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THE FRENCH EXPERIENCE WITH SATELLITE ACCOUNTS

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ABSTRACT

The French satellite accounts describe many **fields of economic and social activity**, such as health, social protection, research, road transportation, housing, energy and the environment. These fields are characterised by **large-scale government intervention in the form of direct expenditures or transfer payments**. The aim of a satellite account is to provide information about a specific set of aggregates, primarily the **characteristic activities**, **expenditures**, **financing**, and **beneficiaries** in its field. The analysis of beneficiaries, however—originally one of the accounts' major purposes—has been hampered by the fact that the **beneficiary of an expenditure is not always easy to identify** ,... (for further details, see item [1] of the bibliography).

Another common feature of the satellite fields is the **importance of non-monetary data**, measured in **physical units**. Sometimes, as in **environment accounts**, the physical quantities are used as a basis to compute expenditure. They may even be regarded as a central element for describing a field: one example is the concept of "natural patrimony" in environmental accounting. The water-use account of economic agents, formulated in cubic meters, will be compared with the water-expenditure account in order to determine the average price of water per cubic meter. In energy, one compile also balance sheets which is an other example of use of physical units. At last, transport satellite accounts use some information on transportation services in physical volumes (tkm).

This paper is divided in three parts : part I is historical and conceptual. Parts II and III deals in the with some kinds of satellite accounts in France, **where physical units are combined with average price to transformation into monetary equivalents : energy, environment**. Their interest is not to give some results but some keys of research : link between monetary data of national accounts and physical units in satellite approach, or compilation of I-O table in physical data.

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CONTENT

I - METHODOLOGICAL PRESENTATION

1) historical overview

The concept of "satellite accounts" emerged in France in the late 1960s as a method of providing detailed accounts in a specific field of economic and social activity. It was noticed that "the central framework is **too rigid to deal with economic reality in all its aspects**. About some key areas such as housing and research, the system tells us little or nothing. The **functional analysis of public expenditures** gives only a partial view. **'Cross-sectional'** analysis is needed. One solution would be to develop a system consisting of a central core surrounded by **many satellites. These would be coherent with the system but linked to it in highly flexible, highly diverse ways.**"

The concepts and economic analyses in the central framework of national accounts occasionally exhibit limitations that restrict the study of the satellite fields such as health, education, transportation, the environment. The framework is obliged to comply with principles of homogeneity and simplification in a number of areas, including definitions of concepts (for example, **production**), accounting frameworks, valuation methods, and choice of classifications. These requirements hamper or prevent the analysis of specific fields. Here are several examples of the constraints on the central framework:

- The classifications of activities and products are not all-purpose, either because the classifications do not distinguish the producer units engaged in certain activities such as tourism, or because the expenditures in one field—the environment, for example—are hard to isolate from other expenditures.

- National accounts are segmented into industries and products: in France, an industry contains homogeneous units of production whose output consists of the same product. By contrast, the administrative units of government activity are more aptly described in functional terms, such as health, education, housing, transportation, and the environment.

- By convention, the central framework does not identify non-market ancillary activity for own account. This makes it impossible to make a full evaluation of the "expenditures" in areas such as services—computing, research, transportation, and so on—whether those services are external or internal.

- The national accounts are based on a monetary unit of account, which guarantees consistent valuation. But in some cases it would be useful to supplement the monetary data

with physical data to measure such significant aggregates as the average cost of health care per patient or the average education expenditure per student.

a) first generation of satellite accounts

The early 1970s consequently saw the emergence of the concept of "satellite accounts" and, with it, the first generation of such accounts in health-care, social protection. This innovation was part of the methodological work undertaken for **INSEE's 1971 rebasing of the annual accounts**—one of whose prime goals was to define a set of **common rules**.

- The definition of 1971 began with the statement that the satellite accounts were intended to assemble information scattered throughout the central framework: **"The compilation of these accounts is designed as a means of progressively structuring all the quantitative data pertaining to a special field in order to construct a coherent system of information and of economic and social analysis."** The 1971 guidelines went on to emphasise the flexibility of the satellite accounts: "A satellite account is an adaptable framework for gathering information in a given field."

- The scope of application of the satellite accounts comprises major **collective functions** in order to give a fuller picture of the economics of their fields. **The concept of "function" is crucial here. It refers to the fact that satellite accounts use methods complementary to those of the central framework in order to measure household consumption or government consumption by function.** This approach tabulates transactions by purpose. For example, the accounts will evaluate the sum total of household expenditures on transportation, including automobile purchases; health-care expenditures, including drug purchases. But the satellite accounts go further: they seek to group together all the flows of **all economic agents** relating to a particular function.

