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New Developments in Environmental Accounting at Istat

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NOTA DI LAVORO 97.2000

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New developments in environmental accounting at Istat

13 December 2000

Technical Abstract

Three projects undertaken by the Istat Environmental Accounting Unit are close to the stage of regular data production. They are: the collection of data on environmental protection expenditure (EPE), respectively by General Government and by Industry and Services, and the production of an Italian NAMEA (National Accounts Matrix Including Environmental Accounts). The paper describes, for each of them, the methodology used and the progress made so far.

Both the project on EPE incurred by General Government and the one on companies' EPE - aim at producing basic data for the construction of the satellite Environmental Protection Expenditure Account (EPEA), in application of the European guidelines on implementation of the SERIEE system of satellite accounts.

As regards General Government, the method chosen at Istat for collecting and quantifying expenditure on environmental protection is budget analysis; specific ways to counteract the drawbacks of this method are applied.

The collection of data on companies' EPE is pursued by means of direct survey; the first survey was conducted within the 1999 Intermediate Census of Industry and Services. Finally, the third project produced in 1999 the first Italian NAMEA, for the year 1990; it includes: in the economic module, the goods and service account and the production account; in the environmental module, emissions of six air pollutants by 52 economic activities and households' consumption, and the direct intake of 4 resources from nature by economic activity.

Non technical abstract

Istat has worked to develop the discipline of Environmental Accounting in Italy since the end of the 80s; all projects carried out over time are consistent with international frameworks and programmes while taking into account the guidelines and priorities set at the national level. The degree of development of the different projects shows considerable variation, with three being more advanced and close to the stage of regular data production. This paper describes, for each of them, the methodology used and the progress made so far.

The purpose of the first advanced project, described in § 2, is the collection of data on environmental protection expenditure (EPE) by General Government; as definition and classification of environmental expenditure, Istat adopts those of the Environmental Protection Expenditure Account (EPEA), belonging to the EU SERIEE system of satellite accounts. Of the possible methods for collecting the data recommended at the European level, the option adopted by Istat is to analyse the budget accounts of general government: this analysis involves scrutinising each item of expenditure included within each account, in order to establish, using all available information, whether that specific item complies with the EPEA definition and, if so, how it is to be classified. The budget accounts approach carries with it two main shortcomings that Istat counteracts by specific solutions.

The second project aims at collecting EPEA-consistent data on environmental protection expenditure by Corporations; the method adopted in this case is direct data collection by means of specific questions addressed to companies. Paragraph 3 describes how different options of data collections were examined, and explains how, finally, the only available option was to conduct the first statistical survey in Italy on business expenditure for environmental protection within the context of the 1999 Intermediate Census of Industry and Services. On the basis of this experience future plans are discussed, highlighting some problems that have to be solved in order to meet the Community statistical requirements on this subject.

Finally, paragraph 4 summarises the work aimed at the production of NAMEAs (National Accounting Matrix Including Environmental Accounts) in Italy. The NAMEA is a statistical information system that ranks very high on the agenda of environmental accountants in the EU. Its appeal stems from the fact that the framework allows to compare existing monetary data - for

example on production and consumption activities - with existing physical data, such as the environmental pressures caused by the same activities. However, in order to be fit into a NAMEA the statistical data used in the environmental module need to be consistent with the structure of the economic module. The work required to ensure consistency is described in the paper with reference to the Italian case. Istat produced in 1999 a first Italian NAMEA for the year 1990; as environmental data it includes emissions of six air pollutants caused by 52 economic activities as well as households' consumption, and the direct intake of 4 resources from nature by economic activity.

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* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

1. Environmental accounting at Istat: background and overview

1.1 Main steps in the development of environmental accounting at Istat¹

The development of environmental accounting activities at Istat is characterised by two different phases. The first one dates back to the end of the '80s and lasted until the beginning of 1994. During this period, although the resources devoted to this field were still limited, Istat ensured its active participation to the international working groups - such as those co-ordinated by Eurostat, OECD (Organisation for Economic Cooperation and Development) and UN/ECE (United Nations / Economic Commission for Europe) - that laid the foundations of the discipline; at the same time, at the national level, Istat played an essential role in the joint effort of experts that produced priorities and guidelines for the implementation of environmental accounting in Italy².

In 1994 the Environmental Accounting Unit was founded as part of Environment Statistics and this marked the beginning of a constant development of activities both at the international and national level, thanks to the slow but steady increase in the number of experts working in the field³.

Therefore, although environmental accounting in Italy was born relatively late with respect to leading countries in Europe, its development has shown an exponential pattern.

Two main features of Istat strategy in pursuing the growth of the discipline are: its consistency with the international context and its deliberately gradual nature, designed to better reflect the continuous changes occurring in the subject. These characteristics, together with the national guidelines mentioned above, led, over the years, to undertake a number of projects, that are summarised below.

1.2 Projects overview of and state of the art

The first column of Table 1 lists all projects on which the Istat Environmental Accounting Unit recently worked or is currently working⁴. All projects have their counterpart in the Eurostat statistical programme on environmental accounting⁵ and, more generally, they fit into the international pattern of development of the discipline⁶. Column 2 of the Table summarises the progress of each project in relation to 5 main steps described in the sub-column headings.

As stated in the previous paragraph, the step by step approach is a key feature of the Istat strategy in the development of environmental accounts; it suits both the innovative character of the issues and the experimental nature of the statistical/accounting instruments used.

¹ For details see Zuliani (1999).

² The experts were part of the Istat-Fondazione ENI Enrico Mattei (FEEM) Commission, whose work is described in Musu - Siniscalco (1993 and, as for the English version, 1996). The Commission endorsed the proposals developed by Istat, included in the Commission's report (see Costantino 1996a and 1996b).

³ See Istat (1996), Istat (1999b) and Istat (2000a) for a comprehensive description of the achievements in the field over time.

⁴ As at June 2000.

⁵ See Eurostat (1999a).

⁶ The Istat statistical programme on environmental accounting covers most of the issues that belong to the field of environmental accounting at the international level but not all of them. For a complete list of the issues that define the discipline of environmental accounting at the international level, and a description of the statistical/accounting tools used to portray them, see Costantino - Falcitelli - Femia (1998).

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Table 1 Projects overview

Environmental indicators and accounts	Progress ^(a)				
	General concepts, definitions, classifications	Methodology	Feasibility check	Pilot project/ pilot survey	Regular survey/ project
Monetary accounts: SERIEE					
Environmental protection expenditure (EPE) by General Government	X	X	X	X	(X)
EPE by Industry and Services	X	X	X	X	(X)
EPE by Households	X	X	X	X	
Environmental taxes	X	X	X	X	
Ecoindustry	X				
Environmental Pressure indicators in physical units					
Pressure indicators: industry sector	X	X			
Pressure indicators: energy sector	X	X			
Pressure indicators: transport sector	X				
Pressure indicators: agriculture sector	X	X	(X)		
Pressure indicators: tourism sector	X	X	X		
Pressure indicators: waste management sector	X	X			
Environmental pressure information system	X	X	X		
Physical environmental accounts					
Material flow accounts: nutrients	X	X	X	X	
Water accounts	X	X	(X)		
Subsoil assets accounts	X	X			
Economy-wide material flow accounts	X	X	X	X	
Integrated economic and environmental accounts					
National Accounting Matrix Including Environmental Accounts (NAMEA)	X	X	X	X	(X)
Integrated economic and environmental accounts for forests	X	X	X		
Monetary valuation					
Monetary estimates of environmental damage	(X)	(X)			

(a) X = completed; (X) = planned or on-going

Two main remarks apply to the overview presented in Table 1.

First, none of the projects has reached the stage of the regular data production yet. This is unusual if compared to the typical statistical products in other areas, but is rather common in many countries for the specific field of environmental accounting.

Second, the degree of development of the different projects shows considerable variation. The three most advanced ones, close to becoming a regular product are: the collection of data on environmental protection expenditure (EPE), respectively by General Government and by Industry and Services, and the production of an Italian NAMEA (National Accounts Matrix Including

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Environmental Accounts). They will be presented in great detail in paragraphs 2,3,4. The least advanced project is the one on monetary valuation, partly due to the need of developing first other parts of the system and partly because of the controversial aspects that still characterise this area.

As regards SERIEE projects other than those already mentioned:

- Istat conducted two pilot surveys on households' environmental expenditure with reference year, 1997 and 1998 respectively (see Istat 2000a);
- on the subject of environmental taxes, a survey of environmental taxes in Italy and an evaluation of the possible use of available data for building the EPEA satellite account was completed in 1996 (see Eurostat 1999c);
- regarding the Environmental Industry, a first selection of economic activities that can be - partly or wholly - identified as environmental industries was completed by comparing the information that can be derived from the Italian classification of economic activities to the two international definitions/classifications of environmental industries: the SERIEE and OECD/Eurostat ones. The exercise will be used for future surveys or analyses of the sector (see Istat 2000a).

On pressure indicators, for each of the Eurostat Sectoral Infrastructure Projects (SIP) sectors - Agriculture, Tourism, Industry, Energy, Transport, Waste Management - completed work includes: the definition/delimitation of the sector; the identification of the production and consumption processes – typical of the sector itself - which are responsible for generating environmental pressure; the identification of the most relevant indicators. In addition, for the sector Agriculture, existing information sources in Italy were surveyed in order to assess whether they could be used to build the indicators; a similar study was undertaken by Istat in 1996 for Eurostat for the sector Tourism (see Istat 1999b and 2000a).

In the area of physical environmental accounts, the most advanced achievement relates to material flow accounts; here Istat lead the pilot group on environment and nutrients of the UN/ECE Task force on «Physical Environmental Accounting» back in 1993 (see Conference of European Statisticians, 1995) and, more recently, compiled a material intake account in the framework of the Italian NAMEA (see Battellini et. al 2000 and Costantino -Falcitelli - Femia 1998).

The next paragraphs provide a detailed account of the three most advanced projects.

2 The Istat methodology for calculating General Government (GG) expenditure on environmental protection

Two out the three most advanced projects - the one on environmental-protection expenditure incurred by General Government and the one on companies' EPE - aim at producing basic data for the construction of the satellite Environmental Protection Expenditure Account (EPEA), in application of the European guidelines on implementation of the SERIEE system of satellite accounts (Eurostat, 1994a). The main features of the EPEA are presented in the following paragraph.

