EMA Micro Macro link
SEEA Revision issues from a corporate accounting perspective
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Abstract:
Harmonisation of disclosure requirements to statistical agencies regarding material and energy consumption, environmental investments and expenditures with the IFAC guidance document on environmental management accounting (EMA) .

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INTRODUCTION

Environmental accounting has a micro as well as a macro level; companies are assessing data for internal use as well as for external disclosure. Statistical and environmental protection agencies are collecting this information, aggregating it and providing it for science and environmental politics.

The core part of this paper is a comparison of definitions and disclosure requirements for environmental accounting on a national and corporate level which results in recommendations to statistical agencies, which are collecting this data worldwide. This is achieved via participation of the author in the revision process of the London Group on Environmental Accounting which has accepted the request by the UN Committee of Experts on Environmental-Economic Accounting to take a leading role in the revision of the SEEA-2003, the worldwide handbook of national environmental-economic accounting (UN SEEA 2003).

Environmental-economic accounting brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment. The System of Environmental-Economic Accounting (SEEA) is a satellite system of the 1993 System of National Accounts (UN SNA 1993). The SEEA 2003 handbook provides a common framework for economic and environmental information, permitting a consistent analysis of the contribution of the environment to the economy and of the impact of the economy on the environment. It is intended to meet the needs of policy makers by providing indicators and descriptive statistics to monitor the interaction between the economy and the environment as well as serving as a tool for strategic planning and policy analysis to identify more sustainable development paths (SEEA 2003).

Four categories of accounts run through the SEEA handbook. These are
1) physical and hybrid flow accounts of material and energy; (related with material flow accounting on a corporate level). Hybrid accounts link the physical accounts with economic (monetary) flows (called NAMEA matrix).
2) accounts that portray the environmental transactions in the existing System of National Accounts (SNA) in more detail, e.g. expenditures made by businesses, governments and households to protect the environment;
3) environmental asset accounts in physical and monetary terms (natural capital in three categories: natural resource stocks, land and ecosystems); and
4) accounts that show how existing SNA aggregates can be modified to account for depletion and degradation of the environment and for environmental defensive expenditure. Such adjustments relate to depletion, so-called defensive expenditures and to degradation.

In 2005 a guidance document on corporate Environmental Management Accounting (EMA) was developed for IFAC, the International Federation of Accountants in New York (Savage and Jasch, 2005). It is based on a publication on principles and procedures for EMA, which was written for the United Nations Division for Sustainable Development, UN DSD (Jasch, 2001). Both documents were funded within the research framework of the Factory of Tomorrow in Austria.

According to the definition of UN DSD, two types of information are considered under EMA: physical and monetary information. Physical information includes data on the use, flows and final destiny of energy, water, materials and wastes. EMA places a particular emphasis on physical information because
(1) the use of energy, water and materials, as well as the generation of waste and emissions, are directly related to many of the environmental impacts of organizational operations and
(2) materials purchase costs are a major cost driver in many organizations (Strobel, 2001).

In the last years both documents have been applied in several case studies worldwide, with the focus on developing internal corporate procedures and standards for data collection and disclosure. Experience showed that national disclosure requirements to statistical agencies vary slightly, as definitions are not consistently applied, even though referencing the same framework document (SEEA 2003). International corporations, who are installing world wide information systems to fulfil their disclosure requirements and voluntary sustainability reporting goals, find significant difficulties in aggregating data from different countries if those definitions differ. Examples contain different definitions of environmental investments, different approaches regarding depreciation and confusion regarding the collection of costs, expenditure, savings or cash flow related data. This has resulted in

recommendations for a further harmonisation of definitions and requirements for data collection and reporting.

The aim of this paper and the research project behind is to further improve consistency of data requirements for statistical purposes with the structure of financial accounting systems as well as with the definitions in the guidance documents. This will significantly support the design of harmonised corporate information systems and help provide consistent and comparable data on a micro and macro level.

Improved and harmonised data quality is essential for corporations as well as for aggregated statistical analysis, as they provide the ground for several decisions, from investment choices to scientific projects and political instruments and allow better benchmarking. In addition, the time needed for data assessments and aggregations can be reduced significantly, as well for corporations as for statistical agencies.

A further aspect is that this data is increasingly being used e.g. for Life Cycle Assessments, which rely on this information for policy recommendations, as often no better data is available on a corporate and product specific level. At the same time companies along supply chains are trying to collect this type of information for environmental product design and product stewardship.

1. Issues related to Material Flow Accounting

1.1. MATERIAL FLOW ACCOUNTING ACCORDING TO IFAC AND UN DSD

Probably the most significant difference between micro and macro definitions is related to the clarification and consistent application of the definitions for materials and products. The IFAC guidance document for EMA (Savage and Jasch, 2005) distinguishes:

Raw and Auxiliary materials, which make up the products of a company. For EMA loss percentages have to be calculated or estimated, as not all raw material inputs are converted into products. They thus also make up a significant share of the costs of waste.

Packaging Materials purchased for shipping of the products also leave the company together with the product and have a loss percentage during production.

A completely different category are Operating materials, which by definition are not part of the product but necessary for production purposes. They contain highly relevant materials from an environmental point of view, like cleaning materials, lubricants, chemicals, maintenance equipment etc. As they are not part of the product, by definition, they are part of waste and emissions and thus constitute the most significant share of total EMA costs in production companies but also major saving potential.

The use of operating materials is often recorded on the related production cost centres. This is normally not the case for raw and auxiliary materials, which are monitored by production planning systems without accounting for the losses during the different production steps. Material flow accounting focuses on tracing the flow of raw and auxiliary materials via the different production steps and process cost centres in physical and monetary terms.