- The satellite fields are characterised by a high degree of **government intervention** through (a) **direct spending**, such as roadbuilding, school maintenance, and compensation of public hospital employees; or (b) **transfers** such as social-assistance benefits, subsidies, and scholarships, where income redistribution policies play a major role.

- Another common feature of the satellite fields is the importance of **non-monetary data**, measured in **physical units**. Sometimes, as in the tourism and environment accounts, the physical quantities are used as a basis to compute expenditure. They may even be regarded as a central element for describing a field : water-use account of units, formulated in cubic meters, will be compared with the water-expenditure account in order to determine the average price of water per cubic meter.

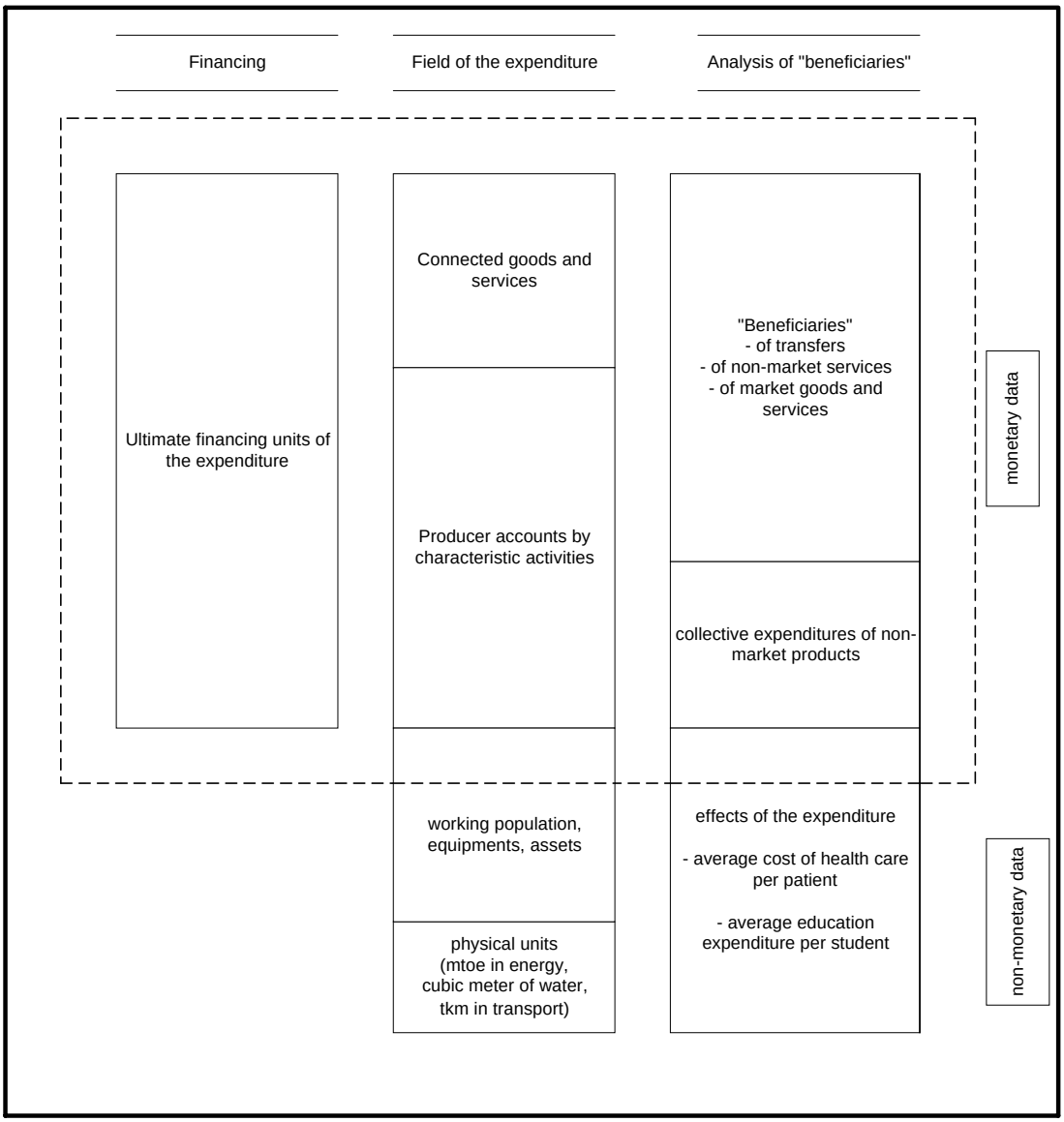
- The satellite accounts adopted a complete **system of accounts**—in particular the accounts of producers of the field—together with a simpler version of the central-framework classification of economic transactions. These choices marked a departure from the "satellite analyses" defined earlier, which were confined to the valuation of a few aggregates.

b) second generation of satellite accounts

The **1980 rebasing** of the French national accounts offered an opportunity to refine the methodology and evaluation procedures of the satellite accounts (such as health and social protection) which are now incorporated in the French system of national accounts (figure 1) [2].

