



MASTER'S DISSERTATION

**Environmental Accounting and Value Creation:
A Systematic Review of the Literature**

Sónia Leonor Galanducho Pinto

Supervisors:

Rúben Miguel Torcato Peixinho, Ph.D., University of Algarve

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Declaro ser autora deste trabalho, que é original e inédito. Autores e trabalhos consultados são devidamente citados no texto e constam da listagem de referências incluída.

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To my son, Ricardo

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The axiom “we manage what we measure” underscores the critical importance of measurement in assessing problems, identifying priorities, gauging effectiveness and tracking progress. If national systems look only at economic performance, then people cannot hold their leaders accountable when it comes to progress on social and environmental matters. New and more tailored metrics as well as bolstered data collection systems and capacities are needed in both public and private sectors. Such metrics will be critical to the post-2015 development agenda, in particular to the sustainable development goals.¹

¹ United Nations Department of Economic and Social Affairs (UNDESA) and the United Nations Development Programme (UNDP), 2012, Synthesis of National Reports for Rio +20. United Nations Conference on Sustainable Development
Sónia Pinto

RESUMO

Embora seja vasto o conjunto de estudos sobre contabilidade ambiental e sobre as implicações financeiras da atuação ambiental das organizações, a literatura especializada não parece fornecer uma resposta definitiva à seguinte questão: serão as práticas organizacionais em matéria de ambiente o reflexo de uma efetiva preocupação com a sustentabilidade ou serão antes meros exercícios de promoção da sua imagem pública ou ‘greenwashing’? (Monteiro, 2007; CPA Australia, 2008; Hopwood, 2009).

Independentemente da resposta a esta questão, é reconhecido que quanto maior a qualidade, o rigor e a abrangência da informação contabilística e financeira sobre aspetos ambientais, maior será a capacidade das organizações de medir, evidenciar e compreender o seu real desempenho ambiental, bem como de desenhar e implementar coerentes em matéria de sustentabilidade. Esta dissertação consiste numa revisão sistemática da literatura em torno da questão ambiental e o seu impacto na criação de valor nas organizações. Em concreto, este estudo relaciona três áreas principais: “contabilidade ambiental”, “investimentos ambientais” e “performance ambiental”. A análise aprofundada destes tópicos contribui para clarificar alguns aspetos e para identificar algumas linhas de investigação nesta área.

Os resultados evidenciam que a relação entre as práticas ambientais das empresas e a criação e valor não é uma questão linear. Por exemplo conclui-se que é fundamental a tradução da atuação ambiental das empresas em informação financeira fidedigna, mensurável e comparável. A criação de valor pode também ser potenciada pelo desenvolvimento de uma metodologia de custeio que tenha em conta o impacto das ações ambientais na determinação de custos. Além disso, o impacto das “fontes de valor ocultas” pode ser crucial para tornar mais rigorosa a mensuração de aspetos como o “valor para o acionista”, o “valor sustentado adicionado” e a “criação de valor ambiental”.

Palavras chave: Contabilidade Ambiental, investimentos ambientais, performance ambiental, criação de valor, revisão sistemática da literatura.

ABSTRACT

Despite the increasing number of studies in the field of environmental accounting (EA) and on the financial implications of organizations' environmental actions, literature does not provide a definitive answer to the question: are organizational practices the evidence of an effective commitment to sustainability issues or are they mainly 'greenwash' public relations exercises to gain community legitimacy? (Monteiro, 2007; CPA Australia, 2008; Hoopwood, 2009).

However, whatever opinion one may hold on this question, there is a general agreement that improving quality, accuracy and comprehensiveness of the accounting and financial information on environmental issues can only contribute to a better understanding of an organization's environmental strategy and performance. This thesis reviews systematically the literature related to environmental and sustainability practices and their actual contribution to effective value creation. In particular, three main areas are connected in this study: "environmental accounting", "environmental investments" and "environmental performance". The comprehensive analysis of these topics contributes to clarify some issues and to identify some research opportunities in this field.

Results show that the relationship between firm's environmental practices and value creation is not a straightforward process. For instance, it is crucial to translate environmental actions into comprehensive, measurable and comparable financial data. Value creation measurement may also be enhanced by the development of a costing method that considers the impact of environmental activities in the determination of cost objects. Moreover, the impact of "hidden sources of value" in this discussion may be crucial to refine the measurement of "shareholder value", "sustainable value added" and "environmental value creation".

Keywords: Environmental Accounting, Environmental Investments, Environmental Performance, Value Creation, Systematic Review of the Literature

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LIST OF ABBREVIATIONS

ABC	Activity Based Costing
CIPFA	Chartered Institute of Public Finance and Accountancy
CSR	Corporate Social Responsibility
EA	Environmental Accounting
EVA	Economic Value Added
EMA	Environmental Management Accounting
EPI	Environmental Performance Indicator
FCA	Full Cost Accounting
IAS	International Accounting Standards
IASB	International Accounting Standards Board
IFAC	International Federation of Accountants
LCC	Life-Cycle Costing
GRI	Global Reporting Initiative
NCRF	Normas de Contabilidade e Reporte Financeiro (Portuguese Accounting and Financial Report Standards)
SNC	Sistema de Normalização Contabilística (Portuguese Accounting Normalization System)
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UN/ISAR	United Nations Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting
US EPA	United States Environmental Protection Agency
WBCSD	World Business Council for Sustainable Development
ROI	Return on Investment

INTRODUCTION

The environmental cause is nowadays far from being considered a trend. It has definitely been incorporated into mainstream policies and planning process throughout the world. Most countries have made substantial progress in the last few decades, as far as the promotion of sustainable development is concerned, by creating institutions aimed at resource management and environmental protection, by passing on of extensive environmental protection legislation and launching innumerable awareness raising initiatives.

Climate change, biodiversity, energy efficiency and renewable energy sources, water supply, waste management, among others, are announced as priority issues in political discourse, in national development strategies (even in developing countries) and in a broad range of institutional reports from public and private organizations. The concept of environmental protection and the wider idea of sustainability are hardly strange notions to anyone. If not sooner, since the Rio Earth Summit of 1992, States and organizations worldwide have committed to environmental and sustainability related goals and many have, in fact, contributed to a fairly robust institutional framework inspired in the Bruntland Report's groundbreaking perspective of the human development process, based on shared responsibility and solidarity among generations: "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs".²

Sustainability became an indisputable principle in the design of development strategies at different levels and it is now widely accepted, not only as a fair and defensible notion, but even as a moral imperative. In the nineties of the twentieth century, this responsibility was brought into the scope of corporate life and was included in the concept of 'corporate social responsibility'.³

²The publication of "Our Common Future" by the United Nations laid the foundations for the resolutions of the 1992 Earth Summit, the adoption of Agenda 21, the Rio Declaration on Sustainable Development and for the creation of the Commission on Sustainable Development.

³ When transposing the idea of sustainability to the business level, corporate sustainability can be defined as "meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc), without compromising its ability to meet the needs of future stakeholders as well." (Dyllick and Hockerts, 2002).

The economic opportunities associated with the protection of ecosystems, the alternative energy sources, resource and energy efficiency and clean production have been acknowledged and explored by nations worldwide. This will happen with increasing intensity in the years to come, if for no other reason, due to the economic argument. Depending increasingly on energy import is in itself an unsustainable state of affairs that threatens nation's subsistence and sovereignty. It is even more so in a scenario of rising energy prices and financial instability.

At the organizational level, environmental awareness has also improved significantly in recent years. Companies understand better, not only the need to mitigate the negative impacts of an organization's behavior and practices towards the environment, but also the potential for value creation associated with eco-friendlier practices: increase in competitiveness associated with a better reputation, access to new markets, cost reduction resulting from efficiency measures, sales increase, among others.

Even public sector organizations have committed to sustainability goals, through the most diverse approaches, with countries like Australia, United Kingdom, Denmark and Canada, leading the movement of public eco-management and sustainability. In Portugal, the Local Agenda 21 movement, focused on building up local sustainability strategies, has been especially widespread.

Although recognizing that a concern with eco-efficiency in *stricto sensu* falls short to consider the broader concept of sustainability (CIPFA, 2004; Farneti and Guthrie, 2008), it is reasonable to assume that the ability to accurately measure environment-related benefits and costs, may very well be the way forward for the promotion of a new attitude of public and private organizations towards 'internalizing' their 'ecological footprint' (Wackernagel and Rees, 1996, *apud* CIPFA, 2004).

To invest in environmental risk prevention, cleaner technologies, alternative low carbon energy sources and more resource efficient technologies is no longer an option. A shift towards greener practices is today imposed on countries, organizations and individuals. The option can only exist as far as the way these investment and technological choices are measured, estimated, implemented and monitored, considering all costs and benefits involved. At this level, the role of EA is of primary importance.

This thesis systematically reviews the accounting literature that focuses on the environmental and sustainability practices within organizations and brings into light some of the most relevant approaches on the impact of organizations' environmental activities and investments in effective value creation. The selected methodology is the systematic review of the literature that, according to Tranfield et al. (2003) differs "from traditional narrative reviews by adopting a replicable, scientific and transparent process, in other words a detailed technology that aims to minimize bias through exhaustive literature searches of published and unpublished studies and by providing an audit trail of the reviewer's decisions, procedures and conclusions" (Tranfield et al., 2003: 209).

The results of this study suggest that EA is a very rich area and its relationship with value creation has research opportunities that cannot be ignored. For instance, it is crucial to translate environmental actions into comprehensive, measurable and comparable financial data. In fact, this is a very complex process since the measurement of intangible or non-easily quantifiable factors is not straightforward and must be discussed in detail. It is also important to develop a costing method that take into consideration environmental costs and environmental activities in the determination of cost objects. The definition of quantifiable indicators may minimize the subjectivity of the appraisal. These two questions are likely to facilitate the measurement of value creation in the environmental area as they would clarify the estimation of costs and benefits associated to environmental practices. The measurement of value creation may also be enhanced if future studies discuss in depth the impact of "hidden sources of value" (i.e., the long term impact of social benefits and value creation to the planet) in this process. This discussion would contribute to refine the measurement of "shareholder value", "sustainable value added" and "environmental value creation" in the environmental domain.

This thesis is structured as follows. Chapter one reviews the key literature allowing the discussion of the problem and the delimitation of the boundaries of this study. Chapter two presents the methodology of this study based on the systematic review of the literature and chapter three presents the findings. Chapter four concludes this dissertation.

1. KEY LITERATURE

Driven by a growing concern with public image, both public and private organizations have embraced the ecological cause. This concern is fuelled by the investment in different environmental initiatives and new environmental management practices that go beyond simple compliance with regulation. The costs associated with these investments are often considered as the necessary economical sacrifice to legitimize the organization to its stakeholders, especially investors and costumers.⁴

The most common approach to organization's environmental issues is likely to be related to environmental and sustainability reporting. These new management tools, often related to the implementation of environmental management systems, are nowadays widespread among private and public institutions and constitute: 1) the main communication tool of an organization's behavior and practices towards the environment; 2) the organization's contribution to the sustainability agenda, that is, to help minimize environmental unsustainable patterns of production and consumption. Importantly, most of these reports are based on the triple bottom line approach that aims at quantifying the economic, social and environmental value created by the organization.⁵ Literature on the characteristic of environmental disclosure and their relationship with accounting and financial management in both the private and public sector is extensive (e.g., UNCTAD, 1997, CIPFA, 2004; Monteiro, 2007; Larrinaga-González e Pérez-Chamorro, 2008; Farneti and Guthrie, 2008; CPA Australia, 2008; Cruz et al., 2009; Braz et al., 2009; Rover et. al., 2009; Marques et al., 2010; IFAC, 2010).

The motivations that drive organizations to carry out environmental investments and projects, across different time and geographical contexts, have also been thoroughly analyzed (e.g., CIFPA, 2004; Wood & Ross, 2006; CPA Australia, 2008; Braz et al., 2009; Murovec et al., 2012, among many others). Empirical studies addressing the characteristics of environmental and sustainability disclosures find that:

⁴ The Legitimacy Theory is concerned with the study of the organizations' response to society's demand: a socially and environmentally responsible attitude. Voluntary disclosure is one of the organization's main legitimacy sources (Burritt and Welch, 1997; Monteiro, 2007; Rover et. al., 2009; Cedillo, 2010).

⁵ Global Reporting Initiative (GRI) is an example of an institution that produces sustainability reporting frameworks and guidelines. The reporting frameworks are based on the performance indicators adjusted to different industries. The performance indicators refer to three distinct reporting dimensions: economical, social and environmental (for more information: <http://www.globalreporting.org>). Asociación Española de Contabilidad y Administración de Empresas (AECA), through its Commission on Corporate Social Responsibility presents an additional reference in this subject (for more information: <http://www.aeca.es/comisiones/rsc/rsc.Htm>).

- there is no universally accepted theoretical framework of corporate EA and reporting (Jones, 2010);
- there is no link between environmental and financial performance (Henri and Journeault, 2010);
- there is no universal indicator to measure environmental performance allowing comparability of environment-related disclosures (Burritt and Welch, 1997; UNCTAD, 1997; Costa, 2006; CPA Australia, 2008; Rover et al., 2009; Braz et al. 2009; Cedillo, 2010; IFAC, 2010; Ribeiro and Gúzman, 2011).

These findings suggest that the current accounting standards on environmental disclosures that private firms have to comply with (e.g., annual reports), are flexible enough to allow different approaches and do not provide a comprehensive integration between environmental and financial performance. This concern is highlighted by Hopwood (2009) when he sums up one of the main concerns of current EA research:

“Rather than environmental issues being seen as ‘out there’, at the boundary of managerial attention, as so often is the case, the aim is to connect them to the consideration of economic and financial matters, hopefully thereby making them a more mainstream part of business.” (Hopwood, 2009:438).

This gap is even more evident in the public sector as the International Public Sector Accounting Standards (IPSASs) do not require the reporting of environment-related financial information. According to Ribeiro and Monteiro (2010), the absence of specific regulation may be the reason why public organizations lag behind in the development of EA practices and disclosure.

Despite the increasing number of studies in this field as well as the development of environmental disclosure practices, literature does not provide a definitive answer to the question: are organizational practices the evidence of an effective commitment to sustainability issues or are they mainly ‘greenwash’ public relations exercises to gain community legitimacy? (Monteiro, 2007; CPA Australia, 2008; Hopwood, 2009). However, whatever opinion one may hold on this question, there is a general agreement that improving quality, accuracy and comprehensiveness of the accounting and financial information on environmental issues can only contribute to a better understanding of an organization’s environmental strategy and performance.

From an academic perspective, several papers stress out the need to integrate the knowledge on EA in order to understand the impact of environmental-related decisions in the economic and financial position of organizations. To Henri and Journeault (2010), “although numerous studies have addressed issues related to environmental disclosure and reporting, little is known about other dimensions of environmental accounting, especially eco-control.” (Henri and Journeault (2010:75). Also, according to Kwok & Rabe (2010), “current literature focuses on environmental sustainability and lacks quantitative ways to make capital budgeting decisions” (Kwok & Rabe , 2010, p: 4).

This chapter introduces some of the main issues related to the accounting literature that focuses on the environmental and sustainability practices which are likely to impact on firms’ value creation process. This discussion is crucial to identify the problem, to delimitate the boundaries of the study and to identify the keywords allowing the search of studies addressing these issues. The chapter is structured as follows: section 1.1. focuses on EA issues, highlighting the multiple approaches to this wide subject, using academic and technical papers; section 1.2. describes the main concepts in the environmental investments area, whereas section 1.3. analyses the link between environmental issues and financial / economic performance.

1.1. Environmental Accounting and Disclosure

A significant amount of studies uses the concept of “environmental accounting” to designate all forms of environment-related practices within the organization. Rover et al. (2009) analyze the characteristics of empirical research on environmental disclosure in accounting journals from 1992 to 2009. In agreement with the focus of their paper, they use the term as a synonym of “environmental disclosure”. Ienciu et al. (2010) refers some of the many concepts of EA: “For a company, environmental accounting takes the form of environmental financial reports or environmental financial accounting and environmental management accounting or environmental costs accounting.”(p.37). According to Bartolomeo et al. (2000) many studies and frameworks include reporting on quantitative and qualitative information associated with the organization’s environmental impact (i.e., environmental and social accountability reporting) as an EA practice. In fact, EA can be broadly understood as a disclosure practice associated with the organization’s corporate social responsibility.⁶

In this study, however, the main focus will lie on the production of environmental management and environmental financial information that serves primarily internal purposes related to planning, budgeting and performance evaluation and is in line with the concept of environmental management accounting (EMA) presented by Bartolomeo et al. (2000): “the generation, analysis and use of financial and related non-financial information, in order to support management within a company or business, in integrating corporate environmental and economic policies and building sustainable business” (Bartolomeo et al., 2000: 37).

The following subsections address both financial EA and environmental management accounting, given their equally important role in environmental impact assessment within an organization.

⁶Environmental accounting appears frequently associated with the concepts of “corporate social responsibility” and “social accounting”, trends that started to be integrated into the corporate universe in the 80’s of the 20th century (Eugénio, 2007). This study focuses exclusively on environmental issues.

