

Research Project
“Regulatory Reform for the Better Functioning of Market”

by Ceps – Centro Studi Confindustria

Chemical Industry and Regulation

by

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Final version : September 1999

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Chemical Industry and Regulation [§]

1. Introduction

This paper deals with environmental regulation and the impact on the competitiveness of the EU chemical industry. The environmental component of social regulation has increased rapidly in most OECD Countries and has a serious impact on the performance of the chemical sector. This issue is particularly relevant for the chemical sector because of its characteristic as an intermediate goods producer. However it is important to stress the importance of other aspects of regulation, which we do not explicitly consider in our discussion :

- regulation on trade and investment and then the impact on international investments and the operation of global firms;
- regulation on market competition and the impact on economies of scale which characterise the industrial structure;
- regulation on the protection of intellectual property right and the impact on technological transfer;
- regulation on the transport system and the effect on logistic costs and the localisation of new plants;
- fiscal regulation (treatment of dividends and holdings) or regulation of specific aspects of taxation (e.g energy tax);
- labour market regulation for the lack of flexibility which characterise the the European labour market;
- regulation on consumer protection and the impact on the purchasing decisions of consumers, given their “perception” of chemical products.

After approval in 1994 of the Communication “An industrial competitiveness policy for the European Union”, the European Commission chose, consequently, the chemicals industry to implement the general principles defined in the document and, before that, in the White Paper on *Growth, Development and Employment*. In 1996 the Communication “An industrial competitiveness policy for the European Chemical Industry: an example” (significantly, an earlier draft specified “a model”) was presented to, and approved by, the European Institutions.

The Commission’s Communication is important for a number of reasons. Firstly, because it is based on a open discussion within the Commission and

[§] The authors wish to thank Pierpaolo Masciocchi for helpful contribution and Gerald Petit for many helpful comments and suggestions. Eleonora Bartoloni provided valuable assistance in data collection and analysis.

because each section was drawn up in consultation with representatives from the European chemical industry. Secondly, because it represents a significant effort to implement, at a specific sectoral level, actions aimed at improving the overall competitiveness of European Industry. Thirdly, because it analyses the reasons why the European chemical industry is strategic for Europe (not merely due to its size, but because of the quality of life it provides, technology transfer and industrial research).

In particular, the Communication is important because of the clear link it establishes between competitiveness and the regulation of the industry, and the importance it places on one of the four actions for promoting competitiveness, i.e. "improving the regulatory framework".

In connection with "the current framework" the following aspects are highlighted:

- "Regulation covering production process and products is of paramount importance for the chemical industry. Being a highly capital intensive industry, it is most important that the legal framework is as stable and predictable as possible" (point 25).

- In relation to the "Free movement of Chemicals" (point 29) it is stated that "while the principle of mutual recognition applies to all types of products, some Member State actions may have the effect of fragmenting the Internal Market" and therefore further states (point 31) that "the Commission will continue to consolidate the internal market for chemicals to avoid difficulties, such as restriction of trade, caused by different sets of national legislation".

Concerning the "Principles for future action" reference is made to the "Guidelines for Regulatory Policy" adopted by the Commission in 1996 with an analysis of "how this could be pursued when legislation affecting the EU chemical industry is being prepared" (point 34).

- Reference is made to the application of the precautionary principle to environmental issues, but with the need for "a detailed analysis to justify intervention", "a risk assessment" and "an appropriate analysis of the costs and benefits". The Communication concludes: "A proper economic and environmental analysis aiming at appraising the net benefit for society of a measure, sheds light on its efficiency and helps add more objectivity to an otherwise potentially emotional debate" (point 36).

- Emphasis is placed on the importance of the "level at which intervention should take place" because "when rules in other industrial economies are less

strict than in the EU, delocalization of certain production lines may occur; this may also encourage imports from third countries of products whose production is no longer possible within the EU" (point 38).

- The potential danger of *environmental dumping* is confirmed by point 39: "When agreement at international level is not possible, the implications of new European environmental measures on the competitiveness of the chemical and other industries will be taken into account. It might be preferable to involve at least the OECD countries and advanced developing countries in environmental rules".