The United Nations Expert Working Group on EMA, which distinctively highlights both the physical and monetary sides of EMA has developed the following definition for EMA. According to the UN group (Jasch, 2001):

EMA is broadly defined to be the identification, collection, analysis and use of two types of information for internal decision making:
physical information on the use, flows and destinies of energy, water and materials (including wastes) and
monetary information on environment-related costs, earnings and savings.

Under the physical accounting side of EMA, an organization should try to track all physical inputs and outputs and ensure that no significant amounts of energy, water or other materials are unaccounted for. The accounting for all energy, water, materials and wastes flowing into and out of an organization is called a "materials balance," sometimes also referred to as "input-output balance," a "mass balance" or an "eco-balance." (United Nations Environment Program and United Nations Industrial Development Organization, 1991; German Environmental Protection Agency/German Environment Ministry, 1995; R. Pojasek, 1997; Environmental Protection Agency of Baden-Württemberg, 1999).

Materials Inputs are any energy, water or other materials that enter an organization. Outputs are any products, wastes or other materials that leave an organization. Any Output that is not a Product Output is by definition a Non-Product Output (NPO). In organizations that use energy and materials but do not manufacture physical products, such as transport or other service sector companies, all energy, water and other materials used will eventually leave as Non-Product Output, by definition. The IFAC guidance document on EMA uses the term NPO synonymously with the term "Waste and Emissions." The Japanese guide for Material Flow Cost Accounting is based on the same concept and distinguishes output into positive and negative products (METI 2007). The physical categories described by IFAC are also in line with the general structure of ISO 14031 for environmental performance indicators for operational systems (ISO 14031), which are referenced in ISO 14001, the standard for environmental management systems.

Figure 1 from IFAC 2005 describes each type of Input and Output.

Materials Inputs	Product Outputs
Raw and Auxiliary Materials	Products (including Packaging)
Packaging Materials	By-products (including Packaging)
Merchandise	Non-Product Outputs (Waste and Emissions)
Operating Materials	Solid Waste
Water	Hazardous Waste
Energy	Wastewater
	Air Emissions

Figure 1 – Physical Materials Accounting: IFAC Input and Output Types

1.2. MATERIAL FLOW ACCOUNTING ALONG SUPPLY CHAINS

Material flow accounting can be done for several system boundaries (see Figure 2). For external disclosure in sustainability reports the system boundary preferably relates to the consolidation units and the financial accounting consolidation rules for subsidiaries and joint ventures are applied also for the environmental and social data. For internal use, one step further down to cost centers and production processes or even down to machineries and single products can constitute a helpful tool for process optimization. Then it becomes the task of process technicians and not so much accountants to tackle and trace the necessary data.

INPUT	System boundaries	OUTPUT
	Nations	

Materials	⇒	Regions	⇒	Products
Energy	⇒	Corporations	⇒	Waste
Water	⇒	Processes	⇒	Emissions
		Products		

Figure 2 – System Boundaries for Material Flow Accounting

Product life cycle assessments (LCA´s) comprise two levels. Company internal is the attribution of the process data (e.g. on a cost centre level) to the products produced. This is a prerequisite for corporate LCA´s. The system boundary for LCA´s follows the product throughout its life cycle by adding upstream and downstream life-cycle stages along supply chains. This method, based on material flow thinking, has been incorporated into ISO 14040.

As obvious, LCA´s require very good data quality from corporations. In addition, they mostly require data from companies outside the direct sphere of influence and data which can also not be gathered from environmental reports, as most companies produce more than one product in more than one process. At global level more than 100 000 companies now have an ISO 14001 management system, which again has a comprehensive impact on supply chains. At the same time, experience shows that the comparability of performance indicators and the consistency of the financial and technical information systems are very weak and not much data is being disclosed.

The only solution often available to scientists and consultants is to refer to data published by statistical agencies on the level of industry sectors (NACE Codes). The necessity to rely on data from national statistics for LACs is increasing as globalisation of supply chains has a fast growth rate due to fast growing economies like China, India and Brazil etc. A number of databases for LCA based on national economic and environmental statistics are now available. These databases are known as "Input-Output databases" or "IO-databases" for short.

So while LCA in general terms may work on a macro level, linking highly aggregated sector specific information on material flows with environmental impacts, and providing very general information on environmental impacts from production sectors, the link to data collected on a micro level remains weak. The information, that LCA´s based on macro data can supply, is relevant e.g. for political decision making for instance related to environmental labelling, but not so much as a decision making tool for companies when it comes to procurement or ecodesign, as the data is not company specific enough.

Environmental management systems, performance indicators and management accounting have their application on a micro level, but this information is not fed back to the macro level. For performance evaluation and product life-cycle assessment (LCA), the production steps and processes covered by the companies or product systems analyzed must be carefully defined so that the production steps covered by an input-output analysis are identical. Figure 4 shows the product life-cycle scheme. Data comparison within sites, processes and products requires that the system boundaries of the participants are comparable, otherwise the results will be meaningless.

Material Flow Cost Accounting in the sense described in this paper is new work item of ISO TC 207 Environmental Management and will thus become even more important in industry. In addition, increasingly life cycle assessments of products are being performed which try to reference to the material flow data provided by national statistics but face significant problems. Ideally, the mass balance as shown in Figure 1 would be available for each NACE industry sub-sector.

In relation to SEEA and Material Flow Accounting, in addition it is recommended to consistently distinguish the outputs of a NACE sector into products and services. Increasingly companies are providing product-service-systems and therefore, for many sectors, a classification between the monetary output of physical products in distinction to services should be established.