Figure 1

Conceptual framework of satellite accounts' field in French publication year 1985



National expenditure =Total of financing	Resources of characteristic producers + expenses of connected goods and services	Total transfers + uses by beneficiaries + capital formation in specifics goods

The base-year French methodology 1980 (SECN) addresses the **key concerns** of **managers and administrators in the satellite-account fields**. Indeed, the satellite accounts have not emerged at random. They meet a strong demand—from officials, professional people, employers' organisations, and trade unions—for fuller information about the economics of a particular field.

SECN does stress the fact that the key issues addressed by the satellite accounts are common to all fields, as are the corresponding aggregates. Admittedly, the accounts can operate under different accounting frameworks. Each account can adopt a distinctive method

for organizing the information in its field. It can also choose its main aggregates, classifications, transactions, and so on. But it must tabulate the economic flows—i.e., assess the expenditure on "characteristic activities of the field" and "field-connected goods and services"—in such a manner as to answer the following questions:

- Who produces the expenditure?
- Who finances it?
- Who benefits from it?

The base-year 1980 system also insists on the need for **two crucial links** with the central framework: a linkage between the **concepts** of the satellite account and the concepts of the central framework, and a linkage between the definition of **expenditures** in the satellite account and the definition of **output** in the central framework. These links are applied in a particularly visible manner in the education satellite account.

2) fields of French satellite accounts

France's experience in satellite accounts covers ten fields: health care, research, education, social protection, tourism, road transportation, energy, the environment, housing services, the audio-visual field, and information technology. One common feature worth noting is that most of the fields centre on services, including market and non-market (table 1).

These accounts can be categorized into three subsets. Those in the first subset cover social functions, and can be described as **generalized functional analyses**: health care, research, education, social protection. The second subset consists of **accounts of economic activities**: tourism, road transportation, housing services, audio-visual. The **environment** is in a subset of its own, because of the **diversity of accounting methods** that have been created to deal with it.

Not all the satellite accounts are at the same level of development. Some, in existence for nearly a quarter-century, are produced on a current-year basis (health, research, social protection). Others (housing, audio-visual) are only in the early phases of methodological development. Some are connected with the central framework, others only partly so. Some are tabulated by the statistical offices of the relevant ministries; others use outside consulting groups for quantification and even methodological support. Over the years, satellite accounts have developed in a pragmatic fashion.

Table 1

French satellite accounts classified by administrative criteria

	Date started*	Annual quantifi-cation	Accounts commis-sion	Organization in charge
"Satellite accounts"				
Before 1980*				
- Research	1970	yes		DGRT - Ministry of research and space
- Health	1970	yes	yes	SESI - Ministry of health
- Social protection	1979	yes	yes	SESI - Ministry of social affairs
- Education	1980	yes		DEP - Ministry of education
After 1980*				
- Transportation				
• Road	1982	yes	yes	SES - Ministry of transportation and tourism
• Greater Paris area	1987	yes		RATP
- Information technology	1985			
- Environment	1986			IFEN - Ministry of the environment
- Tourism	1988	yes	yes	DIT - Ministry of transportation and tourism
- Housing services	1992		yes	DAEI and DC - Ministry of housing
- Audiovisual	1992			SJTI - Prime minister
"Satellite analyses"				
- Transportation	1955	yes	yes	SES - Ministry of transportation and tourism
- Agriculture	1964	yes	yes	INSEE and SCEES - Ministry of agriculture
- Wholesale/retail trade	1963	yes	yes	INSEE (wholesale/retail trade division)
- Energy	1980	yes		OBSERVATORY OF ENERGY
- Services	1987	yes	yes	INSEE (services division)

** Dates shown are for the creation of the accounts commission, which does not always coincide with the establishment of the satellite account. Where no commission exists, we have shown the date of account establishment. Note: there is no accounts commission for social protection in the broad sense, but a Social-Security Accounts Commission with narrower terms of reference.*

3) The 1993 SNA

Many countries, meanwhile, have extended the concept of satellite account to other forms of accounting analysis on the fringes of the central framework—notably in the **environmental, research, tourism** and **social protection** field. In fact, the need for **international comparisons** is becoming an ever more **important aspect of satellite accounting**. Experts working on the new United Nations System of National Accounts of 1993 added a new chapter

(Chapter XXI) entitled "Satellite Analysis and Accounts" to the existing 1968 SNA. The document reasserts the need for satellite accounts to address at least the three basic questions on expenditure, financing, and beneficiaries. The chapter also addresses three issues common to all satellite accounts [3], [4], [5], [6] :

- (1) The experts proposed guidelines for **harmonizing** the methodology of all the accounts in order to allow comparisons.