1.1.1.Environmental Financial Accounting and Environmental Disclosure

Environmental financial accounting issues are addressed in both international and national accounting standards. At the international level, the main references are International Accounting Standards (IAS) that provide some guidelines on environment related issues:

- IAS 1 (Presentation of Financial Statements) – environmental report;
- IAS 16 (Property, Plant and Equipment) - for tangible fixed assets, where impairment arises from an incident of contamination, physical damage, or non-compliance with environmental regulation. IAS 16 allows reduction of the carrying amounts to the value in use or realizable value;
- IAS 36 (Impairment of assets) – impairment resulting from environmental facts;
- IAS 37 (Provisions and contingent liabilities) – addresses the provisions for penalties or clean-up costs for unlawful environmental damage;
- IAS 38 (Intangible Assets) – provides for greenhouse gas emission allowances.

However, there is no specific International Accounting Standard addressing comprehensively environmental issues. This situation has justified the publication of other guidelines on EA by other organizations beyond the International Accounting Standards Board (IASB), such as the United Nations and the European Commission.⁷

The “Environmental Financial Accounting and Reporting at Corporate Level” published by the UNCTAD in 1997 provides guidance on accounting for environmental costs and liabilities. These guidelines are mainly related to accounting transactions that potentially affect the financial position of a company and, as such, should be reported in financial statements. It covers recognition of environmental costs and liabilities, recognition of recoveries, measurement of environmental liabilities and disclosure issues. Financial reporting of environmental data is deemed crucial to assess “the entity's own exposure to risk; to interpret corporate managements' ability to manage environmental issues and integrate environmental issues into general long-term strategic issues; and to compare progress between companies and over time.” (UNCTAD, 1997: 13).

⁷ There is presently extensive regulation and guidance for environmental accounting implementation in the private sector. The public sector accounting framework lags behind in this area. The Public Sector Accounting Sector Standards do not include any references to environmental matters. As for the Portuguese framework, the Public Accounting Official Plan does not mention environmental issues. The same happens with the sector adjusted accounting plans (education, health, local governments, etc.).

According to the same document, one of the main assumptions underlying the presented recommendations is that “there is a need to communicate environmental performance in a standardized and coherent way if it is to be useful or relevant to a potential user” (UNCTAD, 1997:13), since conventional reporting (in annual reports) fails to demonstrate how managers are “attempting to integrate environmental strategy into overall corporate strategy” (UNCTAD, 1997:14) and systematically ignore or underreport environmental issues. The exceptions are some disclosures exclusively related to environmental liabilities and provisions, contingent liabilities. In sum, “at present there appears to be a mismatch between corporate environmental disclosures and the needs of financial sector stakeholders.” (UNCTAD, 1997:15).

The European Commission Recommendation 2001/453/EC on the recognition, measurement and disclosure of environmental issues in the annual accounts, came to provide additional support and guidance on the compliance with the provisions and accounting principles relevant to environmental issues established by the IAS. The document recommends that Member States’ “companies covered by the fourth and seventh Company Law Directives (Directives 78/660/EEC and 83/349/EEC respectively) apply the provisions contained in the Annex to this recommendation in the preparation of the annual and consolidated accounts and the annual report and consolidated annual report.”⁸ The recommendation is concerned with “requirements for recognition, measurement and disclosure of environmental expenditures, environmental liabilities and risks and related assets that arise from transactions and events that affect, or are likely to affect, the financial position and results of the reporting entity.”⁹

This Recommendation also defines the concepts of “environmental expenditure”¹⁰, “environmental liability”, “contingent environmental liabilities”. Moreover, it defines the procedures to recognize and measure these elements, the extent to which environmental issues should be disclosed in the annual report and in the notes (to the extent that they are material to the financial performance or the financial position of the reporting entity), as well as the nature and scope of the disclosures.

⁸Commission Recommendation 2001/453/EC of 30 May 2001.

⁹Ibidem

¹⁰See a definition of “environmental expenditure” below in section 1.1.2.

In Portugal, the regulatory framework applicable to environmental matters is based on the Accounting and Financial Report Standard (NCRF in the Portuguese acronym) nr. 26 – “Environmental Issues”. Since the passing of the Portuguese Accounting Normalization System (SNC in the Portuguese acronym) in 2009, the Portuguese accounting framework includes a specific standard on environmental matters, which establishes commendatory information to be disclosed in the Annual Report and in the Notes, related to:

- Recognition and measurement of environmental costs;
- Environmental liabilities, assets and risks;
- Disclosure of environment-related issues in the Annual Report and in the Notes.

The nature of the required disclosure in the framework of this standard, although generic enough in scope, is nevertheless demanding, if full compliance is aimed at. The annual report should address:

- a) Implemented environmental protection programs and environmental policy;
- b) Environmental measures implemented to comply with existing or future regulation;
- c) Quantified improvement in performance in specific environmental areas, for instance carbon emissions;
- d) Environmental performance quantified information, in areas such as resource intake, energy and waste treatment;
- e) Reference to existing standalone environmental reports and a summary of its content.

The notes should mention:

- a) Used measurement criteria and value adjustment methods in environmental matters;
- b) Environmental-related public subventions assigned to the organization;
- c) Environment-related provisions;
- d) Material environmental liabilities;
- e) Discrimination of each category of material environmental liabilities, according to nature, settlement date and conditions, nature of environmental damages or regulations that demand correction;
- f) If present value has been used, the discount rate used in the current estimate and the liability's undiscounted value;

- g) Environmental contingent liabilities and its specificities;
- h) Accounting policy for long term environmental costs for site restoration and dismantling;
- i) Amount of non-capitalized environmental costs;
- j) Costs with fines and penalties associated with noncompliance;
- k) Amount and calculation methods used for other environmental costs.

To be able to accurately determine environmental related facts, organizations must use an accounting system that allows clear cost identification and allocation. Financial accounting is concerned with two sorts of environmental expenditure:

- Environmental costs that are recognized as expense in the period;
- Environmental costs that may be capitalized (if they meet the criteria to be recognized as an asset). Capitalization of environmental costs is only allowed if future economic cost savings, increased efficiency or improved safety may be expected to result from present expenses (UN, 2001).

One of the main implications of disclosure requirements is the need to report on financial implications of environmental protection measures. Reporting on the above listed individual categories of information may be sufficient to satisfy external stakeholders.¹¹ However, a different approach should be taken by organizations when looking for relevant information in the internal decision-making process and strategic considerations

¹¹ In order to better understand the nature of current environmental financial disclosure by companies, EDP's 2011 annual report was analyzed. EDP is a utility company, listed and the largest generator, distributor and supplier of electricity in Portugal. The company can, therefore, be held as a reference in terms of financial reporting, in our country. In EDP's 2011 annual report extensive information on sustainability matters is reported. This information is presented mainly in two distinct ways: a) descriptive references related with the company's commitment to promoting sustainability; b) environment performance indicators in physical units. Regarding financial information, there has been a concern with providing some information on environmental issues, according to the demands of IAS 16. Data are reported on the following items:

- amount dispended on environmental investments and other environmental expenditure, by category;
- amount of provisions for future environmental costs (dismantling, decontamination and restoration costs);
- amount of fines and other penalties incurred during the year;
- amount and source of environmental revenues.

No relationship is established between environmental expenditure and its impact on business performance.

The report is available at the following link:

<http://www.edp.pt/en/Investidores/publicacoes/relatorioecontas/Pages/RelatorioeContas.aspx>

(Jonäll, 2008). In particular, a relationship should be established between environmental investments and their impact on company's performance.

The following subsection deals with EMA, which gives particular attention to the relationship between EA and internal management. EMA is crucial to complement financial accounting practice and provide managers with value relevant information for their decision making process.

1.1.2. Environmental Management Accounting

Studies on this field clearly suggest that the scope of application of environmental management accounting is very wide and rich. Cost allocation, product pricing, capital budgeting, product design and overall economic performance improvement are some of the possible applications.

EMA, as a system that primarily generates financial information for internal management purposes, is a key instrument in the analysis and accurate evaluation of organizations' environmental investments and environmental performance (United Nations, 2001), to the extent that it will allow:

- To identify and quantify (potentially) all material environmental costs, even the ones traditionally considered as overheads, such as the costs of handling and disposing of waste;
- To allocate these cost to specific functions and projects;
- To identify opportunities to cost reduction and to minimize environmental impact;
- To produce environment-related financial indicators to assess organizational eco-efficiency, important both to internal performance evaluation and to allow external comparability (benchmarking);
- To support budgeting for environmental costs and benefits;
- To support investment decisions.

To the International Federation of Accountants, IFAC (2010), EMA implementation implies the identification and analysis of two sources of information for internal decision making:

- Physical information on the use, flows, and destinies of energy, water, and materials including wastes;
- Monetary information on environment-related costs, earnings, and savings.

Despite the apparent simplicity and objectiveness of the “environmental costs” concept, determining which activities may be classified as environmental activities and, therefore, should be separately recognized as environmental assets or expenses, is not straightforward. Determining which environmental costs are relevant enough to be recognized and measured (Burrity, 2004) is also not an objective matter. In addition, the United Nations (2001) highlights that there is no standard definition for “environmental costs” for two main reasons: the potential inclusion of externalities¹² and the subjectivity of this definition in organizations with particular characteristics.

Nevertheless, the definition of environmental expenditure proposed in the Commission Recommendation 2001/453/EC, seems to be helpful in this context:

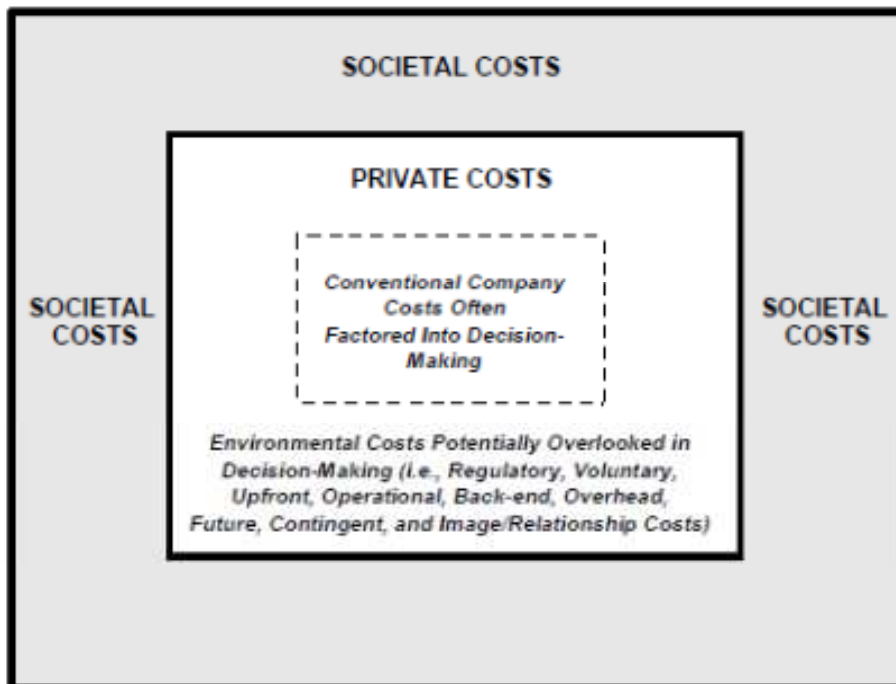
“Environmental expenditure includes the costs of steps taken by an undertaking or on its behalf by others to prevent, reduce or repair damage to the environment which results from its operating activities. These costs include, amongst others, the disposal and avoidance of waste, the protection of soil and of surface water and groundwater, the protection of clean air and climate, noise reduction, and the protection of biodiversity and landscape.” (Commission Recommendation 2001/453/EC)

The US Environmental Protection Agency (1995) in “An Introduction to Environmental Accounting as a Business Management Tool: Key Concepts and Terms” provides a comprehensive list of environmental costs incurred by firms. Societal costs, according to this conceptualization, correspond to the above mentioned concept of externalities, that is,

¹²Some literature argues that costs resulting from resource depletion, although not directly caused by a specific production activity, should be internalized, that is, reflected in accounting, to the extent that it impacts heavily on natural environment and on overall wellbeing, either in a positive or in a negative way (Braz et al., 2009; Cruz et al., 2009; US EPA, 1995). United Nations (2010) consider the concept of environmental costs regards only corporate produced cost. “External costs which result from corporate activities but are not internalized via regulations and prices are not considered. It is the role of governments to apply political instruments such as eco-taxes and emission control regulations in order to enforce the “polluter-pays” principle and thus to integrate external costs into corporate calculations.” Burrity (2004) also addresses this controversy. The complex and controversial nature of the process of accounting for externalities is, however, recognized in all studies, with particular relevance for public sector environmental accounting and reporting practices. In fact, almost all fields of action of public services are closely linked to natural resource management, pollution prevention and well fare promotion (to refer only a few examples: waste management, water supply, land, urban, traffic and mobility planning, management of protected areas) and all their activities impact heavily on citizens’ well being and on the environment, either in a positive or in a negative manner. A true concern with environmental performance and sustainability by public sector organizations should, ideally, comprise comprehensive accounting for externalities.

“the costs of business' impacts on the environment and society for which business is not legally accountable”. Figure 1 represents graphically the difference between private and societal costs. US EPA’s concept of private costs includes a specific category of costs: environmental costs which are not traditionally considered in decision-making.

Fig. 1.1.1.1.: Categories of Environmental Costs
Source: US EPA (1995: 15)



In a document entitled “Environmental Management Accounting Procedures and Principles”, United Nations (2001) states that different companies might define “environmental costs” differently and that a variety of methods for cost assessment are available. The main concern underlying environmental cost is the allocation to specific organization activities and products. This task is important to identify the correct environmental costs associated with each cost object and facilitates the potential reduction of such costs. The methodology advanced by United Nations provides an EMA environmental cost scheme, according to the environmental cost classes used in Environmental National Accounting:

Fig. 1.1.1.2: Overview on environmental cost scheme

Source: United Nations (2001: 16)

Environmental media	Air / Climate	Wastewater	Waste	Soil / Groundwater	Noise / Vibration	Biodiversity / Landscape	Radiation	Other	Total
Environmental cost/expenditure									
1. Waste and emission treatment									
2. Prevention and environmental management									
3. Material purchase value of non-product output									
4. Processing costs of non-product									
∑ Environmental expenditure									
5. Environmental revenues									

This methodology proposes that environmental expenditures are classified and calculated according to each cost category, as well as according to the environmental mediums (soil, water, air, etc.) they impact on.

After cost identification, according to each environmental cost centre, allocation to production cost centers should follow. Finally the costs are attributed to the respective cost carriers (products or activities). As for the choice of the allocation key, one possibility is to allocate the environment-driven costs based on the volume of waste caused by each cost driver (e.g., volume treated by hour, waste/kg of output, and emissions/working hour of equipment). Another possibility is to allocate costs according to the potential environmental impact added of the treated emissions. The environmental impact is calculated by multiplying the volume of waste by the toxicity of the emissions. The choice of allocation key must be adapted to the specific situation.

The methodology proposed by the United Nations, addresses several accounting tools that enable better environmental costs management, such as:

- Activity-based costing: this cost system is designed to improve the allocation of resources to cost objects by allocating, in a first stage, costs to the activities of an organization and, in a second stage, activity costs to cost objects. This methodology is important to reduce the amount of costs hidden in overhead cost

categories. The direct benefits of this method include a more accurate product pricing, as well as a more clear identification of value creation;

- Cost flow accounting: this new method focuses on material flows for assessment of total costs of production. It enables more transparency in the course taken by materials and energy in the production process, thus increasing overall efficiency and cost reduction.

Other relevant cost methodologies in the area of EA are Full Cost Accounting (FCA) and Life-Cycle Costing (LCC)¹³.

Bartolomeo et al. (2000) used questionnaires and interviews in eighty four European firms to assess firms' internal practices on EMA. The survey showed that, in most cases, costs remain hidden or incorrectly allocated to the final product, which prevents business from a strong investment in pollution prevention measures (as more beneficial than end-of-pipe solutions), because managers underestimate these costs. This study also suggests that, although many companies claim some EMA activity, this often represents only a few isolated experimental projects rather than a systematic and comprehensive implementation.

In theory, the use of appropriate EMA techniques in the context of environment-related projects and activities seem to be extremely relevant as a decision-making tool. The cost-benefit approach regarding the implementation of such techniques is a minor issue. According to Jonäll (2008),

¹³ According to IFAC (2010), FCA focuses on internalizing all environmental and social impacts, by identifying and treating a wide range of costs:

- conventional costs;
- hidden costs (found in overheads and general accounts);
- liability costs (contingent liabilities not currently recognized in conventional accounts, such as future cleanup costs);
- (less) tangible costs (costs and benefits that may be assessable in financial terms and are likely to arise from improved sustainability management, such as loss/gain of goodwill, changing attitudes of stakeholders);
- sustainability-focused (moving beyond compliance) costs (costs to ensure zero or near-zero negative environmental and social impacts or to create positive impacts).

The aim is to improve social and environmental performance, by highlighting where externalities can be reduced or eliminated, thus reducing future expenditure related with non-compliance regarding emissions or other environmental damage. Epstein (1996) clarifies that "Full environmental cost accounting takes into consideration the future costs imposed on the environment by a product and allocates them back to the product itself." (p.19) The importance of this methodology is that "More complete identification and measurement of broadly defined environmental impacts and better accumulation, tracing, and assignment of environmental costs usually lead to better management decisions." (p.2)

LCC is an alternative cost methodology that focuses on incorporating the related cost caused over the whole life cycle of a product. This procedure aims at identifying the environmental consequences of a product, process, or activity through its entire life cycle in order to achieve environmental improvements (US EPA, 1995). The main contribution of this technique lies in the possibility to identify, track and accumulate total project or investment costs, over longer-term time horizons and it is especially relevant for capital budgeting analysis.

