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45 indicators of sustainable development: a contribution from Ifen

(Extracts from:
"45 indicateurs de développement durable : une contribution de l'Ifen",
realised by Cécile Dormoy)

institut français de l'environnement

45 INDICATORS OF SUSTAINABLE DEVELOPMENT: A CONTRIBUTION FROM IFEN

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INTRODUCTION

Sustainable development, from Stockholm to Rio

The origins and characteristics of the sustainable development concept as it has emerged today are rooted in international policies for the environment.

In 1972, the United Nations Conference on the Human Environment in Stockholm, adopting the motto "One Earth", issued a declaration and an action programme and established a new institution, the United Nations Environment Programme or UNEP, to take charge of oversight. The conference was held in a context where "growth" [1] was taxed with being "unsustainable", meaning that in order to support continuing growth, raw materials and food resources were being extracted from the planet's natural environment at a rate that it could not sustain indefinitely. The impacts of pollution on human health were already considered to be a matter of concern.

Twenty years later, by the time the United Nations Conference on Environment and Development (UNCED) was organised in Rio, ecology had become an increasing imperative in economic development.

Since 1972, policies have been developed and ministries established to address sustainable development [2], fuelling hopes that the Summit had signalled the coming of age of international environment and development policy - hopes that gained in strength as, in 1980, the World Conservation Strategy, developed by the UICN (World Conservation Union) introduced the concept of "sustainable development" for the first time [3]: "*the aim of the World Strategy for Nature Conservation is to contribute to sustainable development by preserving living resources*". In addressing the issue of the carrying capacity of ecosystems, the UICN drew on the model of economics: "*in a sense, sustainable use is like using the interest on an investment without touching the capital. A society that requires all uses of living resources to be sustainable is making sure it will enjoy the benefit of those resources virtually indefinitely*" [4].

Development issues were included in the strategy, foreshadowing what would later appear in the 1987 Brundtland Report (*Our Common Future*). Although it was written primarily for decision-makers at all levels, this report from the World Commission for Environment and Development was aimed at a broad readership. Briefly, its arguments are based on the idea that not only can economic growth harm the environment, but ecological damage can in turn jeopardise economic growth. Furthermore, developing countries are forced to overexploit their own resources to compensate for the industrialised countries' overuse of their own. The economic interdependence of nations thus goes hand in hand with their ecological interdependence. Conflicts over resource management then become likely, giving rise to hostilities whose consequences can be catastrophic both for humans and ecosystems. Finally, the Brundtland report stresses that if current patterns of development continue unchanged, "future generations" may well be deprived of the vital natural capital they would need to satisfy their needs.

As a "*pool of analyses and arguments that aims to forge alliances with a view to mobilisation*" [5], this document seeks to make strong connections between development and the environment and to stress their inseparable nature.

In 1992, the United Nations Conference on Environment and Development held in Rio de Janeiro was prepared with the Brundtland report as a basis. Three official documents were adopted, the Rio Declaration on Environment and Development, Agenda 21 and the Declaration on Forests. Two international conventions were sent to participating countries for ratification: the United Nations Convention on Biodiversity and the United Nations Framework Convention on Climate Change.
The key concept of the world summit was as follows: if we are to pursue the development of our planet without jeopardising the rights of future generations, development policies must simultaneously encompass all the economic, social and environmental components of the activities that ensue from them.
Agenda 21 is a plan which, if it were put into practice, would create a new generation of institutions with responsibility for worldwide policy-making and governance. It is a guide to the management of our environment that offers political leaders a way in to the integration of ecological and socio-economic issues.

(1) Meadows and al, 1972. *The limits of growth*. Universe Books, NewYork, 1972.

(2) France and The Netherlands established their Ministries for the Environment in 1971, after the creation of the US Environmental Protection Agency (EPA) in 1969.

(3) According to the journal *Problèmes économiques* (n°2764, 5th June 2002), the term "sustainable development" originated in Prussian sylviculture in the 18th century. The concept holds that "*any use of natural resources must ensure that the quality and quantity of agricultural and forest yields remain sustainable*".

(4) and (5) Edwin Zaccaï, 2002. *Le développement durable, dynamique et constitution d'un projet* (Sustainable development: the dynamics and forging of an idea). Brussels, EIE, Peter Lang.

Definitions of sustainable development

Brundtland Commission (1987)

"Sustainable development is a form of development that meets the needs of the present without compromising the ability of future generations to meet their own".

From the 27 principles of sustainable development as declared at the Rio Summit in 1992:

- *"Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature"* (principle 1);
- *"The right to development must be fulfilled so as to equitably meet the developmental and environmental needs of present and future generations"* (principle 3);
- *"In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it"* (principle 4).

French Environment Code

L. 110-1. *"Natural areas, resources and habitats, sites and landscapes, animal and plant species and their diversity and the biological equilibrium to which they are necessary are all part of the nation's shared heritage. Protecting, enhancing, restoring, rehabilitating and managing these features are a matter of common interest and contribute to the objectives of sustainable development, of which the aims are to satisfy the development needs of our generations without jeopardising the ability of future generations to satisfy their own. Within the framework of the laws defining their scope, these actions are based on the following principles: the precautionary principle, the principle of preventive and remedial action, the polluter-pays principle and the principle of participation".*

French Government Charter for the Environment

"Public policies must promote sustainable development. To this end, they must take environmental protection and enhancement into account, and reconcile them with economic and social development" (Article 6).

From the 1990s to advances at the Johannesburg Summit

The late 1990s saw the emergence of a new series of initiatives for sustainable development, particularly within the EU and the Organisation for Economic Cooperation and Development (OECD). A sustainable development strategy was adopted by the EU at the Göteborg Council Meeting in June 2001. The OECD's plans for sustainable development, which were launched in 1998, have been set out in two major publications [6]. They also led to an OECD Council Meeting, in May 2001, between ministers of economics and finance and ministers of the environment, who reasserted on this occasion that sustainable development is a fundamental objective for the governments of member countries and for the OECD itself.

At the Johannesburg Summit, the United Nations General Assembly was given a mandate to review the actions undertaken since the Rio Agreements, and to define new measures to provide for their enforcement. The Summit also called on participants to list the areas where measures need to be strengthened and to highlight new challenges and opportunities. The Johannesburg Summit was convened in order to draw attention to the need to reconcile economic interests with social and ecological concerns, and to boost international commitments to sustainable development. In these respects, the negotiators have fulfilled their mandate.

The undertakings made at the summit include the following: to halve the number of people living on less than one US dollar a day by 2015; to improve access to sanitation for the 2.4 billion people who currently live without; to reduce the rate of biodiversity depletion by 2010 and to maintain and restore fish stocks to levels that allow sustainable fishing by 2015.

Finally, emphasis should be laid on the role of the supporting measures (known as "Type II Initiatives") [7] proposed by groups of countries, businesses and participants in civil society, which involve substantial financial commitments. These are the measures which should allow the objectives set out in Johannesburg to be met, in particular through the multilateral policy commitments negotiated by the governments.

How should sustainable development be measured?

In the Rio Summit's Agenda 21, an entire chapter is devoted to the issue of information to support policy making (Chapter 40). Two objectives are set out:

- To bridge the existing data gap ;
- To improve information availability.

(6) OECD, 2001. *Policies to enhance sustainable Development*. Paris, OECD, 108 p. and OECD, 2001. *Sustainable Development: Critical issues*. Paris, OECD, 420 p.

(7) These are initiatives designed to supplement the "Type I" initiatives adopted by governments.