- (2) The document seeks to define the **conceptual and statistical link between the satellite accounts and the central framework**. A fairly strong link must exist between the two systems of accounts, for it is the only way to compare aggregates. Such harmonization does not exclude the reorganization of the data in the satellite account through disaggregations and reclassifications. But it is hard to imagine a satellite account and the central framework offering different valuations for the same aggregate. Any such discrepancies must be pointed out and explained. The only margin of freedom concerns the conceptual definition of some central-framework aggregates.

- (3) The chapter suggests ways to interlink the aggregates of a single account, in particular the **supply and use of characteristic products**.

Beyond these considerations, the satellite accounts emerge as an "accounting springboard" toward a future SNA. The present conceptual work on specific fields such as research and the environment has not been deemed sufficiently advanced to permit the inclusion of those fields in the 1993 SNA central framework. This aspect is discussed in section D of chapter XXI, "Satellite Analysis and Accounts," entitled "Satellite System for Integrated Economic and Environmental Accounting." The section offers a rough "satellite" accounting model derived from the central framework in order to modify the main aggregates such as GDP. The main purpose is to adjust those key aggregates by introducing into the central framework the costs of pollution and depletion of non-renewable natural resources, even if these are of a non-market type.

We give here a fictitious example with figures. The satellite input-output table is constructed on the same principles as the 93 SNA central framework: output valued at base prices, plus taxes on products (including VAT on products), minus subsidies on products, plus margins on transportation and on distribution, plus imports, give total supply in purchasers' prices and, finally, uses in purchasers' prices (for an example, see table 2.1). This table is linked to the two other economic tables, "financing" and "users/beneficiaries" (see table 2.2).

The example can be applied, in particular, to the French SECN. However, we have simplified it with respect to the 1993 SNA satellite accounts table. We include two characteristic

products, 1 and 2, and a connected product consumed by households. Product 1 is considered to be produced by principal and ancillary market producers, while product 2 is taken to be produced by non-market producers. We assume gross fixed capital formation of characteristic market producers to be equal to 7.

Like a classic input-output table, our example comprises three parts:

(1) **The first part** gives a breakdown of output by characteristic producers into columns for market and non-market producers, each of these being classified into principal, secondary, and ancillary producers. "Characteristic producers" are units producing characteristic products. They can be defined in one of two ways: Ideally, they consist of homogeneous units of production that belong to establishments whose principal activity is characteristic or to establishments performing a characteristic activity in a secondary or ancillary capacity. They can also encompass an extension of the production boundary, which explains the additional subcolumn marked "other" in the "characteristic non-market producers" column of table XXI.5 in the 1993 SNA. In practice, and for the sake of simplicity, one could calculate output for each establishment, at least for those whose principal activity is characteristic. In the example, however, we have selected homogeneous units of production. Only secondary and ancillary output is attributed to homogeneous units of production. The "other producers" column, therefore, includes output of non-characteristic producers except for their secondary or ancillary characteristic output. We can make a further distinction among these producers between (a) producers of connected goods and services and (b) the principal suppliers of intermediate consumption (IC) or of capital formation to characteristic producers.

(2) **The second part** of table 2.1 shows the use of characteristic products, connected goods and services, and other products. These products can be used as IC by characteristic producers or by non-characteristic producers. We take the same columns as in the first part. Naturally, by adding the "other producers" column in part 1, we can record the IC of non-specific goods by characteristic producers. Characteristic products can also be booked under final consumption, capital formation, or exports.

(3) **The third part** of table 2.1 gives a breakdown of value added into compensation of employees, operating surplus, and other transactions. Part 3 can be supplemented with non-monetary data such as numbers of employees or installed equipment units.