“Results suggest that the financial benefits of introducing Management Environmental Accounting do not usually justify major changes and can therefore be better achieved by integrating environment into existing programmes, as with introduction of Activity Based Costing into a business” (Jonäll, 2008: 38).

Notwithstanding, Jonäll (2008) reviewed some reporting results claiming that the UN EMA methodology can contribute to potentially enlarge cost savings and benefits. He presents some case studies of cost and environmental savings that support the theory that investing in more effective prevention (in the EMA methodology: Prevention and Environmental Management) technologies is compensated by better efficiency. Investing in prevention means reducing spending in the so called end-of-pipe solutions, i.e., “material purchase value of non-product output” and “waste and emission treatment”. This last one is, according to the UN, the most expensive of environmental cost categories.

The US EPA (2000) also presents some cases of a successful implementation of EMA and its extremely relevant contribution to decision-making:

- General Motors reduced its disposal costs by \$12million by establishing a reusable container program with its suppliers;
- Commonwealth Edison, a major electric utility company, realized \$25 million in financial benefits through more effective resource utilization;
- Andersen Corporation implemented several programs that reduced waste at its source and had internal rates of return (IRR) exceeding 50%;
- Public Service Electric and Gas Company saved more than \$2 million in 1997 by streamlining its inventory process.” US EPA (2000: 4).

This subsection discussed some important issues regarding accounting, reporting, environmental cost identification and measurement. The next subsections address “environmental investments” and “environmental performance” issues in order to facilitate a comprehensive discussion on the relationship between environmental accounting and value creation. Porter and Van der Linde (1995) contribute to this discussion by highlighting firms’ main categories of innovation in response to the need for environmental improvement:

“Innovation in response to environmental regulation can fall into two broad categories: The first is new technologies and approaches that minimize the cost of dealing with pollution once it occurs.[...] The second and far more

interesting and important type of innovation addresses the root causes of pollution by improving resource productivity in the first place. Innovation offsets can take many forms including more efficient utilization of particular inputs, better product yields and better products.” (Porter and Van der Linde (1995:125).

Moreover, Porter and Van der Linde (1995) also stressed the critical importance of correctly and systematically tracking environmental spending, as the foundation for a correct assessment of the financial implications of environmental performance.

1.2. Environmental Investments

“Most companies have problems quantifying the cost savings of environmental management systems and other environmental activities. [...]. Most of these calculations are based on the question: What would I have to pay today if I had not invested or acted a couple of years ago? Future-oriented calculations additionally face information gaps and uncertainty to answer the question: What will I have to pay in the future if I do not invest or act now? Most of these calculations cover only a tiny part of corporate benefits of environmental management or investments. This is because the calculations are typically done not by the accountant but by the environmental manager, who is aware neither of the total corporate costs of emission treatment, pollution prevention and material efficiency, nor of the methods and principles behind capital budgeting. [...] only a fraction of total costs will be visible.” United Nations (2001:101)

The drivers underlying environment-related investments have been abundantly analyzed in literature (CIFPA, 2004; Wood & Ross, 2006; CPA Australia, 2008; Bras et al., 2009; Hopwood, 2009; Leiter et al. 2011; Clarkson et al., 2012; Pagell et al., 2012; Murovec et al., 2012) and are essentially related to two sets of reasons. First, almost all organizations need to comply with legal requirements (with special incidence on the most polluting ones, such as construction, extraction and industry sectors) and thus need to implement environment protection measures in order to avoid legal penalties, as well as expensive treatment and damage repair measures. Second, there is a wide range of other environmental procedures that result from a voluntary action and may be motivated either by simple public legitimizing goals, without any consideration of direct financial implications on performance, or by a more strategic planning of an organization’s competitiveness and economical and financial sustainability (concerns that may range from simple cost savings, to risk reduction, or even to more systematic economic performance improvement, on the long run). Whatever the drivers and scope of environmental investments, a systematic approach to capital budgeting and financial viability analysis is key when environmental performance is considered strategic within an organization.

One main issue in the understanding of investment appraisal is the clarification of environmental investment concept. Environmental investments are expenditures that gather the following criteria:

- Expenditure that can be capitalized, according to accounting standards and to the Commission Recommendation 2001/453/EC (see previous section);
- Expenditure that is primarily destined to “prevent, reduce or repair damage to the environment which results from its operating activities. These costs include, amongst others, the disposal and avoidance of waste, the protection of soil and of surface water and groundwater, the protection of clean air and climate, noise reduction, and the protection of biodiversity and landscape. [...] Costs that may influence favorably the environment but whose primary purpose is to respond to other needs, for instance to increase profitability, health and safety at the workplace, safe use of the company's products or production efficiency, should be excluded.” (Commission Recommendation 2001/453/EC).

As a result, the identification of a given expense as an environmental investment is often a complex matter. For instance, in the case of cleaner technologies and energy efficiency investments, it is undisputable that these solutions allow for more efficient production processes and reduce emissions at the source, but often, the new technology also uses less energy, is faster and has more production capacity. As such, it is not clear whether and to what degree these technologies should be quoted as investments for environmental protection (UN, 2001). The United Nations (2001) considers that “if there are significant differences and the investment was mainly done for environment protection purposes, the relevant share could be quoted as an environmental investment and the annual costs considered by depreciation. However, if the cleaner technology represents the current state of the art and was installed mainly as a regular replacement of an old device, it should not be regarded as environmental investment.”

According to the United Nations (2001), cleaner technologies should be treated as normal capital investment and not as environmental investment because these investments are made mainly for economic reasons and it is difficult to determine exactly the environmental element of the cleaner technology. Ricco and Ribeiro (2004) sustained this idea and additionally argue that investments in cleaner technologies not considered as an environmental cost should be mentioned in the notes to the financial and/or environmental report.

Decision-making process in the environment related investments requires an accurate and reliable viability analysis, regardless of the how they are accounted for in a financial perspective. Beyond environmental cost assessment and integration, discussed in the previous section, environmental investment appraisal involves a wide range of other inputs. Some of these inputs are common to conventional investment appraisal, but there are some specific implications that need to be highlighted:

- Probabilities attached to the occurrence of the environmental risk and associated costs (US EPA, 1995). These require the consideration of future liabilities and contingencies (related mainly to clean up obligations, fines and penalties), the degree of exposure to present and future environmental risks being an important indicator to both internal and external stakeholders;
- The need to cover a sufficiently long time horizon to capture the long-term benefits of environmental investments, since “environmental performance has a longer-term focus” (US EPA, 1994);
- The need to choose an appropriate discount rate. A conventional discount rate may discriminate against projects with environmental benefits (US EPA, 1994; Kwok and Rabe, 2010);
- Savings resulting from preventing future short-term or end-of-pipe solutions (UN, 2001);
- The “intangible benefits” of improved corporate image, customer satisfaction and creditworthiness with banks (US EPA, 1995; UN, 2001; Ricco and Ribeiro, 2004);
- Legal compliance (UN, 2001);
- Employee motivation (UN, 2001);
- Immediate and long-term implications on community sustainability (UN, 2001).

Consequently, evaluating capital alternatives and investment financial viability appears to be a substantially more complex process when environment-related investments are at stake. In fact,

“a previously profitable project can become unprofitable when externalities are considered. However, it is contra-intuitive to business managers to include external costs and benefits, which reflects the impact of the investment on political, social, and ecological aspects of the future, in their internal business decisions” (Kwok and Rabe, 2010).

An important input regarding environmental investments is the availability, in some contexts, of policy instruments of incentives to environment related projects and equipments, which have acted as important drivers for green investment. For instance, in Portugal, the investment in environmental protection has been stimulated by the inclusion of environmental criteria in the financing opportunities associated with the EU investment grants for both private business and public sector.¹⁴ Wood and Ross (2006) defined subsidies as “the ‘carrot’ among social controls”, that is, as an important influential factor to promote environmental investment in private companies. In addition, the so called “feed-in-tariff” on renewable energies, has also had a definite impact in the implementation of solar photovoltaic (PV) systems in firms, public buildings and homes.¹⁵ Fiscal incentives such as higher depreciation rates for solar energy PV equipment, when compared with the rates applicable to other assets with similar useful life,¹⁶ have also provided additional incentive.

The intervention of governments in environmental matters, namely through regulatory activity, may, on the contrary, act or be perceived as a disincentive for economic investment. Feiock and Stream (2001) argue that, despite their potential benefits, environmental regulation may deter new investment in some contexts by increasing production costs (large capital investments, pollution abatement and control, increased operation costs). Their conclusions were specific for the American context in the period comprehended between 1983 and 1994, but their research raises an important ‘universal’ issue: world governments are faced with the growing challenge of balancing the ‘green’ compliance requirements imposed on business with an incentive framework that reduces financial risk for economical agents, facilitates private environmental investment and, in this way, fosters economic sustainable growth.

¹⁴ Beyond specific grants for environmental projects (energy efficiency measures, improvements in urban and natural environment, a.o.), both national regional scope programs financed by EU structural funds have included actions related with resource sustainability and energy efficiency among the quality criteria of most calls for proposals (Alentejo’s Regional Operational Program 2007-2013 – INAlentejo alone included such criteria in four of its thematic regulations). See INAlentejo’s intermediate evaluation report at:

http://www.inalentejo.gren.pt/index.php?option=com_content&view=article&catid=36%3Amenu-geral&id=112%3AAvaliacao&Itemid=41

¹⁵ However, the Portuguese incentives to the production of renewable energies have decreased recently, due to the reduction in the price offered by KWh production, by governmental decision. Currently, electricity production through solar PV, in Portugal, is no longer interesting for the small scale producer. Return on investment has become excessively distended in time, due to smaller revenues deriving from energy selling. In fact, the electricity selling price per MWh (feed-in-tariff) was 615€ in 2011; in 2013, new installations will only be paid 196€/MWh. Although the investment costs for the equipment have also been declining rapidly in the last few years, these new conditions question the economic viability of electricity production PV installations.

¹⁶ Regulamentar-Decree nr. 25/2009 of 14th September establishes a maximum annual depreciation rate for solar energy equipment of 25%. Previously to the passing of this Regulamentar-decree, depreciation rate was 7,14%, more adjusted to actual useful life of this kind of equipment.

1.3. Environmental Performance

“In terms of environmental performance, when managers are rewarded on the basis of their financial results, they have every incentive to introduce and promote efficiency-based environmental measures in their entities, such as recycling, energy efficiency and waste management. However, these are easier to manage, to quantify, to standardize, and to be specific about than ecological issues which challenge basic values and assumptions [...], involve critical natural capital and uncertain information about environmental outcomes, or require radical change for their resolution.” Burrit and Welch (1997: 553)

This section reviews some of the main issues regarding the measurement of environmental actions in financial performance/ in the creation of competitive advantages. This topic should not be disregarded when discussing environmental issues since it assumes a crucial importance for any business manager.

Since environment protection efforts are not traditionally regarded as strategic within organizations, managers are usually not open to the idea of improving accounting systems as a way to ensure a more accurate and reliable assessment of environmental related costs and benefits. Managers’ reluctance to improve accounting systems in this domain may obstruct the improvement of economic performance in the long run:

“A previously profitable project can become unprofitable when externalities are considered. It is contra-intuitive to business managers to include external costs and benefits, which reflects the impact of the investment on political, social, and ecological aspects of the future, in their internal business decisions. Managers are compensated based on shareholder’s wealth maximization. Because shareholders may not live to receive the long term benefits of sustainability, they may not consider those benefits as a significant part of their wealth”. (Kwok and Rabe, 2011: 3)

Several organizations (e.g., International Federation of Accountants; United States Environmental Protection Agency; World Business Council for Sustainable Development (WBCSD); United Nations) have explored the links between environmental and financial performance. These organizations have published methodological frameworks aiming at improving environmental performance and thus improving the measurement of business success. Table 1.3.1 summarizes some of the main contributions:

Table 1.3.1.: Methodological frameworks for measuring the financial implications of environmental performance

Organization	Contribution
World Business Council on Sustainable Development - WBCSD (1997)	Environmental actions, in a business context, have been predominantly faced as liability reducing measures. However, ignoring “environmental drivers is to miss an important element of competitive advantage.” The guide book “Environmental Performance and Shareholder Value” establishes some principles to take advantage of environmental drivers in order to achieve performance improvement and competitive advantages (measures ranging from consumption rationalization and waste reduction to adequate communication with stakeholders, including minimization of environmental risk exposure). The main idea underlying these recommendations is, again, that incorporation environmental drivers into business strategy lead to long-term improved performance. A set of case studies shows whether eco-efficient management strategies led to higher financial value.
US Environmental Protection Agency - EPA (2000)	US EPA provides a four-step framework to help companies improve their financial and environmental performance, by specifically addressing environmental costs and environmental impacts that result from materials management decisions: <ul style="list-style-type: none"> - Step 1: identifying costs. This stage requires a solid knowledge of material flows within the production cycle, in order to uncover sources of environmental costs; - Step 2: identification of areas and processes with potential for cost saving and environmental impact reducing; - Step 3: quantitative and qualitative analysis of costs and benefits of alternatives identified in the previous stage. It involves the use of management accounting techniques such as activity based costing, life cycle costing, as well as investment assessment methods and risk evaluations. The main challenge will be the quantification of certain less tangible and certain costs and benefits; - Step 4: “decide, implement and manage”. The new practices resulting from the analysis are integrated into the company’s material resource planning and other information systems. The new processes should result in efficiency improvements. For the efficiency to be continuously sought for, is it important to continuously monitor results and review the process in order to ‘update’ cost rationalization and impact reducing opportunities.
United Nations Conference on Trade and Development (2004)	The United Nations Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting suggests that environmental and financial performance indicators can be used together to measure an enterprise's progress in attaining eco-efficiency or sustainability. In particular, the concept of eco-efficiency indicator is introduced as the ratio between an environmental and a financial variable, measuring the environmental performance of an organization with respect to its financial performance. The underlying belief is that the quality of decision-making can be improved by linking environmental and financial items. “For instance, energy requirement per unit of value added provides a good indication of the impact of an energy tax on an enterprise.” (p. 4). The manual is aimed at enabling companies to report their eco-efficiency performance for the following five generic environmental issues: <ul style="list-style-type: none"> (a) Water use; (b) Energy use; (c) Global warming contribution; (d) Ozone depleting substances; (e) Waste.
International Federation of Accountants - IFAC (2010)	The International Federation of Accountants, published for the first time in 2008 a “Sustainability Framework” to help integrate and account for sustainability in organizations. According to this framework, there are some independent measures that may be followed in order to improve performance by integrating sustainability issues into management practices: <ul style="list-style-type: none"> - Cutting costs by minimizing waste and minimizing energy and water consumption; - Calculating organizational carbon footprint in order to manage GHG emissions and make reductions over time;

	<ul style="list-style-type: none"> - Improving Information to Support Decisions and Reporting through appropriate accounting, costing and valuating methods; - Integrated Management Control Systems (integrating environmental objectives with organization's global strategy – that is with financial processes, such as budgeting and forecasting and with quality management); - Performance Measurement, through the definition and assessment of Key Performance Indicators (using strategic performance measurement systems, such as the balanced scorecard)
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Underlying all these methodological frameworks is the concept of “eco-efficiency”. This concept was developed in the late 1980s and was first described in a scientific publication back in 1989 (UNCTAD, 2004). The concept is defined by WBCSD (1997) as the “link between ecological and economical efficiency”, that is, the relationship between environmental performance and economic performance. Eco-efficiency in an organization

“means creating value for society and business by doing more with less, over the full life-cycle by: reducing energy inputs; reducing toxic dispersion; enhancing material recyclability; maximizing sustainable use of renewable resources; extending product durability; enhancing the functionality of goods and services” (WBCSD, 1997).

An eco-efficient company would, then, be one that can improve financial performance, as it creates value for its shareholders, satisfies customer demands, reduces environmental impact and contributes to the conservation of valuable resources.

Accounting plays a crucial role in providing the necessary information to assess the financial value of good environmental performance and to support decision making. This demands that accounting systems go beyond traditional financial accounting outputs and embrace cost management methodologies that identify and assess sustainability related costs. To the UN/ISAR (UNCTAD, 1997), there is no single accepted way of defining or measuring environmental performance. This organization presents different approaches to the concept:

- reporting on compliance with statutory permits or toxic release inventory (TRI) - type requirements;
- reporting reductions in absolute discharges;
- reporting success in achieving emissions reduction targets;
- relating emissions to significant environmental impacts ("environmental footprint");
- developing single (or multiple) index models to give an aggregate environmental performance;

- developing an array of relevant environmental performance indicators (EPIs) which have general industry significance and which are computed on a consistent basis over time.” (UNCTAD, 1997: 15)

The concept of Environmental Performance indicators (EPI) is apparently linear. However, the cross-disciplinary nature of the concept and the lack of standardization in their calculation and dissemination make it more complex than it appears. The UN/ISAR (UNCTAD, 1997) lists a non-exhaustive set of EPI or “eco-financial indicators”, which derive from those indicators used by the International Standards Organization (ISO - ISO 14031: Environmental Performance Evaluation), and highlight the items that are relevant for financial assessment.