Particular emphasis is laid on the need for indicators of sustainable development: "*Commonly used indicators such as Gross National Product (GNP) and measurements of individual resource or pollution flows do not provide adequate indications of sustainability. Methods for assessing interactions between different sectoral, environmental, demographic, social and developmental parameters are not sufficiently developed or applied.* ***Indicators of sustainable development need to be developed*** *to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems*".

The most outstanding initiative that followed on from the recommendations in Chapter 40 of Agenda 21 came from the United Nations Commission on Sustainable Development in 1995. This was a work programme covering a list of about 134 indicators of sustainable development, which were organised into three types: "driving forces", "states" and "responses". "Driving force" indicators are those which illustrate human processes and activities having an effect on the sustainability of development. "State" indicators are used to review factors of sustainability in development processes, while "Response" indicators reflect the policies and measures taken in response to the way development is proceeding.

The relevance of this list of indicators and their ability to be expressed in figures were tested by a number of candidate countries (France, Finland, Belgium, Austria, Germany and the United Kingdom) in partnership with developing countries (Tunisia and Morocco worked with France, for example).

In France, IFEN received a mandate from the Ministry for the environment to contribute to the test [8]. Three conclusions were submitted to the United Nations:

- Half of the indicators were not very meaningful with respect to the concept of sustainable development as defined in the Brundtland report;
- The absence of ranking between indicators was a problem for users ;
- Juxtaposing the three dimensions of sustainable development makes it impossible to discern links of cause and effect between them.

Other initiatives emerged, for example from the OECD and other developed countries.
The idea was to sketch out possible indicators to monitor sustainable development plans or strategies, compiling them into "trend charts" that could be used to monitor progress towards the standards or objectives set out in approved documents.

Working method

While applying to test the method put forward by the United Nations, IFEN undertook, as from June 1997 [9], to build up a set of much more specific indicators that would enable it to reply as coherently and with as much information as possible to the question put by the National Commission on Sustainable Development: "*how far - if at all - has France progressed towards a form of development that may be considered sustainable?*"

To reply to this, we believed that we needed to innovate in terms of both the design of indicators and the method used to build them. These innovations may be summed up in two main points:

- In defining the concept of sustainable development, priority is given to the issue of our "**legacy to future generations**";
- The choice of a method that is at once consistent and open-ended (by alternating relatively prescriptive parameterisation phases with consultation phases that were open to a broad spectrum of scientists and practitioners).

Choosing the vital lead: the Brundtland report's definition and the issue of our legacy to future generations

In many of the countries which have attempted to build up indicators of sustainable development, the experts called upon have often chosen either to "recycle" conventional environmental indicators or merely to add on social or economic data with no real concern for integration [10]. However, we felt that in order to translate the definition of sustainable development set out in the Brundtland report ("*a form of development that meets the needs of the present without compromising the ability of future generations to meet their own*") into quantified data, the one overriding issue that would have to be addressed would be that of intergenerational arbitration, in other words our legacy to future generations.

Even though we cannot define what the needs of future generations will be, it can be assumed that they are all the more likely to be capable of satisfying them if:

- today's generations exercise care and efficiency overall in their patterns of production and con-

(8) IFEN, 1998. *Test des indicateurs de développement durable des Nations unies* (Testing United Nations Indicators of Sustainable Development, Report produced by France). Orléans, IFEN, 410 p. (coll. *Etudes et Travaux*, 17).
(9) IFEN, 1997. *Indicators of sustainable development: a synopsis of work abroad and key points for discussion*. Orléans, IFEN, 72 p. (coll. *Notes de méthode*, 8). Of particular note is Jacques Theys' presentation of the method: "We need to agree on the architecture before we start laying bricks".
(10) For experiences in other countries, readers are referred to the synopsis written by Cécile Rechatin in n°8 of IFEN's methodology notes series, mentioned above.

sumption (which implies that growth has to be "uncoupled" [11] to some extent from resource use and generated pollution) ;
- we preserve and develop (in terms of both quantity and diversity) our natural capital and heritage, especially those components that are considered **"critical"** [12] ;
- we close the widening gap between the needs and aspirations of the most vulnerable social groups and their actual fulfilment ;
- our behaviour patterns and institutions reflect a strong collective preference for the future as well as effective capacities for response to accidental or unforeseeable events;
- the interconnections between local and global concerns are effectively addressed.

The central aim of the indicators proposed by IFEN is to compile, for each question, a set of assumptions that are sufficient for the purpose of making a global assessment as to whether France, when it comes to intergenerational arbitration, is developing sustainably or unsustainably. On questions such as this, the diagnosis can never be categorical, or even synoptic: the idea is to compile quantified information that is as reliable as possible.

The fact that priority has been given to the problems of future generations does not mean that other important aspects of sustainable development have been deliberately left aside. The **linkages between what are known as the "three pillars [13]" of sustainable development - economic, social, and environmental** - are also explicitly addressed, albeit with an overriding concern to integrate the three aspects. Hence the emphasis we have placed, for example, on indicators of "uncoupling" or on hopes of addressing the issue of "ecological inequality" in the future.

Finally, special attention is given to the question of **links between different scales of reference**. Although the indicators put forward by IFEN are mainly for use at the national scale, we have also suggested that information should be compiled to characterise patterns of interconnection between national and global scales, and between national and local scales (such as France's contribution to the greenhouse effect as well as inequalities and risk concentrations within its own territory).

(11) For any given utility produced, the aim is to minimise both the resources used, especially those which are "critical" (scarce, irreplaceable, etc.) and the most important risks involved for future generations (potential disasters, cumulative risks, etc.).

(12) "Critical" capital is capital whose disappearance would gravely jeopardise development for future generations. Capital of this kind is always of strategic importance, vulnerable and impossible to replace with anything else.

(13) The United Nations and other institutions add "governance" as a fourth institutional dimension that addresses the capacity of societies to respond to sustainable development challenges through public policy tools.

The outcome of all these considerations is a list of "specifications" for indicators of sustainable development, which can be summed up into five major characteristics: specificity, the ability to highlight intergenerational arbitration, a clear concern for the integration of economic, social and ecological dimensions, geographical multidisciplinarity and, finally, transparency (hence the decision not to use aggregate indices like "green GDP"). This was the initial ambition.

Methodology - meeting the dual requirement of consistency and openness

A tool for consistency: the modular approach

To meet the specifications given above and avoid inconsistencies, it soon became clear that the only realistic solution was to **build up the indicators around modules, each having specific characteristics but all linked to each other through a common framework**.

The proposed structure has **ten modules**. These have been defined to help assess how far a given aspect of development dynamics (modules 1 and 2) is likely to satisfy the needs of present and future generations (modules 7 and 8) thanks to the timely renewal of different kinds of capital and heritage (modules 3 and 4). Geographical aspects as such are taken into account through dual linkages between national and global scales (module 6) and national and local scales (module 5).
Since the object is to build up indicators of the sustainability of development, particular emphasis has been placed on the long term. Two approaches were used here: firstly, measurement of the implicit preference given to the future in today's behaviour patterns (module 9); secondly, an attempt to assess individual or collective capacities to react to unforeseen circumstances (vulnerability to risks) (module 10).