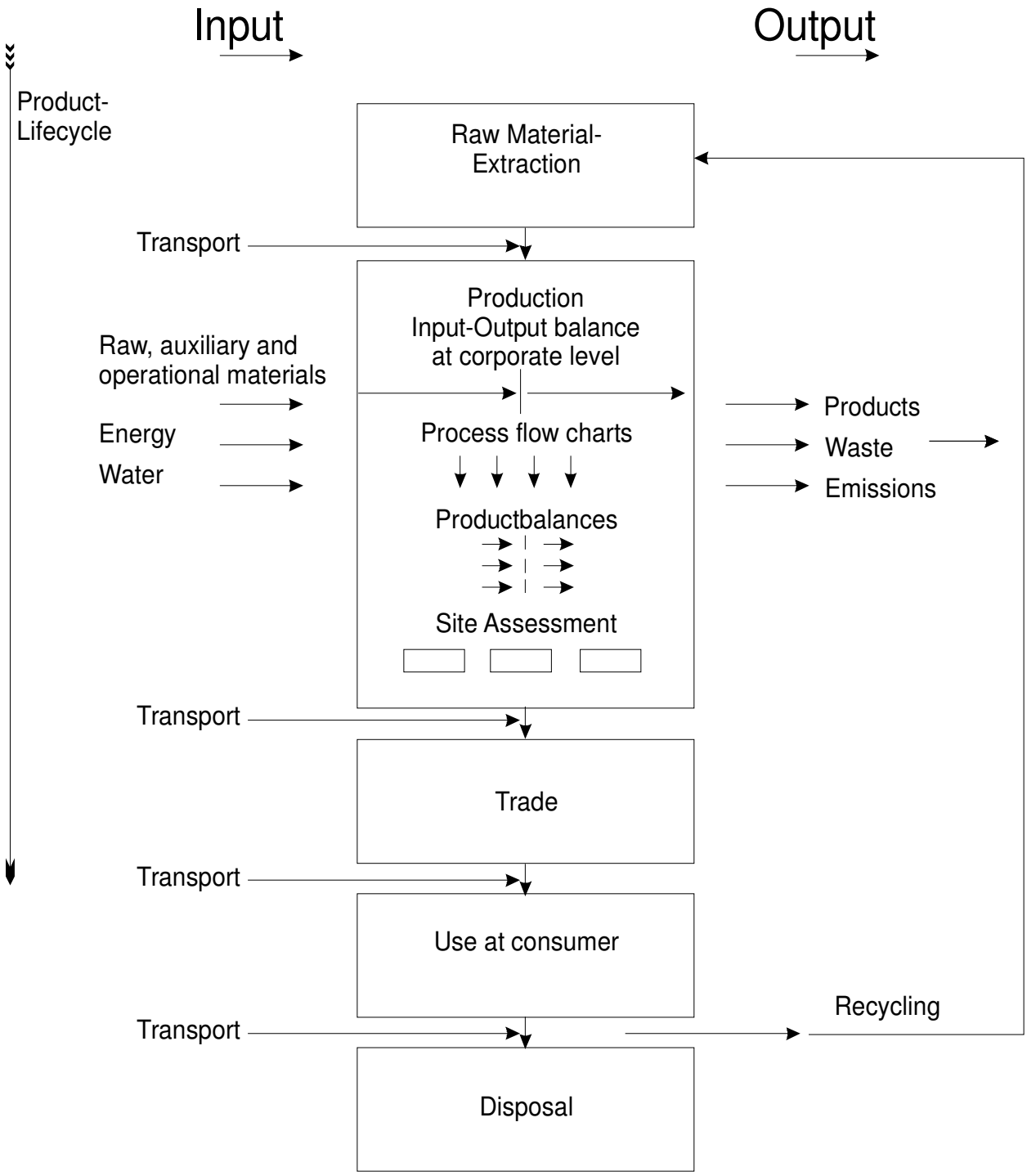

Figure 3 – Product Life Cycle Assessment

1.3. MATERIAL FLOW ACCOUNTING ON A MACRO LEVEL

Material flow accounts (MFA) on a national level are compilations of the overall material inputs into national economies, the changes of material stock within the economic system, and the material outputs to other economies or to the environment. The tradition of economy-wide material flow accounting and analysis goes back to the 1970ies (Kneese, Ayres, and d'Arge, 1970). The increasing policy interest in issues of sustainable resource use in the 1990ies has resulted in a wider application of economy-wide MFA (see the respective programmes and initiatives in the EU, OECD, UNEP, G8, Japan, and China).

The fundamental concept of MFA in SEEA is different to the Input-Output structure on a micro level. SEEA deals with products, natural resources, ecosystem inputs and residuals. The concept of products is taken over from the system of national accounts (SNA). The accounting system of the SNA measures the flows of products (economic goods and services) and shows how in a closed economy some are used to produce other goods and services in the current period (intermediate consumption) or in future (capital formation) and some are used to satisfy current human wants (final consumption). This closed economy must be opened to take account of transactions with the economies of other countries via imports and exports.

Four different types of flows are distinguished in the SEEA (SEEA 3003 p.30): Products are goods and services produced within the economic sphere and used within it, including flows of goods and services between the national economy and the rest of the world. Natural resources cover mineral and energy resources, water and biological resources. Ecosystem inputs cover the water and other natural inputs (e.g., nutrients, carbon dioxide) required by plants and animals for growth, and the oxygen necessary for combustion. Residuals are the incidental and undesired outputs from the economy which generally have no economic value and may be recycled, stored within the economy or (more usually at present) discharged into the environment. .Residuals is the single word used to cover solid, liquid and gaseous wastes. Physical flow accounts consist of merging accounts for products, natural resources, ecosystem inputs and residuals, each account being expressed in terms of supply to the economy and use by the economy.

