approaches of stakeholder theory analyze what are the groups of individuals that management pays attention to (Mitchell *et al.*, 1997). According to the stakeholder theory, stakeholders are receivers and also senders in relation with an entity's actions, requiring a legitimate confidence in the organization. In relation with the environment, trust takes the form of environmental audit, a new and, for the moment, optional area for most entities. The environmental standards ISO 14000 stipulate environmental audit principles and standards for auditing environmental management systems. Compared with the entities that do not resort to environmental audit, the environmental audited organizations are associated with various degrees of stakeholders' influence perception. The environmental audit

provides an entity with a better investment protection due to the auditing process that imposes compliance with procedures and systems able to support sustainable activities from the environmental management perspective (de Moor & de Beelde, 2005). Environmental audit identifies environmental problems before they escalate, diminishing the negative environmental impact, risks and remediation costs for improving external image of the entity. Therefore, organizations that resort to environmental audit communicate complete and reliable information to stakeholders, regarding their environmental concerns.

*Internal stakeholders* include management and non-management employees (Waddock & Graves, 1997) and they have a direct economic role within the organization, being typically located inside the organization (Freeman, 1984). Internal stakeholders are relevant for environmental audit because employees are the initiators of proactive activities within the entity (Daily & Huang, 2001; Hanna *et al.*, 2000; Ramus & Steger, 2000). Such initiatives are deeply rooted in the employees' specialized knowledge, organizational abilities and the way they connect with the natural environment. In this context, environmental audit used by organizations is definitely associated with the acknowledged influence of internal stakeholders.

*External stakeholders* have a more limited influence and control over the entity's resources (Mitchell *et al.*, 1997; Sharma & Henriques, 2005). Nevertheless, there are certain situations where external stakeholders have the ability to regulate the entity's operation and organization (Fineman & Clarke, 1996; Freeman, 1984). Their influence and authority vary, depending on their affiliation to different interest groups:

- Stakeholders having regulatory powers (for example, syndicates or trade unions that can initiate public campaigns and protests that increase internal pressure on entities to improve sustainable performances) influence entities to apply the current environmental regulations, or threat to take legal action pursuing their own agenda (Henriques & Sadorsky, 1996). Environmental audit used by organizations is associated with the perception of the influence exercised by rules-promoting stakeholders;
- Social stakeholders are represented by interest groups in the area of environmental, community and professional organizations. They all have the capacity to influence the public opinion in favour or against an entity, influencing indirectly organizational behaviour. Social stakeholders grant an entity's "social certificate" (Gunningham & Thornton, 2004), and can be decisive factors in its decision to resort to environmental audit;
- Stakeholders being directly or indirectly involved in satisfying customer demands (suppliers, transporters, retailers, clients

themselves) ensure a positive qualitative impact on the environment by reducing the possibilities to use products that are presented as environmental-friendly, but do not meet such requirements (Green *et al.*, 2000).

To conclude, we are able to state that the influence exercised by internal or external stakeholders' is correlated with their interests and power over the environmental audit types. Environmental audit provides stakeholders with assurance that the audited entity complies with sustainability objectives, by minimizing negative external effects and optimizing positive effects on the natural environment (Darnall *et al.*, 2009).

### 3.2 Full Cost Accounting and Social and Environmental Effects

The first attempts made by academics (Estes, 1976) or entities, to integrate social and environmental effects into costs have been less successful, on the grounds of being too costly, too difficult or dissonant with the objective. However, at the end of the 20<sup>th</sup> century, when the global warming threat was made public, the efforts in the full cost accounting (FCA) direction have been intensified. The idea of investment decisions made on the base of accounting information incorporating environmental impacts emerged (Milne, 1992). Rubenstein (1992) advances the idea that the value of an activity's environmental impact must be deduced from the value added and charged to a company's profit. In a 1994 study, the author presents a method for the evaluation of forests, proven to be inadequate due to market perception flaws.

The 1990's have been dominated by various experiences regarding the FCA perspectives, instruments and practices. Bebbington *et al.* (2001) analyze the related literature and present four distinct perspectives: (1) the adoption of FCA perfects the knowledge of an organization's operations and helps to change certain axioms or ways of doing business; (2) some of the measures for sustainable development may be out of reach and divergent to the purpose; (3) the subtraction of external costs from income has a significant impact on an organization's bottom line and can turn profit into loss. The situation suggests that current market systems do not send the right price incentives; (4) no comparison can be made of the external costs sustained or generated by entities due to the differences in the measurement methods used and the externalities taken into account (Antheaume, 2004).

Full Cost Accounting (FCA) is recognized as an accounting technology approaching the concept of externalities. The measurement of externalities is a difficult and controversial issue in FCA, especially since the problems sustainable development attempts to solve emerged from fundamental structural flaws of society that are incompatible with a one-dimensional, monetary expression.