The first two are central to the framework thus constructed: this where we are seeking more specifically to assess the "overall performance" of development trends, in terms of both economic growth and the long-term preservation of environmental quality (residual pollution and extraction of "critical" resources) and employment. In this case, more emphasis has been on indicators of "uncoupling" between the environment and growth (module 1), but also on measuring the integration of the environment (or the social dimension) in production and consumption systems (module 2).
The point is to bring out the tensions or, conversely, the mutually reinforcing aspects between the three "pillars" of development: the economy, social issues and ecology. This is also true, to a lesser extent, in modules 7 and 8, with which we seek

to measure the distances between the perception and fulfilment of needs - distances that are at once objective (module 7) and subjective (module 8). However, attempts made in this area to bring out accumulated inequality - in economic, social and environmental terms - were not successful.

Despite its complexity, the modular structure has a number of advantages:

- Although the structure as a whole is complex and open to discussion, **each individual module is inherently uniform** and consistent, and **can easily by summarised in one or two key words or simple questions**: in module 1, for example, is there a tendency or not to **uncouple** growth from the environment or growth from employment, and therefore, is there a trend or not towards development that is more effective overall in terms of added value, employment and environmental quality?
- The second advantage is the overall coherence of the system: even though each module can be considered independently, they are all closely interlinked, with the output from one becoming the input to another. We have avoided the classic solution, which involves adding different indicators together (economic, social and ecological) without building true composite indicators;
- The third advantage is flexibility: the different modules can be developed either to meet the specific needs of different users, or in accordance with a strategy for gradual implementation.

Nevertheless, the modular structure also has two rather important disadvantages:

- It necessarily produces a large number of indicators, which adversely affects its readability in general;
- It provides no guidance as to ways of ranking or aggregating indicators, which raises problems downstream with the **overall evaluation** of all the data collected.

We felt, however, that for immediate purposes, the advantages of the method should outweigh its two disadvantages provided that a rigorous and open approach is adopted in selecting indicators.

(14) See IFEN Note on methodology n°8, mentioned above.

(15) IFEN, 1999. *Les indicateurs de développement durable - métohodes et perspectives* (Indicators of sustainable development, Methods and perspectives). Orléans, IFEN, 145 p. (coll. *Etudes et Travaux*, 24).

(16) IFEN, 2001. *Propositions d'indicateurs de développement durable pour la France* (proposal for indicators of sustainable development for France). Orléans, IFEN, 106 p. (coll. *Etudes et travaux*, 35).

(17) In accordance with the conclusions of a government seminar held on 28 November 2002, a work programme was carried out under the aegis of the National Planning Commission. The outcome was the publication, in 2004, of a list of indicators resulting from in-depth groundwork at the interministerial level : Ministry of ecology and sustainable development, 2004. *Indicateurs nationaux de développement durable : lesquels retenir ?* (National indicators of sustainable development: making the right choice). Paris, La Documentation française, 236 p. (coll. *Réponses environnement* - Environment Responses).

Selecting indicators: an open-ended approach

Having defined the framework, IFEN's approach to the selection of indicators involved alternating internal work phases and external consultation phases. The process, which lasted for nearly three years, took place in five main stages:

- The first stage was to define "specifications" and a methodological framework [14];
- The framework was then submitted to the scientific community for validation and further suggestions [15];
- Based on the suggestions put forward by the scientific community, a preliminary table of nearly 300 indicators (about thirty for each module) was proposed by an internal IFEN working group [16];
- IFEN then organised a consultation to select about 45 of these, **taking into account the potential for quantifying the indicators selected**;
- The final stage was devoted to the quantification of the chosen indicators, as described in this document.

Work in progress

At this stage in the process, the provisional nature of the list of 45 indicators proposed by IFEN needs to be clearly emphasised:

- The indicators selected are by no means exhaustive: they have merely been chosen to illustrate the problems at issue in each module and are to be read or assessed in that light;
- Given its institutional position, the IFEN has tended to emphasise indicators with an environmental dimension. The work should therefore to be seen as a contribution to efforts on indicator development that can only be undertaken within an inter-ministerial framework [17];
- The final selection of indicators was severely constrained by the information available. Aspects that are of great importance *a priori*, such as trends in ecological inequality or the economic and ecological vulnerability or areas to risks have not been fully taken into account for lack of quantified data.

The following document is therefore in no way intended as a definitive conclusion to ongoing discussions on indicators of sustainable development, but rather as a means of opening up the debate as productively as possible - which necessarily means conducting further statistical studies in the future.

Thierry Lavoux (*), Jacques Theys (*)

(*) respectively Head, Synopses Department and Scientific Director when this work was realised.

THEME 1

Sustainable growth

One of the main challenges of sustainable development lies in the ability to generate long-term, enduring growth. Creating wealth thus appears to be a prerequisite for development and of economic and social progress. However, growth has to be such as to allow the preservation of capital stocks (human, economic and natural) and for wise management of the natural heritage.

Theme 1 aims to characterise society's productive activity from the angle of sustainability. Indicators on this topic therefore have to provide answers to two questions:

- *What evidence is there of coupling or uncoupling between economic growth and growth in the use of capital or resources? Can "eco-efficient" growth be ensured?*

- *Is the organisation of productive structures being improved with respect to the environment?*

MODULE 1: "Eco-efficient" growth.

MODULE 2: Integrating the environment into the production structure.

HOUSEHOLD WASTE PRODUCTION AND INCOME

Relevance

Sustainable development depends primarily on uncoupling economic growth from pressures on the environment. This requires more rational use of natural resources and materials in production systems, but changes in consumer behaviour also have to take place.

To reflect changing lifestyles and consumption patterns, trends in household waste production are analysed with respect to one of the components of economic growth, i.e. household purchasing power estimated through gross disposable household income.

Analysis

According to available estimations, household waste production increased sharply over the last twenty years from about 300 kg per capita in the early 1980s to about 450 kg per capita (some 27 million tonnes) in 2000. The change is largely accounted for by the increase in quantities and use of packaging, mostly in the food sector. According to a CREDOC survey for the ADEME covering 1979-1999, each inhabitant of France was throwing away 126 kg of food packaging in 1999 as against 88 kg in 1979.

From 1980 to 1993, household waste production increased much faster (4% per year) than household income (1,7% per year). From 1993 to 2000, household waste production continued to increase, though at a slower rate (+10% over the whole period), closer to household income growth. The new trend could be linked to policy changes and to new production methods (reduced packaging at source, for example).