Table 1.3.2: **Eco-financial indicators according to UNCTAD (1997: 17)**

Financially relevant (“eco-financial”) environmental performance indicators
1. Cost of environment related capital expenditure
2. Direct environment related operating or management costs as % of sales, value added, net earnings, divisional earnings or other unit of output costs, e.g. production cost or site cost of sales
3. Total costs of regulatory compliance
4. Fines and penalties, damages and remediation costs
5. Cost of waste and waste-disposal charges to costs of materials
6. Avoided costs/benefits of pollution prevention measures/reduced costs of purchased materials resulting from recycling or reuse
7. Marginal cost of environmental protection measures
8. Insurance premiums as measures of the effectiveness of risk management activities
9. Emission reduction/expenditure
10. Average environmental expenditure per....
11. Environmental investments/total investments
12. Cost of energy or fuel consumption or packaging costs
13. Donations and other voluntary environmental costs
14. TRI emission per \$m turnover

The “Environmental Management Accounting Procedures and Principles”, released by the UN (2001), stresses the importance of EPI’s in allowing an organization to manage resources in a more effective and efficient way and highlight the EPI’s role in allowing benchmarking practices. One basic principle in defining and using EPIs to evaluate performance seems to be the possibility of translating environmental protection related data into cost-related figures, i.e., expressing EPIs also in cost-related values (environmental cost indicators). The establishment of adequate EPIs will allow

performance assessment in terms of “Eco-intensity” through indicators like material input in kilogram (absolute indicator) in relation to output in product and/or service units in kilogram (hectoliter, respectively) (e.g., water input per hectoliter of beer production).

Measuring eco-efficiency demands that EPIs are defined not only in terms of physical units such as kilograms, kWh or hectoliters but also in monetary variables, like turnover and profit. An eco-efficiency indicator is, then, one that shows possible relative reduction of material input in relation to increased turnover or profit. UN (2001) and UNCTAD (2004) suggest different performance indicators that relate material input to factors such as production output, profit and turnover with the aim of demonstrating the level of resource and production process efficiency. These indicators are expressed in monetary terms. The creation of performance indicators that are expressed in monetary units is, according to the sources mentioned above, a difficult but necessary task if standardization and benchmarking goals are to be pursued.

1.4. Discussion of the problem and delimitation of boundaries

The previous sections reveal that environmental issues are important in the accounting field. On the one hand, there is a growing concern related to the recognition, measurement and disclosure of such issues in the financial statements. Additionally, environmental cost identification is not a straightforward process but is crucial to recognize accurately total costs of firms and provide relevant information to the decision-making process. On the other hand, one cannot ignore that the objective of a company is to maximize shareholder value. Therefore, it is important to consider all the inputs in the environmental investment appraisal and evaluate whether environmental efficiency improves financial performance and shareholder value.

EA and value creation are two concepts that seem to be developed separately so far. As such, this gap suggests that a systematic review of the literature may help researchers to identify research avenues that can be explored and provide a better understanding of this phenomenon. The contribution of this dissertation is thus to identify studies that analyze whether environmental and sustainability practices contribute to create shareholder value in firms.

The systematic research to be conducted in Chapter 3 will review papers that present conceptual, methodological and empirical contributions allowing the understanding of whether environmental issues are related to value creation. The methodology will contribute to delimitate and refine the discussion of this dissertation and provide evidence on some important questions that drive the search of studies to include in this systematic review:

- What are the main shortcomings of current EA practices?
- What are the main challenges to EA and reporting?
- How do EA practices relate to overall performance evaluation and decision making?
- How to foster/ensure a good environment related financial performance?
- To what extent do environmental investments contribute to business value creation?

These questions are partially addressed in previous studies focusing on EA, environmental investments and environmental performance. This dissertation aims at discussing these issues in the form of a systematic review of the literature, narrowing the scope to environmental related practices and investments with financial performance and value creation. The link between environmental issues and value creation thus differs from other studies addressing broader corporate environmental performance issues.¹⁷ This process is expected to provide a comprehensive and in-depth analysis of this field as well as provide avenues for future research.

Figure 1.4.1. establishes the boundaries of the systematic review. Three main areas of focus were selected according to the different dimensions of the problem: “environmental accounting” is the technical framework underlying all disclosure practices and management decisions; “environmental investments” and costs are the measurable units that translate into financial data all the environmental related practices and decisions; and finally, “environmental performance” refers to practices that estimate and assess the impacts of all environmental investment and accounting related options into the firm’s financial and economical results and value creation. Analyzing comprehensively value creation through environmental decisions involves reviewing all these areas as interrelated aspects of the same problem.

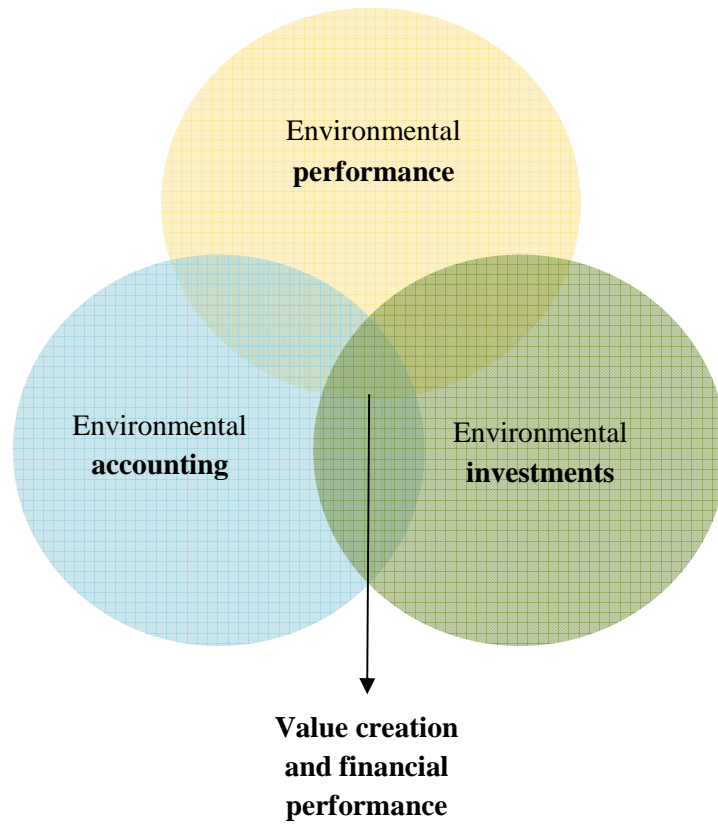
The next chapter presents the methodology underlying the selection and analysis of the relevant papers.

¹⁷ Debnath et al. (2012) produced a very comprehensive review of environmental management accounting (EMA) related papers. The study included a review of published case studies on EMA, as well as of a significant number of studies presenting EMA methods and tools. Some of the case studies were also found in the database research conducted for this systematic review, but were not presented individually, due to size considerations. The study by Debnath et al. (2012) was, however, not conducted under a systematic review framework and, accordingly, some relevant papers on the field were not included.

Two other works that present literature reviews are the papers by Ienciu et al. (2010) and Schaltegger et al. (2011). However these are bibliometric literature reviews, which focus on gathering quantitative data about published articles on the subject.

Also, Blanco et al. (2009) conducted a literature review to analyse the relationship between the voluntary environmental management or performance of firms and their economic results. The review was, however, restricted to studies addressing on firms’ environmental behaviors that are voluntary in nature. It also focused exclusively on papers presenting statistical empirical analysis of firm performance, leaving out works of a more conceptual nature, that propose methodological models for environmental accounting, investment and performance assessment.

Figure 1.4.1.: mapping the field



2. METHODOLOGY

This dissertation follows the systematic review approach, described in Tranfield et al. (2003). The systematic review process, as opposed to the traditional literature review method, employs an explicit and transparent method to identify, select and review the relevant studies related to the research topic.

2.1. The rationale of Systematic Literature Review

A literature review is an indispensable component of all scientific work. It contextualizes the problem, identifies current knowledge of the field, and presents the main conclusions and breakthroughs achieved by those addressing related issues. It is the starting point of any academic study and allows the researchers to understand and justify the relevance of their study.

Hart (1998) emphasizes that there is no such thing as a perfect literature review. Despite all the efforts to eliminate subjectivity, the reviewer biases will always stand in the way to objectivity as a consequence of prior assumptions and personal beliefs. However, researchers should have a strong concern with the comprehensiveness of the studies and theories covered by the research to ensure that conclusions are not driven by a limited perspective of the problem.

A good literature review must, in the first place, be based on a profound knowledge of relevant studies related to the problem that is being studied. Second, the reviewer must be able to create a critical synthesis of these studies and demonstrate ability to understand the findings, their main implications and all different perspectives of the problem. This ensures that researchers' view or biases will be minimized in the scientific process.

The methodology used to conduct the review is usually dependent on the reviewer's own judgment, which may pose the question of whether truly ascertainable methodological rigor really exists in traditional literature reviews. Tranfield et al. (2003) proposed the use of the systematic review of literature which was originally developed in the medical sciences, to the field of management.

“Systematic reviews differ from traditional narrative reviews by adopting a replicable, scientific and transparent process, in other words a detailed technology that aims to minimize bias through exhaustive literature searches of published and unpublished studies and by providing an audit trail of the reviewer’s decisions, procedures and conclusions” (Tranfield et al., 2003: 209).

Using this method implies a greater objectivity. The research is systematic because there is a research protocol that leads to results easily replicable and ascertained by others: “Systematic reviews expose studies to rigorous methodological scrutiny” (Tranfield et al., 2003: 217). However, as Tranfield et al. (2003) assure, the aim is to guarantee that the research is less open to researcher bias, but not to compromise the researcher’s ability to be creative in the literature review process.

2.2. Systematic Review Aims

This dissertation is based on an accurate and consistent compilation of papers related to environmental accounting, environmental investments and environmental performance and seeks to:

- Identify key ideas and elaborate a critical synthesis of the main issues related to the boundaries of the study;
- Understand and clarify the main shortcomings and challenges in the field;
- Identify studies that link environmental issues with value creation;
- Identify research gaps and research questions.

2.3. Systematic Review process

2.3.1. Consultation group

This systematic review benefited from the contribution of my supervisors (see table 2.1), who supported me throughout the whole process and provided the necessary guidance, both in the methodological aspect and in addressing the topic of research.

Table 2.3.1.1.: **Consultation Group**

Person	Title/ Organization	Role in the Review
Dr. Rúben Peixinho	Assistant Professor of Accounting and Finance / Faculdade de Economia da Universidade do Algarve	Supervisor
Dra. Clara Pires	Assistant Professor of Finance / Instituto Politécnico de Beja	Supervisor

My supervisors, Dr. Ruben Peixinho and Dra. Clara Pires, were always available to provide the necessary guidance and motivation and were, therefore, crucial in making this work possible. They committed very seriously to finding a feasible and relevant approach to the topic I wanted to research and, very kindly, brought their vast experience as researchers and academics into this supervising task. The contribution of Dr. Ruben Peixinho, in particular, was key since he introduced me to the systematic review process and helped me find the adequate research framework and guidelines to the selected topic.

2.3.2. Search strategy

A critical stage in the systematic review process is the definition of the search strategy. This study adopts a two-stage process: first, the reading of titles and abstracts in the papers identified in a first stage; second, the reading of the papers considered most relevant. The search was restricted to journal articles, with the aim of limiting the study's working material to information that is reliable and academically relevant.

2.3.2.1. Keywords and search strings

The systematic search is based on the definition of keywords combined in search strings. These keywords were identified in the scoping study made in the previous chapter and were selected based on their relevance to the main question of this study. Table 2.2. presents those keywords, which have been arranged according to the three main framework areas that guided the general research in chapter 1.

Table 2.3.2.1.1.: **Keyword search**

Areas	Keywords
Environmental Accounting	Environmental green accounting cost
Environmental Investments	capital budgeting investments value creation
Environmental Performance	eco-efficiency financial performance performance indicators/ measurement profitability

The keywords led to the definition of search strings that were used in the database search.

Search string 1

(environmental OR green) AND accounting

Search string 2

(environmental OR green) AND (investments OR capital budgeting)

Search string 3

(environmental OR green) AND (financial performance OR profitability OR sustainability)

Search string 4

(environmental OR green) AND (shareholder value OR value creation)

Search string 5

Corporate social responsibility AND (financial performance OR profitability)

Search string 6

Eco-efficiency

As Bartolomeo et al. (2000) state, the term “environmental accounting” is often used loosely and ambiguously. The first string, although too wide in scope, was employed as an exploratory search exercise, with the aim of not leaving behind any papers which might be important to the subject of this study. However, the selection criteria eliminate all papers that are not related to the problem addressed by this dissertation.

The second string was used to identify papers that address specifically investment related issues with the environmental perspective. The third string identified all papers centered in performance assessment and profitability concerns regarding environmental activities and investments. These perspectives were complemented with a search for papers focusing on the shareholder and value creation perspective (search string four).

The concept of “corporate social responsibility” was used in the fifth search string, since many papers in the environmental field focus specifically the social perspective. The aim was not to exclude relevant studies that could eventually not include “environmental” or “green” in the keywords.

Finally the sixth search string consists of an isolated concept which is critical to this dissertation and should, therefore, be analyzed in a holistic way, comprehending all the different approaches and perspectives found in literature.

2.3.2.2. Database search

To narrow the research field to the areas of accounting and finance, all strings were searched for in EBSCO Database. This database covers a large number of a collection of academic journals, thus guaranteeing wide scope research. All papers considered for this study appeared under the items “Academic Source Complete” and “Business Source Complete”, thus guaranteeing that all documents present a reliable academic origin.

2.3.2.3. Other information sources

This systematic review is based on academic journals. Other information sources were also used exceptionally (namely working papers and conference papers found in difference websites), when justified by the document’s relevance, although these cannot

be systematically searched. These sources, especially in the case of unpublished studies, were limited to a minimum, since their academic relevance and quality cannot be stated. Some papers that result from cross-reference of extracted studies were also used, whenever their importance and centrality to the topic advised it.

2.3.3. Selection criteria

After identifying and extracting a list of papers based on the search strings, it is necessary to apply exclusion criteria in order to eliminate duplications, as well as to ensure that only the papers that are important to the research will be considered.

2.3.3.1. Elimination of duplications

The first step is to eliminate all the references that may be duplicated by using different search strings, according to the titles. This procedure ensures that a unique list of studies will be used without duplications.

2.3.3.2. Exclusion criteria based on the reading of titles and abstracts

After eliminating duplications, it is necessary to apply exclusion criteria to eliminate papers unrelated or not relevant to the topic. This selection is based on the paper's titles and abstracts. An analysis of these items allows a first screening that excluded many articles not relevant to the scope of the research. Table 2.3. presents the main criteria used and reasons to exclude papers, at this stage.

Table 2.3.3.2.1.: **Criteria and rationale for exclusion**

Criteria	Rationale	
1. Articles published in other sources than scholarly journals	Environmental issues are referred to on a daily basis on the different media. A very careful screening of the sources of information was required, to ensure both the academic relevance of the sources and the possibility to apply systematic review method. Book chapters and practical guides. Items unavailable for download, such as books or articles to be ordered on-line were also excluded.	
2. Studies that mention the defined keywords as residual issues or in other contexts than accounting and finance.	The reading of some titles is sufficient to conclude that some of the papers are not related to the context relevant to this research. These studies were excluded directly.	
3. Insufficient relation to be considered in the refined scope defined for the systematic review	3.1. Environmental topics not related with accounting, investments and performance	Several topics such as "environmental sustainability", "environmental disclosure", "environmental management", and "operational eco-efficiency" although indirectly relevant to my subject were not central to the research theme and should therefore be excluded.
	3.2. Topics related with accounting, investments and/ or performance but approached from unrelated perspectives or inserted in very specific contexts.	Approaches not focused on organization level analysis and solutions (for example, macroeconomic planning, mathematical programming, specific sector and Environmental Management Systems performance analysis) and/ or focused on specific national contexts were excluded.
	3.3. Topics related with accounting, investments and/ or performance but produced before 1990.	Studies conducted before 1990 or based on data from a period previous to 1990 were excluded. Given the remarkable evolution occurred in environmental corporate practices, studies addressing the 'state of the art' of a few decades ago are not considered relevant, except for conceptual and methodological framework setting purposes. That is why they were considered in chapter 1 – Key literature.
	3.4. Papers that do not add an innovative contribution in terms of theoretic framework and simultaneously are not sustained by an empirical research	Papers focusing on the theoretical framework of Environmental Accounting / Investments/ Performance that do not add a relevant contribution to the "state of the art", as compared to previous studies and that simultaneously do not contain an empirical component related to practical assessment of environmental investments and profitability, were eliminated.
	3.5. Other reasons	Thousands of studies related to environmental accounting and performance were found in the database research. Many cover a broad scope analysis of the theme, not focusing exclusively on financial implications and were, therefore, excluded.