Table 2.1
Supply-and-use table of specific products in the 1993 SNA (fictitious example)

Distributed output	Imports	VAT and other taxes on products	Subsidies on products	**Total supply**	Industries / Products	IC	IC	IC	IC	FCH	FCG	**Total uses**
						Char ind	Char ind	Char ind	Other inds			
						Mkt prod	Mkt prod	Non-m prod				
						Princ	Anc	Princ				
52*	9	9	-2	68	Char product 1	1		2	34*	31		68
25				25	Char product 2						25	25
				10	Connected product					10		
					Other products	11	3	10	100			
					Total IC	12	3	12	120			
					C Emp	20	11	13				
					Taxes	3						
					Subsidy	-1						
					GOS	4						
					Total value added	26	11	13				
					Total output	38	14	25				

* of which 14 ancillary

IC = Intermediate consumption
FCH = Final consumption by households
FCG = Final consumption by government

Char ind / product = Characteristic industry / product
Mkt prod = Market producers
Non-m prod = Non-market producers
Princ = Principal
Anc = Ancillary

C Emp = Compensation of employees
GOS = Gross operating surplus

Table 2.2
(connects to table 2.1)

National expenditure by "user/beneficiary" **Expenditure by ultimate financing unit**

	Mkt prod	Non-m prod	Govt as consu-mer	House-holds	Total	Mkt prod	Finan-cial institu-tions	Gen govt	House-holds	Total
1. Consumption of specific products										
- Actual final consumption										
• Market products				41	41				41	41
• Non-market products										
* Individual				10	10			10		10
* Collective			15		15			15		15
- Intermediate consumption										
• Actual	21	2			23	21		2		23
• Internal	14				14	14				14
2. Capital formation in specific products	7				7	4	3			7
3. Transfers	3				3			3		3
Total national expenditure	45	2	15	51	113	39	3	30	41	113

In conclusion of this part, some international bodies have devised accounting methods in selected fields, notably in **research** (Frascati manual of 1963), and **social protection** (EUROSTAT). **Tourism** and the **environment** (SERIEE) have been the focus of recent methodological work by groups at OECD and Eurostat respectively. In fact, the need for **international comparisons** is becoming an ever more **important aspect of satellite accounting**.

These methods under development will not be discussed here, but there is an obvious risk of applying a multiplicity of methods to a single field. However, we should note that the methods are often compatible with those of the satellite accounts, as they do not pursue the same objectives. The OECD manual of tourism accounts, for example, concentrates largely on domestic demand for the output of characteristic tourism producers and on their production conditions.

II - ENERGY ACCOUNTS

Energy is interesting for several reasons : On one side, one has non- monetary data. On the other side, ESA 95 introduces the concept of basic price.

1) energy balance sheets : definition

Many statistics in this field are devoted to energy balance sheets which are expressed in specific units and in tonnes of oil equivalent. These balance sheets are constructed according to the methodology for « Supplied Energy Balances », where all the operations are harmonized on the basis of the energy content of each source and form of energy. The tonne of oil equivalent is a conventional standardised unit defined on a the basis of a tonne of oil with a net calorific value of 41 868 kilojoules / kg.

Three countable equalities are useful to understand an energy balance-sheet sheet:

(1) about supply :
Primary production + imports - exports + stock change = Gross inland consumption **actual**

(2) about uses :
Gross inland consumption **normal** = Gross inland consumption + climatic corrections =
+ consumption of the energy branch (including distribution losses)
+ final energy consumption +
+ final non energy consumption (chemical industry)
These two last represent the quantities of energy available for the final consumption.

2) example of French energy balance sheet 1995

One take here the example of electricity here where the primary production corresponds to that of hydraulic and nuclear electricity (table 3). One passes to the Gross inland consumption by adding the imports and by withdrawing exports, then with the Gross inland consumption normal of primary energy by taking account of the climatic corrections then finally with final energy consumption by excluding consumption from the branch energy but by adding the public thermal power stations production of electricity starting from coal. Thus, the Gross inland consumption of primary energy is a net consumption in energy balance sheets. This one milked any energy production starting from another energy (thermal production of electricity starting from coal for example) like a negative consumption.

Table 3

Electricity balance sheet (year 1995) ***unit : Mtoe***

aggregates	primary prod.	import.	export.	gross inland cons. actual	cor. clim.	gross inland cons. normal	prod. of elect. coal	cons. of branch elect.	final cons. normal	final cons. actual
	100,8	0,6	-16,1	85,3	0,9	86,2	-8,7	17,6	77,3	76,4

Source : French Observatory of energy

In the balance sheet of table 4, certain boxes include two digits. For electricity, internal consumption includes those of the power stations (auxiliary and transformer primary education) as well as the electricity used for the water raising (consumption of pumping) (5,78 mtoe in 1995).