INPUTS	OUTPUTS
Products	Products
Natural resources	Residuals
Ecosystem inputs	

Figure 4 – Physical Flow Accounts according to SEEA

SEEAs focus is to look at the flow of entities into the economy from the environment and those flowing from the economy to the environment. The environmental inputs flowing to the economy from the environment are divided into natural resources (typically mineral and biological resources) and ecosystem inputs (the water and air necessary for all life forms). The flows from the economy to the environment consist of gaseous, liquid and solid wastes. The term “residual” is used to encompass all these outflows from the economy which use environmental media as a disposal sink and is identical to the terms “waste and emissions” and “non product output” used in EMA.

But, SEEA doesn’t make a clear distinction between materials and products. It sometimes refers to raw materials only, it sometimes uses the terms materials and products as identical and it doesn’t give guidance on the recording of operating materials.

The SEEA classification causes confusion in relation with the IFAC definitions. While residuals may be clearly identified as non product output, all the materials input side remains vague and inconsistent with accounting terminology and records.

Table 3.18 on page 139 of SEEA for instance summarizes all input of the production sector as total material inputs (including intermediate consumption, extraction of natural resources, ecosystem inputs and re-absorption of materials) while at other sections the term materials is used identical to products and sometimes identical to physical flows in general.

The SEEA chapter on Material Flow Accounts (p- 148) takes again a different view: "A major aim of economy-wide material flow accounts is the estimation of the total material requirement of a national economy. This is the sum of the total material input in the economy. Besides the direct material inputs material flows within the environment are also to be taken into consideration. These flows consist of:

ancillary flows: material that must be removed from the natural environment, along with the desired natural recourse, to obtain the natural resource.
excavated or disturbed flows: material that is moved or disturbed to obtain the natural resource.

These flows are sometimes described as hidden flows, indirect flows or unused extraction."

Products can be classified according to different criteria and objectives and a number of international standards exist. The 1993 SNA introduced the Central Product Classification (CPC) for this purpose (SEEA 2003 p- 104). But as the CPC has been developed primarily for economic analysis SEEA 2003 itself notes that supplementary classifications may be used for the analysis of physical characteristics. It references for example the chemical abstract system (CAS) together with a toxicity database to be used to identify harmful effects of chemicals. However, in order to ensure international comparability and coherence with the SNA, SEEA 2003 recommends to ensure that any supplementary classification introduced in the physical flow accounts can be re-aggregated to the CPC. But this doesn't solve the problem of accounting for materials, substances or products in a consistent manner that is compatible with accounting standards.

2. Issues related to the Classification of Environmental Costs

The distinction between End-of-Pipe Treatment and Integrated Prevention is a major achievement in Cleaner Production and highlights the shift in paradigm from emission permits and aftercare to the precautionary principle. Prevention is better than cure is a common saying.

The shift in total environmental costs from treatment to prevention started with the widespread application of environmental management systems about 15 years ago, but till nowadays is not adequately reflected in environmental statistics.

2.1. ENVIRONMENTAL COSTS ACCORDING TO IFAC

For the IFAC EMA document, cost definitions from a variety of international sources were reviewed and a set of cost categories was developed. The goal was to develop a set of cost categories that represents not only widely accepted international practice, but also emerging best practice. Figure 6 defines the set of environment-related EMA cost categories of IFAC. In addition earnings from investment grants, subsidies and sale of waste for recycling are being recorded.

1. Materials Costs of Product Outputs Includes the purchase costs of natural resources such as water and other materials that are converted into products, by-products and packaging.
2. Materials Costs of Non-Product Outputs Includes the purchase (and sometimes processing) costs of energy, water and other materials that become Non-Product Output (Waste and Emissions).
3. Waste and Emission Control Costs Includes costs for: handling, treatment and disposal of Waste and Emissions; remediation and compensation costs related to environmental damage; and any control-related regulatory compliance costs.
4. Prevention and Other Environmental Management Costs Includes the costs of preventive environmental management activities such as cleaner production projects. Also includes costs for other environmental management activities such as environmental planning and systems, environmental measurement, environmental communication and any other relevant activities.
5. Research and Development Costs Includes the costs for Research and Development projects related to environmental issues.
6. Less Tangible Costs Includes both internal and external costs related to less tangible issues. Examples include liability, future regulations, productivity, company image, stakeholder relations and externalities.

Figure 5 – Environment related Cost Categories of IFACs EMA Guidance Document

As the IFAC EMA guidance document is not a financial accounting standard (dealing with expenditures) but focussing on the information needs of internal management, the terminology used applies to cost accounting. It is however noted that most companies, particularly small and medium-sized ones, do not have an independent management accounting system; they simply use data initially developed for financial accounting purposes for internal decision making as well as for external reporting, perhaps with a few minor adjustments. The focus of the IFAC EMA guidance document is on recording actual annual environmental costs or expenditures, but not on investment appraisal or calculating savings. They are however strongly supported by the data collected under EMA.

Most of the EMA cost categories have sub-categories relating to traditional financial accounts, such as equipment depreciation, raw and auxiliary materials, operating materials, personnel, etc. These subcategories are discussed in more detail in the IFAC guidance document.

2.2. CLASSIFICATION OF ENVIRONMENTAL EXPENDITURE BY ENVIRONMENTAL DOMAIN ACCORDING TO IFAC AND CEPA

In accordance with SEEA requirements the IFAC EMA assessment template distributes the costs to the environmental domains effected. The columns in Figure 6 show the IFAC assignment of environment-related costs to environmental domains. These are a slightly modified version of the domains that European statistical offices must use in reporting businesses' environmental protection expenditures to Eurostat, the statistical arm of the European Commission and according to SEEA.

