

# Environmental Management Accounting -

## Overview and Main Approaches



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## **1 PREFACE**

In the environmental accounting literature environmental management accounting (EMA) has been defined in two fundamentally different ways. In the first approach EMA is considered to be represented by internal environmental accounting using a monetary measure (see e.g., Schaltegger et al. 1996, Schaltegger & Burritt 2000). The second approach is that EMA includes monetary and non-monetary approaches to internal accounting (see, e.g., Bennett & James 1998, ECOMAC 1996, IFAC 1998, UNDSO 2000, 39) reflecting a somewhat more encompassing term for internal corporate environmental accounting. To encourage broader establishment of EMA in corporate practice the development of a common perception of EMA would be beneficial. This article tries to combine the main arguments contained in these two definitions and proposes a new integrative framework for a common definition of EMA.

## **2 WHAT IS ENVIRONMENTAL MANAGEMENT ACCOUNTING?**

Management accounting "... is the identification, measurement, accumulation, analysis, preparation, interpretation, and communication of information that assists executives in fulfilling organizational objectives" (Horngren & Foster 1987, 2). Management accounting helps managers make decisions to fulfil the goals of an organization and has internal reporting as its main focus. Synonyms for management accounting are "managerial accounting", "cost accounting" and "cost management" (Garrison & Noreen 2000, Hansen & Mowen 2000).

This section outlines the two mainstream environmental management accounting frameworks:

- EMA limited to internal environmental accounting based on monetary measures
- EMA as a general term for internal environmental accounting

### **2.1 EMA as Monetary Internal Environmental Accounting**

The first approach considering EMA as monetary internal environmental accounting (see e.g., Schaltegger et al. 1996, Schaltegger & Burritt 2000) is derived from a general framework of environmental accounting (Figure 1).

Separate approaches to accounting may be needed to address different sets of issues of concern to different stakeholders. While some accounting systems can provide common information for all stakeholders, accounting systems can also be designed to provide specific information for use by, or to communicate with, different groups of stakeholders.

Accounting-Systems (& Measure)	Environmentally Differentiated Conventional Accounting (MU)						Ecological Accounting (PU)		
	Management Accounting		Financial Accounting		Other Acc Systems		Internal Ecological Acc.	External Ecological Acc.	Other Ecological Acc.
Management	●	●	◐	◐	◐	◐	◐	◐	◐
Shareholders			●	◐				◐	
Tax Agency			◐		●	◐			◐
Creditors			●	◐				◐	
Ecological Rating Agencies			◐	●				●	
Environmental Protection Agency		◐		◐		◐	◐	●	◐
etc.	...	...	...	...	...	...	...	...	...

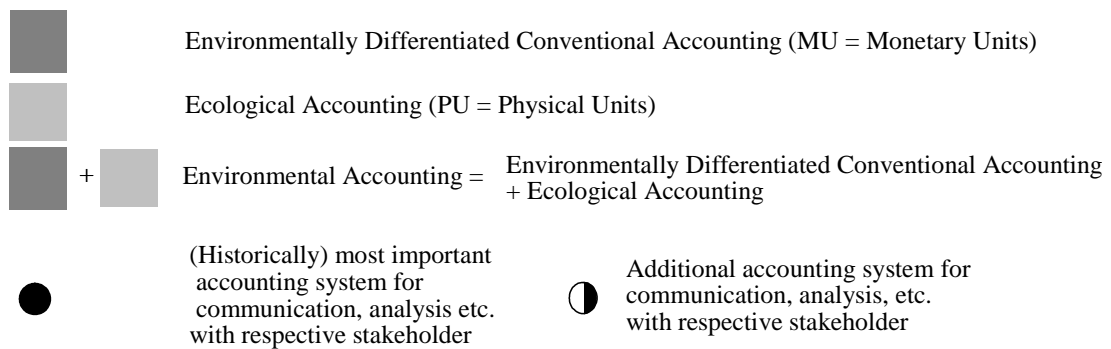


Figure 1: The Framework of Environmental Accounting (similar to Schaltegger & Burritt 2000, 58ff.; Schaltegger et al. 1996, 12ff.)

Figure 1 illustrates the most important stakeholder groups and related accounting categories and systems. While examples of various stakeholders are shown on the vertical axis, the horizontal axis of this framework of environmental accounting is divided into two different categories of accounting:

- Conventional monetary accounting<sup>1</sup>; and
- Ecological accounting<sup>2</sup>.