2.1 Background on EPEA

The EPEA satellite account gives an accounting representation of expenditure on environmental protection incurred by economic units from all institutional sectors of the economy: General

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Government, Corporations, Households and Non-Profit Institutions serving Households (NPISHs). Therefore, the collection and quantification of expenditure on environmental protection incurred by General Government and Corporations, described in this paper, is only part of the input needed in the construction of the EPEA, where we have to collect and quantify the corresponding expenditure incurred by the other institutional sectors as well.

For the purpose of collecting environmental-protection expenditure, it is above all necessary to take account of the structure of the EPEA, which is arranged as a series of accounting tables (Eurostat, 1994a, §§ 2168 *sqq*) and a series of sub-accounts (Eurostat, 1994a, Chapters III-IX). Provision is made for the construction of 5 types of accounting tables (Tables A, B, B1, C and C1) to account for separate aspects of environmental protection and thus to quantify different aggregates.

The EPEA is also arranged in respect of the *purpose* of the transactions recorded: the EPEA provides not only for the construction of the 5 accounting tables referring to all expenditure incurred by the economy for environmental protection but also for these tables to be constructed with reference to the separate “classes”⁷ of the CEPA classification (Classification of Environmental Protection Activities), adopted in the context of the EPEA for classifying expenditure on protection of the environment (these classes are given in Table 2 below).

Table 2 CEPA classes of characteristic activities

Classes of characteristic activities
1. protection of ambient air and climate
2. waste water management
3. waste management
4. protection of soil and groundwater
5. noise and vibration abatement
6. protection of biodiversity and landscape
7. protection against radiation
8. research and development for environmental protection
9. other environmental protection activities

This creates an arrangement of the system as “sub-accounts”. Specifically, the sub-accounts to be constructed are those listed in Table 3 below.

Table 3 EPEA sub-accounts

EPEA sub-accounts
1. ambient air and climate protection account (class 1)
2. waste water management account (class 2)
3. waste management account(class 3)
4. protection of soil and groundwater account (class 4)
5. noise and vibration abatement account (class 5)
6. protection of biodiversity and landscape account (class 6)
7. other environmental protection activities account (classes 7, 8 and 9)

Summing up, the EPEA is configured as a system of accounts comprising:

⁷ This is the first level (i.e. the highest aggregation) of the CEPA classification (see Eurostat, 1994a, Annex 1).

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- the 7 sub-accounts listed in Table 3, each organised into the mentioned 5 accounting tables;
- an overall account obtained by consolidating the 7 sub-accounts, this also being structured into the 5 separate tables⁸.

Because of the structure of the EPEA - briefly presented here - the collection and quantification of expenditure for environmental protection incurred by economic units within any other institutional sector, in theory involves *three logical steps*; they allow to identify in increasing detail the area within which to record expenditure within the EPEA (on this, see Table 4 below).

Table 4 - The three steps needed to collect information from a generic economic unit to build the EPEA

The output of each step	Use in the EPEA building process
1) <i>Identification/selection</i> of environmental protection expenditure within the budget of the economic unit	<i>To identify the expenditure to be recorded in the EPEA</i>
2) <i>Classification</i> of the selected expenditure under CEPA	<i>To identify the relevant EPEA sub-account where environmental protection expenditure has to be recorded</i>
3) <i>Analysis and identification</i> of relevant features of the selected expenditure, e.g. the role of the units involved in the environmental protection transactions (characteristic producer, beneficiary, etc.), the type of environmental protection expenditure (production costs for characteristic activities, purchase of specific products, specific transfers, etc.)	<i>To identify the accounting Table (or Tables) of the sub-account where environmental protection expenditure has to be recorded and the specific position of each item within the Table</i>

The remainder of this paragraph and paragraph 3 describe how data collection is organised at Istat, respectively on General Government and Corporations' environmental protection expenditure.

2.2 Budget analysis as a tool for data collection: general problems

The Istat approach for collecting and quantifying expenditure on environmental protection by General Government is currently centred on gathering the basic data for implementation of the EPEA: at this stage the work is chiefly aimed at *identifying and selecting* the General Government expenditure that falls within the field of analysis of the EPEA and at *classifying* this in terms of the CEPA (that is, step 1 and step 2 in Table 4).

Of the possible methods for collecting the data recommended at the European level (Eurostat, 1994b, page 15), the option which Istat has adopted — after evaluation of previous work conducted in Italy as regards environmental expenditure by General Government⁹ and the methods adopted in the other European countries — is to analyse the accounts of general government: this analysis involves scrutinising each item of expenditure included within each account¹⁰, in order to establish from the information available (description of the item of expenditure, law cited in the description of the item of expenditure, position of the item of expenditure within the structure of the account):

⁸ The total number of accounting tables to be implemented is 40.

⁹ See, for example, Cesaretti (1996), and Ministero del Tesoro (1991).

¹⁰ In this work the wording “budget accounts”, “budget”, “public accounts”, “General Government budget accounts” and similar ones, always refer to the accounting documents produced at the end of the year.

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- whether the item of expenditure falls within the field of analysis of the EPEA (the stage of identifying and selecting expenditure);
- the CEPA category within which to classify the item of expenditure (stage of classifying expenditure).

In developing Istat's methodology we have tried to counteract the shortcomings of the data collection method adopted; these can be summarised as follows:

I. limits of the information source (General Government budget accounts):

- A. one single expenditure item can include *environmental protection and non-environmental protection* expenditures;
- B. environmental protection expenditures in the same item can belong to *different CEPA categories*;
- C. the information on the expenditure item may *not be enough* to decide whether the expenditure item includes environmental protection expenditures;

II. risk of introducing subjective criteria in the choice when different people analyse accounting items and decide whether or not they have to be included in the scope of EPEA and how they are to be classified under CEPA.

2.3 How to counteract the problems of budget analysis: the main features of Istat's methodology and operational tools

The main features of Istat's methodology derive from the solutions adopted to counteract the two specific problems of budget analysis discussed above. The following paragraphs present the way in which each problem is dealt with.

2.3.1 Counteracting the problem of incomplete information source: the two stages of data collection

First of all, under Istat's methodology the work of data collection is subdivided into two stages:

1. first step: **“sift”** the budget in order to:

- **exclude** the expenditure items that **definitely DO NOT include** environmental protection expenditures;
- **select and classify** the expenditure items that **definitely DO include** environmental protection expenditures and are **homogeneous** enough to be classified under CEPA without problems;
- **identify** the expenditure items which are:
 - (a) **non homogeneous** with respect to the expenditure, i. e. which include both environmental protection expenditures and other expenditures (non environmental protection expenditures and/or uncertain expenditure; see point (b) below);
 - (b) **uncertain**, i.e. for which there is **not enough information** to exclude/select them;

2. second step: **look for additional information** to:

- **quantify and classify** the environmental protection expenditures extracted from **non homogenous** expenditure items;

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

- **exclude/select** and, where appropriate, classify the **uncertain** expenditure items;

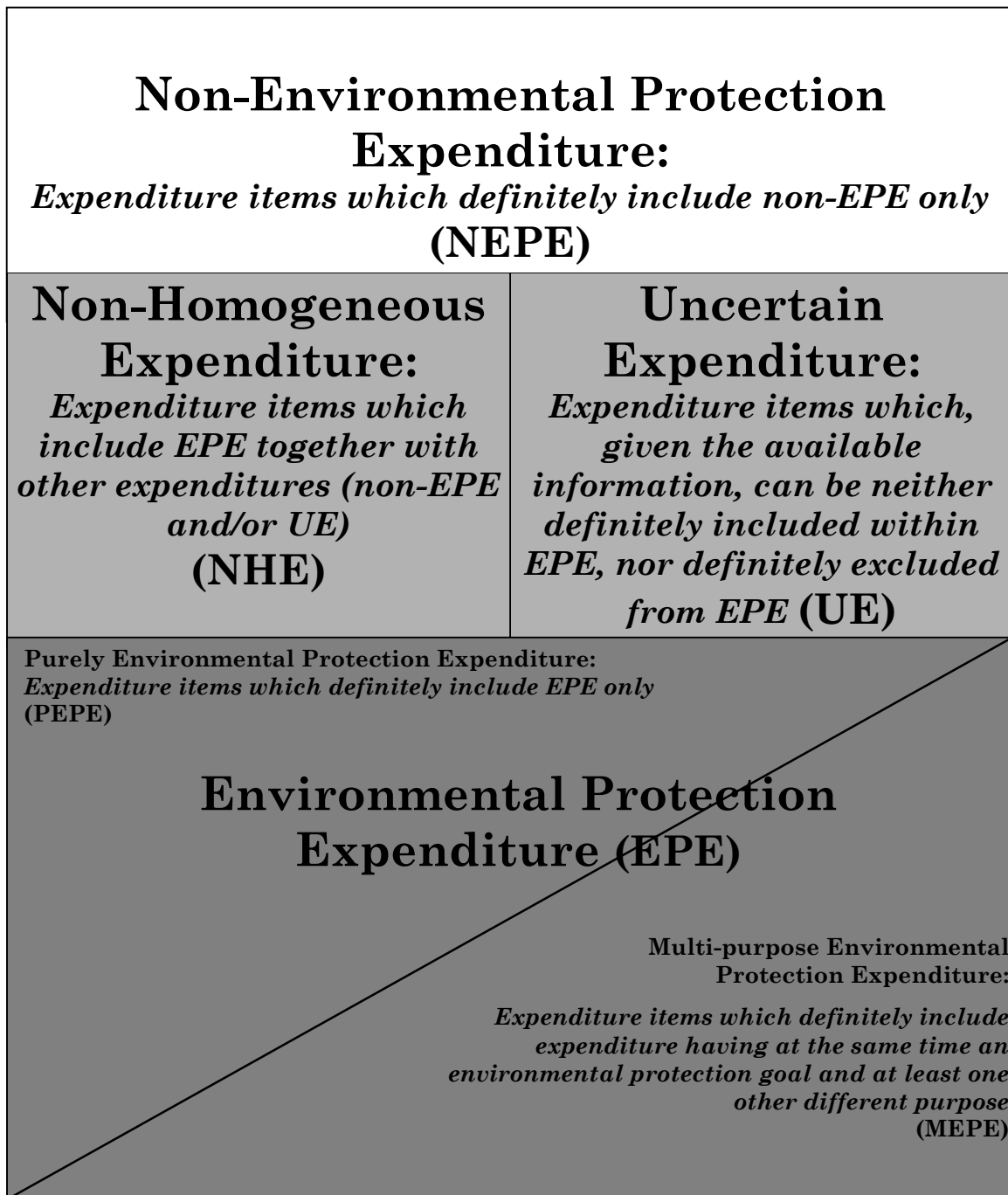
The key to this two-stage arrangement is to identify certain “*intermediate* groups of expenditure” within which to place the items of expenditure examined, during the first stage: these groups — illustrated in Figure 1 and defined in Table 5 — are known as “intermediate” because they are not directly of use for the recording of expenditure within EPEA, but rather to “put away” all those items of expenditure where analysis can be terminated at the first stage and “identifying” those expenditure items where it is necessary to gather additional information in the second stage.