2.3.3.3. Exclusion criteria based on the reading of full text papers

The remaining papers were then submitted to other exclusion criteria based on the reading of full texts. The procedure consists of applying theoretical, empirical and methodological criteria to the text analysis. These criteria are described below:

Theoretical and methodological papers must contain:

1. Clear description of the research problem;
2. Literature review on subject at study and relation of the theoretical model with existing theory and previous works;
3. Clear description of the theoretical model;
4. Discussion of the theoretical model's main contributions, innovation regarding previous models and practical implications for businesses and/or other organizations.

Empirical papers must contain:

1. Literature review justifying the research questions;
2. Description of study hypotheses or research questions;
3. Description of the research methodology;
4. Description of the sample and variables;
5. Discussion of results;
6. Results interpretation and main conclusions in the context of the research question.

2.3.3.4. Exclusion criteria based on quality assessment

The studies that gather all requirements are then subject to a quality assessment according to four different quality criteria:

- Contribution to knowledge
- Discussion of underlying theory
- Appropriateness of the methodology used
- Accuracy of data analysis and its adjustment to the problem at study

A numeric approach has been used, according to the methodology presented by Marcos (2002). Papers are rated for each of the four criteria as zero (absence), one (low), two (medium) and three (high). Only papers that score two (medium) or above for at least two of the criteria are included in the sample.

Table 2.3.3.4.1.: Numerical approach to quality assessment

Elements to consider	Level				Not applicable
	0 – Absence	1 - Low	2- Medium	3- High	
Contribution	The article does not provide enough information to assess this criteria	The paper adds little to the body of knowledge in this area	Contribution to knowledge is trivial in importance and significance	Significant addition to current knowledge; Fills an important theory gap	This element is not applicable to this paper
Theory	The article does not provide enough information to assess this criteria	Literature review is inadequate; Failure to motivate study with practical implications; No underlying economic story	Theoretical base is acceptable	Excellent review of prior literature; Strong theoretical basis; Study has important implications for practitioners	This element is not applicable to this paper
Methodology	The article does not provide enough information to assess this criteria	The idea of study is poorly executed; Inappropriate quantitative methods; Failure to justify proxies for economic variables	Justified research design; Acceptable proxies for economic variables; The idea of study is not fully executed	Research design adequately examine the theoretical argument; Proxies are adequately defined	This element is not applicable to this paper
Data Analysis	The article does not provide enough information to assess this criteria	Data sample insufficiency. Weak connection between statistical results and economic story; Inconclusive statistics	Appropriate data sample. Statistical results relates to economic story; Adequate statistics but inadequate explanation	Adequate data sample; Statistical results support theoretical arguments; Well explained statistics; Include limitation analysis	This element is not applicable to this paper

2.3.4. Data extraction process

Papers that passed all the selection criteria described above are included in the final sample and used as reference for the systematic review. For each of these studies a data extraction form was filled in with the main items necessary for a brief description of the paper. An example of a data extraction form is presented in table 2.5.

Table 2.3.4.1..: Example of a data extraction form

General Description	
Author	Bruce Clemens and Lynn Bakstran
Title	A framework of theoretical lenses and strategic purposes to describe relationships among firm environmental strategy, financial performance, and environmental performance
Journal Title	Management Research Review
Author Affiliation	School of Business, Western New England College, Springfield, Massachusetts, USA
Publication Date	2010
Volume	33
Page numbers	393-405
Research category	Conceptual paper
Study location	Non applicable
Data description	Non applicable
Quality Assessment	
Contribution	3
Theory	3
Methodology	3
Data Analysis	Non applicable
Included (Y/N)	Yes
Exclusion Reason	—
Abstract	This is a theoretical paper which first investigates three constructs: firm environmental strategy, environmental performance, and economic performance. Scholars have argued for different relationships among the three constructs. The paper then discusses two theoretical lenses (strategic choice and the resource-based view) and two strategic purposes (stakeholder and shareholder) used in the literature. The paper argues that the type of theoretical lens and strategic purpose will impact the way the three constructs (firm environmental strategy, financial performance, and environmental performance) are arranged. As different scholars have argued for different relationships among the three constructs, this paper provides a framework that could help justify the seemingly paradoxical relationships. The paper concludes with ideas for future research on these issues.

Keywords	Corporate strategy, Resource management, Environmental management, Financial performance, Stakeholder analysis.
Motivation	The purpose of this paper is to investigate whether the type of theoretical lens and strategic purpose impacts the relationships among firm environmental strategy, financial performance, and environmental performance.
Findings	The paper provides a two-by-two matrix distinguishing between theoretical lens and strategic purpose. The paper argues that the specific choice of theoretical lens and strategic purpose helps define the way firm environmental strategy, financial performance, and environmental performance are arranged.

2.3.5. Literature synthesis process

After selecting the final sample of papers, these documents have to be synthesized into a connected whole. The aim was to identify connections and patterns within the literature, which might help to clarify the gaps in the literature and to refine the research questions.

The papers were organized according to their contribution to the main research topics: “environmental accounting”, “environmental investments” and “environmental performance”. Relationships and connections were identified among papers, so that issues such as development over time of conceptual and methodological frameworks or country specific trends, a. o., could be identified and interpreted critically.

Two main groups of papers were created as a basis for this literature research:

- Papers focusing on one or more of the three main research topics;
- Papers presenting an empirical analysis of the relationship between environmental and economic/ financial performance within organizations (support papers);

Results of studies included in the second group were summarized accordingly to date and type of results and were used as support data for the systematic review. Papers included in the first group were analyzed thoroughly. Their main findings and theoretic constructs were described and interpreted on the light of the following guideline questions:

1. What do we already know in the areas related to my research topics?
2. What are the characteristics of the key concepts?
3. What are the relationships between these key concepts?

4. What are the existing theories?
5. Where are there inconsistencies in existing knowledge?
6. What alternatives can be tested?
7. How can my research contribute to a better understanding of the problem identified in the scoping study?
8. What are the strengths and weaknesses of the available methods?

The next chapter presents and discusses the main findings in the form of a thematic analysis.

3. FINDINGS

This chapter presents the findings of the systematic review process and is divided into two main sections: one dedicated to a descriptive analysis of the selected papers and the other to the discussion of the findings. This analysis is based on the ideas and concepts found in the studies selected according to the research process described in the previous chapter.

3.1. Descriptive analysis of the selected papers

This section presents a descriptive analysis of the papers included in the final sample, which were used in the systematic review.

3.1.1. Process description

The first stage of the selection process is the search for papers in the database according to the search strings. Table 3.1.1.1. presents the number of papers identified in the EBSCO database for each of the six search strings.

Table 3.1.1.1.: Number of documents by search string

Search string	Number of papers – EBSCO database
1	540
2	476
3	693
4	53
5	771
6	121
Total	2654

Table 3.1.1.2. describes the selection process of papers and provides the link between the initial 2.654 papers identified by the six search strings and the 30 papers included in the final stage of the systematic review. The first step of the selection process eliminate 1.281 documents that have no academic origin, i.e., editorials, magazine and newspaper articles. In a second step, 278 items were eliminated due to duplications. From the remaining 1.095 papers, 347 were eliminated due to criterion 1, i.e., papers with an academic origin

but not published in an academic journal (book chapters, practical guides and unavailable documents) whereas 219 were eliminated since keywords are used residually or in other contexts than accounting (criterion 2).

This initial stage identified 529 papers related to the boundaries of this study. Criterion 3 eliminates additional 478 papers that have an insufficient relation to be considered in the refined scope of this systematic review. Among the remaining 59 papers, 33 were eliminated after the reading of the full text and one excluded based on quality criteria. The final number of selected papers is, thus, 25. However a few additions were made to this sample according to 1) cross references resulting from previous readings and 2) suggestions by the panel. As a result, the papers to be considered in the systematic review amounted to 30.

Table 3.1.1.2.: Selection of papers process

Documents from all sources	2654
Other sources than academic papers	-1281
Academic papers	1373
Duplications	-278
Academic papers after duplication removal	1095
Papers excluded based on criterion 1.	-347
Papers excluded based on criterion 2	-219
Papers related with my research	529
Papers excluded based on criterion 3.1.	-166
	363
Papers excluded based on criterion 3.2.	-131
	232
Papers excluded based on criterion 3.3.	-2
	230
Papers excluded based on criterion 3.4.	-13
	217
Papers excluded based on criterion 3.5.	-158
Papers included in my refined scope	59
Papers excluded based on reading the full text	-33
	26
Papers excluded based on quality criteria	-1
Papers selected based on the methodology	25
Papers included based on cross-references	3
Papers included based on panel suggestions	2
Final sample of papers	30

3.1.2. Descriptive Statistics

This section presents a brief descriptive analysis of the 30 papers selected for the literature review. Table 3.1.2.1. lists these studies by author and date of publication.

Table 3.1.2.1.: List of papers included in the systematic literature review

Author	Date	Author	Date
1. Bargliani and Martini	2012	16. Masurel	2007
2. Burnett and Hansen	2008	17. Moutinho and Mouta	2011
3. Clemens and Backstran	2010	18. Nelling and Webb	2009
4. Enticott and Walker	2005	19. Pagell	2013
5. Epstein and Roy	1997	20. Raar	2008
6. Epstein and Young	1998	21. Rogers and Kristof	2003
7. Figge	2005	22. Roy	2008
8. Figge and Hahn	2004	23. Rüdinhauer et al.	2005
9. Figge and Hahn	2012	24. Schaltegger	2008
10. Gibson and Martin	2004	25. Schaltegger and Figge	2000
11. Gonzalez et al	2003	26. Sharfman and Fernando	2008
12. Jasch	2003	27. Stanojjević et al.	2010
13. Jasch	2006	28. Tam	2002
14. Jeffers	2008	29. Vellani and Ribeiro	2009
15. Kraemer	2001	30. York	2009

Figure 3.1.2.2. presents the number of studies by year of publication. The fact that most papers were published after 2002 highlights the growing concern of environmental issues in the accounting field.

Figure 3.1.2.1.: Papers by publication year

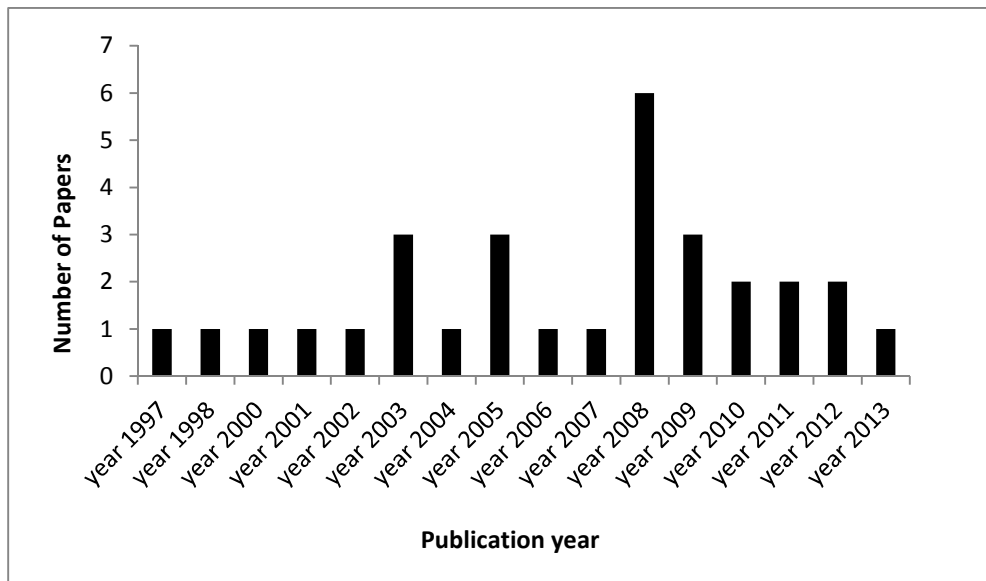


Table 3.1.2.3. shows the distribution of papers by journal, title and projected quality grading according to the Scimago Journal Ranking. This indicator expresses the average number of weighted citations received in the selected year by the documents published in the selected journal in the three previous years, i.e. weighted citations received in year X to documents published in the journal in years X-1, X-2 and X-3.¹⁸ Since the selected papers were published over a period of almost two decades (1997-2013), the ranking here reproduced comprises more than one year (2008-2013), assuming a natural fluctuation in the academic relevance of the journals in which the papers were published. I assumed however that to display indicators for all the publication years would become too fastidious for the purpose and, accordingly, I selected a sample of the six most recent years. The line was drawn in 2008, the year with the highest number of published papers used in this research.

¹⁸ The portal is available at <http://www.scimagojr.com>.

Table 3.1.2.2.: Journal Ranking

Journal Title	Nr. of papers	Journal Ranking						
		Scimago Journal and Country Rank						
		2008	2009	2010	2011	2012	2013	2008-2013 Average value
<i>Accounting, Organizations and Society</i>	1	2,683	1,616	1,948	2,396	2,727	2,092	2,244
<i>Review of Quantitative Finance and Accounting</i>	1	0,401	0,380	0,405	0,643	0,640	0,424	0,482
<i>International Journal of Production Economics</i>	1	2,030	2,154	2,058	2,433	2,072	2,393	2,190
<i>International Journal of Operations and Production Management</i>	1	0,158	0,147	1,252	1,112	1,901	1,344	0,986
<i>International Journal of Production Research</i>	1	0,983	0,825	0,962	1,217	1,333	1,333	1,109
<i>Journal of Business Ethics</i>	1	0,667	0,621	0,622	0,802	0,990	0,962	0,777
<i>Ecological Economics</i>	1	1,471	1,647	1,717	1,988	2,286	1,910	1,837
<i>Strategic Management Journal</i>	1	7,400	5,372	6,349	6,148	6,198	7,909	6,563
<i>Business Strategy and the Environment</i>	2	0,688	0,811	0,892	1,119	1,223	1,229	0,994
<i>Contabilidade Vista & Revista</i>	1	—	—	—	—	—	—	—
<i>Corporate Social Responsibility and Environmental Management</i>	1	0,451	0,610	0,638	0,734	1,123	1,018	0,762
<i>Ecological Indicators</i>	1	0,923	1,051	1,281	1,222	1,240	1,351	1,178
<i>Eco-Management and Auditing</i>	1	—	—	—	—	—	—	—
<i>Environmental Quality Management</i>	3	0,191	0,266	0,231	0,196	0,230	0,220	0,222
<i>Greener Management International</i>	1	—	—	—	—	—	—	—
<i>Journal of Environmental Engineering and Science</i>	1	0,495	0,446	0,474	0,590	0,647	0,465	0,520
<i>Journal of Cleaner Production</i>	2	0,799	0,949	1,435	1,491	1,722	1,699	1,349
<i>Journal of Industrial Ecology</i>	1	1,202	1,169	0,895	1,034	1,028	1,169	1,083
<i>Management Research Review</i>	1	—	0,171	0,194	0,256	0,302	0,318	0,248
<i>Renewable and Sustainable Energy Reviews</i>	1	2,625	2,650	2,462	2,878	2,873	3,273	2,794
<i>Review of Business Research</i>	1	—	—	—	—	—	—	—
<i>Revista Contabilidade e Finanças</i>	1	—	—	—	—	—	—	—
<i>The Icfai University Journal of Environmental Economics</i>	1	—	—	—	—	—	—	—
Total	27							
Conference papers	3							
Total	30							

3.2. Report of the Findings

3.2.1. Environmental accounting

Several studies refer to the key importance of correctly identifying and measuring environmental costs, both in the perspective of financial accounting and management accounting (Bartolomeo, 2001; Jasch, 2003; Gibson and Martin, 2004; Jasch, 2006; Jeffers, 2008). However, this systematic review of the literature reveals that current EA practices, generally, do not fully or accurately reflect the environmental costs of business operations (Roy, 2008). For instance, the lack of corporate accounting practices to measure externalities or social costs distorts the accounting information and leads to bias internal decision makers, stakeholders and society.

Roy (2008) mentions that the coexistence of different meanings of environmental accounting hinders the construction of a unified conceptual framework in this area. The analysis of the papers in this systematic review suggests that this difficulty lies at the very heart of the problem of implementation and standardization affecting environment related accounting practices. In fact, this field of study revealed to be as rich in contributions as it is atomized, diverse and often contradictory in its assumptions, findings, theoretical models and conclusions deriving from practical implementation.

There are some contributions that aim at clarify some basic environmental financial accounting procedures. For instance, Jeffers (2008) presents a categorization of environmental costs that should be used to measure USA organizations' green initiatives and should complement the traditional cost analysis in accounting. These include "1) regulatory costs; 2) up-front costs and 3) voluntary costs. Each of these three category costs can then be subdivided into: a) observable and hidden costs, b) contingent costs, c) image relation costs and d) internal and external costs." (p.79). After cost identification and measurement, firms would be able to incorporate green costs (and revenues) into the financial statements which would be extended to include the following information:

"1) the impact of internal flows which would show the economic value added, the social value added and the environmental value added; 2) the external flows would show the external environmental costs and benefits; 3) the balance sheet would show the changes in stockholders' equity and include intangible assets along with liabilities & provisions and finally, 4) the

changes in cash flows would show the increase/decrease in cash flows as well as the breakdown into operating, investing, financing of green activities as well as the non-cash investing and financing activities in the supplemental section.” (Jeffers (2008:82)

Jeffers (2008) also proposes the presentation of a “separate environmental financial statement [entitled “Environmental Financial Statement” or “Green Management Report”] or a separate green initiatives line item in the financial statements of corporations”, which “can prove to be beneficial to managers for planning, control and decision making. In addition, this statement showing costs and environmental savings can be used by stakeholders, creditors, regulators and other users for assessment of the corporation.” (p.82). Jeffers (2008) proposes that this financial statement could be divided into various sections: 1) Total Environmental Costs - including materials costs, Labor costs, operating expenditure, regulatory costs, capital expenditures and other costs; 2) Total Environmental Benefits – including revenue generated, cost savings, regulatory costs avoided, tax credits and other incentives, grants/subsidies received and other benefits; and 3) Net environmental costs/benefits – including the net result of the environmental costs and the benefits.