<sup>1</sup> According to this framework conventional monetary accounting comprises accounting for all monetarized aspects no matter whether they are environmentally-driven (see Schaltegger et al. 1996, 12f. and Schaltegger & Burritt 2000, 58f.).

<sup>2</sup> Ecological accounting in the context of this framework stands for all accounting for physically measured environmental interventions and impacts (see Schaltegger et al. 1996, 14ff. and Schaltegger & Burritt 2000, 61ff.).

The areas shaded in light and dark gray in Figure 1 illustrate that both of these accounting categories deal with environmental issues and therefore are part of environmental accounting. According to this framework environmental accounting thus covers issues in conventional monetary accounting (defined as environmentally differentiated conventional accounting<sup>3</sup>) as well as in ecological accounting.

The dark gray shaded areas in the conventional accounting category of Figure 1 represent the *environmentally differentiated conventional accounting systems*. Being part of conventional accounting, they measure the environmentally-driven impacts on the company in monetary terms. The remainder of the conventional accounting category, which does not address environmental issues, is shown in white. Conventional monetary accounting is further divided into three accounting systems:

- Conventional management accounting;
- Conventional financial accounting; and
- Other conventional accounting.

*Conventional management accounting* is the central tool and basis for most internal management decisions, and is not widely available to external stakeholders because such information is commercially sensitive and confidential (see Figure 1). A management accounting system considers questions such as: what are environmental costs and how should they be tracked and traced? How should environmentally driven costs be treated – should they be allocated to products or “counted as overhead costs”? What are the environmental responsibilities of a management accountant?

In addition to this system, *conventional financial accounting* is typically designed to satisfy the information requirements of external stakeholders of firms with respect to the financial impacts of corporate activities. Issues in financial accounting include, for example, whether environmentally-driven outlays should be capitalized (as assets) or expensed, what standards and guidelines exist concerning disclosure of (contingent) environmental liabilities, and what recommendations are provided on how to treat these liabilities in accounting. What are environmental assets and how might they be measured? How should emission trading certificates be treated in a financial statement?

“*Other conventional accounting systems*” is a term used to cover several additional, specific accounting systems such as tax accounting and bank regulatory accounting. Tax accounting is mandatory for all regular businesses, as the government tax agencies require tax “reports”, whereas, for example, bank regulatory agencies have special accounting

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<sup>3</sup> In the framework introduced above environmentally differentiated conventional accounting comprises the accounting for environmentally driven impacts on the firm measured in monetary units. Environmentally differentiated accounting thus remains within the scope and logics of conventional accounting (Schaltegger et al. 1996, 13f. and Schaltegger & Burritt 2000, 59f.)



and reporting requirements only for banks. Each of these separate conventional accounting systems considers different aspects of how environmental issues influence organizations (see also Schaltegger & Stinson 1994).

In addition to financial stakeholders, various internal and external stakeholders are interested in environmental issues. Therefore, to be useful, conventional accounting needs, first, to incorporate the monetary impacts of environmental issues and should, second, also be extended to include a *category of ecological accounting systems*<sup>4</sup> (shaded light gray in Figure 1). A distinction between ecological and conventional accounting categories is necessary because:

- From a material point of view, the focus of ecological accounting is very different from that of conventional accounting. The focus of ecological accounting is on environmental impacts whereas the focus of conventional accounting is on monetary impacts.
- Environmental and monetary information are often derived from different sources.
- Environmental information is often required for different purposes and by different stakeholders than monetary information.
- Environmental information has different measures of quality and quantity (e.g. kilograms) from monetary information (e.g. monetary value added).

It is thus not astonishing that these differences have resulted in the emergence of new, ecological accounting systems. The category of ecological accounting, which is shaded light gray in the environmental accounting framework in Figure 1, measures the ecological impact a company has on the environment. Its measurements (unlike those of environmentally differentiated conventional accounting) are in physical terms: the term “PU” stands for “Physical Units” (e.g. kilograms or joules). Ecological accounting can also be divided into three systems, corresponding to the structure of conventional accounting systems:

- Internal ecological accounting;
- External ecological accounting; and
- Other ecological accounting.

*Internal ecological accounting systems* are designed to collect information about ecological systems, expressed in terms of physical units, for internal use by management.

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<sup>4</sup> For the definition of the term ecological accounting see Fn. 2. However, the term ecological accounting is being used less in the literature recently. The comprehensive framework of EMA presented in this article provides a terminology to integrate ecological accounting in the framework of environmental accounting under the term of physical environmental accounting.