- The reference to the chemical industry and the positive measures adopted so far emphasizes (point 40) in relation to the types of action: "Besides regulation, voluntary action and economic instruments can play a complementary role in achieving desirable health and environmental targets. Voluntary agreements and economic instruments are more likely to be effective in improving environmental performance than in regulating the free circulation of chemicals"

In support of this statement (part 41) a number of initiatives are cited: the "unilateral industry programmes", such as Responsible Care and the Voluntary Energy Efficiency Programme promoted by CEFIC (European Chemical Industry Council) and the "voluntary approaches and agreements" reflecting bilateral cooperation between public authorities and industry.

- The guiding concept is that when analysis justifies intervention, the instrument used must be "the simplest and the least costly ... which ensures a high level of health and environment" (Summary).

The Industrial competitiveness policy which emerges from the Communication is clearly based on the improvement of the role of public authorities, since the competitiveness of a chemical company, by its very nature, is closely linked to external factors over which the company's managers have little or no control. But the chemical industry is also an interesting example because it is the only large, innovative sector in which Europe has maintained world leadership. The chemical industry is also used as an example because its role as provider of intermediate goods makes it important for the diffusion of innovation and for the improvement of the energy and environmental performance downstream, i.e. throughout European industry.

The European chemicals industry has substantial competitiveness problems compared to the United States, partly related to technical aspects, but also in

connection with external factors such as employment regulation, plant authorizations, and so on.

The analyses and actions developed in Europe for the chemicals demonstrate the importance of a strongly integrated approach to competitiveness policies, substantially involving industrial and company representatives, and approaching the question from the standpoint of sustainable growth.

Since the 1996 Communication, attempts to develop industrial benchmarking have gone in the direction of seeking to establish best practice, which should not be limited only to the company but extended to public subjects, whether national or European. This paper will frequently refer to the activities and documents of the Commission, particularly in the context of the efforts made in the direction of "benchmarking on competitiveness".

In relation to the other three actions, the same Communication emphasizes in more than one place (i.e. in relation to policies concerning competition, intangible investments and SMEs) the importance of industry regulation. This paper will concentrate on regulations related to the environment, health and safety, which certainly have a fundamental role in the correct current management of a chemicals company and for opening a new production facility.

2. Chemical Industry and Regulation: The European Framework

In the industrialised countries, regulation represents a key instrument of government in the promotion of public interests. Since the 1970s, the environmental issue represents one of the main objectives of European legislation, also as a consequence of some industrial accidents that have stressed the need for a more stringent control on pollution. The growing concern of European policy and legislation for the environmental issues is clearly shown by the new formulation of Art. 130(R) of the Treaty, that explicitly requires the EC institutions to promote environmental policies aiming at a high level of protection, with regard to health and environment.

In the development of EU regulation, environment protection has been coupled either with workers and citizens protection from different polluting sources, and namely from dangerous substances. Environment, health and safety represent therefore the joint objective of regulation aiming at pollution control.

Environmental legislation has a significant impact on industry. According to the regulation categories identified by the OECD Report on Regulatory Reform (1997), environmental legislation represents a significant part of social regulation pertaining to business (see Table 2.1).

Table 2.1 - REGULATIONS PERTAINING TO BUSINESS

ECONOMIC REGULATION

- Antitrust policies
- Price control
- Property Rights
- Company Law

SOCIAL REGULATION

- Environmental, health and safety regulation
- Employment regulation
- Consumer protection

ADMINISTRATIVE REGULATION

- Fiscal regulation
- Information provision about company performance
- Qualification requirements

Source: OECD Report on Regulatory Reform, 1997

The chemical industry is one of the industrial sectors most strictly regulated for environmental reasons. The assessment of environmental regulation impact on the

chemical industry is therefore a key step for the general assessment of the possible links between regulation and performance in the chemical sector.

This paragraph has two main objectives: a) the first objective is to make a description of European environmental regulations that are of particular significance for the chemical industry. For the main areas, a check of the state of implementation of EC Directives in different Member States will be also made. For different pieces of European legislation, it will be important to briefly point out the main critical aspects from the point of view of industry. As a matter of fact, this represents one of the necessary step to find out the possible links between regulation and competitiveness; b) the second objective of this paragraph is to give some keys for the identification of possible links between regulation and competitiveness in the European scenario, on the basis of the structural and functional characteristics of European environmental regulation on one hand, and of the more general regulatory framework on the other hand. It is clear enough that a complete assessment of the impact of regulations should take into account at the same time business, social and institutional areas. In the field of environmental regulation, this should mean a general cost-benefit analysis of the impact on industries' competitiveness and innovation, on the environmental targets actually achieved as well as on the organisation and functioning of public institutions. This report will focus only on the possible impact of environmental legislation on industry, with specific regard to the chemical sector. The general cost-benefit analysis approach will be nevertheless kept on the back of the analysis as a ground of general evaluation and conclusion.