In practice the first stage of the approach is intended to make a partition of the universe of items of expenditure in terms of the groups shown in Figure 1 and defined in Table 5. This partition is exhaustive: for all expenditure, whatever the information supplied by the public accounts and whatever the level of aggregation within the items, we succeed in finding one (and only one) position, although in some instances it might not be final.

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Figure 1 - *Intermediate* groups of expenditure items

Total Expenditure: *all the expenditure items included in a given General Government budget (TE)*



* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

All items of expenditure regarded as NEPE are excluded from the analysis at the first stage. Items of expenditure allocated to the PEPE and MEPE groups are immediately and definitively “put away” - i.e. included within the field of analysis of EPEA. Items which include environmental protection expenditures combined with other expenditures (NHE) are in the first stage (provisionally) included entirely within the EPEA field of analysis, pending the more detailed phase in the second stage when they can be divided proportionately between the PEPE and/or MEPE groups and the NEPE groups. Items for which the information available is found to be so general that we cannot decide whether to put them inside or outside the field of analysis (i.e. belonging to UE) are in the first stage (provisionally) included within the field of analysis until, on the basis of the outcome of the more detailed phase in the second stage, they can be excluded or be re-allocated to PEPE or MEPE as appropriate.

Table 5 - Definitions of the *Intermediate* groups of expenditure items

<u>NEPE</u>	Non-Environmental Protection Expenditure: expenditure incurred for activities and actions not intended for environmental protection
<u>PEPE</u>	Purely Environmental Protection Expenditure: expenditure incurred for activities and actions exclusively intended for environmental protection
<u>MEPE</u>	Multi-purpose Environmental Protection Expenditure: expenditure incurred for activities and actions which simultaneously and in combination serve multiple purposes including that of environmental protection; for such activities, attainment of the purpose of environmental protection necessarily includes attainment of the other purposes or is included in it ¹¹ .
<u>NHE</u>	Non-Homogeneous Expenditure: expenditure incurred for multiple activities and actions among which some but not all are definitely intended for environmental protection (exclusively or in combination).
<u>UE</u>	Uncertain Expenditure: expenditure incurred for activities and actions which <i>might</i> be entirely or partly intended for environmental protection.

It should be noted that each of the NHE and UE groups is a basket that can hold both environmental-protection expenditure and expenditure that has nothing to do with environmental protection. At aggregate level, the only difference is that only the former *always*, with mathematical certainty, includes environmental-protection expenditure.

¹¹ This means expenditure financing activities or actions which, by their nature or because of the manner of implementation, are not capable of pursuing environmental-protection objectives without at the same time meeting other purposes directly and immediately. The inclusion of such expenditure within the field of analysis stems from the instructions given in Chapter XXI of the SNA93 manual in Section C: “functionally oriented satellite accounts”. In particular, § 21.56 specifies that, where one activity (or action) serves at the same time various separate purposes for which separate satellite accounts are desired, the activity (action) is to be considered for the purposes of *all* the accounts to which it is relevant (United Nations, 1993b). The expenditure relating to this is therefore to be shown in full in each of those accounts (which will therefore not be additive), and not assigned to one or other of these, nor divided between them (either of these approaches would be arbitrary) (Istat, 1999a). The environmental protection group of expenditure – EPE – therefore consists of two sub-sets: $EPE = PEPE + MEPE$.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

After the first stage of data collection, it is still not possible to produce a single estimate of General Government expenditure on environmental protection, and only an *interval* can be calculated.

In order to make such a calculation, we have to define an intermediate aggregate called “Enlarged Environmental Protection Expenditure” (EEPE), as follows (Figure 2):

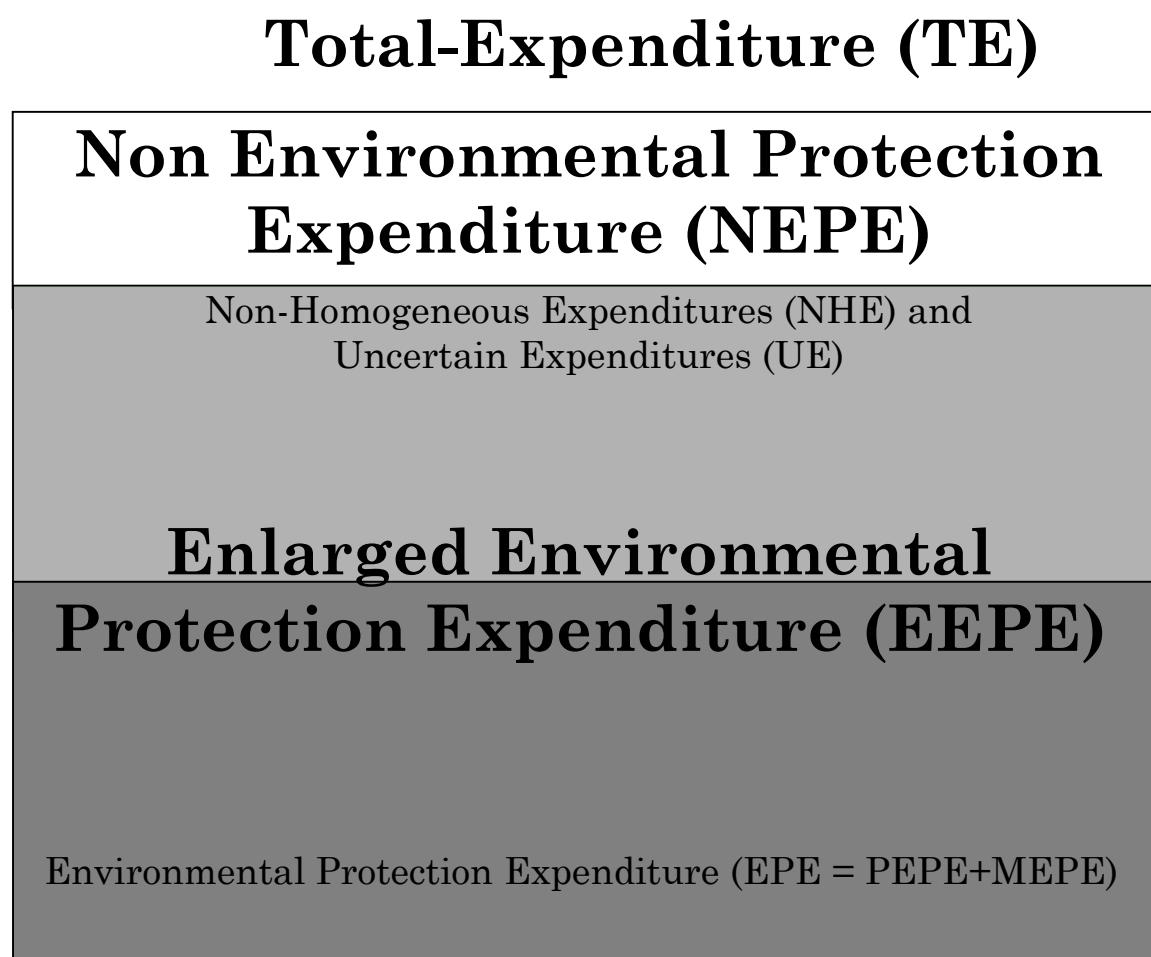
EEPE - Enlarged Environmental Protection Expenditure:

$$EEPE = EPE (= PEPE + MEPE) + NHE + UE$$

Thus the unknown aggregate \hat{EPE} (i.e. the whole of General Government expenditure on environmental protection) is included in the following interval:

$$EPE \leq \hat{EPE} \leq EEPE.$$

Figure 2 - Intermediate aggregates



The aggregate EPE (Figure 2) represents the *minimum certain amount* of expenditure on environmental protection, since it only includes expenditure which is *definitely* so at the first stage. The EPE aggregate is therefore the lower end of the interval referred to above. The upper end of this interval is given by the aggregate EEPE, since from it is excluded only expenditure which *definitely* has no purpose of environmental protection¹². The aggregates EPE and EEPE therefore give the lower and upper limits between which expenditure on environmental protection will

¹² I.e.: $EEPE = TE - NEPE$

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necessarily be found. The range of the *margin of uncertainty*, $EEPE - EPE$, is of course equal to $NHE + UE$.

The point estimate of expenditure on environmental protection is calculated after completion of the second stage. This stage relates to items of expenditure which are allocated to the NHE and UE groups at the first stage. The way in which any item is examined further differs according to the group in which it belongs. Here are two types of further examination:

1. for items belonging to NHE we have to quantify the amount of expenditure for environmental protection, since each item also includes expenditure for other purposes and therefore not coming within the field of analysis of the EPEA;
2. for items belonging to UE, we first have to establish whether they have to be put inside or outside the field of analysis of the EPEA (that is, whether they include expenditure on environmental protection); then, if they are included, we have to quantify the amount of expenditure for environmental protection (since they might be only partially expenditure for environmental protection or they might, after further examination, be found to belong to the NHE set).

Thus the two stages of data collection in practice comprise:

1. **Filling up** the intermediate groups of expenditure (NEPE, NHE, UE, PEPE and MEPE); and
2. **Emptying** the NHE and UE groups.