Such information complements conventional management accounting systems. Methods of measuring the impact of a company's products and processes on the natural environment are a necessary foundation for good management decisions. Various ways of examining pollution discharges and damage to ecological capital have been developed over the last decade. Whether sophisticated or unsophisticated, internal ecological accounting is a necessary precondition for any environmental management system.

The counterpart of conventional financial accounting is *external ecological accounting*. Under external ecological accounting, data for external stakeholders interested in environmental issues – namely the general public, communication media, shareholders, environmental (or ethical) funds, non-government organizations and pressure groups – are collected and disclosed. Over the last ten years hundreds of firms have published separate external environmental reports thereby providing a public stocktaking of their environmental impacts. Many of these reports are produced annually and contain extensive data on discharges of pollutants.

*Other ecological accounting systems*, which also measure data in physical units, provide a means for regulators to control compliance with regulations. Also, these accounting systems are necessary for computation of environmental taxes such as a CO<sub>2</sub> tax or a VOC tax.<sup>5</sup> Without information about discharge levels, environmental tax rates could not be multiplied by the volume of releases of pollutants to derive a figure for total taxes due. Apart from tax agencies and environmental protection agencies, which are primarily interested in specific information on discharges of specific pollutants, an increasing number of stakeholders such as banks and insurance companies require reliable information on the ecological impacts of companies as part of the risk assessment processes when lending funds, or agreeing to insure a risk.

Figure 1 shows how the information collected by these various environmental accounting systems has different values for different stakeholders. Ecological accounting systems are relatively new and have only recently become important information tools for many stakeholders.

As environmentally differentiated conventional accounting systems and ecological accounting systems process information triggered by environmental issues, they constitute – when taken together – *corporate environmental accounting*. A definition of environmental accounting which covers all of the outlined accounting systems above is that *environmental accounting* is a sub-set of accounting which deals with (Schaltegger & Burritt 2000, 63):

- Activities, methods and systems

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<sup>5</sup> CO<sub>2</sub> or VOC tax rates are based on the emission or consumption of the respective compounds and therefore require the provision of related information to tax agencies. Such tax regimes have been introduced or are discussed in various countries including Denmark, the Netherlands, Norway, Switzerland, etc. (see e.g. OECD 1994).

- Recording, analysis and reporting
- Environmentally-driven monetary impacts and ecological impacts of a defined economic system (e.g. a firm, plant, region, nation, etc.)

As a conclusion to the general environmental accounting framework outlined above, *environmental management accounting (EMA)* has been defined (Schaltegger & Burritt 2000) to include only the environmentally-driven monetary aspects of accounting that help managers to make decisions and be accountable for the outcome of their decisions.

Following this framework of environmental accounting information about (non-monetary) environmental impacts for decision making and accountability are distinguished separately in an accounting system which is called *internal ecological accounting*. The fact that conventional and ecological accounting are recognized as two different accounting categories is no obstacle to their integration as information from both accounting categories can be combined through separate eco-efficiency indicator analysis for use by managers and external stakeholders. Environmental management accounting and internal ecological accounting are brought together through eco-efficiency indicators that require the integration of these two systems.

However, this approach of defining EMA may not stress enough the need to integrate monetary and environmental issues.

## **2.2 EMA as a General Term of Internal Environmental Accounting**

The second definition of EMA reflects a broader term for corporate internal environmental accounting and includes both monetary and non-monetary internal accounting approaches (see, e.g., Bennett & James 1998, ECOMAC 1996, IFAC 1998, UNDSO 2000).

IFAC (1998, para. 1), for instance, defines environmental management accounting as "... the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, full cost accounting, benefits assessment, and strategic planning for environmental management."

From this definition it can be seen that IFAC makes no analytical distinction between monetary and non-monetary aspects of environmental management accounting. Bennett and James (1998), in line with IFAC terminology, call these two aspects "Environment-Related Management Accounting".

The basic difference relative to the first definition (section 1.1) is that, in the second definition, EMA also includes material flows and environmental impacts expressed in physical units. EMA is therefore not purely monetary but rather a multi-measurement management unit information system. The logical consequence of this perspective for the general concept of environmental accounting is to distinguish three accounting systems (see Figure 2):

- *Environmental management accounting* includes environmentally driven monetary aspects as well as physical measures of environmental impacts for internal company decision making.
- *Environmental financial accounting* includes environmentally driven monetary aspects as well as physically measured environmental impacts for reporting purposes with external stakeholders. This second category of accounting systems would have to cover the accounting relationships with specific external stakeholders, no matter whether their information interest is financial or environmental.
- *Other environmental accounting* includes monetary and physical environmental aspects of specific accounting systems, such as tax accounting, or other regulatory accounting systems.