2.1 EU Environmental Regulation and the Chemical Industry

Since the 1970s, the European environmental policy has developed a growing regulatory framework, mainly based on the so-called command and control system. It is only with the Fifth EC Program for environment protection and sustainable development that a new trend towards the use of economic and voluntary instruments, as integrated measures with the command and control tools, is clearly affirmed by the EC Institutions. Within the Fifth EC Program, the background of the new integrated system of regulatory, economic and voluntary instruments is represented by the basic principles of the EU environmental policy: polluter pays, precautionary principle, prevention, diffuse responsibility, integration of environmental issues in the whole of economic and social EU policies.

The objective of this study is the analysis of regulatory means of control. The role of economic and voluntary instruments will be briefly taken into consideration while discussing the possible routes of regulatory reform in view of a better functioning of competitiveness. It can be nevertheless immediately stressed that, in spite of the new principles included in the Fifth Program with specific regard to the introduction of non-regulatory means of environment protection, voluntary instruments, such as voluntary agreements or self-regulation, still represent a minor area of environmental policy implementation.

As far as environmental regulation is concerned, particular attention shall here be

given to: a) the general regulation of chemicals; b) the main sectoral environmental regulations, with specific regard to water, air and waste; c) the main general control systems, and namely the prevention of major accidents connected with some dangerous substances, environmental impact assessment and integrated pollution prevention and control (IPPC).

ENVIRONMENTAL REGULATION AREAS OF MAJOR CONCERN FOR THE CHEMICAL INDUSTRY

- Classification, labelling and packaging of dangerous substances and preparations
- Imports/exports of some dangerous substances and preparations
- Restriction on the marketing and use of certain dangerous substances and preparations
- Major accidents connected with some dangerous substances
- Water Protection and Management
- Air Protection (VOCs)
- Substances that deplete the ozone layer (CFCs)
- PCBs
- Waste disposal and management
- Transfrontier movement of Waste
- Environmental Impact Assessment
- Integrated Pollution Prevention and Control, IPPC

Particular attention must be given to **regulations concerning chemical substances**.

It is not the aim of the present study to give the details of this part of regulation, which is significantly wide and complex. To our purpose, it is rather sufficient to point out the main pieces of legislation in this field, the critical aspects, as well as possible differences between the European and the USA framework.

The first European piece of legislation in this field is the Directive 67/548/EC, including standards for work safety and aiming at the approximation of laws, regulations and administrative provisions concerning the **classification, packaging and labelling of dangerous substances**. The main goal of this Directive is to introduce at EC level a classification and labelling system for chemical substances in order to ensure safety for workers and the environment. The Directive 67/548/EC has been significantly amended in view of making the control system more stringent (see Table 2.2). Particularly important is the following Directive 79/831/EC, bringing the 6th Amendment to the mother Directive, which has introduced a mandatory notification system for new chemical substances (the Directive 79/831/EC came after the Directives 69/81/EC, 2nd Amendment, 70/189/EC, 3rd Amendment, 73/146/EC, 4th Amendment, and 75/409/EC, 5th Amendment to Directive 67/548/EC). It is to be

stressed that the 6th Amendment requires a person-specific notification: this implies that the same substance may need to be registered several times. From this point of view, the European regulation is characterised by more extensive requirements if compared with the USA Toxic Substances Control Act (Fleischer states that “the European regime seems to be a *zero-risk approach* whereas the U.S. regulation can be regarded as the *risk-cost balancing approach*”), as it is furthermore demonstrated by the follow-up reporting system foreseen only in the EC Directive 79/831. The European rules in this field have become even more stringent with 7th Amendment of Directive 67/548/EC (Directive 92/32/EC, see Table 2). It has been maintained that the 7th Amendment “leads to a reduction of innovation activities and a significant decline of new substances placed on the market annually. Due to the 7th Amendment, some product sectors, particularly SMEs, are failing to innovate new substances at all. This leads to a detrimental effect – companies fall back upon existing chemicals and notification expenditure prevents the introduction of a more environmentally sound alternative chemical”(Fleischer).