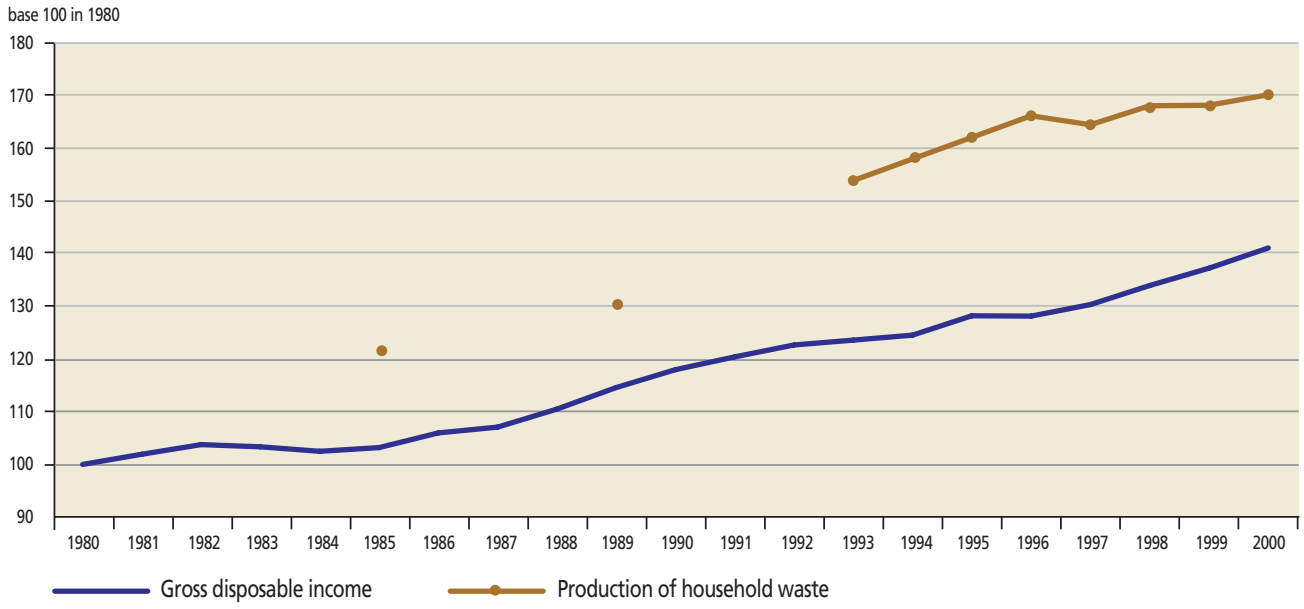
Nevertheless, caution is needed in interpreting the new trend, especially in view of the gradual improvement in the statistical coverage of household waste treatment centres, which has only been exhaustive since 1993. Consequently, the trend in quantities of waste produced until 1993 may have been slightly overestimated.
It does appear, however, that there is no clear correlation between household income and the quantities of waste produced, which tends to strengthen the assumption that more "qualitative" factors are at work, such as changes in lifestyle and consumption patterns.

The declared aim, at EU and national level, of reducing quantities of waste has therefore not been achieved. In most European countries, household waste production is still increasing, generally at a faster rate than growth.

European Union strategy for sustainable development

The priority objective set out in the EU's sustainable development strategy is to "*break down the links between economic growth, use of natural resources and waste production*".

INDICATOR : Household income and production of household waste



Gross disposable income volume (euros at 1995 prices).
Production of household waste in the broad sense (i.e. including waste from enterprises collected with household waste) in millions of tonnes.
Source: INSEE, National Accounts - ADEME.

For more information

- ADEME, 1998. *Atlas des déchets en France* (Atlas of waste in France) Paris, ADEME, 23 p. (coll. *Données et références*).
- Poquet G., 2001. "*Nouveau regard dans nos poubelles*" (A different view of dustbins), *Consommation et modes de vie*, n° 152, July 2001, 4 p.
- Ronconi M., 2001. *Measuring progress towards a more sustainable Europe - Proposed indicators for sustainable development - Data 1980-1999*. Luxembourg, Eurostat, 167 p.

Methodology

Household waste in the broad sense includes waste from small enterprises that is collected along with it. Estimations are mainly based on the ADEME's inventory of installations for the treatment of household and similar waste (ITOMA - *installations de traitement des déchets ménagers et assimilés*). The *questionnaire* covers treatment centres for household and similar wastes as well as authorised landfills with a capacity of 3 000 tonnes per year and more, particularly as to the quantities of household and similar waste they receive.

Organisations

ADEME: French Agency for Environmental and Energy Management.

CREDOC: Research Centre for Studies and Observations of Living Conditions .

EUROSTAT: Statistics Office of the European Communities.

INSEE: National Institute of Statistics and Economic studies.

Units

Kg: kilogramme.
Per capita: per inhabitant.

THEME 2

Critical heritage and resources

Sustainable development depends on the preservation and enhancement of our economic, natural, human, institutional and cultural heritage. Some aspects of our heritage have become "critical" in terms of the extraction or releases to which they are subject, and sometimes in terms of their symbolic character. We have to ensure that they are maintained and enhanced for the benefit of future generations. To do so, the pressures exerted on these forms of heritage by human activities have to be limited. Technical advances (in recycling, substitution, etc.) are implicitly required here to ensure that we are able to recover enough room for manoeuvre in the use of our heritage.

The chosen indicators are designed to illustrate:

- *The extent to which our heritage and resources are being exploited in view of available stocks, in order to assess the sustainability of development patterns;*

- *The state of "critical" heritage and capital, in order to assess the value of our legacy to future generations.*

MODULE 3: Sustainable use of resources.

MODULE 4: Maintaining and transferring our heritage.

CHANGES IN ARTIFICIALLY SEALED LAND

RELEVANCE

Because it is generally irreversible, the increase in artificially sealed land is a negative legacy to future generations. Man-made landscape alteration has multiple effects on the environment: encroachment over fragile areas such as coastlines, grasslands and wetlands, losses of natural and agricultural resources, fragmentation of natural habitats through infrastructure construction - creating obstacles to the movement of various fauna species - increasing impermeability of soils and a consequent increase in flood risks, blighted landscapes, etc.

The artificially sealed areas under consideration include built-up areas, roads and car parks, as well as other non-built areas such as building sites, landfills, quarries and amenity parks and gardens.
The chosen indicator shows changes in artificially sealed land, illustrating the increasing pressure of urbanisation and infrastructure development in comparison to the increase in population from 1982 to 2001.

ANALYSIS

In 2001, artificially sealed areas covered 43 685 km^2, or 8% of mainland France. Roads and car parks accounted for 39% of these areas and built-up areas for 25% (*Source : SCEES, TERUTI survey*).

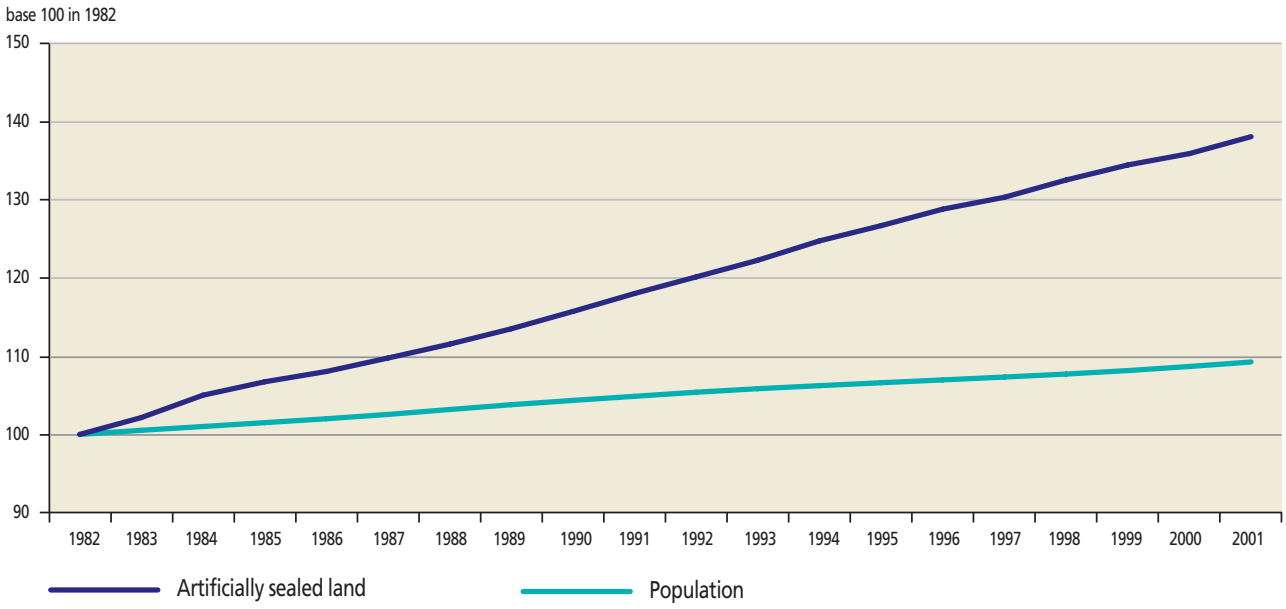
The extent of artificially sealed areas rose sharply (+38%) from 1982 to 2001, encroaching mainly on agricultural and natural areas.