3) Conceptual and statistical link with the input-output table of the central framework (commodity flows)

. At first, in the balance sheet of energy, the stock changes are affected of a sign (-) in the event of storage and of a sign (+) in the event of restocking in the energy balance sheet. Conversely, in the commodity flows, the domestic market includes the inventory changes which are positive when there is storage and negative when there is restocking.

. In addition the distribution losses, excluded from the national accounting, are included in the physical balance sheets.

. On the other hand, industrial subcontracting that one finds in the commodity flow of national accou ts of the oil refining or the production of heat in is excluded thus that the internal exchanges from gas between the various companies.

. Moreover, to compare energy balance sheet and commodity flows from national accounts of energy, we must keep in mind that uses are valued at purchasers' price so the share of oil refining among the whole energy are most important in the commodity flows because uses include taxes on product.

. Also let us note that the energy balance sheets published until now undervalue actual consumption of renewable energies (solar heat, geothermal energy, biomass, wind energy, hydroenergy). In particular, they do not integrate the production of heat, included in the classifications of the national accounting.

Table 4

French energy balance sheet ***unit : Mtoe***

	COAL		PÉTROL		GAS		ÉLECTR.		ÉNERGY	TOTAL
	hard coal	coke	crude oil	refinery petrol	Natural	derived gas	output	Consumption	RENEWABLE	
SUPPLIES										
Primary production P	5,11		2,49	0,61	2,78		H : 17,03 N : 83,75		4,20	115,97
Imports	8,34	0,66	78,02	27,44	27,97	-	0,63			143,06
Exports	-0,27	-0,24	-	-14,48	-0,61	-	-16,14			-31,74
Stocks (+=dést., -=stockage)	+1,15	-0,09	-	-0,25	-0,62	-				+0,19
GROSS INLAND CONS. (Actual)	14,66		80,51	13,32	29,52	-	85,27		4,20	227,48
Independence energy (%)	*34,9%*		*3,3%*		*9,4%*		*118,2%*			*51,0%*
USES										
Cons. of energy branch										
Refineries			79,96	-74,70			-0,41	0,78		5,63
prod. of power stations	5,71	-		1,09	0,54	0,77	-8,30		0,10	-0,09
internal uses of branch	4,93	-4,17	-0,10	0,14 0,10	0,28	-0,72		4,54 5,78		10,78
losses and statistical differenc	0,05	-0,18	0,65	-0,19	0,77	0,20		6,53		7,83
TOTAL (A)	10,69	-4,35	80,51	-73,56	1,59	0,25	-8,71	17,63	0,10	24,15
final energy consumption (climatic corrections)										
iron and steel industry	1,34	3,65		0,12	0,57	1,12 -1,56		2,31	-	7,55
manufacturing industry	1,50	0,46		8,26	9,92	0,11		25,33	0,60	46,18
household and services	0,86	0,42		17,23	15,93	0,04		47,18	3,50	85,16
agriculture	-	-		2,55	0,20	-		0,55	-	3,30
transport	-	-		46,72	-	-		1,91	-	48,63
TOTAL (B)	3,70	4,53		74,88	26,62	-0,29		77,28	4,10	190,82
Final. non-energy consumption										
TOTAL (C)		0,18		13,04	2,11	0,05				15,38
GROSS INLAND CONSUMP. (climatic corrections)										
TOTAL corrected (A+B+C)	14,75		94,87		30,33		86,20		4,20	230,35
whose climatic corrections	*+0,09*		*+1,04*		*+0,81*		*+0,93*		-	*+2,87*

indices of climatic rigor = 0,93 H : Hydro, N : Nuclear

III - THE ENVIRONMENT SATELLITE ACCOUNT

There are several accounting approaches to the environment, all of them focused on the following issues [7], [8], [9], [10], [11] :

- What are the environmental protection expenditures and how are they financed ?
- What is the state of a country's "natural patrimony" ?
- How should the environment be integrated into national accounting?

Far from being antagonistic, these approaches are to some extent **complementary**. In particular, natural patrimony accounting may be viewed as a textbook example of accounts expressed in **physical units**. Many elements such as water, air, and wildlife cannot be assessed in monetary terms. By calculating the ratio of water expenditure to its use by economic agents, we obtain the **average price of water**. Another major aspect is the valuation of **quality**: in a water account, quality is as significant as the available quantity.

Environmental accounting also recognises the importance of physical data as a basis for estimating certain monetary data. For example, the cost of waste treatment can be estimated by multiplying the quantities of waste treated using different processes by the unit treatment costs.