A very interesting analysis of different regulation frameworks in EU and USA in this specific field has been made by the IPTS "Comparison of Regulatory Requirements for the Notification of New Chemical Substances in the European Union, the USA and Japan" (1998). The IPTS Report compares the existing legislations controlling the notification procedure for new chemical substances in force in the EU, the USA and Japan. The same objective (to protect the man and the environment from the exposure to unacceptable risks) is realised through different requirements: as already stressed, the EC Directive 92/32 requires a technical dossier containing a fixed list of physical-chemical, toxicological and ecotoxicological data; the US TSCA-EPA legislation requires that the Pre-Manufacture Notification dossier contains all available data concerning the new test substance; the Japanese legislation is enforced by stages requiring first environmental data relating to the persistence of the new chemical, and consecutively additional toxicological data if persistence is shown. The IPTS Report, after stressing the main differences between the notification procedures, gives the following data on the amount of notification dossiers introduced in EU, US and Japan: from 1983 to 1996, 4.514 dossiers in EU; from 1980 to 1996, 25.545 dossiers in US, and from 1987 to 1996, 2.895 dossiers in Japan. The reason for such situation could be that the US EPA only requires the submission of existing data for the Pre-Manufacture Notice, that no obligation exists to perform laboratory tests and that, therefore, the costs are reduced at the introduction phase. More particularly, the Report outlines the following main differences between the notification procedures:

- **content of the notification dossier:** a) **in the EU**, the amount of data necessary to file a notification dossier depend on the amount of new substance to be marketed. Depending on the tonnage different levels are determined. A technical dossier must be submitted in accordance with the requirements of Annex VII or Annex VIII of Directive 92/32/EEC; b) **in the USA**, the EPA PMN dossier contains technical, physical-chemical and human exposure data as well as information on environmental release. Other data on toxicology and ecotoxicology may be added if available. Additional information may be

required by the authorities; c) **in Japan**, environmental data on biodegradation and bioaccumulation are requested first. If the new substance is readily biodegradable, no further data need to be submitted. If not, additional information is required by the authorities, in relation to the future designation of the chemical as Specified Class 1 Chemical, Specified Class 2 Chemical or Designated Chemical;

- **classification of new substances:** classification of new substances according to their intrinsic properties is in force in the **EU** and **Japan**. No comparable classification system exists in the **US**;
- **exemption for the low volumes:** exemption for the low volumes of new substances placed on the market in the **EU** and in the **USA** are accepted for amounts <10/kg/year/manufacturer. In **Japan** this limit is <1.000 kg/year/manufacturer;
- **duration of the procedure:** in the **EU**, authorisation to place the new substance on the market can be granted within 45 days after submission of the notification dossier. The Premanufacture Notice (PMN) in the **USA** has to be introduced 90 days before import or manufacturing. A Notice of Commencement of manufacture or import (NOC) has to be provided 30 days before the substance is manufactured or imported. A manufacturer in **Japan** will obtain a designation of the new substance within 3 months. For a new chemical substance exported to Japan the duration of the procedure will take 4 months;
- **costs related to the notification procedure:** when a notification in accordance with **EU** legislation is submitted for a new chemical at a level above 1 tonne per year, the costs at the start are higher compared to the costs in the **US** or **Japan**. However, in accordance with **US** and Japanese legislation, if the new substance represents some risks to human health or to the environment, supplementary data will be requested. In this case, the costs will level up with costs to introduce a **EU** notification dossier.

An 8th Amendment to Directive 67/548/EC has followed with the Directive 96/56/EC.

The regulation of “new” substances is completed by the **regulation of existing chemicals** (Regulation 793/93/EC), whose scope is to evaluate their possible risks and to take, if necessary, measures to reduce them. According to CEFIC, the Existing Substances Regulation 793/93/EC must be seen and promoted by the EC Commission and the Member States as the “key legal instrument for the sound management of chemicals within the European Union”.

A significant number of Directives and Regulations are furthermore foreseen in Europe to control classification, packaging and labelling of specific chemical preparations. Besides the general Directive 88/379/EC, the following specific Directives can be recalled:

- Directive 73/173/EC, solvents, amended by Directive 80/781/EC

- Directive 77/728, paintings, amended by Directive 83/265/EC
- Directive 78/631/EC, antiparasitic agents, amended by Directive 81/187
- Directive 91/155/EC, safety reports, amended by Directive 91/442/EC.

Another relevant piece of European legislation concerning chemical substances is the Regulation 2455/92/EC on **imports and exports of some dangerous substances** and preparations, to which the Directive 76/769/EC on **restriction on the marketing and use of certain dangerous substances** and preparations must be added.