The classification that SEEA 2003 suggests for organising environmental protection activities is the Classification of Environmental Protection Activities (CEPA). The classification also applies to expenditure and products. Within the CEPA, environmental protection activities are first classified by environmental domain (air, waste, nature protection, etc.) and then by type of measure (prevention, treatment, etc) (SEEA 2003, p. 201).

It is important to notice, that in the IFAC guidance document the environmental costs are first assessed by standard accounting categories and only then assigned to environmental domains affected. This way it is the task of the accountants with support from the environmental manager to set up a consistent and complete data information system.

The CEPA approach and the questionnaires send out by statistical agencies go the other way round. They ask for environmental domains and thus the questionnaire is being answered by the environmental manager who often has no direct access to the accounting system and no overview on the total corporate cost structure. The information reported is thus often not complete and consistent.

In addition, the IFAC approach primarily distinguishes between treatment and prevention expenditure. It is emphasized that with more sophisticated environmental protection approaches corporations are shifting their emphasis from treatment to prevention and that this shift should be the focus of environmental management and reporting as well.

The CEPA classification in contrast focuses on treatment activities and the impact on environmental media and excludes all activities which make sense to corporations as they pay off. Activities are only to be recorded if the primary purpose is environmental protection and if the expenses don't have a positive return on investment. By this definition most activities that companies are taking for integrated pollution prevention are excluded!

ENVIRONMENTAL DOMAINS ENVIRONMENT-RELATED COST CATEGORIES	Air and Climate	Waste Water	Waste	Soil, Groundwaterand	Noise and Vibration	Biodiversity and Landscape	Radiation	Other	Total
1. MATERIALS COSTS OF PRODUCT OUTPUTS									
Raw and Auxiliary Materials									
Packaging Materials									
Water									

2. MATERIALS COSTS OF NON-PRODUCT OUTPUTS									
Raw and Auxiliary Materials									
Packaging Materials									
Operating Materials									
Water									
Energy									
Processing Costs									
3. WASTE and EMISSION CONTROL COSTS									
Equipment Depreciation									
Operating Materials									
Water and Energy									
Internal Personnel									
External Services									
Fees, Taxes and Permits									
Fines									
Insurance									
Remediation and Compensation									
4. PREVENTIVE and OTHER ENVIRONMENTAL MANAGEMENT COSTS									
Equipment Depreciation									
Operating Materials, Water, Energy									
Internal Personnel									
External Services									
Other									
5. Research and Development COSTS									
6. LESS TANGIBLE COSTS									

Figure 6 – Distribution of environment related Costs by environmental Domain according to IFAC

2.3. ENVIRONMENTAL EXPENDITURE ACCORDING TO SEEA

In order to understand the SEEA approach to environmental expenditure it is necessary to understand the underlying concept of the "environmental domain of interest" (SEEA 2003, p.169): "The two main purposes designated to be of environmental interest are protection of the environment and the management of natural resources and their exploitation. In addition, there are some activities which, though not primarily aimed at protecting the environment, may have environmentally beneficial effects. Damage avoidance and treatment may also be included in the field of interest though these activities are more concerned with rectifying damage already done than with preventing it in the first place. Lastly, and perhaps less obviously, minimisation of natural hazards may be included although these are activities to protect the economy from the environment where the others are concerned with protecting the environment from the economy. For simplicity, the expression "environmental activity" is used as shorthand for all the environmentally related purposes just described."

The accounts for environmental protection and resource management established in SEEA aim to identify and measure society's response to environmental concerns through

- the supply and demand for environment goods and services,
- the adoption of production and consumption behaviour aimed at preventing environmental degradation and

- by managing environmental resources in a sustainable way.

The approach taken by SEEA (p. 170) in identifying environmental activity is to subdivide products and industries into those which are typical, or characteristic, of environmental activity and those which are not. But this neglects the fact that nowadays practically in all sectors environmental management systems have been installed and within them initiatives are being taken to reduce the environmental impact of production and products and in addition develop more sustainable products. It also doesn't solve the problem that products typical of environmental activity may be used for other purposes and some non-typical products may be used by environmental activities.

SEEA tries to solve the issue by introducing a further classification into the supply and use matrix, where the purpose of the expenditure undertaken is identified. This too is subdivided to show the purposes which are environmental in nature, and thus of interest here, and other purposes. In this case the purposes of interest are those listed above:

- protection of the environment,
- management and exploitation of natural resources,
- environmentally beneficial activities and
- the minimisation of natural hazards.

But in every day decisions of organisations, investments and current expenditure items are no longer either environmental protection OR production related. It is the success of integrated technologies and management systems (e.g. integrated quality, environment and health and safety systems) that environmental protection is no longer a "satellite system" to general management, but an incorporated strategy and procedure.

Ideally what SEEA 2003 wants to measure are "the expenditures connected with the designated environmental purposes". For practical reasons concerning available data sources, SEEA looks into what has been defined as environmental industries or environmental products. (p.198).

SEEA itself recognizes that "one of the most difficult distinctions to make is whether the primary purpose of the spending is environmental protection, or whether environmental protection is simply a result of decisions taken for some other purpose." It provides the example of spending on equipment which may reduce pollutant emissions but which may also be more energy efficient.

But the solution taken by SEEA is not to include the energy efficient equipment, which is not really understandable also from an environmental point of view. This has e.g. let to a strong decline in environmental investments since 1990 (Statistisches Bundesamt, 2006) which is not at all related to a degradation in the state of environment, as companies at the same time have invested in integrated pollution prevention techniques and management systems and actually improved environmental performance in relation to production.