The systematic review of the literature suggests that, to date, there is no universal practical implementation of these financial accounting tools and conceptual frameworks, which is certainly due to the complexity of its implementation. Accordingly, it is reasonable to conclude that firms do not consider that benefits of implementing such tools compensate the implementation costs. On the contrary, EMA tools are reported to have been broadly used. This is not surprising as the internal focus on calculations and analysis in EMA are crucial to improve financial performance.

The relevance of studies in the environmental management accounting area justifies a particular look to this area. In fact, environmental cost classification and treatment under the framework of EMA allows a comprehensive understanding of environmental cost gathering and allocation that should support decision-making process facilitating value creation in profitable firms.

The International Federation of Accountants’ Statement *Management Accounting Concepts* defines EMA as “the management of environmental and economic performance through the development of appropriate environment related accounting

systems and practices.’’ (Burnett and Hansen, 2008: 552). Burnett and Hansen (2008) further complement this notion by stating that

“[...] environmental management effectiveness depends on an output-based approach that, in part, relies on an internal assessment of how well an organization uses its resources to gain competitive advantage. Thus, for an EMA system, the environmental-economic performance pair is the most important and critical relationship.”(Burnett and Hansen, 2008: 552).

Jasch (2006) provides further detail to this discussion:

“Simply defined, environmental management accounting is management accounting with a focus on physical information on the flow of energy, water, products and materials as well as monetary information on environmental costs and revenues and projects related to environmental protection.” (Jasch (2006: 1194).

Jasch (2006) proposes a methodology of environmental cost assessment based on the UN (United Nations, 2001) framework to the EMA environmental cost scheme – see above section 1.1.2. Following the results of pilot projects, the author claims that it is possible to execute this annual cost assessment and calculation in a one-day workshop with the participation of all departments using previous year’s costs. This task should be based on EMA’s fundamental information systems, Material Flow Accounting and Environmental Cost Accounting. “These two are the basic tools of EMA and provide the data for other EMA tools like Investment Appraisal, Budgeting, Life Cycle Assessments and calculating Savings or Costing.” (p.1195). EMA is, thus, helpful in waste reduction, value generation, and can provide support to strategic planning in business through the use of reliable accounting data.

Activity Base Costing (ABC) is one of the most well-known costing techniques in EA literature given their relevance to accurately identify and allocate all input costs, especially indirect environmental costs. Jasch (2003) and Bargliani and Martini (2012), present a very thorough analysis of ABC’s potentialities and usefulness in correctly assessing all costs involved in an organizations environmental activities and environmental impact evaluation.

In line with the reports of EMA successful implementation cases presented in Chapter 1, (Bartolomeo et al., 2000; US EPA, 2000), Rogers and Kristof (2003), add some more quantified results of successful EMA implementation:

“Over the past ten years, Pitney Bowes has taken on a number of proactive and aggressive environmental programs (including waste reduction, design for environmental quality, and energy management) that have saved the company more than \$1 million.” (Rogers and Kristof, 2003: 18);

“Once the environmental accounting project targeted the packaging issue, Xerox was able to reduce the number of containers to just two reusable and adjustable sizes. The new packaging cost \$12.08 less per unit than the old packaging. On an annual basis, Xerox anticipated savings of \$1.2 million.” (Rogers and Kristof, 2003: 23).

As stated by Bartolomeo et al. (2000) (see above Chapter 1), more recent studies (Burnett and Hanson, 2008; Rogers and Kristof, 2003)¹⁹ reinforce the lack of adequate management systems for proper managing and measuring environmental costs. In other words, literature continues to highlight that “traditional” accounting systems typically underestimate environmental costs. The use of an EMA tool in the context of environment-related projects and activities is extremely relevant as a decision making tool, since it facilitates the estimation of accurate financial information, introduces cost saving measures and supports capital budgeting for pollution prevention investments. This level of contribution to a company’s financial performance entails an evident value creation potential. The degree to which the specific measures will translate into effective value creation will depend on their scope as well as on the extent to which these instruments are integrated into the organizations’ strategic planning and executive decisions.

Although literature almost invariably claims that the implementation of an environmental cost accounting system contributes to firm’s best practices and provides economic benefits that improve firm’s performance, a more pragmatic perspective suggests a cost-benefit analysis before adopting such techniques. Importantly, Schaltegger (2008) argues that it is important that the environment-related accounting system “must not be set up as a parallel system but rather be integrated into the core accounting, information management and management systems”. In addition, Bartolomeo et al. (2000) concluded

¹⁹ According to Rogers and Kristof (2003), “[...] environmental costs can account for up to 20 percent of a product's total cost. If these costs are allocated to overhead, managers are making pricing decisions based on only 80 percent of the product's cost.” (p.22).

that the financial benefits of introducing EMA do not justify major changes and are better achieved by integrating environment into existing processes (for instance activity-based costing).

The next subsections of this systematic review of the literature explore how empirical studies have assessed EMA's contribution to a firm's performance and, thus, to value creation.

3.2.2. Environmental Investments

Epstein and Young (1998) were among the first to point out that “companies also often require payback periods for environmental projects that are substantially shorter than for other capital investments and are not subjecting these projects to the same rigorous analysis that the capital investment process normally entails.” (p.2) and that “without the proper incentives and analytical tools, the company will bypass potentially value-creating investments and the opportunities for competitive advantage that can sometimes be realized through more efficient resource utilization” (p.3). They propose that investment analysis should be framed in terms of value creation. This can be done by applying discounted cash flow analysis to environmental investment decisions, as is commonly done with other sorts of capital investment. Through this method, the value of a project, and the amount of resources the company is willing to allocate to it, is based on how much cash the project is expected to generate in the future, with the cash flows discounted at a rate of return that reflects firm’s cost of capital. As an alternative, Economic Value Added (EVA) can be used for capital budgeting, since it produces equivalent results. EVA measures the difference between the return on a company's capital and the cost of that capital (both equity and debt)²⁰ and brings the shareholders interests into the core of the analysis.

It is interesting to find, however, that more recent studies came to contradict this exact notion that environmental investments should be subject to the same exact appraisal methods as common investments. Discount rate is one key element in investment appraisal techniques such as Net Present Value, Internal Rate of Return and Return on Investment.²¹ According to Raar (2008) and Kwok and Rabe (2010), discount rate is one of the elements that require special treatment in environmental investment appraisal.

²⁰ EVA is calculated as follows:

Net sales – Operating expenses = Operating profit

Operating profit – Taxes = Net operating profit

Net operating profit – Capital charges = EVA

Capital charges are based on the company's invested capital times the cost of that capital (what finance professionals call the weighted-average cost of capital (WACC). (Epstein and Young, 1998)

²¹ According to IAS 36 – Impairment of Assets, the discount rate is a pre-tax rate that reflects current market assessments of the time value of money and the risks specific to the asset for which the future cash flow estimates have not been adjusted. It is “the return that investors would require if they were to choose an investment that would generate cash flows of amounts, timing and risk profile equivalent to those that the entity expects to derive from the asset.” (IAS 36, §56).

Environmental investments require usually a long time horizon analysis (Epstein and Roy, 1997; Raar, 2008), if all positive impacts on economic performance (and on external sustainability, ideally) are to be considered:

“The first step in the process of integration is the time dilemma, i.e. one year for economic performance measurement, a five-year period for business strategy, ten to fifteen years for pollution prevention outcomes, and up to fifty years for environmental impacts to manifest in observable effects. Pollution and health effects arising from management decisions taken a number of years ago, may impact on current cash flows in terms of clean up costs or litigation claims.” (Raar, 2008, p.570).

The most direct implication is that viability may be found absent if a conventional discount rate is applied to cash flows. The author suggests that a higher discount rate can be applied to projects that offer early benefits, and a lower rate applied to projects that offer benefits in the longer term. In addition, “estimations regarding cost savings, cost effectiveness, cost avoidance, discount rates and risk management issues” should be considered as key input to environmental investment evaluations. (Raar, 2008).

Roy (2008) stresses the idea that the usual investment appraisal techniques fail to take adequate account of the environmental impacts, risks and liabilities and associated remediation costs. “The cost of an investment should also include waste disposal, fines, insurance and clean up costs.” (p. 43). To Epstein and Roy (1997), “by including all environmental impacts [made through a broader identification and measurement of costs and benefits], companies can apply the same discount rates as they do for other projects.”(p.8) It is not surprising that for businesses, internal criteria aimed at value maximization will prevail in the process of establishing a discount rate and that it will almost always be estimated according to current financing conditions, management’s own standards and investors’ expectations.

Hopefully, the potential trade-off between profit and environmental sustainability will result from a strategically weighed balance of financial return and environmental impact risk (Raar, 2008). Raar (2008) points out that the predisposition to incur in environmental capital costs that may prevent future liabilities depends on the kind of the organization’s strategical vision (essentially long term or short term oriented). If the main goal is to maximize short term economic performance, environmental accountability will hardly be a main concern:

“In practical terms, management will determine quantifiable objectives associated with strategic goals, both monetary and nonmonetary terms, for both economic and environmental benchmarks. For example, in order to maximise shareholder return, it may be necessary to reduce pollution emissions by “x” per cent to avoid potential regulatory penalties.” (Raar, 2008:567).

Stanojievic et al. (2010) observed that environmental investment feasibility studies have to be supported in green accounting methodologies that will guarantee an accurate calculation of all relevant costs and benefits and thus reinforce the economic advantages of investments in renewable energy. The authors carried out compared feasibility studies for the investment in a biofuel-powered combined heat and power (CHP) generation plant: one using the conventional discounted cash-flow methodology and the other using “green accounting standards”, taking into account all associated environmental costs. For the latter analysis, the authors used a system they devised, called Project Evaluation and Green Accounting System (PEGAS). This system is based on EMA which takes into consideration various costs and benefits related to environmental management and protection: waste and emission treatment, prevention and environmental management, environmental taxes, material purchase value of non-product output, processing costs on non-product output, environmental incentives, etc., which were not adequately considered in the traditional approach. The most important conclusions can be summarized as follows:

- 1) Basing on a traditional financial appraisal, gasification from coal is the best ranked, followed by gasification from wood, naphtha, flash pyrolysis oil, etc. According to this analysis, coal is the cheapest fuel for CHP production.
- 2) In the ranking that takes into account green accounting principles, gasification from coal has slipped to third place. Naphtha fell from third to eighth place, among other changes.

These conclusions highlight that investors’ perspective on the most favorable investment can change when the environmental impact is accounted for, in investment project appraisals.

Stanojievic et al. (2010) also explore whether countries fail to consider environmental degradation into their national accounts²². Gross Domestic Product as a measure of national welfare is considered totally inadequate, since this indicator does not consider the costs of pollution and environmental degradation altogether. In fact “Environmental degradation frequently looks good for the economy [...] because the additional costs of the clean-up are added to GDP instead of being subtracted.” (p. 2475). In sum, “natural capital is missing from the accounts”, natural resource depletion is not held fully understood or measured. As such, the paper’s point of view offers a recommendation to accountants:

“Too long accountants have been turning the blind eye to the real world affairs, the substance of which is their business to capture. The accountants are actually the best equipped to help businesses to play their roles in reducing the greenhouse gases and other pollutants pouring into the environment. They should include the value of diminishing natural resources, and the cost of increasing atmospheric pollution, into the price of what we buy and consume!” (Stanojievic et al., 2010: 2475).

A large number of studies on environmental investments focus on social and economic analysis (e.g., Hill & Crabtree, 2003; Ball, 2005; OECD, 2006; Atkinson & Mourato, 2008; Jones, 2010; Baumgärter & Quaas, 2010; Moutinho and Mouta, 2011). In particular, they tend to focus on the social and economic impact of environmental investments, from a global community perspective, e.g., on their effect on resource preservation or depletion.²³ These studies are not analyzed in detail, since they are not central to this systematic review of the literature. It is, however, important to stress that there is a common idea underlying all of these papers: environmental investment analysis based exclusively on financial appraisal and/or business performance goals will be insufficient if a true goal of sustainability measurement is to be met.

²² Many EA studies address national environmental accounting, a topic which was excluded from the scope of this dissertation, since it was not considered to be directly relevant to the discussion. IUCN – The World Conservation Union (2000) defines national environmental accounting as “the modification of the national income accounts to take into account the economic role of the environment. According to the IUCN the level of implementation is low or inexistent in many countries and a considerable degree of controversy on concept and implementation matters still involves the process. The United Nations Statistics Division published Integrated in 1993 a document entitled “Environmental and Economic Accounting: Handbook of National Accounting (SEEA)”. SEEA is a system of statistical accounts for environmental assets measured in physical and monetary terms, which is destined to permit investigation and analysis of the interaction between the economy and the environment at a state level.

²³ Some of the most common methods of analysis referred to in literature are **cost-benefit analysis** and **cost effectiveness analysis**.

An interesting conceptualization of holistic investment impact assessment is presented by Moutinho and Mouta (2011). According to this study, investment decisions should include subjective considerations that financial techniques cannot capture, such as less tangible factors and the identification of competitive advantages. These considerations will contribute to improve and reduce risk associated with financial projections. Stimulating local community's involvement in company's projects, introducing a corporate environmental strategy that establishes a voluntary minimum standard for environmental requirements and performing systematic environmental impact assessment, are some of the recommendations put forward.

Gonzalez et al. (2003) point out that the evaluation of investments with environmental effects should always consider their environmental objectives and/or consequences, beyond the traditional financial analysis. This procedure alone will assure coherence with the assumption of an environmentally sustainable attitude as part of firm's strategy. Recognizing the inherent complexity of the task, they suggest the "up-dated value of the social cost or benefit derived from the social impact generated" (p.64) should be taken into consideration, so as to obtain a more realistic view of a given project's possible return. This can be done using the contingent valuation method, which adds to the traditional financial evaluation (NPV, Payback and IRR) of environmental costs, through the inclusion of environmental/social benefit's present value, obtained through a pollution reduction investment. An example of a social benefit would be the reduction of atmospheric pollution levels. No reference is made to the sources used to calculate the income associated with pollution reduction within a given period.

The approach of York (2009) is similar in terms of scope and holistic nature of the theoretical framework. York (2009) presents an "ethical framework" to support environmental investment decisions by business managers, which is referred to as "classical American pragmatism". This methodology is said to overcome the main obstacle to effective integration of environment related concerns into business decision: business managers simply do not understand the language of environmentalists, because however rational and admirable the environment protection argument sounds to them, they just argue back that environmental investments with no immediate return do not create shareholder value. The pragmatism method is based on the concepts of experimentation and innovation. Managers should promote a process of careful, collaborative and reflexive thought around any issues demanding strategic planning and

decisions. From this almost dialectic process new ideas will arise and will afterwards be subject to consideration, discussion and adjustment. This creative path leads to finding new answers to old problems, allows the consideration of otherwise ignored “hidden sources of value” and lays the foundations for the creation of competitive advantages for the company. “Through the implementation of pragmatic moral principles, managers can create better outcomes for their company and the environment in which it operates.”(p.102). In the case of the implementation of environmental projects with no immediate financial feasibility (according to traditional project appraisal methods) the pragmatic approach can lead to uncovering benefits not initially considered such as:

1. Differentiated Cost Savings

- Reduced operating and manufacturing expenses – derived from reuse, waste reduction, and reduced resource consumption
- Risk reduction (legal, regulatory and social)
- Decreased employee expense (increased satisfaction and productivity)

2. Increased revenue and market share (through product innovation and differentiation)

The theoretical models presented above represent only a few of a very large number of specialized studies published in the last decades focusing on the assessment of environmental investments from a financial and economic perspective. Theoretical arguments in favor of environmental investments seem, thus, to be diverse and mostly reasonable and valid. As far as practical evidence is concerned, however, the following questions arise: to what extent is it expectable that businesses will incur in costs with sustainability promotion actions that do not have an immediate financial return, although they may be perceived as relevant to the community’s present and future welfare on the long run? To what extent do business perceive and are able to demonstrate that environmental investments actually create value to their shareholders? In other words, “Does it pay to be green?” (Clarkson et al., 2011).

Sharfman and Fernando (2008) conclude that higher investment in environmental risk management (measured through the level of emissions and disposal of toxic substances, obtained from different U.S. corporate social and environmental performance databases) leads to a decrease in a firm’s cost of capital (especially debt capital, but also equity

capital),²⁴ due to: greater willingness of the market to invest in them (decrease in equity capital); reduced risk of potential fines, other penalties and litigation charges and the reduced vulnerability to negative impacts in firm reputation, among other aspects (decrease in debt capital). Consequently, these factors lead to improve the overall economic performance in the long term.