Lastly, an environment satellite account must provide summary indicators, in particular for environmental **stress** (industrial activity, pollution), **conditions** (pollution rate, water quality), and **responses** (cleanup rate, percentage of population with access to water-treatment network). By logic, a highly industrialised country should devote substantial resources to protecting its environment.

As regards the "expenditures/financing" approach, we emphasized in introduction that **the field is complex to define**, and the overall expenditure is thus hard to assess. There are two distinct issues, however, in the field-definition problem. The first is the **identification of specific environmental-protection activities or actions**. The second is the **definition of the field boundary**.

1) defining the field

• The first problem relating to the **field boundary** concerns the use of natural environments, such as water-resource utilisation. Water-resource production and utilisation is not a characteristic activity of water protection. However, as it is often closely linked to

environmental-protection activities, it can justifiably be included as a linked activity of the water-protection field.

In France, water treatment and purification on the one hand, and water-resource utilisation on the other, are administered by the same supervisory organisations at both central and local level, known as "water agencies" (*agences de l'eau*). Another reason for this inclusion is that some treatment and purification programs are financed by water-related taxes and levies.

The **profitability** criterion can also affect the field boundary. Two alternatives are available. The first is to include only unprofitable environmental-protection expenditures, that is, those whose **costs** outweigh the revenues they produce for businesses. This option notably excludes profitable recovery activities, i.e. those in which **the economic value of the waste treated exceeds the treatment cost**. The second alternative is to include all the activities that allow environmental protection.

• As regards the identification of **specific activities**, we saw in §I that most expenditures do not correspond to purchases of products but to **actions** (such as developing "cleaner" products) or programs (natural-park conservancy, water treatment) that are not listed as such in the classification of activities and products, since they consist of **functions**. To return to our example of a soundproofing wall, the characteristic environmental activity is not its construction in itself but the government procurement order for it. The question then arises of whether the capital expenditure of soundproofing-wall producers should be included in national expenditure when those producers also manufacture other products.

The same question arises in connection with certain **anti-pollution investments** incorporated in production processes. Indeed, the anti-pollution component of corporate expenditures is often hard to determine. A company may manage and protect the environment by observing certain pollution-control standards, by **changing its production process**, or by setting up what is known as an **"end-of-pipe"** system such as a sewage treatment plant. As a rule, investments of the second type can be identified. That is not the case with production-process changes involving the incorporation of environmental-protection systems. The only reasonably effective method for handling such systems is to calculate the **additional cost** they generate by comparison with similar techniques that do not meet environmental-protection goals. This approach has been adopted by the INSEE annual survey of industrial firms, which since 1992 has been asking companies to describe their "anti-pollution" activities.

A final issue here is **"clean" products**. To begin with, it is difficult to establish a **list** of clean products. Some specialists argue that the list should be confined to products whose **consumption** produces less pollution. Others want to include products that reduce pollution levels during their **manufacturing process**. Moreover, should the corresponding **capital**

expenditure be recorded for consumed products? The most acute problem, however, is the valuation of the **"surcharge"** involved in manufacturing or consuming a clean product, for it is important not to include the overall value of such products in environmental-protection expenditure.

Typically, the "surcharge" is estimated by comparison with **standard products** that do not comply with pollution standards but provide an equivalent user value. In most cases, however, the user value is not strictly identical—"clean" detergents may wash less thoroughly, "clean" fuels may be less efficient, and so on. Also, the **unit manufacturing cost** may be lower for a clean product than for a "standard" product. How should that decrease be reflected in the valuation of national expenditure? And how should the "surcharge" be assessed when the standard product goes out of production?

2) expenditure and financing

The French environmental account covered six fields: management of continental waters (including water-resource production and utilisation), national parks, regional natural parks, waste disposal and recovery, hunting, and maritime-area protection. Definition of the environment field was based on the classification of the Environment Ministry's "environmental" programs, which lists budget allocations by area of action. The programs cover the exploitation of the natural environment, the prevention of environmental degradation, the conservation of the environmental patrimony, improvements in the quality of life, and general environmental administration. This option is a compromise between the minimalist approach (i.e. including only action programs specifically targeted at pollution) and the maximalist approach (i.e. including urban planning and regional development programs).