In practice, the second stage is accomplished by:

- “discarding” expenditure items below a given threshold (to be specified);
- looking for further information on expenditure items above the threshold.

2.3.2 Counteracting the risk of subjective criteria: the decision tree for selecting expenditure items and including them in the *intermediate* groups

A further leading characteristic of the Istat approach in collecting and quantifying EPEs by General Government is the decision tree which is to be used at the first stage, for allocating the items of expenditure within the various intermediate groups. Using the decision tree, we analyse, in the following order: (1) the description of the item of expenditure as shown in the public account; (2) any law cited in the description of the item; (3) the section of the public account which contains the item of expenditure. Starting from one element (1 or 2), we continue to a later element (2 or 3) only if the information provided by that element is not sufficient to establish whether the item concerned includes expenditure for environmental protection. Depending on which information is used (1; 1 and 2; 1, 2 and 3) to establish which expenditure group a particular item belongs to, the analysis of the item of expenditure by means of the decision tree gives a different outcome. The development of this decision tree is related to the need to standardise the process as far as possible in order to contain the danger of bringing in subjective and arbitrary elements in analysing the items of expenditure¹³.

A useful tool for using the decision tree and for recognising expenditure items which include environmental protection expenditure is the CEPA classification. As a matter of fact the CEPA classification is a list of activities which definitely have environmental protection as their principal

¹³ The decision tree is described in dept in Bombana et al. (2000).

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

aim: to acknowledge that an item finances activities included in the CEPA is to confirm that the corresponding expenditure is for environmental protection. However, the fact that the activities financed by a given item of expenditure are not among those listed in the CEPA does not allow us automatically to exclude the corresponding expenditure from the field of analysis: the CEPA is an “open” classification (it includes item 9.4 – “Activities not elsewhere specified”): this means that, using the end-purpose criterion, it is possible to identify activities which are intended for protecting the environment but are not explicitly listed in the CEPA.

A very similar approach applies to the CEPF and to the available lists/examples of adapted and connected products: to acknowledge that an item finances the purchase and hence the use of capital goods included in the CEPF or of adapted or connected goods is to confirm that the corresponding expenditure is for environmental protection; not acknowledging it, however, does not allow us to exclude such expenditure from the field of analysis.

For these reasons Istat has developed a set of CEPA operational table (one for each CEPA class) to be used as a check list during the application of the decision tree: the information analysed with the decision tree can be compared with the contents of CEPA by means of Istat CEPA operational tables¹⁴.

2.4. Three approaches

2.4.1 The Istat approach compared to other options: critical issues and perspectives

Istat’s methodology – described above – takes it for granted that the method of collecting the data is *budget analysis*, i.e. the process takes the form of an *on-the-desk* analysis of the accounts of general government, as far as possible avoiding direct inquiries to the administrations (*if appropriate*)¹⁵ only for those items where the second stage of work is necessary).

For the sake of simplicity this could be called the “**approach based on the environmental accountant’s desk**” (Figure 3). The main advantage of this approach is that it is based on an administrative source “as it stands” (the account) and causes no disturbance (or only very little) to the administrations, with the request to produce customised information on environmental protection expenditure which they have incurred. Against that, however, there is the disadvantage that the information which the environmental accountant has on his desk (the public accounts and any laws cited in the description of the items of expenditure examined) does present the problems explained above. It should also be stressed that this approach substantially *centralises* the function of budget account analysis with the environmental accountant: although on the one hand such centralisation seems to be workable if the analysis is limited to state and regional administrations¹⁶

¹⁴ These tables are available in: Istat (2000b) and in Bombana et al. (2000)

¹⁵ To trace the extra information needed for the additional detail at the second stage, there is not only the option of approaching individual administrations for explanations of the content of problematical items of expenditure: there is for example the option of approaching the individual inspectorates of the Ragioneria Generale dello Stato (Ministry of the Treasury, Budget & Economic Planning) whose province is the expenditure of the various bodies of general government (Ministries, Regions, etc) and who hold information on individual spending actions under each item of expenditure in each account.

¹⁶ In this phase (under a Contract made with the Ministry of the Environment) Istat has begun to collect and quantify the environmental protection expenditure incurred by state administrations in the years 1995 and 1996. As at June 2000 we are in the final phase of stage one of the approach, involving the analysis of slightly under 12,000 items of expenditure.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

(NUTS I and II), on the other hand there is the danger of creating a bottleneck, if the analysis is extended to all other government administrations (Provinces, Communes¹⁷, etc – NUTS III); the possible consequences of this would certainly include an increase in the time-gap between the date on which the administrative source arrives on the “environmental accountant’s desk” and the date when the data on environmental protection expenditure are disseminated.

It is also in the light of these questions that we have to consider the alternative option, which we might call the **“approach based on the government administrator’s desk”** (Figure 7). This approach would essentially mean that environmental protection expenditure would be collected and quantified by each administration for itself. The benefit of this approach is, first of all, that it circumvents the problems described above relating to the information available on the “environmental accountant’s desk”: this differs from the “government administrator’s desk” in that the former holds much less information than the latter, where by contrast – by definition – most information lies. A further benefit is linked with the fact that, with this approach, the databases on environmental protection expenditure could be made available more speedily, especially if each administration were to collect and quantify such expenditure *at the same time as* it compiled its budget account and not *afterwards*. On the other hand, for this second approach actually to be feasible would require Istat to transfer to general government the know-how required for it to be able to collect and quantify its own environmental protection expenditure in accordance with the definitions and classifications of SERIEE and EPEA. The various administrations might acquire such know-how in a non-uniform way (e.g. misinterpretation of the reference definitions and classifications) with the danger, at least in the introductory phase, of introducing distortions in the information.

We might also identify a third approach which stands “midway” between the first two: **“the approach based on taking the environmental accountant’s desk to the government administrator’s desk”** (Figure 3). This approach involves analysing the budget account using the “approach based on the environmental accountant’s desk” and interacting with the administrator as the analysis advances, when there arise items of expenditure for which the information available on the “environmental accountant’s desk” is insufficient: such interaction requires sustained contact and hence that the environmental accountant and the public administrator be “nearby”. Essentially, it means conducting the first- and second-stage analyses of Istat’s approach almost at the same time. This manner of proceeding – currently under experiment on the study case in Puglia Region for 1995 – can be of benefit especially for the local administrations, who might not always find it easy and speedy to put certain information (e.g. regional law) on the “environmental accountant’s desk”; on the other hand, there is a drawback to this approach, with the need to conduct the analysis on the spot.

¹⁷ For example, there are more than 8,100 Communes in Italy.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Figure 3: Three approaches



**On the environmental
accountant's desk**

**On the government
administrator's desk**



**Taking the environmental
accountant's desk
to the government
administrator's desk**



* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

2.4.2 Critical issues to be considered in evaluating the alternative approaches: an overview

The critical issues to be considered in evaluating the alternative approaches can be summarised as follows:

1. **Access to all relevant information** on expenditure: incomplete for the environmental accountant but complete for the government administrator
2. **Additional work for government administrator**: none, little or a lot, according to the approach
3. **Number of environmental accountants compared with number of administrations**: enough or not enough, depending on the approach

In Table 6 below, the benefits (pros) and drawbacks (cons) of the three approaches are shown with reference to the critical issues listed above.

Table 6 – Pros and cons of the three approaches: an overview

Approach	On the environmental accountant's desk		On the government administrator's desk		Take environmental accountant's desk to government administrator's desk	
	pros	cons	pros	cons	pros	cons
Access to all relevant information		(X) incomplete	(X) complete		(X) complete	
Additional work for government administrator	(X) none			(X) a lot	(X) little	
Number of environmental accountants		(X) not enough	(X) enough			(X) not enough

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

3. Collecting data on environmental protection expenditure by Industry and Services

While the collection of General Government EPE data at Istat is based on administrative sources (as explained in the previous paragraph) for the collection of data on EPE by Corporations Istat adopts the approach of directly collecting the data by means of specific questions addressed to companies. This choice - which is consistent with other countries' approach - is due to the fact that companies' financial statements do not include information needed for the EPEA¹⁸.

This section of the paper describes the process that led to the first statistical survey in Italy on business expenditure for environmental protection, based on the requirements of the European layouts for environmental accounting (§3.1).

During the stage of setting up the survey, a number of alternative options were considered, and they are described in § 3.2. Of the options considered, only the Intermediate Census of Industry and Services provided the opportunity of really putting questions to companies on environmental expenditure (§3.3).

3.1 The demand side: data on industry environmental expenditure needed for the EPEA

As the starting point for organising the survey we used the documents produced by Eurostat in connection with the construction of satellite accounts on expenditure: the EPEA (Environmental Protection Expenditure Account)¹⁹ as a model for the method, and the guidelines in the “intermediate system” relating to the business sector²⁰ as the instrument to convert the theoretical approach of the EPEA into instructions on the collection of data which could be used for operational purposes. The list of the variables to be surveyed has been taken from the questionnaire used for the voluntary collection of data on business environmental expenditure conducted by Eurostat from the National Statistical Offices of Member Countries in 1996 (here referred to as Eurostat 96) in order to check data availability in each country for the years 1990-94²¹. Although the questionnaire was addressed to national statistical institutes and not directly to companies, it does represent a model of the kind of company data on environmental expenditure that is needed to build the Environmental Protection Satellite Account (EPEA) of the SERIEE system (*Système Européen de Rassemblement de l'Information Economique sur l'Environnement*)²².

¹⁸ See Tudini (1999).

¹⁹ See Eurostat (1994a) and § 2.1 in this paper.

²⁰ See Eurostat (1994b).

²¹ See Eurostat (1996).