Finally it is also to remember the **Ecolabel scheme** (Regulation 880/92/EC) for **indoor paints** restricts the concentration of given substances and namely: white pigments, volatile organic compounds, aromatic hydrocarbons. This system is based on voluntary adhesion of interested companies.

Apart from this last voluntary instrument, the brief description of the EU regulation of chemical substances and preparations (and of the major pieces of national measures of transposition, see Table 2.2) gives a clear idea of the extreme complexity of regulation concerning chemical industry.

Water regulation is another area of environmental legislation of major concern for chemical industry. The European regulation in this field includes a significant number of Directives and Regulations. It can be certainly maintained that water regulation represents one of the widest sector of European environmental legislation. The legislation aiming at **protecting the aquatic environment of the Community from the pollution of certain dangerous substances** seems particularly complex. This part of regulations is based on the framework Directive 76/464/EC, aiming at a general and simultaneous action by EU Member States to protect the aquatic environment of the Community from pollution particularly caused by certain persistent, toxic and bioaccumulable substances. To ensure an effective protection of the aquatic environment of the Community, a first list (List I) of specific substances was selected on the basis of their environmental toxicity, persistence and bioaccumulation, with the exception of those which are biologically harmless or which can be converted into substances which are biologically harmless. In principle, Directive 76/464 states that discharge of List I substances must be eliminated. Additionally, a second list of dangerous substances was established (List II). The List II (grey list) substances are those which have a deleterious effect on the aquatic environment, which can, however, be confined to a given area and which depend on the characteristics and location of the water into which they are discharged. Any discharge of these substances should be subject to prior authorization which specifies emissions standards based on quality objectives. In the period 1976-1990 a significant number of so-called daughter Directives of 76/464 have been introduced, with regard to specific dangerous substances.

Table 2.2 - CLASSIFICATION, PACKAGING AND LABELLING OF DANGEROUS SUBSTANCES/PREPARATIONS

Major EC Directives and Regulations

- **Directive 67/548/EC**, notification of new substances, classification/labelling of substances
- **Directive 79/831/EC**, sixth amendment of Directive 67/548/CE
- **Directive 88/379/EC**, classification/labelling of preparations (time limit for national transposition: 7/6/1991 ; 31/12/1999 for Austria, with specific regard to art. 13; 31/12/1999 for Sweden, with specific regard to artt. 3, 5, 13 and Annex I)
- **Directive 89/178/EC**, amendment of Directive 88/379/EC (time limit for national transposition: 1/12/1990)
- **Directive 90/492/EC**, second amendment of Directive 88/379/EC (time limit for national transposition: 1/1/1991)
- **Directive 92/32/EC**, seventh amendment of Directive 67/548/CE (time limit for national transposition: 31/10/1993)
- **Directive 93/18/EC**, third amendment of Directive 88/379/EC (time limit for national transposition: 1/7/1994)
- **Regulation 793/93/EC**, evaluation and control of existing substances
- **Directive 96/65/EC**, fourth amendment of Directive 88/379/EC and amendment of Directive 91/442/EC concerning dangerous substances whose packagings must be equipped with safety locks for children (time limit for national transposition: 31/5/1998)

Major National Regulations

AUSTRIA:

- Chemikalienverordnung – ChemV, 16/3/1989

BELGIUM:

- Arrêté Royale du/Koninklijk Besluit, 11/1/1993 and 23/6/1995

DENMARK:

- Bekendtgørelse n. 586 om klassificering, emballering, mærkning, salg og opbevaring af kemiske stoffer og produkter, 8/8/1991
- Bekendtgørelse n. 589, 8/8/1991
- Miljøministeriets lov bekendtgørelse n. 583, 9/6/1993, Bekendtgørelse af lov om kemiske stoffer og produkter

FRANCE:

- Arrêté ministériel, 21/2/1990
- Loi 31/12/1991, n. 91-1414

- Arrêté, 31/3/1992 – agrément INRS
- Décret 3/12/1992, n. 92-1261
- Arrêté ministériel, 23/12/1992
- Arrêté ministériel, 5/1/1993

GERMANY:

- Verordnung zur Novellierung der GefahrstoffVO, 1992
- Aufhebung der GefährlichkeitsmerkmaleVO, 1992
- Änderung der Ersten VO zum SprengstoffG, 1992
- Verordnung zur Novellierung der GefahrstoffVO, Aufhebung der GefährlichkeitsmerkmaleVO und zur Änderung der Ersten VO zum SprengstoffG, 1993