SEEA itself recognizes practical data collection problems such as trying to estimate the cost of the additional "clean" part of new capital equipment, particularly where the clean element becomes a standard part of the equipment and there is no "dirty" alternative. This could be solved by introducing a criterion for "actual environmental impact" of a measure, a criterion that corporations often apply when defining the environmental "share" of a measure.

The SEEA approach to environmental expenditure explicitly only "concentrates on steps taken to deal with residuals and does not consider explicitly protection of the environment through means of water and energy conservation or the effects of recycling" (p. 215). In effect, this means that the SEEA approach only focuses on the output of waste and emissions and neglects all activities to reduce the inputs of materials, water and energy. It is thus in complete contrast to the approach of cleaner production and pollution prevention.

The CEPA Definiton (SEEA p.559) states: "Protection of ambient air and climate comprises measures and activities aimed at the reduction of emissions into the ambient air or ambient concentrations of air

pollutants as well as to measures and activities aimed at the control of emissions of greenhouse gases and gases that adversely affect the stratospheric ozone layer. Excluded are measures undertaken for cost saving reasons. (e.g. energy saving)."

CEPA 2000 is designed to classify transactions and activities whose primary purpose is environmental protection. The management of natural resources (for example, water supply) and the prevention of natural hazards (landslides, floods, etc.) are not included in CEPA.

According to SEEA (p.200) Environmental protection activities are only those where "the primary purpose is the protection of the environment; that is, the avoidance of the negative effects on the environment caused by economic activities. Examples include spending by companies on end-of-pipe equipment to reduce or eliminate emissions or make them less hazardous and spending on environmentally protective technology to minimise emissions and pollutant discharges during the production process."

Relevant activities and expenditures are identified by the criterion of the primary purpose. To find out, if the "primary purpose" definition applies, SEEA proposes "the following criteria (p.200):

A) The pure purpose criterion: Activities and expenditure where the main objective is protecting the environment are included in full. This criterion works best where the main objective of protecting the environment is clear and unambiguous, for example end-of-pipe capital expenditure.
B) The extra-cost criterion: is used to identify the portion of the cost of more environmentally friendly technologies and changes in processes and products to be attributed to environmental protection. The investment and operating expenditure are compared to those of a "standard" or less environmentally beneficial alternative, if there is one, or the estimated additional cost of incorporating the environmentally beneficial feature. Only the extra expenditure is included.
C) The net-cost criterion: Only expenditure undertaken for environmental protection purposes which leads to a net increase in cost (that is where spending exceeds any savings or income arising before the net cost was actually incurred) is included. When expenditure is recorded, this criterion only applies to operating expenditure.
D) The compliance criterion: Expenditure undertaken with the main objective of protecting the environment but specifically in order to comply with environmental protection legislation, conventions and voluntary agreements. This can be further sub-divided to show those activities and transactions undertaken in order to comply with legislation only."

The decision of SEEA to exclude all activities of environmental protection which pay off has in addition contributed to the expectation that environmental protection is costly. But, as environmental prevention projects in the last 20 years have shown very successfully, it is neglected environmental protection and resource management that is costly!

An additional charm of integrated measures is that they pay off for the organisation. To exclude them from environmental statistics really only captures a very tiny and the least important picture of pollution prevention! But, companies need to record the costs for resource flows in order to be able to measure this. IFAC therefore explicitly introduced the costs for non-product output. But unfortunately, costs for resource management are excluded from the environmental expenditure definition of SEEA:

Current expenditure by enterprises is defined by SEEA 2003 (p.215) as including internal operational spending on environmental protection activities including, for example, wages and salaries of people involved with the operation of pollution control equipment and environmental management, leasing payments for environmental equipment, and materials such as air filters and scrubbers. External expenditure such as waste disposal by specialists contractors, waste water treatment, regulatory charges to environmental agencies and so on are also treated as current expenditure whether made by enterprises, government or households."

So while the examples are end-of-pipe oriented, the definition in principle includes all general environmental management activities. But, if those activities result in the reduction of environmental

impact of products it would be requested to separate these expenditures, as they relate to the category of “environmental protection products”. From a practical point of view this can hardly be reasonable.

3. Issues related to the Classification of Environmental Investments

3.1. ENVIRONMENTAL INVESTMENTS ACCORDING TO IFAC

The IFAC EMA guidance document clearly separates between equipment for treatment and prevention. As the focus is on annual costs, annual depreciation is collected for total annual costs but in the assessment template developed for the data assessment the annual investment volume is collected as well. Equipment Depreciation Costs are the investment costs for a piece of equipment spread over its expected lifetime, recorded on an annual basis. In accordance with financial accounting rules an investment is being recorded at the time of put in function and not during the project development phase (cash outflow of the company).

However, the definition of technologies for integrated prevention and guidelines on how to estimate the “environmental share“ of integrated prevention technologies remain an open issue, as by definition they are not stand alone equipment but integrated into production processes. But, it is also obvious, that non-production related treatment of emissions is expensive and can only be enforced by environmental laws while production integrated prevention at the same time reduces costs for further treatment.

Examples of waste and emission control equipment include:
waste handling equipment (such as solid waste dumpsters, waste transportation equipment);
waste and emissions treatment equipment (such as wastewater treatment systems, air scrubbers);
waste disposal equipment (such earth moving equipment for an on-site landfill).

Waste and Emission Control systems include both standalone, “end-of-pipe” control equipment, where the sole purpose is to control waste and emissions, as well as integrated control equipment, which may be closely integrated into actual production equipment. Organizations with large, standalone waste and emission control equipment, such as wastewater treatment plants, often record cost information related to the operation of this equipment in separate cost centers within their accounting systems. In such cases, many of the associated Waste and Emission Control Costs can be taken directly from these cost center reports.

