

A Debate on Environmental Management Accounting

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Abstract – Environmental Management Accounting (EMA) refers to a set of accounting and performance tools dedicated to companies' actions towards improvement of their environmental impact. Furthermore, EMA deals exclusively with the company's internal costs, as it does not include the external costs of individuals, society, or the economic environment over which the company has no decision-making power. It is recognised that EMA is a relatively new tool in environmental management, which can be defined as the identification, collection, estimation, analysis, internal reporting, and use of information regarding materials and energy flow and environmental costs for both conventional and environmental decision-making process within an organisation. Thus, EMA incorporates and integrates two of the three milestones of sustainable development (environmental and economics dimensions), as they relate to an organisation's internal decisional process.

Keywords: Environmental management accounting, environmental costs, cost management, decisional process

I. INTRODUCTION

Environmental management accounting (EMA) has been designed to support companies to better manage resources, energy and diminish or eliminate their social-environmental impact (e.g., referring to their waste and pollution). EMA has been developed based on specific environmental accounting research and then by providing useful guidelines to support and facilitate the knowledge transfer into organizational practices, as the following:

- Guidelines (IFAC, 2005);
- Procedures and principles of action into practice (UN, 2001);
- Standards (ISO 14051:2011) that assist organization "to better understand the potential environmental and financial consequences of their material and energy use practices, and seek opportunities to achieve both environmental and financial improvements via changes in those practices";
- Workbooks (METI, 2002).

Valuable knowledge experiences are provided by case studies and best practices presented in the literature (e.g., Burritt et al., 2019). In addition, EMA has become an acknowledged approach to fostering manufacturing cleaner production via new and emergent technologies as Artificial Intelligence and circular economy principles (e.g., Chen et al., 2022), design for sustainable manufacturing (Ching et al., 2022), accompanying by circular economy measures (Gonçalves et al., 2022), and spread via the supply chain management efficiency (Bux & Amicarelli, 2022).

From the organizational practice, there is a strong need for sustainable development approaches, but most regarding the environmental impact of businesses. In addition to initiatives such as reduction of carbon footprint and compliance to environmental regulation, companies need to have a better understanding on the financial impact of their environmental-related actions. This is mostly significant in the context of underestimation of internal environmental costs and reduced productivity (Chen et al., 2022). Environmental Management Accounting (EMA) can be regarded as a set of accounting and performance tools dedicated to companies' actions towards improvement of their environmental impact (Qian et al., 2018). EMA deals exclusively with the company's internal costs, as it does not include the external costs of individuals, society, or the economic environment over which the company has no decision-making power. The focus of EMA is on environmental costs because it processes information related to the cost of the environment and, also, explicitly deals with information on movement and consumption of material resources and energy. It is straightforward to specify that a company will primarily use EMA for environmental protection activities, but this type of accounting is not limited to this, the output data being used in a variety of management and decisional processes (as presented by the United States Environmental Protection Agency (1995)).

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II. ENVIRONMENTAL MANAGEMENT ACCOUNTING: ADVANTAGES AND BENEFITS

Decision-makers in an organisation can use physical consumption information and costs provided by EMA to make decisions that impact both the organisation's financial performance and the environment. It is important to note that, while EMA provides support in decision-making, its implementation is not a guarantee of obtaining financial or environmental performance. However, EMA provides useful information to achieve goals referring to cost minimisation and reduction of negative environmental impact (Gunarathne & Lee, 2021). EMA is considered in the context of a company's environmental strategy, being a major vector for identification of economic benefits, improvement of both environmental and economic efficiency, and for revealing key financial data for strategic optimisation. EMA not only presents the cost data needed to estimate the financial impact of these initiatives, but also data on physical consumption (using raw materials and their renewal rates) that help characterise how these initiatives will influence the environment. Among the environmental initiatives that benefit from using EMA are the following (Jovanović et al., 2022):

- Pollution prevention;
- Environmental improvement design;
- Design and estimation on the costs of the life cycle in the environment;
- Management of products movement from an environmental perspective;
- The environmental perspective on procurement and supply chain;
- Responsibility of the product or manufacturer;
- Environmental-centred management systems;
- Evaluation, testing, and reporting of performance in environmental activities;
- Identification of potential investment opportunities and associated long-term decisions.

However, EMA is not just a tool for managing interaction with the environment among so many others, it is rather a set of principles and methods that provide data on material and energy consumption and costs, indispensable for the success of any activity (Metin, 2009). In this context, EMA is becoming increasingly important not only for environmental management, but also for other routine managerial activities, such as: design of processes and products; allocation and cost control; capital budgeting; the supply process; price policies; and performance evaluation.

Table 1 presents key benefits of implementing an accounting management system for environmental purposes. Besides the prominent benefits regarding diminished environmental impact (through initiatives such as waste reduction, efficient water usage or reduction in energy consumption), implementation of EMA has the potential to stimulate productivity and

improve public perception on the company (Asiaei et al., 2022).