GREECE:

- Décision du Conseil Supérieur de Chimie, n. 1197/1989

IRELAND:

- EC (Classification, Packaging and Labelling of Dangerous Preparations) Regulations 1992
- EC (Classification, Packaging and Labelling of Dangerous Preparations) Regulations 1995

ITALY:

- D.Lgs. 3/2/1997, n. 51
- D.Lgs. 16/7/1998, n. 285

LUXEMBOURG:

- Loi 10/7/1995
- Règlement Grand Ducal, 29/9/1995

NETHERLANDS:

- Besluit, 18/9/1991
- Wijziging nadere regels Verpakking en Aanduiding Milieugevaarlijke Stoffen, 1991
- Besluit, 21/12/1995

PORTUGAL:

- Decreto-lei 30/6/1992, n. 120/92
- Portaria 18/12/1992, n. 1164/1992

SPAIN:

- Real Decreto 2/7/1993, n. 1078/1993
- Orden Ministerial 20/2/1995

UNITED KINGDOM:

- Health and Safety (The Chemicals) (Hazard Information and Packaging) Regulations, 1993
 - Health and Safety (The Chemicals) (Hazard Information and Packaging)(Northern Ireland) Regulations, 1993
 - The Notification of New Substances Regulations, 15/12/1993
-

They are briefly summarised in the following Table 2.3. It is interesting to point out that the trasposition of these Directives into Member States legislation has been largely complete, showing nevertheless big differences between Member States due to widely differing backgrounds in terms of administrative and legal systems and resources.

A first step of rationalisation of water regulation has been made with Directive 91/271/EC on urban waste water treatment. Nevertheless the state of national trasposition is rather incomplete. Italy, for instance, has only recently implemented the Directive 91/271/EC with the D.Lgs. n. 152 of May 1999. Such Decree represents a piece of extremely relevant reform of the already existing water legislation in Italy and it will therefore take a significant period of time before the new rules will be actually able to come into force. All this implies the existence of different control systems on water discharges within the European context.

A second and wider step of rationalisation is included in the recent Directive proposal for a framework of EU water policy (26/2/1997, modified proposals 26/11/1997 e 17/2/1998). The aim of the proposal is to coordinate the application of water emission standards fixed by existing regulations.

Table 2.3 – WATER PROTECTION

PROTECTION OF AQUATIC ENVIRONMENT OF THE COMMUNITY FROM CERTAIN DANGEROUS SUBSTANCES

EC Directives

- **Directive 76/464/EC**, framework Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
- **Directive 82/176/EC**, discharges by the chlor-alkali electrolysis industry (mercury) (amended by Directives 90/656/EC and 91/692/EC)
- **Directive 83/513/EC**, discharges by manufacturing of cadmium compounds and other industrial activities leading to the discharge of cadmium (cadmium) (amended by Directives 90/656/EC and 91/692/EC)
- **Directive 84/156/EC**, discharges by other sectors than chlor-alkali electrolysis industry (mercury) (amended by Directives 90/656/EC and 91/692/EC)

- **Directive 84/491/EC**, discharges caused by the production of HCH and extraction of lindane (Hexachlorocyclohexane, HCH) (amended by Directives 90/656/EC and 91/692/EC)
- **Directive 86/280/EC**, discharges caused by the production of carbon tetrachloride and chlorofluorocarbons (carbon tetrachloride, CCl₄), DDT including formulation of DDT on the same site, sodium pentachlorophenate by hydrolysis of hexachlorobenzene (amended by Directives 90/656/EC and 91/692/EC)
- **Directive 88/347/EC**, discharges caused by the production of aldrin and/or dieldrin and/or endrin and formulation on the same site (aldrin, dieldrin, endrin, isodrin), hexachlorobenzene (HCB), Hexachlorobutadiene, chloroform
- **Directive 90/415/EC**, discharges caused by the production of 1,2-dichloroethane (EDC) and trichloroethylene (TRI)

URBAN WASTE WATER

EC Directives

- **Directive 91/271/EC**, urban waste water treatment (amended by Directive 98/15/EC as regards some requisites of Annex I. Time limit for national transposition: 30/6/1993 for Directive 91/271; 30/9/1998 for Directive 98/15)

Major National Regulations

FRANCE:

- Loi 3/1/1992, n. 92-3 sur l'eau

GERMANY:

- Verordnung zur Umsetzung der Richtlinie 91/271/EWG des Rates über die Behandlung von kommunalem Abwasser (Reinhalteordnung kommunales Abwasser – ROkAbw), 23/8/1992
- Verordnung des Umweltministeriums zur Umsetzung der Richtlinie 91/271/EWG des Rates über die Behandlung von kommunalem Abwasser (Reinhalteordnung kommunales Abwasser – ROkA), 10/12/1993
- Verordnung zur Umsetzung der Richtlinie 91/271/EWG des Rates über die Behandlung von kommunalem Abwasser (KomAbwVOBln), 19/5/1996
- Verordnung zur Umsetzung der Richtlinie 91/271/EWG des Rates über die Behandlung von kommunalem Abwasser (KomAbwVO), 25/10/1996

IRELAND:

- The Environmental Protection Agency Act (Urban Waste Water Treatment) Regulations, 23/4/1992

ITALY:

- D.Lgs. 11/5/1999, n. 152

SPAIN:

- Real Decreto Ley n. 11/95 por el que se establecen las normas aplicables al tratamiento de las aguas residuales urbanas, 28/12/1995
- Real Decreto n. 509/96 de desarrollo del Real Decreto Ley n. 11/95 por el que se establecen las normas aplicables al tratamiento de las aguas residuales urbanas, 15/3/1996

UNITED KINGDOM:

- The Urban Waste Water Treatment (England and Wales) Regulations, 1994
- The Urban Waste Water Treatment (Scotland) Regulations, 1994
- The Urban Waste Water Treatment (Northern Ireland) Regulations, 1995

QUALITY OF WATER INTENDED FOR HUMAN CONSUMPTION**EC Directives**

- Directive 80/778/EC, quality of water intended for human consumption (time limit for national transposition: 17/7/1982)

New regulatory trends can be stressed also in the field of air protection. In this sector, there are two main areas of legislation that are particularly significant for the chemical industry: a) control of air emissions from industrial plants, with specific regard to VOCs; b) control of greenhouse gas emissions.

As far as the first area is concerned, a wide trend towards rationalisation must be seen in the Directive 96/62/EC on assessment and management of air environment quality in the Community, fixing standard emissions and specific quality standards to be reached within specified time limits, and namely: sulfur dioxide, nitrogen dioxide, particulates and lead (31/12/1996); benzene and carbon monoxide (31/12/1997); polycyclic aromatic hydrocarbon, cadmium, arsenic nickel and mercury (31/12/1999).

VOC regulation will be widened after approval of the Directive proposal of last 18 february 1997 - COM(96)538 def. 96/0276 (SYN) - setting maximum permitted VOC levels in industrial activities other than petrol storage and distribution.

Another significant piece of environmental legislation is , and will be in the next years more and more represented by regulations limiting greenhouse gas emissions. Until now, the main efforts of EU regulation has been put on CO₂ emissions (see Table 2.4), but in the next years the implementation of the Kyoto Protocol will bring to the introduction of new legislation concerning: CH₄, N₂O, HFC, PFC and SF₆. As a matter of fact, it is clearly stated in the EC Commission Communication to the Council and the Parliament "Preparing the Implementation of the Kyoto Protocol" - COM(1999)230, 19 May 1999 – that "an efficient climate policy will have to contain a multitude of measures covering all 6 gases". It is nevertheless to be stressed that in the same Communication the EC Commission put a strong accent on the use of

voluntary and flexible instruments - therefore different from command and control means – for the implementation of the Kyoto Protocol.

Table 2.4 – AIR PROTECTION

EC Directives

QUALITY OF AIR ENVIRONMENT

- **Directive 96/62/EC**, assessment and management of air environment (time limit for national transposition: 21/6/1998)

EMISSIONS FROM MAJOR COMBUSTION PLANTS

- **Directive 94/66/EC**, amending Directive 88/609/EC (time limit for national transposition: 13/7/1995)

EMISSIONS FROM WASTE INCINERATION PLANTS

- **Directive 89/429/EC**, incineration of urban waste (time limit for national transposition: 30/11/1990)
- **Directive 94/67/EC**, incineration of dangerous waste (time limit for national transposition: 31/12/1996)

VOC

- **Directive 94/63/EC**, control of volatile organic compound emissions resulting from petrol storage and distribution (time limit for national transposition: 31/12/1995)

GREENHOUSE GAS EMISSIONS (CO₂)