In the last decade (from 1992 to 2001), the total artificially sealed area increased sharply, by almost 15%. Areas built up for individual housing rose by 20%, areas planted with amenity parks and gardens linked to housing developments rose by 18% while the area covered by roads and car parks increased by 11%. This trend, which reflects growing urban sprawl, is less a result of demographic growth (the population increased by only 3% over the same period) than of a higher standard of living and societal changes, and particularly a desire for more living space among many city-dwellers. Urban sprawl is a factor of increasing environmental stress, however, as it creates ever more demand for transport and infrastructure.

EUROPEAN UNION STRATEGY FOR SUSTAINABLE DEVELOPMENT

In its conclusions set out on the 3rd December 2001, concerning key environmental indicators for sustainable development to enable it to monitor progress in implementing the EU strategy for sustainable development, the Council of the European Union recommends the use of an indicator on changes in land use by major categories (extension of built-up areas, for example), among the indicators listed for development.

INDICATOR: Changes in artificially sealed land and population



Artificially sealed zones (in km²) : series stopped in 1991, mainland France.
Population: average population between two consecutive January 1st

Source: Ministry of Agriculture, Food, Fisheries and Rural Affairs (SCEES), Teruti survey, physical nomenclature - Insee, National accounts.

For more information

- European Environment Agency, 2002. "Land" in *Environmental Signals 2002 - Benchmarking the millennium*. Copenhagen, EEA, pp. 106-1133. (coll. *Environmental assessment report*, 9).
- IFEN, 2003. "*Ville et agriculture : dialogue ou monologues ?*" (Cities and farms: dialogue or monologue?), *Les données de l'environnement*, n° 81, 4 p.
- IFEN, 2003. "*L'artificialisation s'étend sur tout le territoire*" (Changes in artificially sealed land are affecting the entire territory), *Les données de l'environnement*, n° 80, 4 p.

Methodology

The data on artificially sealed areas are from the TERUTI survey carried out by the Ministry of Agriculture's statistics department (SCEES). The operation is carried out annually, using aerial photographs and ground surveys, to produce land use data over grids with 36 points 300 metres apart. Each year, the survey describes 15 500 grids, covering 1/10th of the territory of France.

Organisations

IFEN: French Institute for the Environment.

SCEES: Central Office for Statistical Studies and Surveys (Ministry of Agriculture).

INSEE: National Institute of Statistics and Economic Studies.

Units

Km² : square kilometre.

THEME 3

The spatial dimension and the global perspective

The sustainability of development is of concern at every geographical scale, from local to global.
Our third theme addresses the geographical dimension of development, in terms of distribution across France (spatial distribution of population and of environmental pressures or risks), but also in terms of France's role in the world with regard to poverty reduction, to the preservation of the world's natural resources and to world governance.

The indicators have been selected to answer the following questions:

- *Are we seeing any concentration of spatial inequalities (economic, social and environmental) across France?*

- *What role does France have in global regulation? What is France's contribution to worldwide environmental concerns such as control of the greenhouse effect?*

MODULE 5: Inequality and spatial distribution.

MODULE 6: Relationships between France and the rest of the world.

OFFICIAL DEVELOPMENT ASSISTANCE

RELEVANCE

Ensuring fair treatment within a given generation - which requires that the industrialised countries contribute to development in the South, mainly by providing technical and financial aid - is one of the principles of sustainable development. The amounts of aid are partly dictated by rules governing the funding of multilateral organisations and institutions and the mandatory contributions they require from their members, but they also depend on national priorities.

Official Development Assistance (ODA) is defined as the net amount of donations and loans awarded, under preferential conditions, by public bodies to the countries and territories listed as beneficiaries by the OECD's Development Assistance Committee (DAC). As well as financial contributions, ODA also includes technical cooperation.

Reducing poverty worldwide is the core objective of development assistance, to which all DAC members are committed (*Source: OECD, 2001*). The *DAC's Guidelines on Poverty Reduction* define priorities for action and criteria for awarding aid which combine the economic, social and environmental aspects of sustainable development.

ODA is made up of bilateral and multilateral aid. Bilateral aid is the portion of ODA which is awarded directly by the government in question to partner countries. There are various forms of bilateral aid, including donations or loans at preferential rates to finance capital investments, technical assistance, budget support, food aid and emergency aid. Multilateral aid covers all ODA contributions to international organisations having States as members and whose activities are partly or wholly concerned with development. These include multilateral development banks, United Nations institutions and regional organisations. ODA does not include donations, loans or credits awarded for military purposes.

ANALYSIS

Despite repeated undertakings made by France to international bodies, French ODA has been dropping consistently over the last few years, both in terms of financial volume and as a percentage of Gross Domestic Product (GDP). The ratio of French ODA to GDP fell from 0.57% in 1992 to 0.34% in 2001. Of all DAC member countries, France has made the largest reductions in its ODA since 1994. In 2001, France paid out 4.8 billion euros in ODA, or 0.34% of its GDP.
It should be noted that aid amounts were artificially overestimated until 2000 because calculations included transfers to French overseas areas.

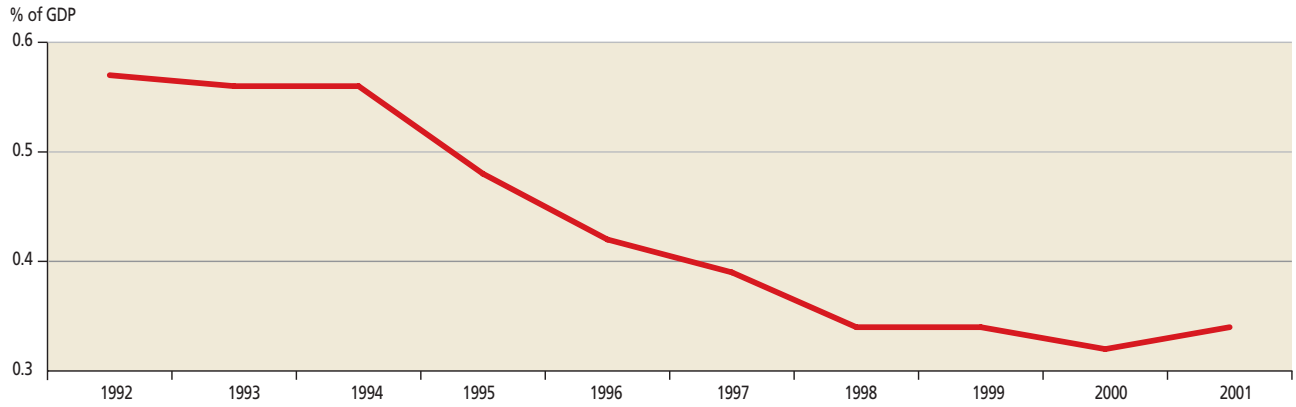
Bilateral aid still makes up by far the largest share of French ODA, even though there has been a proportional drop in relation to multilateral aid (from 78% of all ODA in 1994 to 63% in 2001). The main components of bilateral aid have changed in substantially different ways. Means allocated to technical cooperation have increased slightly, in particular because of a notable expansion in programmes to host students from developing countries in French universities. Support to projects and economic assistance in general have dropped. France devotes over half of its bilateral aid to Africa, with 41% spent in sub-Saharan Africa.