Some equipment used for Prevention and Other Environmental Management can be stand-alone equipment (such as a new computer system for environmental data collection). The annual depreciation costs for such equipment would be included under this cost category. Other equipment used for Prevention may be closely integrated into production equipment (such as a solvent distillation and re-use system that is an integral and automated part of a chemical manufacturing process). In other cases, equipment (for example, a high efficiency paint spray gun) may simply contribute to Preventive Environmental Management because it inherently uses energy or raw materials more efficiently and produces less waste than alternative equipment. In such cases, an organization may wish to estimate what percentage (if any) of the annual depreciation costs for the equipment should be designated as “environment-related.” This estimate might be based on a consideration of the primary reasons for purchasing that particular piece of equipment, for example, for environmental or materials efficiency considerations.

3.2. ENVIRONMENTAL INVESTMENTS ACCORDING TO SEEA

Two types of capital expenditure are distinguished in SEEA 2003 (p. 215):

Expenditure on end-of-pipe technologies "used to treat, handle or dispose of emissions and wastes from production. This type of spending is normally easily identified even within the context of ancillary activity because it is usually directed toward an .add on. facility which removes, transforms or reduces emissions and discharges at the end of the production process."

Expenditure on integrated investments, also called cleaner technologies. "These are new or modified production facilities designed so that environmental protection is an integral part of the production process, reducing or eliminating emissions and discharges and thus the need for end-of-pipe equipment."

But this distinction between treatment and prevention is not applied for environmental protection expenditure, an issue that has been raised in chapter 2.2. and 2.3.

The CEPA definition for cleaner technologies reads (SEEA p.559): "Activities and measures aimed at the elimination or reduction of the generation of air pollutants through in-process modifications related to cleaner and more efficient production processes and other technologies (cleaner technologies). Prevention activities consist of replacing an existing production process by a new process designed to reduce the generation of air pollutants during production, storage or transportation (e.g., fuel combustion improvement, recovery of solvents, prevention of spills and leaks through improving air-tightness of equipment, reservoirs and vehicles, etc."

SEEA states (p.215): Integrated investments may result from the modification of existing equipment for the explicit purpose of reducing the output of pollutants, or from the purchase of new equipment whose purpose is both industrial and for pollution control. In the first case, expenditure can be estimated from the cost of the modification of existing equipment. In the second, the extra cost due to pollution control has to be estimated; that is, the cost of .non-polluting or less-polluting. Equipment is compared to that of "polluting or more polluting" reference equipment.

Such estimates are difficult to make when reference equipment no longer exists or new equipment presents other advantages in addition to its beneficial effects on the environment. These may include savings or substitution of raw materials, higher productivity and so on which cannot be isolated in terms of cost. The difficulty arises because the steady integration of environmental standards in equipment and processes means that eventually it becomes impossible to identify a part of the expenditure as environmental. Given the different speed at which new environmental standards are incorporated into different types of equipment and in different countries, comparison of long time series across industries and countries is difficult. However, a misleading picture is obtained if the cost of significant capital equipment is ignored.

SEEA requests to make a clear distinction between purpose and effect. For example, in the case of environmental protection, actions undertaken for other than environmental purposes can have positive environmental effects (for example new technologies may lead to reductions in energy use, material consumption and discharges to the environment), whereas it is conceivable that actions undertaken with an environmental protection purpose may not actually have a beneficial environmental effect. But only the "environmental purpose criterion" is applied to qualify an environmental investment!

The CEPA definition which request that measures undertaken for cost saving reasons are excluded from environmental expenditure is not only difficult to understand from a corporate perspective, but also poorly defined. In corporate accounting companies often specify a required return of investment period (e.g. 3-4 years) and allow for longer periods for environmental protection equipment. CEPA doesn't specify, if a technology that falls out of the standard corporate investment pay off period, but eventually will pay off, could qualify as environmental investment (likewise Sprenger, 2007). This is

not suggesting that SEEA should define pay off cycles but rather demonstrating that the criterion is not practical.

When comparing the definitions for pollution prevention and cleaner production of IFAC with the SEEA approach, it is important to notice that SEEA

- Does not include measures to reduce the input of materials, energy and water and increase resource efficiency
- Does not include measures for energy efficiency and renewable resources as they would qualify under "resource management"
- Does not allow for measures which have a positive pay back
- Does not allow for measures, where the primary purpose is not environmental protection but resource and production efficiency
- Does not allow for measures related to reduction of the environmental impact of products.

Different levels of national environmental production standards also cause a question. International corporations have been faced with the question, if the same technology can be treated as integrated prevention in one country and state of the art in another. This has led to the situation, that the same technology is treated different in each country. In company projects this was accepted, as in many countries technologies, which are state of the art in the European Union, are requested by environmental ministries elsewhere and clearly qualify as mandatory environmental protection there.

Clarification is also needed on whether to record investment volumes and/or annual depreciation. In some countries both is required (e.g. Germany), in some countries only the investment volumes (Austria) and annual depreciation is estimated by the national statistical agency.

Another open issue to be clarified is the point of time for recording of an investment. In many organisations the recording for environmental statistics in done by the environmental manager, who has no access to the corporate accounting system. He therefore tends to report investments at the stage of projects, which show the annual cash outgo, spend for these investments, but differ from the treatment in the accounting system, which records a project only at the put in function stage, which is also the point of time, when deprecation starts. Some countries, e.g. Rumania, explicitly ask for the cash outgo in a given year which conflicts with the set up of the corporate wide accounting system, which flags environmental investments at the time of put in function, records the investment volume at this point of time, and lists related investment grants. The depreciation in future years is thus automatically calculated.