²² As regards the general definition of environmental protection, the EPEA collects data on all expenditure resulting from “actions and activities which have as their prime objective the prevention, reduction and elimination of pollution and any other degradation of the environment.” (SERIEE § 2006). According to this definition, only expenditures related to activities of which the prime objective is environmental protection should be included, while expenditures for “...actions and activities which have a favourable impact on the environment but which serve other goals do not come under environmental protection. Hence, excluded from the field of environmental protection are activities which, while beneficial to the environment, primarily satisfy technical needs or the internal requirements for health and safety of an enterprise...” (SERIEE § 2007) The definition excludes the saving of energy or of raw materials (to the extent that their primary objective is cost savings), and includes recycling activities only as far as they constitute a substitute for waste management; see. Eurostat (1994b). Other parts of the SERIEE, not as developed as the EPEA and not described here in detail, include: (i) the use and management of the natural resources account; (ii) a module to account for Eco-Industries' activities; (iii) the input-output analysis of environmental protection expenditures.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Items to be collected for the EPEA are²³:

1.1 Investment in 'End-of-pipe' equipment²⁴

End-of-pipe equipment concerns additional technical installations for use in the context of environmental control. These installations operate independently of or are identifiable parts added to production facilities, in order to treat pollution that has been generated, prevent emissions or spread of pollutants or measure the level of pollution (monitoring).

1.2 Investment in 'integrated technologies'

An 'integrated technology' is an installation or a part of an installation that has been adapted in order to generate less pollution. As opposed to 'end-of-pipe' investment, the environmental equipment has been integrated into the production process. The investment in the environmental equipment consists of the extra capital costs due to the integration of the equipment. This type of environmental equipment is not identifiable as a separate part of the production process. The costs therefore should be estimated, for example, by comparing it with available alternative installations (or parts thereof) that would not satisfy existing or future environmental regulations.

2. Current expenditure

Current expenditure on environmental protection generally occurs as a result of previous investment in environmental equipment.

2.1 Internal current expenditure includes: compensation of employees²⁵; other, i.e. payment of rents, consumption of goods and services (energy, materials, maintenance, transport, information, insurance, etc.) necessary to run, repair and maintain the environmental protection facilities and equipment; purchase of environmentally-friendly products;

2.2 External current expenditure includes the cost of purchasing environmental services from private or public third parties

3. Operational benefits

Measures for preventing or treating pollutant emissions may generate additional gains for the units which execute them. These gains may consist of sales of goods and services produced by an environmental protection activity (e.g. sales of recovered materials or energy from waste treatment activities), or of savings in energy consumption (e.g. energy produced by waste incineration plants, etc.) or savings obtained by using recovered materials and productivity gains.

4. Labour inputs

Number of persons (full time equivalent) who work on environmental protection activities.

All the items listed above should be provided - separately - for the following environmental "sectors"²⁶:

- Air and Climate
- Waste Water Management
- Waste Management
- Soil and Ground Water
- Noise and Vibration

²³ Items 3 and 4 are not themselves expenditure items but are necessary for calculating specific expenditure items: "operational benefits" allow to calculate the "net" expenditures; the labour input allows to calculate personnel expenditure for environmental protection.

²⁴ For the sake of simplicity only part of the definitions are included here. For a complete description see Eurostat (1996).

²⁵ The estimate should be consistent with the estimate of labour inputs - see below.

²⁶ The sectors correspond to the 9 classes of characteristic activities of the CEPA classification, see *Classification of Environmental Protection Activities* UNECE/Eurostat DOC/CES/822 and SERIEE (Eurostat, 1994b) page 71 and Table 2 in this paper.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

- Biodiversity and Landscape
- Protection against Radiation
- Research and Development
- Other Environmental Protection Activities

By using the Eurostat 96 questionnaire as a model for data collection we also ensured compliance with the requirement for statistical information set out in the Regulation on structural business statistics²⁷, as regards the variables on environmental expenditure. The Regulation includes among the variables to be collected data on end of pipe investment and, among pilot studies, data on integrated investments and total current expenditure.

3.2. Identifying alternative options for the collection of business expenditure data

The options considered for the purposes of collecting environmental protection expenditure (EPE) data are two:

1. use of existing data on EPE; this requires the identification of regular or occasional Istat surveys which include one or more questions on environmental expenditure, although the specific purposes of environmental accounting may not have been considered at the stage of organising the actual inquiry;
2. collection of new data on EPE; this implies the identification of new or ongoing Istat inquiries suitable for including questions on environmental expenditure consistent with the EPEA methodology.

In the case of option 1, the existing data are a “given” and the purpose of the work was essentially to check the compatibility of the data collected with the aim of constructing satellite accounts for environmental expenditure. Three existing surveys including EPE were considered; for two of them the work done is described below since it has relevant implications either for the actual survey conducted or for future work, while no description is provided for the third one²⁸.

With respect to option 2, we attempted to include questions on business expenditure for environmental protection in the context of two new surveys which in fact had a separate purpose. Of the two attempts of this kind, one finally lead to the actual collection of data and is fully presented below²⁹.

In one case only, that of the business-accounts survey (see the following paragraph), both objectives 1 and 2 were being pursued, by asking both whether the existing questions met the requirements of environmental accounting and whether such an inquiry could be used to include further questions on expenditure.

3.2.1 EPE data regularly collected by the business accounts survey (SCI).

The SCI (the annual survey of business economic accounts) is of particular interest in collecting environmental expenditure. From 1992, the survey covers companies with 20 employees or more in

²⁷ Council Regulation (EC, EURATOM) No 58/97 of 20 December 1996 concerning structural business statistics, Official Journal of the European Communities 17.1.97. Specific data requirements are included in Eurostat (1998 a,b).

²⁸ The third one is a survey conducted by ISTAT and the Italian Union of Chambers of Commerce on the costs incurred by companies for administrative tasks (reference year 1996). For details see Istat (1998).

²⁹ The second one is the PRODCOM survey. For details see Falcitelli - Tudini (1999).

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

sections C, D, E, F, G and I of the classification of economic activities ATECO91³⁰ and companies with 10 employees or more in some divisions of section K³¹.

Since 1989 the survey includes one question on “expenditure for waste disposal, waste water treatment and air-emission abatement”. At least three problems indicate that data collected by means of this single question are not sufficient to reconstruct the aggregates of expenditure for environmental protection. First, the expenditure collected is incomplete in that it relates only to current expenditure and it is restricted to three environmental sectors. We also find insufficient detail, because the only datum at present surveyed relates to total expenditure and therefore does not allow an analysis by environmental sector. Third, the data on expenditure are not sufficiently representative, since they are not subjected to the integration process, with appropriate imputations for non-responses, that is applied to the other data collected in the survey; the data are therefore not included in Istat's official publications³².

Clearly, the data are also insufficient in terms of the requirements of the Community Regulation on structural business statistics, both as regards the variable which *must* be surveyed (expenditure on “end-of-pipe investments”) and as regards the variables in the pilot studies (“expenditure on investments in integrated plant” and “current environmental expenditure”).

On the basis of the above considerations, we considered surveying business environmental-protection expenditure as part of the SCI survey, by introducing new questions; two options in particular were considered:

1. introducing the single variable which the Regulation requires to be surveyed, that on “investments in end-of-pipe plant and equipment”;
2. inclusion of a separate questionnaire containing all the variables of environmental expenditure to be surveyed for the EPEA, to be annexed to the survey questionnaire.

The first hypothesis was ruled out because the experience of other countries has shown that collecting a single environmental variable as part of a general survey on economic accounts generally does not produce satisfactory results.

The second hypothesis was also abandoned, considering it preferable not to tamper with the structure of a survey that was already working but to leave the collection of new variables to surveys that were still at the definition stage.

3.2.2 EPE data collected by the R&D survey.

The usefulness of Istat's statistical inquiries into scientific research and experimental development (described here as “R&D survey”) stems from the fact that one of the phenomena which this collects – expenditure on R&D activities by business and by public institutions/bodies – falls within the field of analysis of the EPEA³³.

³⁰ The new classification is the Italian version of NACE Rev.1. These sections are: extraction of minerals (C), manufacturing activities (D), production and distribution of electricity, gas and water (E), construction (F), transport, storage and communications (I), real-estate activities, computer rental, research, other professional and business activities (K).

³¹ Beforehand, the survey covered companies with 20 employees or more and found within branches 0 to 8 of the ATECO81 classification of economic activities (excluding sub-classes 042, 043, 81, 82, 831, and 841). ATECO81 is the Italian version of the NACE.

³² See Battellini – Taccini (1996), where some characteristic ratios are calculated for environmental expenditure for the years 1989-1992.

³³ The transactions for R&D for environmental protection purposes have to be accounted for within the EPEA sub-account called “Other environmental protection activities account”.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

In order to establish whether the information collected with the R&D survey meets the EPEA's need for information, we have to consider the two aspects below:

- the *variables* on which the data are collected, in order to establish whether these are consistent with the content of the accounting tables to be implemented;
- the *classification* of the expenditure data collected, in order to establish whether, from the complex of R&D expenditure, it is possible to extract that incurred for environmental protection purposes.

This section appraises these aspects of the survey from the viewpoint of the EPEA's need for information.

The object of the Istat survey is expenditure incurred for R&D activities by companies and public institutions/bodies, plus other information regarding such activities (financing received; personnel employed; structures used; any national and international research programmes under which the activity falls; any collaborators with whom the activity has been pursued; etc). In particular, as regards the expenditure data, a single survey is used to find the *outturn* expenditure for a given reference year and the *forecast* expenditure for the two years following.

In practice, the survey comprises two inquiries: one is aimed at business (questionnaire RS1) and one at public institutions/bodies (questionnaire RS2).

As regards the *variables* (and ignoring the aspects relating to classification) the data collected in the R&D survey include information which can be used for constructing the EPEA accounts tables. However, for the *potential* possibility of using certain variables for the purposes of the EPEA to become a *real* possibility, these variables must be capable of covering only R&D expenditure linked with the aim of environmental protection: we must therefore have regard also for the *classification* adopted for the "purpose of the research". From this standpoint, only the information collected in one part (certain "tables") of the questionnaire sent to public bodies is classified with reference to a classification (NABS) where we can extract the R&D expenditure intended for environmental protection (the content of Chapter 3: "Control and protection of the environment" of this classification is compatible with the definition of environmental protection in the SERIEE and the EPEA). However, the information collected in the corresponding "tables" of questionnaire RS1, sent to companies, is so classified that it is not possible to extract R&D expenditure intended for environmental protection.