Table 1. Key benefits of EMA

Benefit	Explanation
Improved information support	Separate disclosure of environmental costs (otherwise hidden in the classical accounting systems) will lead to improved information provided to decision-makers, influencing because of the increase of profitability;
Discovery of new opportunities	While the analysis of environmental costs can identify new opportunities, they can be used to save resources by recycling or re-use;
Assistance in the data reporting process	Identification of environmental costs supports organisations in collecting environmental impact data necessary for internal/external reporting;
Increased competitive advantage	Due to the early stage of development of environmental management accounting, its use and appropriate publicity can give a competitive advantage to an organisation;
Improved organisational image	Efforts to reduce environmental costs constitute valuable image capital;
Attracting and motivating staff	By demonstrating that an organisation tries to consider the effects of its operations on the environment, the organisation attracts better staff, also benefiting from a high employee retention rate;
Social benefits	Efforts to reduce costs and influences on the environment (which will lead to a cleaner environment) will generate benefits at the society level.

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Based on the snowball effect, a positive public image and strong reputation generate competitive advantage and the possibility of revenue gains due to consumer preference for purchasing products from companies that are actively engaging in sustainable and environmental-related initiatives (Asiaei et al., 2022). Nevertheless, such initiatives raise employees' awareness on environmental protection and adequate practices, generating improved organisational culture and higher employee retention rate.

III. A DEBATE ON ENVIRONMENTAL MANAGEMENT ACCOUNTING IMPLEMENTATION

Proper identification and collection of physical and financial data enhances decisional process within the

company and environmental data are no exception. Environmental accounting brings more information to management by identifying and quantifying measures such as (Yusoh et al., 2021):

- Obligations associated with significant influences on the environment;
- The cost of alignment with the legal provisions in the field;
- The benefits (or cost savings) achieved from the implementation of environmental management systems;
- Economic advantages of other initiatives (effective growth and improvement of business conduct).

A broad view of the steps an organisation needs to take to implement an environmental accounting system follows the algorithm presented in Fig. 1.

The first step in developing an environmental accounting system is to link environmental management to financial accounting. This is achieved by determining the environmental aspects of the organisation and selecting those that are considered significant and about which managers want information; these are environmental cost objects (Metin, 2009).

The identification of significant environmental aspects for environmental accounting will largely depend on the purposes of the old environmental assessment system. Many organisations have, or are in the process of implementing, environmental management systems that focus on the environmental aspects of the company's activity and identifies the resources and results obtained from those activities (Table 2).

However, the purpose of a management system that favours environmental accounting may differ somewhat from the model indicated by international environmental management standards, such as ISO14001.

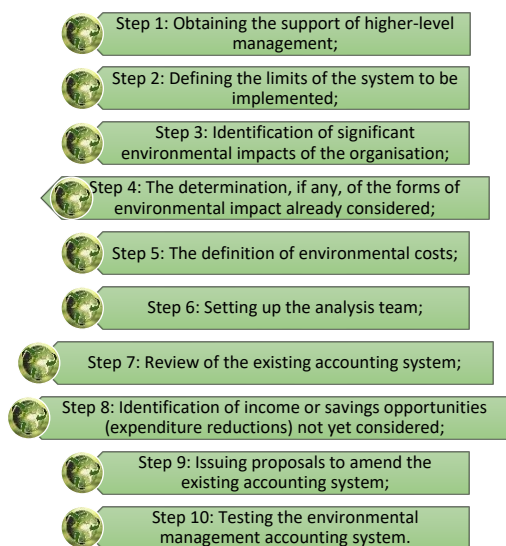


Fig. 1 General steps an organisation needs to take to implement an environmental accounting system.

Table 2. Example of connection between environmental aspects and environmental costs.

Environmental issue	Environmental impact	Potential costs/benefits
Use of electricity	Greenhouse gas emissions; use of non-renewable resources	- activities oriented towards reduction in electricity consumption; - reduction of electricity costs.
Dust	Environmental damage — potential danger for dust to affect the development of photochemical reactions	- fines and penalties from state authorities; - assessment of impact on affected areas; - negative public image.

By identifying the associated activities at organisational or company level, the relationship between environmental management and costs becomes more visible. If the activities, and the resources they use, can be quantified by costs, then the costs and the benefits of managing environmental problems are closer to the level of perception of managers (Yusoh et al., 2021). Financial responsibilities and objectives may also be designated.

Unfortunately, traditional accounting methods do not provide the ideal framework for identifying the necessary information, as they generally focus on the costs of the used resources and on their aggregation, without considering environmental-related activities. As a result, many actual and potential environmental costs will be 'lost' in indirect costs (Jovanović et al., 2022). For example, the labour cost required to remedy an environmental incident may be included (amalgamated) in a financial accounting system, combined with other labour costs, without being allocated to the specific activities that generated them. If these costs have been generated by the correction of an environmental incident, it is more appropriate to identify and allocate responsibility criteria for their control.