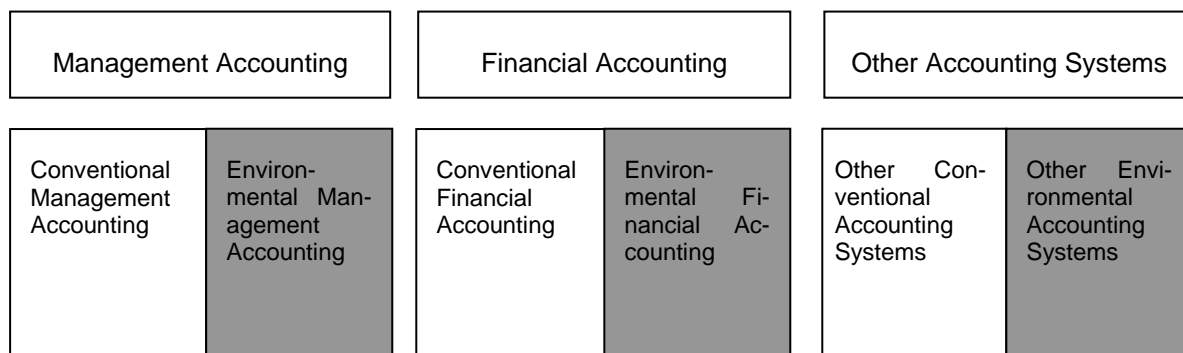


Figure 2: Environmental Accounting Including Monetary and Physical Units of Measurement

Reasons supporting this framework of environmental accounting, and specifically environmental management accounting, include:

- The *need for integrating* environmental and monetary issues is stressed by combining them together in one category. Environmentally-driven monetary impacts of a company are strongly interrelated with the environmental performance of a firm measured in physical units.
- A conceptual separation between internal and external accounting is based on the fact that the *level of detail and aggregation of information* and the *extent of confidentiality* differ between management and other stakeholder needs.

- *Conventional accounting in physical units* exists independently, and prior to, the development of accounting systems considering physical impacts on the environment. For example, productivity measures of efficiency, expressed in physical units, have long been derived in most conventional management accounting systems.

Hence, to be precise, for conventional management accounting monetary and physical aspects coexist insofar as the monetary accounts are based on and supplemented by physical measures. Standard costing provides a case in point, where variance analysis includes price and quantity variances, not just price (monetary) variances for control purposes.

Likewise, other conventional accounting systems combine the rules laid down by a specific stakeholder (e.g. a tax agency) about calculation and reporting of physical inventories, as well as monetary measures of those inventories.

However, this approach neglects the fact that the information interests vary very much between different stakeholders. For instance, shareholders are interested in the financial bottom line and may only partially be interested in a separate report with pollution information in physical units even it is put into a clear context with its financial consequences. Shareholders are interested in pecuniary information including environmentally driven monetary issues. Environmental protection agencies on the other hand are interested in various waste and pollution figures expressed in physical units and may not have much interest in whether the costs of pollution abatement or waste reduction measures are capitalized or considered as expenses in the financial accounts.

Furthermore, with this approach the distinction between conventional and environmental accounting becomes somewhat unclear. The differences in units of measurement, in the data quality and sources as well as the regulations and very different market requirements cannot just be neglected. The fact that the units of measurement have to be consistent for calculations becomes especially virulent when software solutions are developed.

### **3 CONCEPTUAL SUGGESTION FOR A FRAMEWORK DEFINITION OF ENVIRONMENTAL MANAGEMENT ACCOUNTING (EMA)**

Comparing the two approaches to defining EMA and their pros and cons reveals that sound arguments exist for both perspectives. Given the assumption that the philosophy and tools associated with EMA can assist the drive towards a sustainable society, it is important to create a common understanding of EMA in order to facilitate its communication and promotion among managers and other stakeholders. We therefore suggest an approach to integrate both perspectives by defining EMA in the following way:

		<b>Environmental Management Accounting (EMA)</b>			
		<b>Monetary Environmental Management Accounting (MEMA)</b>		<b>Physical Environmental Management Accounting (PEMA)</b>	
		<b>Short Term Focus</b>	<b>Long Term Focus</b>	<b>Short Term Focus</b>	<b>Long Term Focus</b>
<b>Past Oriented</b>	Routinely generated information	Environmental cost accounting (e.g. variable costing, absorption costing, and activity based costing)	Environmentally induced capital expenditure and revenues	Material and energy flow accounting (short term impacts on the environment – product, site, division and company levels)	Environmental (or natural) capital impact accounting
	Ad hoc information	Ex post assessment of relevant environmental costing decisions	Environmental life cycle (and target) costing  Post investment assessment of individual projects	Ex post assessment of short term environmental impacts (e.g. of a site or product)	Life cycle inventories  Post investment assessment of physical environmental investment appraisal
<b>Future Oriented</b>	Routinely generated information	Monetary environmental operational budgeting (flows)  Monetary environmental capital budgeting (stocks)	Environmental long term financial planning	Physical environmental budgeting (flows and stocks) (e.g. material and energy flow activity based budgeting)	Long term physical environmental planning
	Ad hoc information	Relevant environmental costing (e.g. special orders, product mix with capacity constraint)	Monetary environmental project investment appraisal  Environmental life cycle budgeting and target pricing	Relevant environmental impacts (e.g. given short run constraints on activities)	Physical environmental investment appraisal  Life cycle analysis of specific project

Figure 3. Proposed Framework of Environmental Management Accounting (EMA)

- The term EMA shall include internal monetary *and* internal physical accounting, as suggested by the second definition, in order to stress the necessity of integration of ecological and monetary issues.
- A distinction shall be made between monetary accounting and physical accounting, as suggested in the first definition, in order to place the different conceptual tools in the context of management decision making and accountability issues.

Hence, it is proposed that EMA shall be defined as a generic term that includes, both, Monetary Environmental Management Accounting (MEMA) and Physical Environmental Management Accounting (PEMA) as illustrated in Figure 3. This comprehensive framework allows the integration of both views and frameworks on EMA discussed above.

*Monetary Environmental Management Accounting (MEMA)* includes the environmentally differentiated conventional management accounting system according to the first perspective on EMA (section 1.1 of this paper) and is thus part of conventional management accounting. It deals with the environmentally-driven impacts on a company expressed in monetary terms. It is the central, pervasive tool providing, as it does, the basis for most internal management decisions as well as addressing how to track, trace, and treat environmentally driven costs (Schaltegger & Burritt 2000, chapter 4.1.2). MEMA is an accounting system for the monetary impacts of environmental related activities. It supports strategic and operational planning, provides the main basis for decisions about how to achieve desired goals or targets, and acts as a control and accountability device (Schaltegger & Burritt 2000, chapter 6.1).

*Physical Environmental Management Accounting (PEMA)* also serves as an information tool for internal management decisions. However, in contrast with MEMA it focuses on a company's ecological impact on the natural environment, expressed in terms of physical units such as kilograms. PEMA tools are designed to collect environmental impact information in physical units for internal use by management (Schaltegger & Burritt 2000, 4.1.3). According to Schaltegger & Burritt (2000, 11.1) PEMA, as an internal accounting approach for company related environmental impacts, serves as:

- an analytical tool designed to detect ecological strengths and weaknesses;
- a decision-support technique concerned with highlighting relative environmental quality;
- a measurement tool that is an integral part of other environmental measures such as eco-efficiency;
- a tool for direct and indirect control of environmental consequences;
- an accountability tool providing a neutral and transparent base for internal and, indirectly, external communication; and
- a tool with a close and complementary fit to the set of tools being developed to help promote ecologically sustainable development.

A further *distinction* to assign the different accounting tools to this classification is made *in relation to time*. Ecological issues are generally considered to be *long term*; while management is frequently criticized for adopting a *short term* perspective, to appease the financial markets and one group of stakeholders - shareholders. Accounting systems and associated tools of analysis, used to attach meaning into the signals produced, can be classified into those with a *focus on the past*, and those looking to the *future* (e.g. budgeting). From the viewpoint of internal management decisions, both, past and future oriented approaches can be further distinguished into routinely generated information (general ac-

counting systems that *routinely produce information* for management) and ad hoc information (specific accounting methods that produce information on a “needs” basis for particular decisions). As a result, this paper suggests a comprehensive conceptual framework of EMA within which the different approaches to internal environmental accounting, MEMA