In 2000, France ranked fifth among the twenty-two CAD Member States in terms of overall aid amounts, but only eighth in terms of GNI (Gross National Income), far behind the Scandinavian countries.

Although the rich nations had decided in 1970 to devote a 0.7% share of their GNI to ODA (following a recommendation from the OECD's Pearson Committee in 1969 which was adopted by the United Nations in 1970), the average for the year 2000 was just 0.22%. Shortly before the opening of the European Council meeting in Barcelona in March 2002, the EU came to an agreement on development aid to poor countries, which provides for an increase in European ODA from the current figure of 0.33% to 0.39% by 2006. The aim is still to reach the target figure of 0.7% of GNI by 2010.

It must be stressed that this indicator, because of its purely quantitative nature, is by no means perfect. It does not allow for any appreciation of the quality or effectiveness of ODA, nor of the ways in which it contributes to the sustainability of development in recipient countries, since this depends on criteria that are specific to each of the latter. Discussions with a view to defining such criteria and producing performance indicators are currently under way in France, under the guidance of the Ministry of Ecology and Sustainable Development.
It should also be noted that this indicator does not include contributions to ODA via domestic policies aiding development in the countries of the South (government procurement, fair trade measures, etc.).

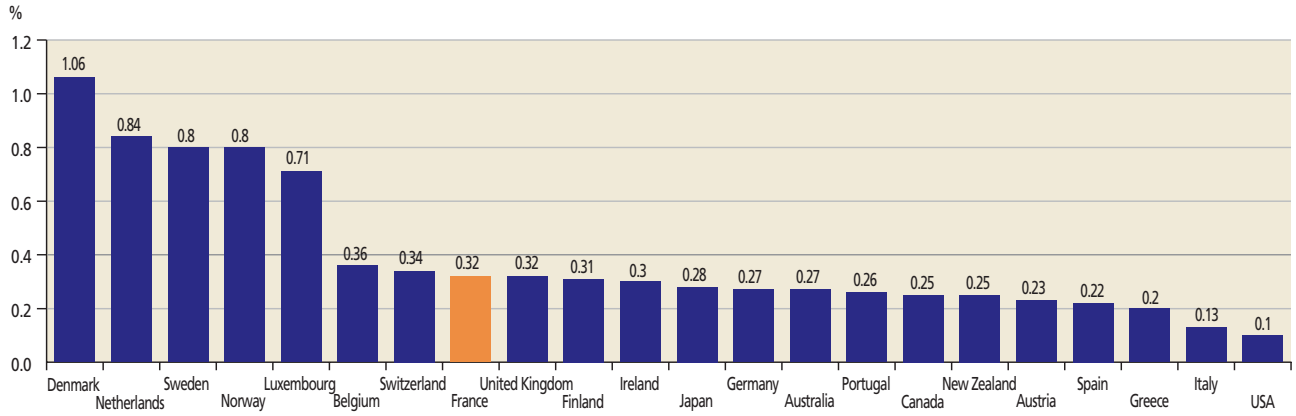
INDICATOR: Changes in the share of French GDP allocated to Official Development Assistance



Excluding transfers to Overseas Territories.

Source: Ministry for the Economy, Finance and Industry (Directorate for the Treasury) - Office for Development Assistance.

INDICATOR: Share of Gross National Income allocated in 2000 to Official Development Assistance in DAC Member States



Source: OECD 2002.

European Union strategy for sustainable development

In the conclusions of the Council meeting in Göteborg, the EU reconfirmed its undertaking to achieve the United Nations target for ODA of 0.7% of GNI "*within the shortest possible time*". In a communication entitled *Towards a global partnership for sustainable development* (COM (2002) 82 final/2), which adds an "external" dimension to the Lisbon Strategy, the European Commission sets an intermediate objective of a minimum of 0.33% of GNI for every EU country as from 2006.

For more information

- Agence française de développement, 2001. *Rapport annuel* (French Development Agency, Annual Report 2001): http://www.afd.fr
- Preparatory Committee for the International Conference on Financing for Development, 2002. *Draft resolutions of the International Conference on Financing for Development. Monterrey Consensus*, United Nations General Assembly.
- OECD, 2002. DAC *Development Cooperation Report 2001: Efforts and policies of DAC Members*. (vol. 3, n° 1).
- OECD, 2001. *DAC Guidelines on Poverty Reduction*.
- Tavernier Y., 1999. *La coopération française au développement. Bilan, analyses, perspectives* (French cooperation for development. Review, analysis and perspectives), Ministry of Foreign Affairs, Paris, ed. la Documentation française, 174 p.
- Ministry of Foreign Affairs (web pages on French policy for development assistance): http://www.diplomatie.gouv.fr

Organisations

OECD: Organisation for Economic Cooperation and Development.

THEME 4

Satisfying the needs of present-day generations

While sustainable development is characterised by a concern to guarantee the future of upcoming generations, it also addresses issues relating to present-day aspirations. This theme addresses the ***satisfaction of present-day needs****, from the angle of inequalities that people have to live with, but also in terms of French people's own perceptions of the state of their country and its institutions. The topics addressed thus refer as much to differences in income between different social categories as to inequality in people's exposure to risks, to the vitality of participatory democracy and to trends in behaviour reflecting dissatisfaction.*

These indicators are designed to provide points for discussion on the following questions:

- *Has inequality increased within our society?*
- *What is the overall state of mind in French society and what are French people's perceptions with regard to environmental preservation and democracy?*

MODULE 7: Inequality and exclusion.

MODULE 8: Behaviour reflecting dissatisfaction.

CONFIDENCE IN FRENCH INSTITUTIONS REGARDING ENVIRONMENTAL ISSUES

RELEVANCE

Through problems like air quality, chemical risks and water pollution by nitrates and pesticides, the question of the environment also links up with concerns for public health and safety. It is largely the responsibility of the public authorities to ensure that every citizen enjoys the highest possible level of environmental safety and health. In a context where proven and potential collective risks are on the increase (global warming, water and air pollution and the management of radioactive waste), the question of confidence in the information produced by the government, elected politicians or public research institutions is crucial.
In 2000, a survey was conducted among the French population on their confidence in various institutional players to tell the truth on environmental matters. The chosen indicator presents the results of this survey (*Source : EDF Baromètre environnement*).

ANALYSIS

According to a survey conducted by EDF in 2000 (*Baromètre environnement*), "doctors" and "scientists" are those in whom the population has the most confidence to tell the truth on matters regarding the environment (cited by more than 8 people out of 10). The least credible sources of information on this topic are "politicians" and "the government" (more than 9 people out of 10 say they have "little confidence" in them or "no confidence at all"). "Ecologists" and "journalists" rank in intermediate positions.

This lack of confidence in public authorities in France is also reflected in the extent to which the population gives credence to government measures to protect the population. According to a survey conducted by the Institute for Nuclear Protection and Safety (IPSN) in 2001, 51% of those surveyed had no confidence where nitrates and pesticides were concerned and 48% had no confidence where water pollution and radioactive waste were concerned. 45% had no confidence in government measures on transgenic plants and atmospheric pollution. Similarly, 61% believed that they were not told the truth on the dangers of chemical wastes, 65% thought the same regarding radioactive waste and 58% regarding GMOs. Confidence in public authorities is at its lowest where information on nuclear energy is concerned: 86% of the French population believes that the government is not telling the truth, while 53% say they trust consumer associations on the same topic.