Once environmental cost objects have been identified, one further step is to establish a method for quantifying the cost associated with each of them. Identifying the activities associated with each of cost categories provides the link between what happens in the organisation and the costs and revenues generated by the consumption of resources corresponding to each activity (Fuzy et al., 2018). Each activity requires certain resources (work force, vehicles, cleaning materials, etc.), thus comprising a lot of associated costs (Elhossade et al., 2020).

Identifying how resources are consumed within the framework of the activity keeping and selecting the most suitable forms of measurement for the resources consumed an organisation can start to allocate the corresponding costs (resource carriers) on each activity (Fuzy et al., 2018). They are then linked to cost items by identifying the characteristics of the relevant

activities for each cost object, selecting the most appropriate measures for the activity concerned (activity measures) (Elhossade et al., 2020). Traditional accounting methods overlook the activities, at best allocate the cost of resources directly to cost objects (such as the cost of labour). Resource carriers and activity measures sometimes require special monitoring.

Implementation of EMA is, in fact, a process where companies start from using a tool for a specific category of data (e.g., water management) and move towards expansion of applicable areas until the company reaches implementation of a comprehensive and well-established system operating with both short-term and long-term data (Gunaratne & Lee, 2021).

IV. SOME CONSIDERATIONS ABOUT ENVIRONMENTAL ACCOUNTABILITY AND ORGANIZATIONAL PRACTICE

A more recent use of EMA comes from the increasing adoption of ISO 14000 family of standards regarding environmental management. In the complex process of certification for ISO 14001, EMA provides relevant data on potential approaches to benefits measurement (Jovanović et al., 2022).

The first frameworks proposed for environmental management accounting had a series of shortcomings generated, on the one hand, by the fact that environmental accounting includes both monetary and physical elements, and, on the other hand, by the misleading perception regarding the focus of environmental management (Burritt et al., 2002). As presented in the previous chapter, EMA pertains to the corporate perspective of environmental costs and, therefore, does not deal with the ecological implications at the society level. The most comprehensive and generally accepted framework for

EMA was developed by (Burritt et al., 2002) and includes five dimensions:

- (1) External and internal;
- (2) Short-term and long-term;
- (3) Monetary and physical;
- (4) Past and future-oriented;
- (5) Information gathering ad-hoc and as a routine.

The framework (presented in Table 3) has the major advantage of offering a wide array of accounting tools to use for various purposes, from the operational level (where physical and short-term dimensions are more prominent) to strategic planning (where aggregate, long-term data is preferred) (like presented in (Schaltegger et al., 2008)). In addition, the “comprehensive decision-making framework using EMA tools is based on whether information gathered is: physical or monetary; relates to past or future corporate activities; provides a short- or long-term perspective; and is routine or ad hoc. While the framework provides an overview of sixteen possible decision settings (see Table 3), development paths for using EMA tools in specific companies have yet to be examined” (Burritt et al., 2019).

EMA comprises three main categories of tools: measurement tools, auditing and benchmarking tools, and control tools. While the traditional approach in accounting would typically ignore non-monetary benefits of environmental management, EMA consists in framework for assessment of all elements and activities with potential environmental implications (Qian et al., 2018).

To meet environmental targets, companies ought to compare their performance with relevant standards and guidelines, as well as to key competitors’ performance (through auditing and benchmarking tools); nonetheless, the requirement of an established management control system as part of EMA generated control tools to serve the larger companies’ purposes (Qian et al., 2018).

Table 3. EMA framework according to (Burritt et al., 2002)

		Monetary EMA		Physical EMA	
		Short-term	Long-term	Short-term	Long-term
Past	Routine	Environmental cost accounting	Environmentally induced capital expenditure and revenues	Material and energy flow accounting	Environmental capital impact accounting
	Ad-hoc	Ex post environmental costing decisions	Environmental life cycle costing	Ex post assessment of short-term environmental impacts	Life cycle inventories
Future	Routine	Monetary environmental budgeting	Environmental long term financial planning	Physical environmental budgeting	Long term physical environmental panning
	Ad-hoc	Relevant environmental costing	Monetary environmental investment appraisal Environmental life cycle budgeting	Relevant environmental impact	Physical environmental investment appraisal life cycle analysis

V. GENERAL CONCLUSIONS AND FINAL REMARKS

Despite the major benefits and importance of EMA advocated by the research literature, certain studies demonstrated that several companies did not consider justified the cost-benefit ratio for implementation of such an accounting system (Jovanović et al., 2022). Moreover, applicative research on this matter concluded that EMA is implemented as an isolated tool, despite that it should be integrated in the overall accounting activities of a company (Jovanović et al., 2022).

This leads to the conclusion that even though EMA represents a key component for efficient and successful implementation of environmental management systems, without a systematic approach EMA will remain just a remote tool used for the sake of compliance with legislative requirements. In fact, EMA is the best vehicle towards achieving environmental-related goals, supporting key decisions with relevant data and reliable forecasts. In the context of increasing adoption of ISO 14000 family of standards, implementation of EMA tools will become an element of major interest, the main drawbacks regarding its implementation becoming a matter of the past.

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