The review of studies related to environmental investments reveals at least two lines of research: 1) the “socioeconomic” impact of environmental investments and its contribution to sustainability; 2) profitability of environmental investments and its contributions to business value creation. The first line of research focuses on the social and economic impact (costs and benefits) of environmental activities, while the second is centered in analyzing the financial return for the business. Although the first trend falls outside the scope of this study, the issue of environmental sustainability, broadly speaking, it can be understood as ‘the other face’ of value creation. In fact, environmental practices are expected to create value to the planet, in the long run. As such, a comprehensive cost-benefit analysis applied to environmental investments and specific projects is particularly relevant when assessing public investments.

The analysis of studies addressing environmental investments shows a very rich discussion and suggests that such investments are likely to impact positively and significantly in businesses’ economic performance. The next section explores this issue in detail.

²⁴ “First, the cost of capital is the expected rate of return demanded by a firm’s investors for investing in the firm. The higher the rate of return demanded by a firm’s investors for the capital they provide to the firm, the more costly it is for a firm to finance itself [...] Second, the cost of capital is the rate that investors use to discount a firm’s future cash flows. The higher the cost of capital, the lower the present value of the firm’s future cash flows.” (Sharfman and Fernando, 2008: 571).

3.2.3. Environmental Performance

Analyzing how far environmental and sustainability practices are integrated and contribute to organizations' financial and economic performance is presently one of the major challenges in EA and environmental sustainability matters (Figge and Hahn, 2012).

Since the 1980's, there have been innumerable empirical studies focusing on the link between environmental performance, business profitability and competitiveness (according to Clemens and Bakstran, 2010). According to many authors (Epstein et al., 1997; Russo and Fouts, 1997; King and Lenox, 2001; Montabon et al. 2007; Burnett and Hansen, 2008; Ienciu, 2009; Lioui and Sharma, 2012; Pagell et al., 2013) it was Michael Porter²⁵ who, in 1991, first challenged the conventional notion that pursuing environmental standards and goals was harmful to the competitiveness of firms and argued that improved environmental performance, based on innovation, resulted in a competitive advantage.²⁶

Studies addressing the link between economic and environmental performance are not consensual. Some of them claim a positive link, others are inconclusive, whereas some studies point to a non-existing association. The multiplicity of results may be justified by different approaches and methodologies used by different studies. The economic and financial variables,²⁷ the sort of environmental practices considered, the sources used (annual reports, environmental reports, GRI reports, direct surveys, ...),²⁸ the dates and time spans, the industry sectors, the geographical contexts, the underlying theoretical perspectives or the sample size, are some of the differences that contribute to this lack of consensus. As such, it seems reasonable to conclude that environmental performance analysis, in terms of its financial implications, is still evolving, leaving too much room for

²⁵ Two of Porter's most relevant articles on this subject are:

- Porter, M.E., 1991. America's green strategy. *Scientific American* 264 (4), 168;

- Porter, M.E. and van der Linde, C., (1995) Green and competitive: ending the stalemate. *Harvard Business Review* 73 (5), 120–134.

²⁶ Appendix 1 describes some of the main studies on the subject. A few papers related to the subject were left out, since their scope was considered too country and industry specific and therefore not as relevant for this systematization.

²⁷ Examples of variables for financial performance used in empirical studies are: **Tobin's Q** (measures the market valuation of a firm relative to the replacement costs of tangible assets, that is, it reflects what cash flows the market thinks a firm will provide per dollar invested in assets – King and Lenox, 2001); **Return on Assets (ROA)**; **Return on Investment (ROI)**; **Return on Sales (ROS)**; **Sales Growth**; **Economic Value Added (EVA)**, **Stock Returns** and **Capital Intensity**. Worthy of notice is the fact that many studies use manager's perceptions (through questionnaires and interviews) as a base for measuring business performance, which implies a high degree of subjectivity.

²⁸ Which depart from a wide range of non-standard guidelines and approaches to environmental reporting and measurement.

subjectivity. Theoretical frameworks and results always depend on the perspective adopted by the analyst.

Nelling and Webb (2009) brings an important rationale to this discussion:

“Does good financial performance cause a firm to become more socially responsible, or does a high level of [Corporate Social Responsibility] CSR lead to subsequent superior financial performance? Good financial performance may result in more resources being available for the pursuit of CSR goals. A high level of CSR may attract the attention of investors or customers or motivate employees to perform better and reduce costs, boosting financial performance. Another possibility is that a “virtuous circle” exists, and the causality runs in both directions.” (Nelling and Webb (2009: 203)

In fact, the organizations’ characteristics and contexts are always unique, their interactions with the conditions under which they operate assume such a high level of complexity that causality, as far as environmental performance is concerned can hardly be assessed in an objective way.

One of the main prevailing debates in specialized literature is the examination of the extent to which projects and actions with an environmental impact are considered strategically within an organization. In other words, it is important to understand if environmental values and principles have become integrated within an organization, since it is commonly agreed that disclosing information on environmental performance to external stakeholders in environmental reports is rather ineffective in terms of financial performance and a mere exercise of ‘corporate citizenship’ (or simple “greenwashing” for the most skeptical) (Metcalf et al., 1995; Azzone et al., 1996; Epstein and Wisner, 2001; Jeffers, 2004; Perego and Hartmann, 2009; Peters and Mullen, 2009; Godfrey et al., 2009; Clarkson et al., 2011). This notion is strongly connected with Porter’s concept of competitive advantage: implementing a corporate environmental strategy means creating an advantage through differentiation from potential competitors.

Many studies (e.g., Epstein and Roy, 1997; Scherpereel et al., 2001; Dias-Sardinha et al., 2002; Montabon et al., 2003; Kim and van Dam, 2003; Hitchens et al., 2003; Hitchens et al., 2005) contribute to the understanding of firm’s strategic positioning towards the environment by creating a scale for ranking the degree to which environmental concerns

are assumed as strategic and as core concerns for firm performance. Many distinguish between “reactive” and “proactive” approaches; others refer to “prevention solutions” as opposed to “end-of-pipe solutions”,²⁹ others still differentiate a “crisis-oriented strategy” from a “process-oriented strategy” and a “chain-oriented strategy”.

Vellani and Ribeiro (2009) use a sample of Brazilian listed firms to examine and classify business promoted environmental actions and sought to identify which of these activities actually contributed to business’ strategy by increasing its eco-efficiency (understood as an ability to integrate the organization’s environmental and economic performance, by simultaneously meeting cost, quality and performance goals). They concluded that about 74% of the sustainability related activities carried out (a total of 608 actions) had no impact in eco-efficiency. The underlying concept was that environmental actions with a potential to improve eco-efficiency are those that fulfill the following criteria:

- Costs generated by these activities generate a (direct) financial benefit;
- These activities contribute to waste and emissions prevention.

Actions that do not qualify as eco-efficient may be, according to Vellani and Ribeiro (2009), exclusively related with compliance measures (to respond to regulation and certification requirements), with environmental education projects, recycling programs and restoration of damaged areas, among others. Although relevant as far as sustainability is concerned, this kind of measures lacks the pro-activeness and strategic nature of preventive action.

Eco-efficiency implies the concept of “pollution reduction through process change” rather than through the use of end-of-pipe solutions (WBCSD, 1996). Accordingly, Vellani and Ribeiro (2009) have not considered as eco-efficient those environmental measures that consist in remediation and impact control, as opposed to preventive measures, such as waste and emissions reduction. Prevention measures are more likely to be assumed strategically within an organization and to be incorporated into the organization’s management culture and long term goals.

²⁹ According to the United Nations (2001), “Investments which are incurred solely for the purpose of emission treatment are typically end-of-pipe technologies, i.e., devices which are installed for cleaning purposes after the production processes. Filters, waste collection equipment and wastewater Principles treatment plants are typical end-of-pipe technologies which help to concentrate or hold back toxic substances. However, they usually do not solve the problem at the source, but rather prevent uncontrolled release in exchange for controlled release.”

According to Figge (2005),³⁰ eco-efficiency is the relationship between environmental performance and economic performance. It is fairly safe to assume that eco-efficiency is a key concept in business environmental literature and that it cannot be dissociated from business strategy, to the extent that it demands a systematic, planned and controlled action towards improving environmental performance while meeting financial performance goals. Therefore, it is also possible to assume a direct link between eco-efficiency³¹ and value creation, since eco-efficiency is the ability to produce in the most environmentally friendly way possible and simultaneously improving financial performance, thus adding value to the productive process and to business performance.

Rüdenhauer et al. (2005) conducted an eco-efficiency analysis of an organization's products and processes (based on life-cycle assessment and life-cycle costing), which is described as an integrated approach to the assessment of the economic and environmental implications of production. The authors assume that the proposed method is not yet a comprehensive product assessment in terms of sustainability, since "the social or societal side is still missing." This methodology implies the weighing of impact categories, their aggregation into a single score and, afterwards, the comparison of the global environmental cost of a given product or process to the costs they represent for the business. The system implies that the results of the impact categories being considered are related to national or international environmental targets or indicators. Beyond measuring eco-efficiency, the method allows an analysis of the effectiveness (output value) of the solution at study, since "efficiency does not tell us anything about the effectiveness of the measures compared". Moreover,

"a very efficient measure (which provides an environmental benefit for very low cost per unit "environmental benefit") might lead to only very small reductions, whereas a less efficient measure (with higher costs per unit "environmental benefit") might lead to considerable reductions." (Rüdenhauer et al., 2005:111)

"Sustainable Value Added expresses in monetary terms whether the company has been able to create a positive extra VA after it has taken into account any changes in eco- and social effectiveness for every single relevant environmental or social impact." (Rüdenhauer et al., 2005:183)

³⁰ In agreement with the definition presented by the World Business Council for Sustainable Development (WBCSD, 1997)

³¹ As well as the link between "eco-effectiveness" and value creation, according to the concept mentioned in the paragraphs below.

Figge and Hahn (2004) focused also on the distinction between eco-efficiency and eco-effectiveness to build the concept of “sustainable value added”: “only a company that enhances simultaneously economic, eco- and social effectiveness contributes to sustainability.” (p. 182). Sustainable value added is a framework to measure corporate contribution to sustainability. The sustainable performance of a company is measured against a benchmark which, in this study, is the national economy.³² The authors argue that measuring environmental performance exclusively in terms of eco-efficiency,³³ which is a relative measure, gives us no information about effectiveness: “If e.g. it is common knowledge that a company produces 4€ value per ton of CO₂, one can neither tell how much value the firm created nor how much CO₂ it emitted in absolute terms.” (Figge and Hahn (2004: 176). This means that an increase in eco-efficiency can lead to a decreasing eco-effectiveness, since a more eco-efficient company can consume more resources in absolute terms, if it produces a larger amount (economic growth can be the cause of this) which will cause environmental performance of the company to deteriorate. Even if a given company increases its eco-efficiency in time, it can simultaneously lower its eco-effectiveness.

Schaltegger and Figge (2000) focused their analysis on the concept of shareholder value. They argue that shareholder value is the most important measure of economic success and, therefore, the impact of environmental protection measures should be assessed according to its impact on shareholder value. Shareholder value is “the discounted net current value of a company's future free cash flow”. Shareholder value is calculated by subtracting the cost of borrowed capital to the expected free cash flows. It is a future oriented assessment, and incorporates all costs associated with investment decisions, including the opportunity costs of neglected alternatives. It is clear that investments in environmental protection can only increase shareholder value when they generate a return that is higher than the costs of capital and, therefore, capital-intensive investments in the so called “end-of-pipe” technologies reduce shareholder value. According to this rationale, measures involving a minimum of fixed assets and contribute to increase the

³² “In the context of corporate contributions to sustainability, the most obvious question to answer is whether a company has contributed to the sustainability of a national economy during the period of time under observation. Therefore, we propose to choose the national economy as a benchmark.” (Figge and Hahn,2004: 179)

³³ Eco-efficiency is defined by Figge and Hahn (2004) as a ratio (Value Added/Environmental Impact Added). “Here VA of a company is defined as the residual value that remains after the turnover has been reduced by the cost of goods and services purchased by the company. EIA represents the aggregate of all energy and material flows under consideration induced by economic activity weighted by their relative harmfulness to the environment. (p.175)

efficiency and productivity of the production process should, therefore, be privileged. The calculation of financing costs should not neglect the benefits often associated with borrowing capital for an environment-friendly project or company. This is referred to by Schaltegger and Figge (2000) as the “green bonus”: “lower interest rates on environmental loans, inclusion in environmental funds, ethical investments, etc.” (p.37).

This approach represents an improvement to the analysis based exclusively on income or profit measures, used in financial accounting, which leaves out the assessment of the required capital investment. Schaltegger and Figge (2000) assume that the concept of shareholder value does not include any explicit analysis of the social aspects of corporate environmental protection, thus possibly neglecting the risk of legitimacy loss and leaving out the wider concern with sustainable development. However, they assure that there is no conflict between shareholder value and environmental protection, provided that the shareholder value is always carefully assessed.

More recent approaches have clearly been more successful at incorporating wider sustainability concerns into the theoretic frameworks for measuring the link between environmental and financial performance.

“Environmental business case” is a concept that is closely related to eco-efficiency. According to Schaltegger (2008),

“an environmental business case” exists when environmental performance is voluntarily and strategically incorporated into business management, as opposed to compliance related and non-strategic environmental activities. A business case for sustainability involves the creation of “economic success *through* (and not just along with) a certain environmental or social activity. [...] A business case for sustainability is characterized by three requirements which have to be met. Firstly, the company has to realize a voluntary or mainly voluntary activity with the intention to contribute to the solution of societal or environmental problems. [...]. Secondly, the activity must create a positive business effect or effect on corporate success which can be measured or argued for in a convincing way. Such effects can be cost savings, the increase of sales or competitiveness, improved profitability or reputation, etc. The cause and effect relationship can be direct or indirect, however, must not be speculative but rather based on a sound business argumentation. Thirdly, a clear and convincing argumentation must exist that a certain management

activity has lead or will lead to both, the intended societal or environmental effect, and the economic or business effect.” (Schaltegger, 2008: 26).

To Figge and Hahn (2012), “the green business case posits that suitable strategies for sustainable businesses exploit win–win situations that reconcile environmental protection and financial success.” (p.92) In short, a business case for sustainability exists when the sustainability related actions and procedures are approached strategically by management, in order to achieve a stable framework to continued cost reductions (less resource and energy use) and higher revenues (new and greener products).

To Figge and Hahn (2012) eco-efficiency is defined as “the return on the environmental resource” and it is related to the efficiency with which the resource is used. Environmental value is created when this return on the environmental resource lies above its opportunity cost. The authors believe that the generation of environmental value does not have to be subordinated to economic value and can be achieved separately: “environmental investments and proactive environmental strategies are drivers of economic value creation” (Figge and Hahn, 2012). Environmental value is created “whenever a company uses its environmental resources more efficiently than the market on average” and this will guide management to a true assessment of a company’s contribution to environmental sustainability.

Assessing environmental value creation involves, thus, a benchmarking exercise. Figge and Hahn (2012) add to the eco-efficiency indicator proposed by UNCTAD (2004) a comparison element. Environmental resource efficiency of the company is the equivalent to ROI in standard investment. “Environmental value thus expresses the monetary value of an excess resource efficiency of the company compared to the market”. (Figge and Hahn, 2012).

The study includes an example of environmental value assessment, basing on the CO₂-performance of the German car manufacturer BMW, using the sector as benchmark. During the period selected for the analysis, BMW achieved €2,992 earnings before interests and taxes (EBIT) per ton of CO₂-emissions whereas the car manufacturing sector, on average, reached only €783 EBIT per ton of CO₂-emissions. As such, BMW achieves €2,209 more EBIT per ton of CO₂-emissions than the sector on average. During the same period BMW’s average yearly CO₂-emissions were 1,209,115t, which equals to

about €2.67bn. BMW created €2.67bn more EBIT with its CO₂-emissions than the sector would have created with the same amount of emissions. This CO₂-value corresponds to the excess resource efficiency of the company compared to the sector.

This indicator measures, after all, the extent to which a firm uses natural capital in an efficient manner. Through the calculation of this performance indicator, organizations can identify four different types of strategies:

- “1) Strategies that lead to a value-creating use of both economic capital and environmental resources, i.e. there is economic value creation and environmental value creation;
- 2) Strategies that lead to a value creating use of economic capital but a value-destroying use of environmental resources, i.e. there is economic value creation at the expense of environmental value creation.
- 3) Strategies that lead to a loss of economic value but with a value-creating use of environmental resources, i.e. there is a loss of economic value but a positive environmental value;
- 4) Strategies that use neither economic capital nor environmental resources in a value-creating way, i.e. there is a loss of economic value and a negative environmental value.” Figge and Hahn (2012: 95)

The innovation underlying this perspective is that it treats the creation of environmental value as an end in itself, which will ultimately lead to economic value creation through an increase in competitiveness.

There are, without a doubt, a large number of challenges to measuring environmental performance and its financial and economic implications: the organization’s culture, the complexity of the task of establishing viable and universal indicators, the interdisciplinary nature of the analysis and procedures, the need to “upgrade” accounting systems, among others. Despite the ongoing discussion on these issues and the different methodologies proposed, the debate remains open on what are the most adequate inputs, indicators and methods to assess financial and economical impact of environmental performance. One question that every organization will have to answer individually is ‘what constitutes good environmental management and performance?’ (Schaltegger and Syinnestvedt, 2002; Henri and Journeault, 2010). Environmental performance measure approaches will, firstly and necessarily, have to be adjusted to corporate objectives and management culture.