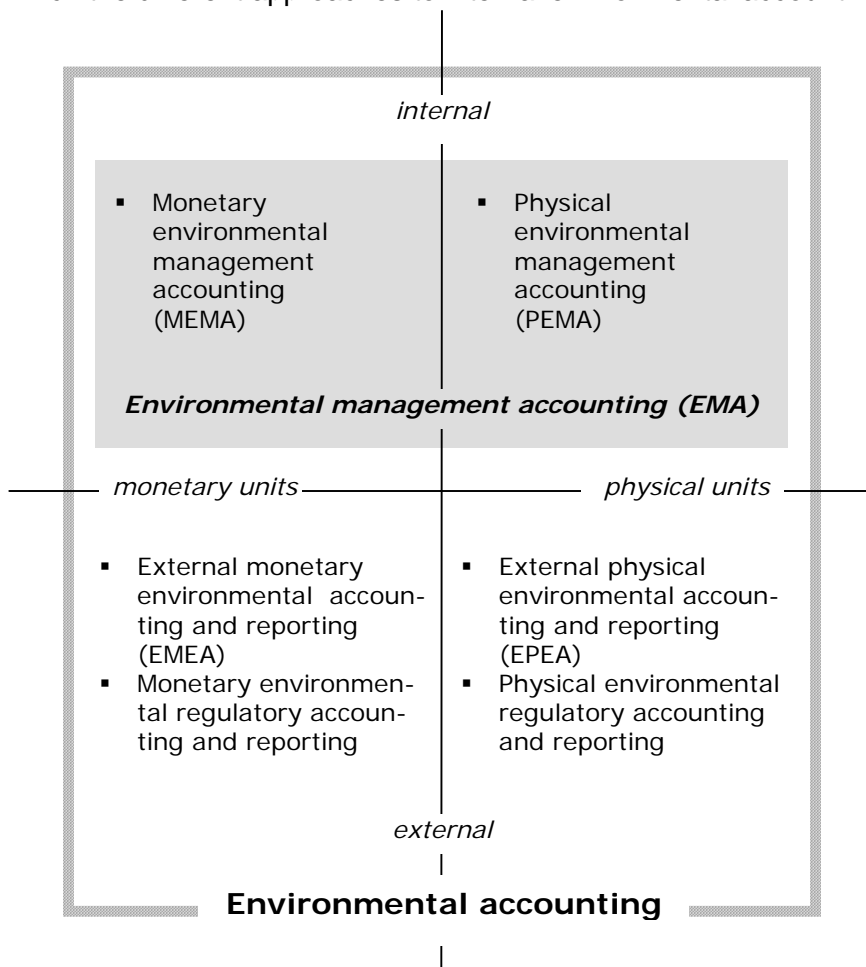


Figure 4: Comprehensive Framework of Environmental Accounting (modified from Bartolomeo et al. 2000, 33)

as well as PEMA, can be placed and assigned according to the decision setting. Figure 3 shows that EMA encompasses a large range of different accounting approaches that serve the different needs

that depend on the decision context, purpose and management level. Discussion of the EMA tools mentioned in the cells in Figure 3 are further discussed in the standard environmental accounting literature.

The structure of the integrated framework of EMA introduced in this article can also be used for the wider context of environmental accounting. Analogous to the distinction between MEMA and PEMA environmental accounting in general can be divided into the two main categories Monetary Environmental Accounting (MEA) and Physical Environmental Accounting (PEA) (see Figure 4). EMA then is clearly defined as a subset of environmental accounting being concerned with the provision of environment related information to management, i.e. serving the information needs of internal company stakeholders.



## 4 OUTLOOK

At present there is still no precision in the terminology associated with EMA. This article outlines and discusses the two main approaches of EMA in the existing literature. Drawing upon this discussion it has been argued above that there is scope for deriving an agreed basis for EMA. Such an opportunity depends on the recognition of:

- monetary and physical accounting systems that, both separately and in combination, are of use to managers in seeking to reduce environmental impacts from the activities of their organizations;
- a mapping of the tools available for EMA with the time frames used by managers for analysis (the length of the decision horizon – short or long term); and
- a mapping of the tools available for EMA related to the timing of impacts (impacts in the past, contemporary impacts, impacts in the future).

Among the main advantages of the proposed new framework for EMA are:

- the movement towards a closure of the debate about what EMA is, or what it might be, is necessary for effective scientific communication and research as well as for the promotion and establishment of modern EMA approaches in practice;
- the recognition that EMA needs to include monetary and physical measures, albeit in systems that can be considered independently of each other, or in combination;
- the mapping of tools with EMA sub-systems that facilitate particular types of decisions; and
- the incorporation of time as a key element in the classification, in order to bring stronger focus on the links between short term and long term monetary considerations and short and long term ecological considerations in management decision making.

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