An externality appears when a company's economic, social or environmental-related activities have an impact on one or more different entities, that is not fully recognized or compensated for by the generating entity. This is a fundamental component of the conditions imposed on long-term sustainable technologies, as it is essential for explaining depreciation or appreciation of all forms of capital. The beginning of the third millennium brought a real increase in researchers' interest for the transdisciplinary approach of focused externalities on: energy (Kim, 2007; Markandya & Tamborra, 2006; Söderholm & Sundqvist, 2003; Krewitt, 2002), agriculture (Pretty *et al.*, 2000), transports (Friedrich & Bickel, 2001) and urban development (Xiang *et al.*, 2008).

In accordance with the objectives formulated in this paper, a thorough study of accounting technologies associated with FCA and developed, among others, by Birkin (2000) and Lamberton (2005) is essential. First, we find that an overview of general externalities approach in FCA is necessary, since it generates information regarding externalities that are not currently reflected in market prices, nor will be in the near future. An adaptation of the specific FCA "four steps" model originally developed by Bebbington and MacGregor (2005) is presented in Table 2.

*Table 2. The „four steps” FCA model*

<b>STEPS</b>	<b>SPECIFIC ACTIVITIES</b>
1 <i>Establishing the objective or the interest costing area</i>	A product, a production process, a part of the economic entity, the entity as a whole, an entire industry etc. is identified as the overall full costing objective along with the associated conventional costs
2 <i>Defining the scope and/or limits of analysis</i>	All negative and/or positive effects are identified and the relevant effects in relation to the scope or the defined area of interest are outlined
3 <i>Identifying and measuring the relevant external impacts</i>	The relevant externalities in relation to the defined scope or area of interest for full costing are monetized
4 <i>Full costing</i>	Full costing, recognizing private (conventional) and social (external) costs, as a support for market pricing

The costs generated by FCA are not "real" in the sense that they are not generated by the business process. Full costs are more theoretical in nature, offering a vague image of an entity's costs and benefits associated with a defined activity (Frame & Cavanagh, 2008). The primary benefit of FCA consists of the information on externalities it generates in terms of costs and benefits, which was unavailable to decision makers prior to the conceptualization of such a technology.

## DISCUSSIONS AND CONCLUSIONS

In addition to financial information, non-financial information is necessary for relevant disclosures of the risks associated with global warming. In order to provide a real and accurate image of corporate performance in an operational and functional context, non-financial reporting is designed as a new informational tool able to describe the impact of global warming and the way entities adapt to the new reality (by changing regulations, modifying activities that have a negative social and environmental impact), choosing sustainability as a socio-economic way of doing business in a clean natural environment. Global warming is characterized by risks and uncertainties. Stern (2006: 1) suggests that economic analyses of global warming phenomena must be comprehensive and have a large timeframe, use risks economy and examine the possibility of carbon trading. His suggestions are affiliated with post-normal science, describing a research methodology appropriate in certain settings where facts are uncertain, values in dispute, stakes high and decisions urgent.

The vast domain of techniques and practices meant to promote sustainability can be reconceptualised from a post-normal science perspective as defined in the 1970-1995 period by de Jerry Ravetz and Silvio Funtowicz (Funtowicz, 2006; Ravetz, 2006; Ravetz & Funtowicz, 1999) and subsequently in the scientific literature (Funtowicz, 2006; Ravetz, 2006; Ravetz & Funtowicz, 1999). The concept of post-normal sustainability technologies – PNSTs emerges from the works of the two authors as a result of value judgements under complex and uncertain conditions, taking into account the global restrictions related to natural resources (Frame & Brown, 2008; Haag & Kaupenjohann, 2001; Mayumi & Giampietro, 2006). Given the present interest, the subject adopts and develops its own technology that may appear new, but has a full history (Frame & Brown, 2008). There is a perfect compatibility between the critical environmental problems identified in the '70s (Rittel & Webber, 1973) and contemporary problems, manifesting on a much larger scale, restated by Rayner (2006) as:

- Symptomatic of deeper problems;
- Unique opportunities that cannot be easily reversed;
- Unable to provide a pertinent set of alternative solutions;
- Characterized by contradictory certitudes;
- Contain redistributive implications for entrenched interests; and
- Persistent and insoluble.

The stakeholders' engagement in sustainable development problems is critical for decision legitimacy and quality, as well as for accepting complexity and value judgements in the process of decision-making and accountability. Stakeholders need new and traditional experiences interacting and leading to the co-production of sustainability knowledge. Ideological pluralism and value diversity are also essential for sustainability conceptualization and PNSTs implementation.



The value-based nature of the aspects involved is expressed in a way looking to achieve multidimensional support. Frame and Brown (2008) have identified some essential processes for the practice of PNSTs:

- Some are centred on both society and heuristics (as initially proposed by Funtowicz and Ravetz); and
- Others are agonistic (Bebbington *et al.*, 2007; Brown, 2007; Frame & Brown, 2008; Mouffe, 2000, 2005).

In order to face the measurement requirements necessary to create sustainable policies, accounting procedures must be extended to estimate the evolution of a phenomenon by measuring new characteristics that can emerge, as well as new consequences of a process, product or relation. In future research, we propose a sustainability approach from a post-normal science perspective and measurement models. Such approaches can create a spatial, temporal, complex and dynamic representation of three-dimensional accounting and reporting issues and subjacent public policies.

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