According to the same survey, confidence in technology is also ebbing. In 2001, 61% of respondents believed that scientific and technical progress would not solve the environmental problems affecting Europe today, as against 50% in 1994.

On subjects such as these, where scientific knowledge may be incomplete, contested or give rise to conflicts of interest, the independence of those producing information and the transparency of the procedures used to produce it have become a matter of paramount importance. In view of the waning legitimacy of public institutions, public debate can become a vital resource in the development of decisions affecting the environment.

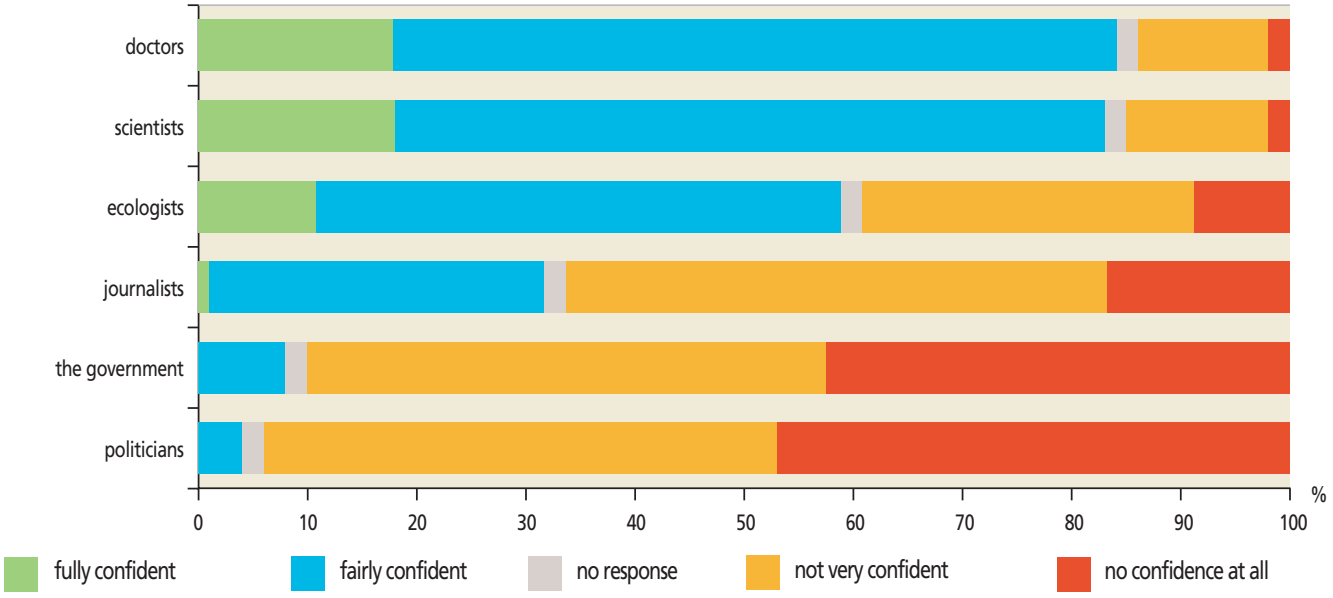
EUROPEAN UNION STRATEGY FOR SUSTAINABLE DEVELOPMENT

In view of increasing disillusionment with politics and weakening confidence in scientific experts among the public, the EU is recommending more open decision-making processes in order to encourage more interest among citizens and to guarantee transparency in decisions.

In its White Paper on European governance (COM (2001) 428 final), the Commission provides for the establishment of more systematic dialogue with local government representatives from the earliest policy-making stages, through national and European associations. To help re-establish confidence in the opinions of scientific experts, the Commission will be setting out guidelines on its own use of experts.

INDICATOR: Confidence in French institutions regarding environmental issues

"In which of the following sources of information do you have confidence to tell the truth on environmental issues?"



Source: Baromètre environnement EDF R&D - volet France - Preliminary results from the survey conducted in early 2000.

For more information

- Hammer B., 2000. *Baromètre environnement EDF - R&D - volet France*. Paris, EDF, 106 p.
- IFEN, 2002. "Les attentes des Français en matière d'environnement" (Expectations among the French population on environmental issues), *Les données de l'environnement*, n° 74, 4 p.
- IFEN, 2000. *La sensibilité écologique des Français à travers l'opinion publique*. (Environmental awareness among the French population through public opinion.) Orléans, IFEN, 187 p.
- Institut de protection et de sûreté nucléaire, 2001 (Institute for nuclear protection and safety). *Perception des risques et de la sécurité - Résultats du sondage de 2001*. (Perceptions of risks and safety - 2001 survey results.) Paris, IPSN, 90 p.

Methodology

The data used in the graph are from the *Baromètre environnement EDF - R&D - volet France*, a survey conducted in early 2000. The question on confidence was asked in 2000 for the first time. The survey was conducted with a panel made up by the SOFRES polling institute (3000 people surveyed and about 2500 respondents). It addresses topics of concern to EDF (including the greenhouse effect, industrial pollution and waste, technological risks, renewable energy and management of water and scarce resources), placing them within a broader context (major issues of concern, intentions to carry out projects).

The 2001 barometer published by the IPSN (which became the IRSN - Institute of Radioprotection and Nuclear Safety - in February 2002) on perceptions of risks and safety was conducted in November 2001 through face-to-face interviews with a sample of 1032 people representing the French population aged 18 and over, using the stratification method (habitat x region) and quotas (gender, age and socio-professional category).

Organisations

EDF: Électricité de France.
IFEN: French Institute for the Environment.

Abbreviations

GMO: Genetically Modified Organism.

THEME 5

The long term and future generations

In the long term, the ability of society to take future generations into account, and the ability of society, the economy and ecosystems to adapt over time and develop a certain amount of resilience are fundamental to successful sustainable development strategies.

As our final theme, we have set out to develop indicators that allow assessments of French society's opportunities and failings in this respect. Emphasis is given to society's capacity for organisation with a view to long term dynamics, but also to areas of vulnerability that result from its history. Principles of responsibility and precaution, flexibility and the development of reactivity are all appropriate strategies to meet the challenges of the future. The topics addressed therefore concern investments for the long term, expenditures on research and continuing education, monitoring of residual pollution and the implementation of mechanisms for the prevention of risks and crises.

The theme is addressed through two key questions:

- *What efforts is society making to reduce its vulnerability?*
- *Has society increased its capacity to respond to breakdown or crisis?*

MODULE 9:	**Principles of responsibility and precaution.**
MODULE 10:	**Vulnerability and adaptability to unforeseen circumstances.**

RESEARCH AND DEVELOPMENT EFFORTS

RELEVANCE

Research and Development (R&D) and the human and financial means invested in them are integral to sustainable development trajectories, in the sense that they reflect how far a society takes the future into account and the extent to which it implements capacities for innovation and adaptation.
Domestic Expenditures on Research and Development (DERD) are those which concern R&D work taking place in France itself, regardless of the source of funding. They include corporate expenditure on research as well as public expenditure on civilian research, and cover running costs (salaries and overheads) as well as capital expenditures (capital investments and real estate operations in a given year). R&D effort is traditionally measured as a ratio of expenditures to Gross Domestic Product (GDP).