The only information collected in questionnaire RS1 that can be linked directly with environmental protection is that on expenditure for R&D activities pursued in-house and intended, in particular, for "Environmental Technologies". Such expenditure falls within the field of environmental protection, where "Environmental Technologies" include technologies intended for the prevention, reduction or elimination of pollution and also of any other cause of environmental damage, but not when the technologies are intended for savings or rational use of natural resources; in the latter case they do not belong to the scope of the EPEA but, as arranged in the SERIEE, to the field of use and management of natural resources. Where the "Environmental Technologies" come within the EPEA scope, we can use the corresponding data to calculate the total amount of the production costs and capital expenditure for in-house R&D activities intended for such technologies. It should be stressed that, to be able to record this information in the EPEA accounting tables, it has to be broken down as regards the variables (various items of production cost and investment expenditure). Furthermore, even if the datum is broken down, the information does not necessarily account for all expenditure on R&D activities for environmental protection which the respondent company has

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

incurred: in addition to conducting research within the field of environment-protection technologies, it may also (for example) be engaged in R&D activities for the identification and analysis of sources of pollution, of mechanisms of dispersion of pollutants in the environment, and their effects on the well-being of man, of animal and plant species and the biosphere or, more generally, R&D activities to prevent and eliminate all kinds of pollution.

Summing up, only very limited information useful for EPEA purposes can be brought out directly by the RS1 questionnaire sent to companies.

However, information on R&D expenditure for environmental protection incurred by companies can be derived *indirectly* from the data collected by means of the RS2 questionnaire sent to public bodies: the arrangement of some of the expenditure data requested from public institutions is capable of showing the nature of a range of expenditure on R&D for environmental protection incurred by business.

The information which can be used for this is:

1. the expenditure incurred by each public institution/body for R&D projects commissioned from outside structures, recorded by “objective”. The external structures which can be identified include companies and, hence, the expenditure incurred by institutions/bodies in commercial commissions for undertaking R&D projects on “objectives” which come under NABS Chapter 3 represents expenditure incurred by these companies to engage in characteristic R&D activities for environmental protection.
2. the expenditure (likewise recorded by “objective”) which is incurred by each institution/body for R&D activities pursued in-house, by the source of finance covering it. Among the sources of finance, we can identify some forms of finance coming from business (agreements, contracts, orders, sale of goods and services, etc). Hence, the expenditure incurred by institutions/bodies and financed by business for R&D projects on “objectives” coming under NABS Chapter 3 represents expenditure incurred by those companies to finance characteristic R&D activities for environmental protection.

Briefly, most of the information produced by the R&D survey which can be used to quantify the expenditure incurred by companies for R&D for environmental protection can be derived from the RS2 questionnaire sent to public bodies.

However, it should be stressed that such information alone is not sufficient to account for all the expenditure on R&D for environmental protection needed for EPEA purposes. Questionnaire RS2, in fact, catches only the business expenditures which imply some transactions with public institutions/bodies; the companies may however be incurring expenditure on R&D for environmental protection that does not involve any transaction with public institutions/bodies. Furthermore, in some cases neither the information which can be extracted from questionnaire RS2 nor that which can be extracted from questionnaire RS1 presents a level of detail as required by the EPEA accounting tables.

Therefore, in order to calculate at least the overall scale of the expenditure incurred by business for R&D activities (conducted in house and commissioned from external structures) for the purpose of environmental protection (that is, coming within NABS Chapter 3), we plan on the one hand to use and process the information currently collected in the Istat R&D survey, and, on the other, to use any additional information available to achieve the latter objective, we included a specific question

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

on expenditure for “in-house” and “out-house” R&D activities for environmental protection in the context of the latest intermediate census of business and services (see §3.3).

Summing up, the analysis of existing EPE data led to the conclusion that they are not suitable to construct a satellite expenditure account; we therefore moved on to option 2, i.e. the collection of new data on EPE. This option was only feasible in the context of the intermediate census of industry and services.

3.3 Surveying business environmental expenditure within the scope of the Intermediate Census of Industry and Services

3.3.1 General features of the Intermediate Census³⁴

The unit of survey is the undertaking, meaning the organisation of an economic activity pursued on a professional basis with the aim of producing goods or supplying services for sale.

The economic activities within the Census are all those in the ATECO91 classification except for the following divisions (two-digit codes) or groups (three-digit codes) of activity³⁵: 01 Agriculture, hunting and related services; 02 Forestry and use of forest area and related services; 05 Fisheries, fish-farming and related services; 75 General government and defence, compulsory social insurance; 80 Education; 85 Health and other social services; 91 Activities of voluntary organisations n.e.c.; 92.5 Activities of libraries, registers, museums, other cultural activities; 92.6 Sporting activities; 92.7 Other leisure activities; 95 Domestic services to households and residential homes; 99 Extra-territorial organisations and bodies.

The census operation was planned earlier than usual, considering the standard ten years gap between censuses, for two main reasons³⁶. A first reason was related to the creation of the Statistical Register of Active Companies (ASIA)³⁷. ASIA was originally constructed merging information available in the principal administrative registers³⁸. In order to supplement, correct and verify these data, it was necessary to conduct a survey of companies as at 31 December 1996. The first phase of the Census – known as the *short form*, undertaken in 1997 and repeated in 1998 – answered this need with a survey of 550,000 companies³⁹ that collected the main variables identifying companies⁴⁰. The second reason which led to bringing the date of the census forward is the intention of observing the changes of a structural nature which have occurred in the world of production during the 90s. This purpose is fulfilled by the *long form*, the second module of the census operation; the long form investigates certain structural aspects of business activity (characteristics of the company, relations with the market, collaborations-agreements-consortia, structure of employment) and devotes three specific sections to collect detailed data on particular

³⁴ See SISTAN (1998) and, in particular, the attached Regulations on the intermediate industry and service census (Presidential Decree of 2.10.1997).

³⁵ See Vicari (1999).

³⁶ The Intermediate Census of Industry and Services was established by Law No. 681 of 31.12.1996.

³⁷ ASIA is to be supplemented by an register of agricultural companies and institutions.

³⁸ Meaning the registers of: Ministry of Finance, Chambers of Commerce, INPS (National Institute of Social Insurance), INAIL (National Institute for Workplace Accident Insurance) and ENEL (the national electricity corporation).

³⁹ It covered all companies with more than 50 employees and all multi-location companies, single-location companies with under 50 employees and a sample of companies with more than 100,000 employees and of self-employed professionals. See SISTAN (1998) p.3.

⁴⁰ Name and address of company, legal coding, economic-activity coding, employees, etc.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

features: group membership, mergers, de-mergers and disposals, and expenditure on environmental protection⁴¹.

The survey is part census and part sample⁴². In particular, it enumerates:

1. all companies with 20 employees or more,
2. companies below 20 employees, and above a size threshold which varies according to the economic activity and the province coding⁴³),
3. the companies with fewer employees than the variable threshold located within industrial districts which are engaged in the prevailing economic activity for that district .

The companies which do not come within the above categories, are surveyed on a sample basis in order to ensure that they are representative at division level (first two digits of the ATECO classification) by Province, and at group level (first three digits of the ATECO classification) by Region.

The three detailed sections on specific phenomena, including therefore the section on environmental-protection expenditure, are only meant for companies with 20 employees or more.

A pilot survey was carried out during May and June 1998⁴⁴. The final census questionnaires, modified on the basis of the outcome of the pilot survey, were sent out during February 1999⁴⁵.

3.3.2 The section on environmental protection expenditure.

The section relating to “expenditure for environmental protection” was structured in a manner consistent with the Eurostat 96 questionnaire. Even in the early drafts of the proposed section on environmental expenditure, it was seen clearly that the section was complex, and this created concern as to the possible negative repercussions on the quantity and quality of responses. To reduce this danger, only a subset of the theoretically desired questions were actually included in the final questionnaire; they were selected on the basis of two criteria. The first relates to the intention of not aggravating the burden of response placed on companies, considered both in connection with the total of statistical surveys sent to companies and specifically in connection with the size of the long-form questionnaire. The second criterium consisted in giving priority to questions linked to statistics that it was compulsory to collect and those which could be expected to give least difficulty to companies in their response.

Finally, details such as the measurement unit in which the expenditure needed to be recorded as well as the exact wording of the questions were decided on the basis of the results of the pilot survey conducted in May 1998. The list of question included in the final questionnaire is presented below.

⁴¹ The *short form* questions, relating to 1997, have also been repeated.

⁴² See Vicari (1999).

⁴³ The threshold is 15% of employment (calculated overall from the largest companies) for characteristically medium-sized activities such as (e.g.) the metals industry, and 5% of employment for characteristically small-scale activities such as (e.g.) professional-service companies.

⁴⁴ The pilot survey on the Long Form portion of the Intermediate Census of Industry and Services involved 937 companies; 505 of these (54% of the companies involved) responded to the survey. These 505 companies correspond overall to 1,182 local units (ULs). The response rate to the filter question was considered satisfactory with only a 5.8% recorded rate of non-response, against 94.2% of responses properly provided by companies. 19.2% of companies responding declare expenditure incurred in 1997 for environmental protection, whilst 75% of companies state they did not incur such expenditure. For more details see Falcitelli -Tudini (1999).

⁴⁵ As at May 2000 results are not available yet.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tadini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Questionnaire of the Intermediate Census on Industry and Services 1999
SECTION 11 - CAPITAL AND CURRENT EXPENDITURE FOR ENVIRONMENTAL
PROTECTION

All companies which are principally engaged in “Disposal of solid waste”, “Disposal and purification of waste water and related activities” or “Recovery and preparation for recycling” must complete this section.

11.1 - In 1997, did the company incur expenditure for environmental protection?

Environmental-protection expenditure means all current and capital expenditure in which the principal purpose is one or more of the following objectives, even if only in the form of Research and experimental Development: prevention, reduction, elimination or monitoring of waste, noise and pollution of the air, water or soil; restoration of damaged nature and landscape (for example, reafforestation or restoration of water-bearing strata). It does not include expenditure for activities and action which, whilst producing a favourable impact on the environment, has other principal purposes, as for example hygiene and safety of the working environment. 1 ☐ Yes 2 ☐ No

If you answer no, go to section 12

For companies which are principally engaged in activities of “Disposal of solid waste” or “Disposal and purification of waste water and related activities”, environmental-protection expenditure means all capital and current expenditure incurred in pursuit of their principal activity. For companies which are principally engaged in activities of “Recovery and preparation for recycling”, environmental-protection expenditure means all capital and current expenditure incurred for the collection, transport and treatment of waste.