For consistency reasons, it should be made clear, that the put in function is the point of time for recording environmental investments and not the annual cash flow related to the current projects. This is also the point of time where investment grants related to these equipments are being posted on the related accounts. The definition of environmental investment grants should be directly linked to the definition of environmental expenditure and not to the reasons of the agencies for granting the money.

Guidance is needed on how to treat investments that have been considered as environmentally relevant in the upcoming years. In many organisations, this data is taken directly from cost centre reports, which collect depreciation, operating materials, services and personnel for a defined cost centre. Equipment that has been defined as environmentally relevant consequently should be reported with its operating costs also in the following years.

Several publications by national statistical institutes and other bodies tend to report environmental investments and expenditure in one aggregated figure. From an accounting point of view this figure is not very reasonable. If an aggregate of total annual expenditure is reported, than the estimated or calculated annual depreciation must be aggregated and not the total annual investment.

4. Summary of recommendations for the SEEA revision from an accounting perspective

Since about 30 years environmental protection related data is being collected in national statistics in Austria, Germany, Japan and the USA. But since the implementation of environmental management systems and the development of integrated cleaner technologies, end-of-pipe approaches are loosing ground. Integrated pollution prevention is good for the environment, as emissions are prevented at source, and is good for organisations, as these equipments are often not only less polluting, but also more efficient. But, how to estimate the "environmental share of integrated prevention" remains an open issue. The approach taken by SEEA 2003 is to allow only for such measures, where the primary purpose is environmental protection and which don't pay off. This definition in effect is directly controversial to the merits of integrated pollution prevention and in addition has resulted in a decline in corporate environmental expenditure data, although corporations are increasingly installing environmental management and pollution prevention systems.

The solution can not be to neglect prevention as its difficult to measure and profitable for corporations!

The harmonization of definitions and data requirements for disclosure regarding environmental management accounting is in the core interest of organizations, scientists, environmental politics as well as statistical agencies. The recommendations for the SEEA revision process from an accounting perspective developed in this paper are summarized as such:

Recommendations related to material flow accounting:

- Relate environmental expenditure and material flow accounting. Currently they stand completely separate and the costs of non-product output are not even mentioned.
- Apply a distinction between material inputs and product outputs throughout the document.
- Definition of materials and consistent application throughout the SEEA 2003.
- Classification of material inputs into raw and auxiliary materials, which become products, as well as packaging in opposition to operating materials.
- Clarification, if and when energy and water inputs are part of material inputs.
- Clarification of related disclosure requirements in statistical assessments.
- Separate recording of NACE code inputs of materials, water and energy.
- Separate recording of NACE code outputs of products and services.

Recommendations related to the classification of environmental costs

- Reconsider the concept of environmental protection as a "satellite system" to general production and establish a more integrated environmental management approach.
- General reconsideration of the definition of environmental protection activities.
- Allow for the inclusion of measures which result in cost savings (e.g. energy efficiency measures)
- Opening the SEEA approach to include measures related to reduction of the input of materials, water and energy, improving resource efficiency.
- Inclusion of resource management activities (e.g. measures related with improving material, energy and water efficiency).
- Clarification, if water withdrawal costs are part of environmental expenditure.
- Inclusion of a criterion of "actual environmental impact" in addition to the "environmental purpose criterion" for the classification of environmental protection activities.
- Separation of costs for treatment and costs for prevention as a general structure for all environmental costs.
- Classification of sub-categories of environmental expenditure according to accounting terminology.

- Assessment of data from management and financial accounting (costs and/or expenditures), but not relating to potential savings or actual cash flow of money which is recorded differently on financial accounts due to accounting standards.
- Applying a top down approach from total costs by financial accounts to SEEA requirements to the distribution by environmental domain effected. (This requires changing the CEPA classification into a format that first distinguishes between costs for treatment and prevention, then lists the accounting categories and only lastly classifies them by environmental domain effected.)
- Preferably applying the term "costs" to allow for more flexibility and not requiring the application of strict accounting rules. Many of the requested data have to be estimated and are thus not "expenditure" in the strict sense of financial accounting.
- Avoiding the need to further disaggregate accounts and cost centre reports by tracing invoices to the extend possible (e.g. requiring to separate cleaning materials for production from cleaning materials for administration).

Recommendations related to the classification of environmental investments

- Redrafting on the definition for integrated pollution prevention technologies to include measures to reduce the input of materials, energy and water and increase resource efficiency, to allow for measures which have a positive pay back, to allow for measures, where the primary purpose is not environmental protection but resource and production efficiency, include measures for energy efficiency and renewable resources and measures related to reduction of the environmental impact of products.
- Recording of investments at the point of put in function when depreciation starts and not during the project development phase.
- Clarification, if depreciation should be recorded as part of annual costs. (As depreciation regulation differs significantly from country to country many organization are estimating it for EMA based on average depreciation cycles. It is thus recommended to make clear that depreciation should not to be reported to statistical agencies.)
- Linking of investments grants to the definition of environmental relevant equipment. That means, if an equipment has been considered as 40 % environment, than 40 % of a related investment grant should be recorded at the time when the grant is being granted, regardless of who is granting it and why. The annual depreciation of the grant is not considered.

Within the current research project funded by the Austrian Ministry for Transport, Innovation and Technology the recommendations developed for the SEEA revision process have also been discussed with the national statistical institute, the ministry of Environment and the Chamber of Commerce and have resulted in a revision of the Austrian assessment template for the environmental expenditure assessment of the years 2006 and 2007, which takes place in summer 2008.

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