ANALYSIS

From 1978 to 1993, R&D effort grew, on average, at a faster pace than GDP. However, the trend subsequently went into reverse, with R&D effort diminishing from 1994 onwards. A phase of renewed economic expansion, with a boost to employment, began in 1997 but had no notable effects on R&D expenditure. A steep rise in DERD in 1999 appears to have been mainly fuelled by corporate expenditure. Figures show that the trend continued in 2000 and 2001: in 2001, DERD amounted to 32.2 billion euros (at current prices), or 2.2% of GDP.

According to these results, France ranks slightly above the European average in terms of its research effort, with 2.13% of GDP in 2000, and behind Germany (2.48%), the United States (2.7%) and Japan (2.98%) (*Source : Eurostat*).

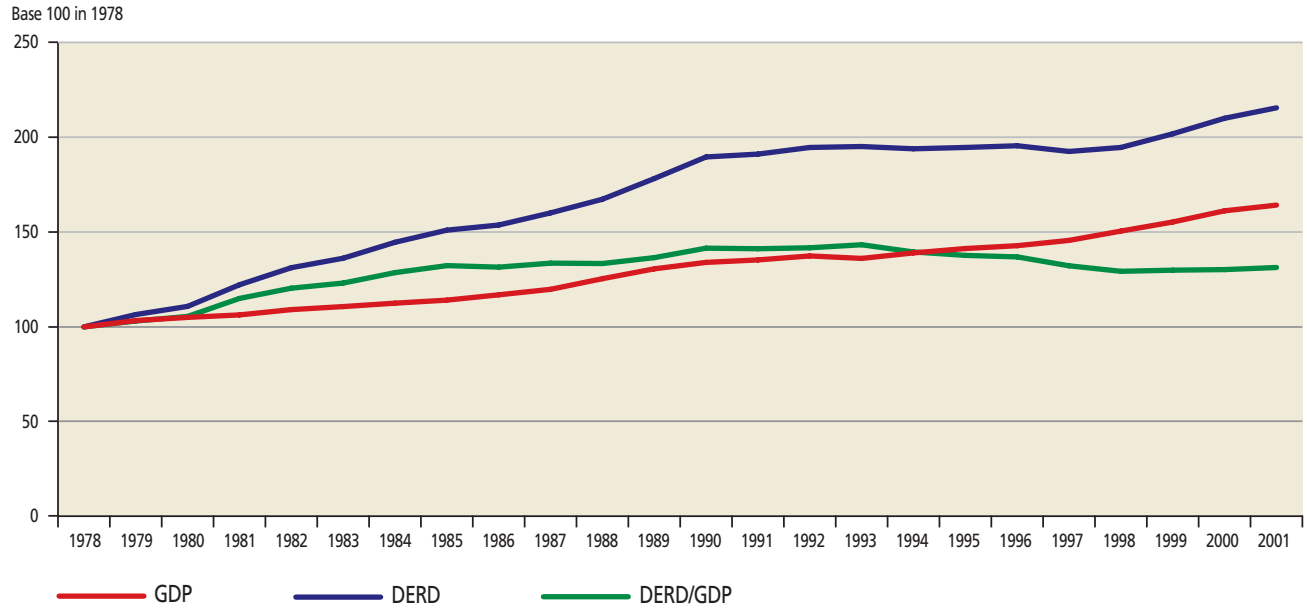
The last twenty years have seen profound changes in the executive structures and funding of research, with an increasing share of corporate effort in executive research functions (from 59.7% in 1978 to 62.4% in 2001). However, corporate research effort in France is still lower, as a percentage of GDP, than in the other OECD countries. On the other hand, the government's share in research financing has fallen steadily, dropping below 50% in 1995 and still further to 45.5% in 2001. Besides the stagnation of the civilian R&D budget from 1993 to 1997, the trend is essentially accounted for by the drop in expenditure on research for defence. Since 1999, corporations have been taking over from government administrations. Nevertheless, France, along with Germany, is still is the lead among OECD countries where public expenditure on civilian research is concerned.

Excluding the defence sector, research and development was providing the equivalent of 319 000 full-time posts in 2000, a 3.7% increase over 1999, with researcher posts accounting for the largest proportion (+6,9%).
Four main research branches account for 50% of all expenditure on research in France, as against 47% in 1992. These are the automobile industry (with 13.8% of all Domestic Expenditure on Corporate Research and Development - DECRD), the telecommunications industries (13.7%), the pharmaceutical industry (12.4%) and the space and aeronautics industry (10,2%). The services share is growing, but remains low at around 10% of all DECRD.

Expenditure on research is an indicator of investment, not an indicator of performance. The latter also depends on the efficiency of the system of innovation, which can be addressed in part through other indicators, such as numbers of patents, numbers of scientific publications and numbers of citations in scientific publications.

With about 120 European patents taken out per million inhabitants in 2000 and 69 US patents applied for per million inhabitants, France's position corresponds exactly to the EU average. However, of all EU countries, France is progressing at the slowest pace in this respect. Concerning scientific publications, France ranked slightly above the EU average in 1999 (with 652 scientific publications per million inhabitants compared to the EU average of 613), but progress is slower than average and the number of frequently cited scientific publications is lower (*Source : Eurostat*).

INDICATOR: Trends in research and development efforts



Series stopped in 2000 ; estimations for 2001.
Unit: euro at 1995 prices.

Source: Ministry of Youth, Education and Research (DPD).

EUROPEAN UNION STRATEGY FOR SUSTAINABLE DEVELOPMENT

The European Council meeting in Lisbon stressed the importance of moving to a knowledge-based economy, through improvements in policies for R&D, education and the information society. It recommended the adoption of measures aiming to *"strengthen the European area of research and innovation by setting a target of 3% of GDP for the overall level of public and private spending on research and development by the end of the decade. Within that total, the amount funded by business should rise to around two thirds against 55% today"* [1].

The DERD/GDP ratio and the number of patent applications sent to European and US Patent Offices are two of the structural indicators measured by Eurostat to illustrate the "innovation and research" topic.

For more information

- European Commission, Research, 2001. *Towards a European Research Area - Key Figures 2001. Special edition. Indicators for benchmarking of national research policies*.
- Ministry of Education, Research and Technology, 2001. *"Recherche et développement en 1999 et 2000", Note d'information 01.50* (Research and Development in 1999 and 2000, Background Notes 01.50), November 2001.
- Ministry of Education, Research and Technology, 2001. *"L'effort de recherche et développement des principaux groupes industriels français", Note d'information 01.41* (The research effort and the development of the major industrial groups in France, Background Notes 01.41), August 2001.
- Ministry of Youth, Education and Research, 2002. *"Dépenses de recherche et développement en France en 2000", Note d'information 02.53* (Research and Development expenditures in France in 2000, Background Notes 02.53), November 2002.

Methodology

The data in the graph are from the Programming and Development Directorate of the Ministry of Youth, Education and Research. The results were compiled from surveys conducted among businesses and government offices by the Office of Statistical Surveys on Research.

Definitions:

Domestic expenditures on research and development are expenditures allocated to R&D work taking place within France, regardless of the source of funding. They include payroll expenditures for R&D staff and overheads or other recurrent costs, capital expenditures required to carry out tasks that are specific to R&D plus any real estate operations taking place in the year.

A distinction is made between **corporate** and **public** expenditures on research and development.

Total funding to research work carried out in France and abroad by French corporations and government administration is known as **National Research and Development Expenditure** (NRDE).

Organisations

OECD: Organisation for Economic Cooperation and Development.

(1) COM(2002)14 final.