The French environment satellite account compiles two tables for each sub-field. The first table summarises the accounts of characteristic-activity producers broken down by sub-field. The second is a "financing-performance" table of domestic and national expenditure. Accordingly, the waste-recovery satellite account classifies producers into two categories: The first, "merchants, recovery contractors, scrapping contractors," represents the "long" recovery cycle. The second category consists of the waste-producing industries themselves, representing the "short" recovery cycle. Domestic expenditure is shown by total production costs of the field's characteristic producers. On average, the basic information is of uneven quality. The Environment Ministry makes a fairly accurate estimate of environmental investment expenditures of general government. By contrast, the operating expenditures of general government are much harder to determine

3) natural patrimony accounting

France have also compiled a **natural patrimony accounting**. It present the passage between the opening stock and the closing stock using a nomenclature of natural flows and operations of the human agents. One can establish, for a theoretical element located on a given territory, change-in-balance-sheets account.

a) Forest account

For forest, one retains two units for the accounts (table 5). Surface makes it possible to define the rate of timbering " wooded area/ total area": thus, in France, wooded surface passed from 10 million hectares to 14 million in one century (1878 -1990) and the rate of timbering of 17 % to 25 %. The other indicator is " total volume on foot ", expressed in " m3/écorce ". One thus estimated in 1990 at 1626,6 million " m3/écorce " the stock of the total volume of the French forest.

Table 5

Example of forest account of France (1980/1990)

1 - forest-area (« hectares »)

USES		SUPPLIES	
Clearing	50	OPENING STOCK	13 420
		Natural growth	355
FINAL STOCK	13 875	Timber out of forest	150

2 - volume unit (« m3/écorce »)

USES		SUPPLIES	
Mortality and destruction natural exceptional	13 200	OPENING STOCK	1615000
Field Crop	39 680	Natural growth	64 500
Net Natural growth	11 620		
CLOSING STOCK	1626620		

b) water account

For water, one distinguishes two types of accounts (table 6) :

. An " input-output " table of the cycle of water, conceived on the same principle as the « input-output ». national accounting of the central framework, details the elementary systems of circulation of water in nature and their internal transfers and records the operations of taking away and return (rejections, irrigation) which connect this cycle to the system of use: primary taking away (which correspond to the use by the economic agents), evaporation and flow (either towards the sea, or worms of other territories) which one gathered here in " various outputs ". Thus all the gross annual disposability of the interface ground-atmosphere " leaves " in evaporation (50,0 in table 5).

In this table, one finds the two significant agregates of the accounts of natural inheritance : the the gross annual disposability is equal on the whole of the resources making it possible to carry out various final employment without attacking the opening inventory; the other significant aggregate is rross accumulation (or net). One distinguishes two types of accumulation: accumulation coming from the natural environment and accumulation in the system of use. Total accumulation is the sum of both.

. An account of use of the water, which functions in " double part " with respect to the precedent, specifies which economic agents (agriculture, industry, households...) carry out these operations and details the exchanges of water which intervene between them. For example, the farmers use for 4,5 of water, including 0,2 products by the drinking water distributors.

This table also shows how the farmers use water : it is used for the irrigation for 3,5, the remainder (1,0) going in " losses and escapes ". The water returns or rejections " are thus reallocated " in the dial of the total resources of table " input-outputs ": the largest share goes to the rivers (23,0).

Table 6

Input-Output table of continental water (year 1995 : France) * units : billion of m3

	Flows		interf.	ground	rivers	others	total	primary	finals	net .	total
			ground atmos.	+ Plant cover			interm consu..	withdrawals.	uses	accum	uses
Elements											
			section "internal transfers"				section " final uses"				
ground-atmos.				380,1	121,9		502,0		50,0		552,0
Plant cover						130,7	130,7		252,9		383,6
rivers						10,4	10,4	30,6	281,7		322,7
others					138,8	0,5	139,3	6,6	2,1	22,6	170,6
total				380,1	260,7	141,6	782,4	37,2	586,7	22,6	1428,9
			section "total supply"								
raining			552,0		1,0	22,0	575,0				
external contribu.					38,0		38,0				
water come-back					23,0	7,0	30,0				
irrigation				3,5			3,5				
total supplies			552,0	383,6	322,7	170,6	1428,9				

Account of uses of ground water

	interm.	entries	total	distr.	agricul.	others	total	water	irrigat.	exit	total
	cons.	uses	entries					come back	others exit	water	exit
water-distribution	0,6	5,6	6,2	0,5	0,2	3,6	4,3	1,9		1,9	6,2

agriculture	0,3	4,2	4,5				0,0	1,0	3,5	4,5	4,5
others	6,0	27,4	33,4	0,1	0,1	2,4	2,6	27,1	3,7	30,8	33,4
total	6,9	37,2	44,1	0,6	0,3	6,0	6,9	30,0	7,2	37,2	44,1

Source : see [7],

(*) "aggregate GROSS ANNUAL AVAILABILITY" = 1428,9 - 782,4 = 646,5

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