11.2 - In 1997, did the company invest in plant and equipment for the control and abatement of pollution (also known as “downstream” or “end-of-pipe type” or “end of cycle” action)? *This means all appliances, installations or devices for the control and abatement of pollution which are additional to and identifiable separately from the productive equipment and plant*

1 ☐ Yes 2 ☐ No

If so, state the value* (in thousand lire) against the environmental sector concerned:

Environmental sector		Investments in Plant and Equipment for control and abatement of pollution
air and climate	1	
management of waste water	2	
soil and groundwater	3	
solid waste	4	
noise	5	
nature and landscape	6	
TOTAL	7	

* This must include expenditure to prolong working life and to increase productivity from the items (technical improvements, modifications and replacements). It must exclude capital expenditure on intangibles (patents, licences), depreciation and items acquired by merger.

11.3 - In 1997, did the company invest in reduced environmental impact (or “integrated”) plant?

This means any reduced environmental impact appliances, installations or devices which are an integral part of the productive equipment and plant and which therefore cannot be identified separately from the latter.

1 ☐ Yes 2 ☐ No

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

11.4 - In 1997, did the company incur current expenditure to carry out environmental protection activities in-house or by acquisition from third parties of environmental-protection services?

3 ☐ Yes 4 ☐ No

If so, state the value in thousand lire against the environmental sector concerned:

Environmental sector		Current expenditure for environmental-protection activities conducted in-house		Expenditure on environmental-protection activities bought in	
		Personnel expenditure	Other	Fees and other payments to public bodies	Payments to private companies
air and climate	1				
managing waste water	2				
soil and groundwater	3				
solid waste	4				
noise	5				
nature and landscape	6				
TOTAL	7				

11.5 - In 1997, did the company incur expenditure on R&D for environmental protection, carried out in-house and/or commissioned outside?

1 ☐ Yes 2 ☐ No

If so, state the value in thousand lire:

R&D activities for environmental protection conducted in-house			R&D activities for environmental protection commissioned outside		
CAPITAL EXPENDITURE*	1	_____	TO PRIVATE BODIES AND COMPANIES	4	_____
CURRENT EXPENDITURE	2	_____	TO PUBLIC BODIES	5	_____
Of which: Personnel expenditure	3	_____			

*excluding depreciation.

The launch of the census survey marked the end of the work planned in connection with the survey of business expenditure on environmental protection. The next section takes stock of the entire operation and sketches out some future lines of development.

3.4 Conclusions and hypotheses for future work

The Italian experience is a significant example of how the survey process which it is possible to adopt in practice does not necessarily match the process which is theoretically preferable. Indeed, an earlier study identified three options for ISTAT to introduce surveying of environmental expenditure⁴⁶:

1. To include all the environmental questions needed into existing surveys collecting business data.
2. To collect the data on business environmental expenditure by means of two parallel inquiries: the existing survey on the system of business accounts, to include the environmental questions provided in the Regulation, and a survey specifically to collect data for the purposes of the EPEA.
3. To collect the data in a single survey, based on the EPEA methodology and so arranged as to make it possible to extract the data needed to meet the requirements of the Regulation as well.

⁴⁶ See Sammarco – Tudini (1996) and, in particular, section 4.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Of the three options considered, the first was felt to be the least practicable, because of the low level of compatibility between a survey for a different purpose and statistical information of the quantity and complexity needed for EPEA purposes.

However, the process adopted for collecting the business expenditure, which is to include the questions on expenditure within the Census, is actually in line with the first of the three options identified.

The opportunity afforded by the Intermediate Census, and the need to restrict the number of inquiries sent to companies, required us to exclude options 2 and 3 at this stage of the work.

Upon completion of the experiment, it is possible to evaluate how the survey as established meets Community statistical requirements.

The questions included in the Census adequately reflect Community indications as regards the variables to be surveyed and the sectors and economic activities covered.

On the variables to be surveyed, the questions proposed within the Census meet the requirements of the Regulations on structural business statistics as regards the compulsory variable “investments in end-of-cycle plant”, but only in part as regards the pilot-study variables “investments in integrated plant” and “current environmental expenditure”, since the value of the investments is not found in the former. On the survey requirements connected with the construction of satellite accounts for environmental expenditure, the Intermediate Census does not make it possible to find expenditure on integrated investments, the operational benefits obtained through the environmental-protection activities or current expenditure for adapted products.

Of the environmental sectors which EPEA provides are to be surveyed, all are covered except “protection from radiation” and the residual sector “other activities”; and the sector “noise and vibrations” is considered only in respect of noise.

The cover of economic activities by the Census – which is concerned with companies operating in the industry and services sectors – fully meets the requirements of the Regulation and of the questionnaire Eurostat 96, which provide for a limited survey of the industrial sector.

Notwithstanding the positive evaluation, there remain some unresolved problems regarding the aspects discussed of the characteristics of the census survey on business expenditure for environmental protection.

The first problem that remains open is to collect environmental expenditure by companies with under 20 employees. In addition, the Census makes it possible to collect data on environmental expenditure only for 1997 and fail to meet either the requirement to provide Eurostat with the value of investments in end-of-pipe plant – an environmental variable specified by the Regulation – on an annual basis, or the requirement to construct a historical series of data for the satellite accounts.

Consideration is therefore now required here on how to resolve these two problems in the future.

On the surveying of environmental expenditure by small companies it is possible (following the Census) to consider undertaking a supplementary study aimed at companies which have stated at the Census filter question that they have incurred expenditure for environmental protection.

On the establishment of a regular survey, we are considering separating the calculation of environmental R&D expenditure from all other environmental expenditure. In particular, as regards expenditure incurred by companies for R&D on environmental protection, the current working hypothesis is that of using and processing the information now collected in the R&D survey together with other *additional* information to give the overall scale of the phenomenon. This sort of information is now being collected – on a one-off basis – through the Intermediate Census of Companies and Services now being taken: here companies are being asked to report expenditure incurred for in-house and bought-in R&D that is aimed at environmental protection (but in particular without asking the environmental domain(s) concerned in those activities). If the current

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

working hypothesis gives positive results, there will be a need to identify spaces within the ISTAT surveys which can be used for a regular collection of the *additional* information which at present is being collected on a one-off basis through the Intermediate Census. Nevertheless all other information has to be collected by the use of direct survey again. As in the past, two alternatives are available here. The first is to include a separate questionnaire on business environmental-protection expenditure within an ordinary survey (this has the benefit of using the existing survey network but, as census experience has shown, it makes the specific needs of collecting data on expenditure subject to compliance with the constraints of the principal survey). Alternatively, we can consider repeated use of a separate survey on business expenditure, with the benefit of greater independence in organising the survey but also the problems of starting up a fresh survey.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

4 The 1990 Italian NAMEA

4.1 Background on NAMEA

The National Accounting Matrix Including Environmental Accounts (NAMEA) is a statistical information system that combines national accounts and environmental accounts. The system was originally developed by Statistics Netherlands⁴⁷. In order to present the main features of the matrix, a simplified NAMEA is shown in Figure 4⁴⁸. The economic module of the Figure records monetary flows and the main aggregates of national accounts; the environmental module records - in physical units - some of the pressures caused by economic activities on the environment, in a way consistent with the economic module, i.e. with respect to the same economic and consumption units.

The items belonging to the first column of the economic module - output of goods and services by economic activities and imports of goods and services from abroad - add up to the total *resources* available in the economy⁴⁹. The same column, records, in the environmental module, the intake of materials by the economic activity that is directly responsible for their extraction⁵⁰. The possible *uses* of resources are shown in the first row of Figure 4: the available goods and services can be either used as further inputs to the production process (intermediate consumption by economic activities) or they can leave production and become part of "final uses", that includes: final consumption (mainly by households and general government), investments, exports. The second row of the matrix is specifically introduced to show that part of households' final consumption (already included among final uses) that is particularly significant in terms of environmental impact, namely households' expenditures for transport and heating; these expenditure cause the environmental pressures recorded, in physical units, in the same row of the environmental module. Similarly, the production of goods and services by economic activities - shown in the third row - is linked to the environmental pressures (air and water emissions, waste) caused by the economic activities themselves, shown in the same row of the environmental module. By definition, the difference between output and intermediate consumption is the value added of the economic system (row 4 and column 2). In the environmental module, the emissions are generally broken down by pollutants. They can also be grouped by environmental themes, specifically, climate change, acidification, eutrophication.

⁴⁷ See De Haan, Keuning (1994).