Some literature (Russo and Fouts, 1997; Lefebvre et al., 2003; Salama, 2004; Al-Tuwaijri et al., 2004; Wagner, 2005; Soyka, 2006; Montabon et al., 2007; Sharfman and Fernando, 2008; Peters and Mullen (2009); Bartkoski et al., 2010; Clarkson et al., 2011; Orellano and Quiota, 2011; Guenster et al, 2011; Lioni and Sharma, 2012; Ameer and Othman, 2012; Pagell et al. 2013)³⁴ concludes that pursuing proactive environmental strategies leads usually to improved financial results. However, this conclusion by itself may not mean that it always ‘pays to be green’, since these results refers to specific contexts and it is virtually impossible to isolate, in any empiric research, the weight that other factors, such as size, dimension of markets, local context characteristics, fiscal and regulatory environment, among other lot less important, may have on a firm’s economic performance.

After all, as Tam (2002) points out, even in those cases where environmental information is made public,

“the reporting of environmental indicators by companies varies widely. This leads to questions such as whether progress is truly being made on reducing environmental effects, where the reductions occur, how can different companies be compared and benchmarked, and whether the reporting of environmental parameters by companies is largely a marketing effort. The National Academy of Engineering (1999) notes that “a metric expressed in pounds per vehicle produced may be different for otherwise comparable vehicles because of differences in vertical integration and supplier chains among manufacturers.” (Tam (2002: 419).

“Furthermore, this type of reporting is usually geographically insensitive: water used for manufacturing in North America is likely to produce different environmental consequences than water used for manufacturing in an impoverished nation.” (Tam (2002: 421).

Together, these results strongly suggest that there is a high level of subjectivism in the analysis of an organization’s environmental performance.

³⁴ The systematic research identified a considerable number of empirical studies focusing on the relationship between environmental and economic performance, which were not included in the review sample, due to size considerations. Some of the most relevant are the following: Russo and Fouts (1997); King and Lenox (2001); Menguc and Ozanne (2003); Hitchens et al. (2003); Lefebvre et al. (2003); Salama (2004); Benito and Benito (2004); Hitchens et al. (2005) Wagner (2005); Soyka (2006); Montabon et al. (2007); Godfrey et al. (2009); Peters and Mullen (2009); Henri and Journeault (2010); Ferreira et al. (2010); Bartkoski et al. (2010); Clarkson et al. (2011); Orellano and Quiota (2011); Guenster et al. (2011); Lioui and Sharma (2012); Ameer and Othman (2012).

Pagell et al. (2013) also discuss country related variations in addressing environmental issues. The authors state that more proactiveness in carrying out environmental investments is more common in more liberal economies:

“the more limited governmental response to environmental issues in North America and parts of Europe has had the effect of forcing forward-thinking businesses located in these regions to take voluntary initiatives to address issues that have often been addressed via regulation in continental Europe [...] firms based in North America, Ireland, and the UK have developed explicit environmental strategies, while organisations in continental Europe have generally dealt with environmental (and social) issues implicitly because of the higher regulatory burdens and societal expectations.” (Pagell et al. (2013: 429)

Empirical research confirmed that the average level of corporate environmental investment does vary significantly by country.

As a consequence, the concept of environmental performance continues to require contributions that can shed light on how to effectively and objectively measure achievements and negative impacts. The complexity of task derives to a great extent from the difficulty in setting boundaries around what it is that should be measured, since according to different perspectives (all legitimate), a diverse set of indicators and results can be taken into account. Standardization of performance assessment will hardly be reached, until after some degree of maturity in this endeavor is achieved. As Burnett and Hansen (2008) point out, the empirical evidence of the positive impact of eco-efficiency is in its infancy and more studies are needed.

An interesting question is how this issue is approached in public sector organization, where the drive to maximize profit or to create value is practically non-existent and the concern which eco-efficiency gains, which are normally only effective on the medium/long term goal, is usually not among the main public management priorities. A few papers address this topic.

Enticott and Walker (2005) propose that assessments of performance within public agencies need to be expressed in terms of impact, accountability, responsiveness and formal effectiveness. The authors examined whether sustainable management practices were positively associated with organizational performance and with sustainable performance in English local governments. They concluded that sustainable management

was, in fact, related to sustainability performance but not to other measures of organizational performance, that is, the achievement of a high level of performance had no connection with sustainability concerns.

The UK is one of the leading countries in public sector sustainability concerns. Enticott and Walker (2005) suggest that even more difficult than translating organizational environmental performance into an objective measure, is trying to assess the integration of environmental and sustainability issues in overall performance, through non-financial measures. In addition, the result may simply be a reflection of organizations' (in general) traditional poor performance on eco-efficiency management and assessment. Enticott and Walker (2005) highlight the need for sustainability indicators that may help in assessing performance at other levels than quantified outputs (such as recycling and air pollution), which seems to be a task as complex as it is relevant.

The effort towards eco-efficiency gains, which are normally only effective on the medium/long term goal, is understandably not a priority for public managers, who usually make decisions according to the governmentally issued policy frameworks and priorities (CIPFA, 2004). Besides, the public budgetary restrictions aggravate this need to prioritize expenditure related with the public services' core competences, which usually means a small percentage of public financing allocated to environmental projects.

The low levels of environmental performance measurement in the public sector may be also explained by the inexistence of legally established reporting frameworks that address specifically environmental performance indicators. This can be understood when we analyze, for instance, the Portuguese case. In fact, aside from responding to the requirements of environmental management systems (when applicable), namely in the framework of the European Eco-Management and Audit Scheme (EMAS), no other disclosure is imposed on public organizations in Portugal. Some Municipalities have begun implementing GRI's guidelines and have reported on economic, social and environmental information (a few examples are Porto, Marinha Grande and Sertã).³⁵ However no connection is established between environmental and financial performance,

³⁵To see Porto's Sustainability Report: http://www.cm-porto.pt/users/0/58/RelatriodeSustentabilidade_43eaa5f844b47a03ef593a97772900ca.pdf;
To see Marinha Grande's Sustainability Report: http://ww2.cm-mgrande.pt/filecontrol/site/Doc/1818RS-MarinhaGrande-Final_CD-Rom.pdf;
To see Sertã's Sustainability Report: <http://www.cm-serta.pt/conteudos/default.asp?ID=194>

in an eco-efficiency perspective, apart from some monetized data on resource and energy consumption and environmental expenditure.

Regardless of the reported poor performance of public institutions as far as environmental and sustainability goals are concerned, it is important to bear in mind that public authorities have an undeniable responsibility in the promotion and fostering of environment friendly investment. Public sector is, after all, (or should be) the main agent of sustainability awareness raising and the manager of the major green initiatives and incentives. There is a natural expectation from society in general that public institutions should lead by example.

According to the dominant trend in literature, especially the most recent studies, it is reasonable to argue that the question “Does it pay to be green?” has long ceased to be a side issue for businesses and organizations in general. The amount of empirical evidence suggesting a positive relationship between environmental actions and firm valuation is too relevant to be ignored. This evidence is particularly salient in more recent years (see note reference 34 above) and has important implications for business managers (Clarkson et al., 2011). This can be justified not only for the growing concern with the environmental implications of business operations, but also by the important developments that environmental management and accounting methods have undergone as an answer to challenges in this area.

Although it is not reasonable to expect that all organizations are in the position to implement EMA systems and to start assessing their investment decisions and financial performance, it is certainly an imperative that the main financial implications of environmental practices, either voluntary or imposed by regulation, are taken into account in an accurate and sensible way. The cost of not doing it may be too high both in short term and long term as a consequence of the inevitable loss of competitive value.

4. CONCLUSIONS

4.1. Implications for further research

Although EA can be considered a “marginal” issue within the vast scope of the accounting and finance areas, this systematic review of the literature confirmed that it is a very rich field of research. The systematic research identifies an extensive number of papers focusing on these issues. Importantly, the diversity and quality of the studies addressing the process of value creation and its relationship with EA, environmental investments and environmental performance was also found to be significant.

Value creation will always be the main purpose of business. Accordingly, the methods to accurately measure the financial implications of environmental activities will have to be in the spotlight of EA practices. Notwithstanding, the measurement of intangible or non-easily quantifiable factors (such as public image, workers motivation, customer satisfaction and creditworthiness, or a firms’ effective contribution to environmental protection or improvement) is a very complex process.

According to Jeffers (2008) “accounting for green initiatives is still a developing science, not every environmental component can be considered or valued in a manner which is accurate, consistent or widely accepted as norms by expert academic opinion” (Jeffers, 2008: 77). The ultimate challenge is to devise a model that not only is technically accurate, but also incorporates all the multiple dimensions of environmental matters for organizations. Consequently, this model must be adjusted to the organization’s needs and purposes allowing the identification of undisputable drivers of value creation. Until such a solution is achieved, it is unlikely that managers fully acknowledge the importance of environmental issues for organizations since they will not know how to effectively measure the related costs and benefits and, in this way, to measure their contribution to value creation.

Previous studies reveal that, to a large extent, organization’s environmental activities impact on its financial performance. This systematic review of the literature demonstrates that most papers arguing for a positive link between the environment and financial success are the most recent ones (see Appendix 1) and that this trend is most evident from

the year 2011 on. Accordingly, it is acceptable to argue that environmental activities and environmental impact in businesses and other organizations are increasingly significant.

The existing body of specialized literature, although very rich and almost unanimous in advocating the key importance of measuring environmental implications, is far from converging to a consensual approach. Some studies focus on the production of accounting data for reporting (Jeffers, 2008) and for internal decision making (Jasch, 2003; Jasch, 2006; Bargliani and Martini, 2012; Bartolomeo et al., 2000; Rogers and Kristof; 2003) whereas others present frameworks for investment appraisal. Importantly, some of these last studies argue that environmental investments should be subjected to the same appraisal methods as conventional investments (Epstein and Young, 1998) whilst others claim that environmental investments require specific methods (Raar, 2008; Roy, 2008; Stanojjević et al., 2010). There is also a significant number of studies focusing on how to measure social and economic implications of organizational activities, but that fail to establish a connection between this level of impact assessment and the measurement of financial success or value creation (Hill & Crabtree, 2003; Ball, 2005; OECD, 2006; Atkinson & Mourato, 2008; Jones, 2010; Baumgärter & Quaas, 2010; Moutinho and Mouta, 2011; Schaltegger, 2008; York, 2009). This study also concludes that many conceptual and empirical papers based their models on the concept of eco-efficiency and eco-effectiveness (Figge, 2005; Rüdinhauer et al., 2005; Vellani and Ribeiro, 2009; Figge and Hahn, 2004; Figge and Hahn, 2012). Finally, three papers (Schaltegger and Figge, 2000; Figge and Hahn, 2004; Figge and Hahn, 2012) bring forward three concepts that measure the degree of economic success linked with a given (set of) environmental action(s) or investment(s): the notions of “shareholder value”, “sustainable value added” and “environmental value creation”, respectively.

These last three contributions are the most relevant to link environmental performance with financial performance, to the extent that they provide a measurable and objective framework to assess the financial implications of the environmental protection in businesses. The first concept, “**shareholder value**” measures the impact of environmental protection on shareholder value and implies that investments in the environment can only increase shareholder value when they generate a return that is higher than the costs of capital. It is a fairly defensible notion, although it does not include any explicit analysis of the social aspects of corporate environmental protection (such as legitimacy issues and the wider concerns with sustainable development). The

notion of **“sustainable value added”** is a relative measure that compares the environmental performance of a company to a benchmark. It measures added value in terms of the compared efficiency and effectiveness in the use of external costs (contribution to sustainability) and of the opportunity cost (of the invested capital). The environmental or sustainable contribution here considered implies that economic, social and eco-value added is simultaneously created. **“Environmental value creation”** is also based on the return generated by a given environmental investment and posits that environmental value is created when the generated return lies above its opportunity cost. It also entails a benchmarking element: environmental value created measures the level of efficiency with which an organization uses environmental resources, compared to the market on average (for instance, compared to the industry sector average).

Common to these models is the idea that environmental value creation involves joint achievement of economic success and an improved level of environmental performance. Despite the mathematical objectivity underlying the formulation of these theoretical propositions, the “weakest link” seems to be the quantification of the contribution to environmental sustainability, that is, of the external costs of business activities. The notion of environmental performance is, in itself, rather subjective, as shown above, since it may refer to the amount of “green” investment, the amount of CO₂ emissions over a given period or a more systematic effort to include environmental issues into the business’s strategy. None of the proposed models seem to definitely solve this problem. Extensive implementation efforts will be necessary to test the validity of these propositions.

This systematic literature review has contributed to the EA literature to the extent that it has identified and described critically some of the main studies focusing on how organizations’ environmental activities are accounted for and assessed in terms of their impact on financial performance and on value creation. It also pointed out that this field of study could benefit a lot from further developments, towards the attainment of a satisfactory theoretical framework.

Due to the still emerging nature of scientific work on the subject of EA and value creation, further research could achieve interesting contributions by focusing on at least three main study avenues:

- This literature review has shown that the number of studies in the EA area is immense and, more importantly, that the concepts used to address EA issues are not consensual. Many approaches are country specific and the understanding and application of EA has varied widely across time, especially in the last few decades. Therefore, it is important to conduct a critical analysis of the concept and practices of EA in order to contribute to the desirable standardization of terminology allowing the establishment of a solid foundation for further scientific debate and developments;
- One limitation revealed by this study is the inexistence of a standard costing system that includes environmental costs in the determination of cost objects. Additionally, it has been identified that an increasing number of papers are discussing theoretic models to measure the impact of environmental activities in value creation. As such, the development of an Activity Based Costing method specifically designed to identify environmental activities may contribute to an accurate identification of costs in organizations as well as to measure the impact of environmental activities in the value creation process. The definition of quantifiable indicators may minimize the subjectivity of the appraisal;
- The measurement of value creation in the environmental area is a very complex task since it is difficult to estimate both cash-flows associated with such investments and the discount rate of such investments. This complexity is related to “hidden sources of value”, i.e., the underestimation of social benefits that are only observable in the long run and create value to the planet. The importance of such issues suggests that the connection between environmental investments and public policy decisions offers a rich area to explore. One of the possible research opportunities is related to the impact of green taxes in firms’ decision making process and value creation.

4.2. Methodology Appraisal

The systematic literature review process, as opposed to the traditional literature review methodology, has allowed for an improved academic rigor in the research method. The selection of papers based on relevant keywords, search strings and exclusion criteria add transparency and robustness to the research and reduce personal bias significantly.

As a main shortcoming I would like to mention the following: some papers resulting from previous key literature research were included into the final sample of papers for the systematic literature research (a total of 5 papers). This option was made after careful consideration. Although the papers concerned were not found in the systematic research, I assumed this was due to the following reasons: the use of a unique database and the multidisciplinary nature of the issue at study justifies widening the scope of the sources used. Many titles of some very relevant papers to the topic did not include the selected keywords, because they were written in Portuguese and not published in international journals (2 of them) or because they were published as conference papers (the remaining 3).

It may be argued that the scope of keywords and search string should have been widened. However, one major concern in this thesis was to keep the number of papers identified in this systematic review of the literature within a manageable size, allowing the discussion of the central question of this study. Unquestionably there is some subjectivity in these choices as well as in the definition of the selection criteria and it is a given fact that subjectivism cannot be altogether eliminated from the process. Notwithstanding, I believe the systematic review methodology enhanced the quality of this dissertation.

4.3. Learning Experience

The process of writing this dissertation has been a very enriching learning experience. From the methodological point of view, developing a systematic literature review methodology was extremely rewarding, since it allowed me to improve significantly my research skills and the privilege of employing a method that is academically validated. The systematic review process ensured a level of comprehensiveness and quality to the final work, that the traditional literary review method would not allow.

The discussion of papers related to EA and value creation was enhanced by the use of the systematic literature review methodology. The subjectivity around the selection of the sample papers was minimized, as more objective and transparent procedures were employed. Instead of a random collection of papers, the process was conducted through the use of a reliable method to include all possible relevant papers avoiding personal bias. This contributed unquestionably with added value to my findings.

4.4. Concluding remarks

The idea to develop a dissertation around the topic of EA departed from a personal conviction that sustainability is an unavoidable issue in today's society. The point of intersection between environmental and sustainability concerns, accounting and value creation is definitely the challenge of accurately and rigorously measuring organizations' impacts, whether in terms of harm caused to the natural environment or as far as the generated benefits are concerned.

Many organizations claim to be environmentally aware and responsible but cannot translate their efforts to become more sustainable, that is to reduce environmental impact and to act preventively, into measurable and objective data. They also fail to properly assess the implications of their environmental activities in terms of the financial performance since, at a first glance, the creation of economic value to a business seems to be incompatible with environmental protection.

Carrying out this "silent revolution" is, to a great extent, the role of accountants and financial managers, who will have to become increasingly aware and prepared to deal with this challenge. EA should be regarded as a challenge that involves costs, especially in the early implementation stage. However, environmental concerns enclose some very serious opportunities to improve firms' performance and to create value, as long as it is approached in a strategic way and supported by adjusted accounting and financial practices.

After all,

“[...] industrial society will evolve to the point where sustainable development is the norm”.

(Russo and Fouts, 1997: 553)

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