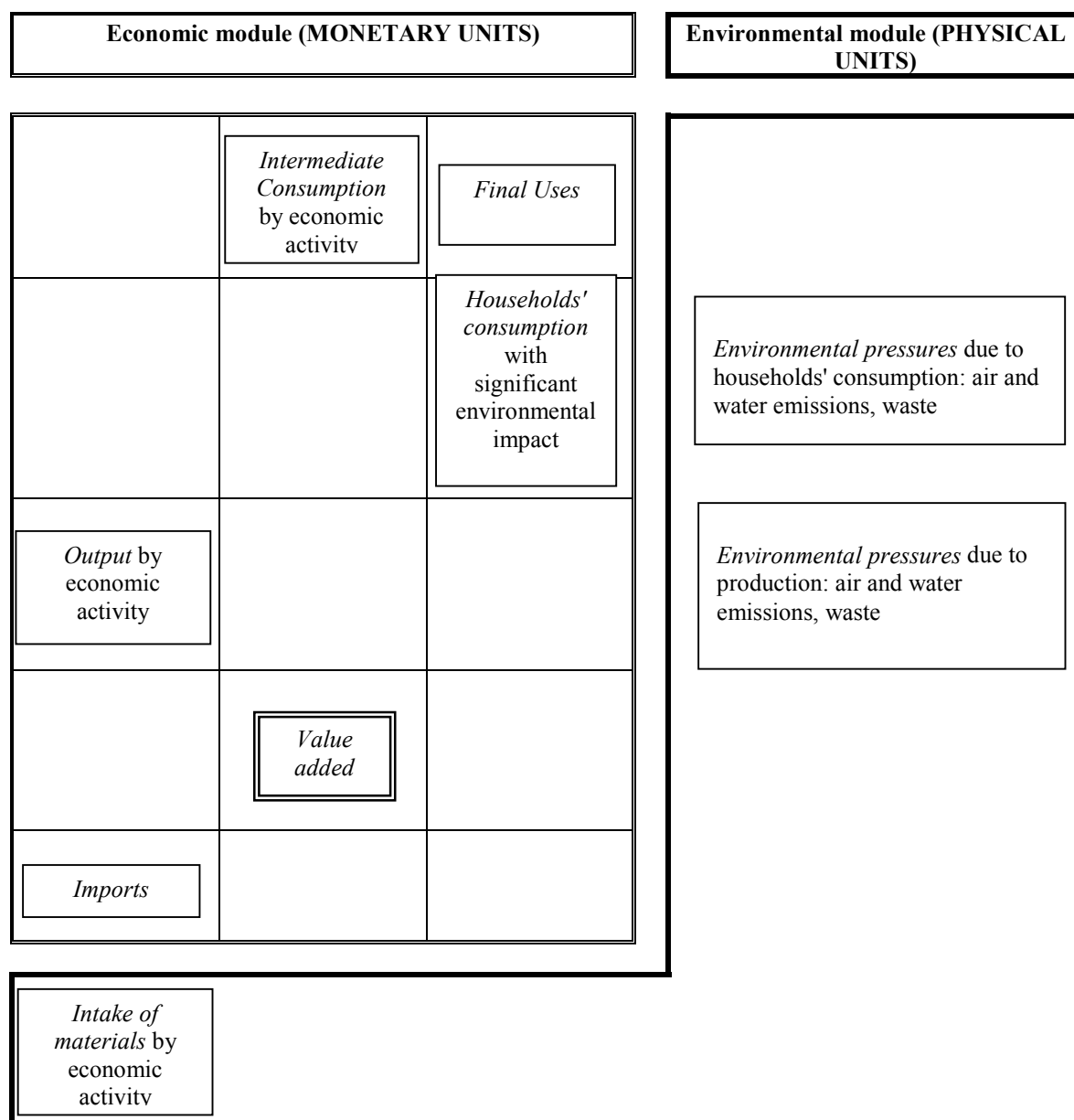
⁴⁸ Both the economic and the environmental module of Figure 4 do not include some parts of more general versions of the NAMEA; for a comprehensive NAMEA see Battellini – Tudini (1996).

⁴⁹ Trade and transport margins – that ensure that the value of the supply of goods and services is equal to the value of their use - are not included in the Figure, that focuses on the main conceptual aspects of the NAMEA. For the same reason indirect taxes are not shown.

⁵⁰ Therefore, for example, extraction activities are held responsible for all the material they actually extract, despite the fact that the part of the material can be subsequently used, (as intermediate consumption) by other economic activities as well.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Figure 4 - A Simplified NAMEA



From a methodological standpoint, a NAMEA requires the statistical data used in the environmental module to be consistent with the structure of the economic module. The consistency does not - in general - occur *ex ante*, since environmental data are not produced to be used together with environmental accounts data and hence adopt different definitions and classifications. Therefore, although it is possible to produce a NAMEA using existing economic and environmental data, some work is needed on the environmental statistics to make them suitable for a NAMEA framework.

4.2 Building a NAMEA matrix in Italy

The development of NAMEA-related projects in Italy is part of the EU-wide effort towards the adoption of the scheme.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

Since 1995 most EU countries have attached a high priority to the production of NAMEA-type frameworks. This is due to the appeal of a framework that, as shown in the previous paragraph, allows to compare existing monetary data - on production and consumption activities - with existing physical data on the environmental pressures caused by the same activities. Moreover, the availability of funds from the European Commission was a substantial spur to the launch of national projects. A fairly common path can be observed among EU countries as regards the environmental pressures included in the environmental module: most countries started to produce NAMEAs including air emissions' accounts only, due to the better availability of these environmental data compared to other pressures. Then, some countries have extended their environmental accounts to water: water intakes, discharges of waste water and water emissions; the production of waste accounts is still at the experimental level. Other areas in which individual countries have attempted to include data into a NAMEA framework include material intakes and environmental expenditure. To date, national NAMEAs differ with respect to the classifications used, the pollutants considered, the reference years chosen and other relevant methodological aspects. Existing differences are currently being addressed by Eurostat, in an effort to standardise national outputs.

As far as Italy is concerned, the first step towards an Italian NAMEA was the feasibility study conducted in Battellini - Tudini (1996) in order to explore data availability. On the basis of the results of that study Istat completed a project aimed at producing the first Italian NAMEA for the year 1990 (here referred to as NAMEA90)⁵¹. The Italian NAMEA for the year 1990, includes:

1. In the economic module: the goods and service account and the production account, i.e. all the items of Figure 4 economic module, with additional details;
2. In the environmental module: emissions - by 52 economic activities and households' consumption - of six air pollutants, namely carbon dioxide (CO₂), sulphur dioxide (SO_x), nitrogen oxides (NO_x), nitrous oxide (N₂O), ammonia (NH₃), methane (CH₄); the direct intake from nature - by the 52 economic activities - of 4 resources: endogenous steam, wood and fossil fuels, minerals, biotic materials.

The main methodological effort was devoted to build air emission accounts as summarised hereafter.

In Italy the emissions of air pollutants are calculated for the Community CORINAIR inventory. Therefore, the 1990 CORINAIR emissions data, classified according to SNAP94 (Simplified Nomenclature for Air Pollution)⁵², are the basis for the air emissions accounts of the Italian NAMEA matrix. In the CORINAIR inventory, emissions data are classified according to the production process causing them. The NAMEA environmental module, instead, requires to record the amount of emissions generated by each economic activity of the NAMEA NACE-based classification. Thus, the main problem, when compiling air emissions accounts based on CORINAIR data, is to shift from a process-based classification to an economic one. In the Italian NAMEA the problem was solved in two stages. The first stage addressed the question: in which economic activities does each process take place? The answer to this question produced two groups of processes:

- processes with a one-to-one link to the economic activities of the NAMEA classification;
- processes with a multiple link to the economic activities of the NAMEA classification.

For processes belonging to the first group, the CORINAIR emissions were allocated to the corresponding NAMEA economic activity without further calculations.

⁵¹ Battellini et al. (2000) includes a complete NAMEA90 representation, detailed data and a methodological description of the work.

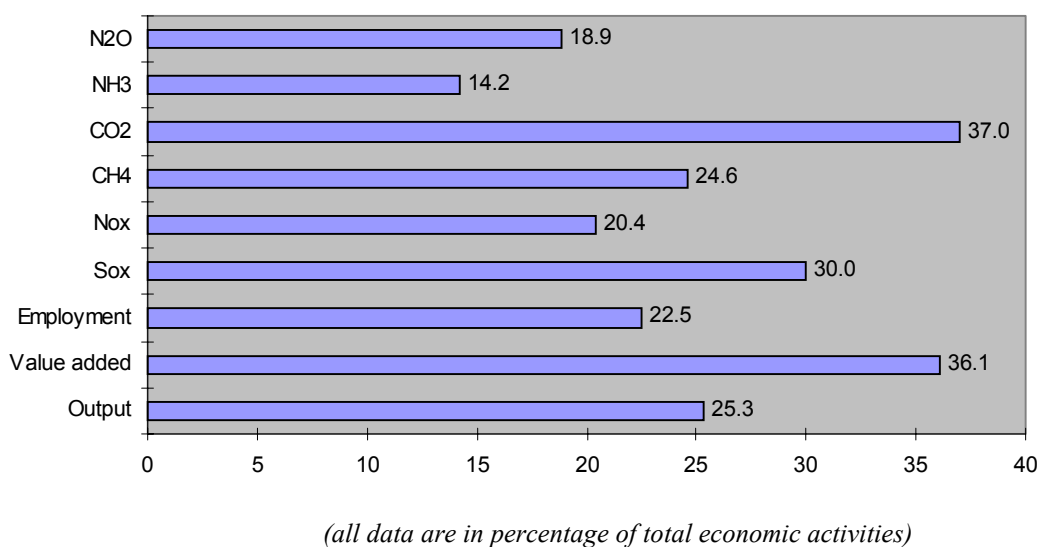
⁵² 1990 CORINAIR data classified according to SNAP94 are available in Italy in addition to the 1990 air emissions classified according to the SNAP90 nomenclature.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

For all the other processes additional steps were necessary to split the emissions among the corresponding NAMEA economic activities and households. Two main methods proved to be suitable for distributing most of the emissions; one used information derived from CORINAIR point source estimates, the other used weights derived from national accounts data on the consumption of energy products by NACE industry. In addition, ad hoc methodologies were designed for a few specific processes (electricity for own use, off-road transport in industry, waste water treatment).

NAMEA data can be used for different types of analysis. In the Italian NAMEA90, the data were used to produce two main kinds of results. First, for a given grouping of industries, the percentage share of total value added, total output and total employment are compared to the percentage share of total emissions (for each of the six pollutants). This comparison is called *environmental profile*⁵³ and an example is shown in Figure 5⁵⁴. Second, for each pollutant, the percentage contribution of economic activities and households to total emissions are presented in decreasing order i.e. starting from the activities accounting for most of the emissions.

Figure 5 - Example of environmental profile for a given groupings of economic activities



A second NAMEA project to be completed at Istat⁵⁵ includes:

1. the extension of 1990 environmental accounts to emissions of CO (carbon monoxide) and non-methane volatile organic compounds (NMVOCs);
2. the compilation of 1991 and 1992 NAMEA matrices on air emissions and intake of resources

Also, in the medium term Istat plans to regularly produce NAMEAs on air emissions and intake of resources and to extend the environmental module to waste.

⁵³ See Eurostat (1999b).

⁵⁴ Figure 5 shows mock data.

⁵⁵ As at June 2000 the project was undergoing.

* Cesare Costantino wrote §1; Federico Falcitelli wrote §§ 2.1, 2.2, 2.3, 2.4.1, 3.2.2, 3.4; Angelica Tudini wrote §§ 2.4.2, 3.1, 3.2.1, 3.3, 4.

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