- **Decision 93/389/EC**, control of CO₂ emissions and other greenhouse gas emissions (no time limit for national transposition)

SUBSTANCES THAT DEplete THE OZONE LAYER (CFCs)

- **Regulation 3093/94/EC**
-

A complete change of the existing framework is presently characterising the EU **waste regulation**, where the Directive 91/156 has introduced a new integrated waste management system based on the prevention principle, and on waste recovery and recycle as primary techniques of waste disposal. The transposition of the new framework Directive into the Member States is a cause of great complexity: waste recovery and recycle regulations are putting the biggest questions, particularly with regard to the always difficult distinction between waste and non-waste. This last issue

is of great importance for industries, since different definitions of waste and non-waste materials give rise to different impacts of the control system (i.e.: administrative licensing system). The present situation in Europe is characterised by big differences between regulations applicable in Member States, with clear disadvantages for industries operating within the European market.

Within waste regulation, particular attention must then be given to Regulation 259/93/EC on **transfrontier movement** of waste. The Regulation imposes strict controls on the shipment of waste, both for recycling and disposal, throughout the European Community. The policy goal achieved by the Regulation 259/93/EC is the reduction of potential damage to the environment caused by hazardous waste material. This Regulation is generally criticised by industry for being unproportioned to hazard and risk, too prescriptive, too complex in application and inconsistently enforced among Member States.

The recent Directive 96/59/EC (following the Directive 76/403/EC), has regulated the **disposal of PCBs and PCTs**. The time limit for national transposition of such Directive is 16/3/1998. Until now, among the Member States, only France has implemented the new Directive with the “Loi 26/2/1996, n. 96-151, relative aux transports” and with the “Arrêté ministériel relatif aux installations spécialisées d’incinération et aux installations de coïncinération de certain déchets industriels spéciaux”, 10/10/1996 (to which the “Décret 21/5/1997, n. 97-503, portant mesures de simplification administrative” must be added). The inconsistent enforcement of such Directive among Member States must be connected with the enactment of the new European regulation of dangerous waste (see Table 2.5), which is causing a lot of difficulties in national transposition, the main problem being represented by the catalogue of dangerous wastes that must be written by Member States according to the new Directive 91/689/EC.

Table 2.5 - WASTE DISPOSAL AND MANAGEMENT

EC Directives

- **Directive 91/156/EC**, Framework Directive on Waste, amendment of Directive 75/442/EC (time limit for national transposition: 1/4/1993)
- **Directive 91/689/EC** on dangerous Waste, amended by Directive 94/31/EC (time limit for national transposition: Directive 91/689, 27/6/1995; Directive 94/31/CE, 22/7/1994)
- **Directive 94/62/EC** on Packaging and Packaging Waste (time limit for national transposition: 30/6/1996)

Major National Regulations

Transposition of Directive 91/156/EC

FRANCE:

- Loi n. 75-663 relative à l'élimination des déchets et à la récupération des matériaux, 15/7/1975
- Loi n. 76-663 relative aux installations classées pour la protection de l'environnement, 19/7/1976
- Décret n. 77-1133 du 21/9/1977 pris pour l'application de la Loi n. 76-663 relative aux installations classées pour la protection de l'environnement
- Décret n. 92-377, 1/4/1992
- Loi n. 92-646, 13/7/1992
- Décret n. 93-139 du 3/2/1993 relatif aux plans d'élimination des déchets ménagers et assimilés
- Décret n. 94/609 du 13/7/1994 portant application de la Loi n. 75-663 relative à l'élimination des déchets et à la récupération des matériaux et relative notamment aux déchets d'emballage dont les détenteurs ne sont pas les ménages

GERMANY:

- Gesetz zur Förderung der Kreislaufwirtschaft und Sicherung der umweltverträglichen Beseitigung von Abfällen (Kreislaufwirtschaft-und-Abfallgesetz-KrW-/AbG), 27/9/1994
- Gesetz zur Vermeidung, Verwertung und Beseitigung von Abfällen, 27/9/1994

ITALY:

- D.Lgs. 5/2/1997, n. 22
- D.Lgs. 8/11/1997, n. 389

UNITED KINGDOM:

- Controll of Pollution Act 1974
- Control of Pollution (Special Waste) Regulations, 1980
- Food and Environmental Protection Act, 1985
- The Control of Pollution (Landed Ship's Waste) Regulation 1987
- Town and Country Planning (Assessment of Environmental Effects) Regulations, 1988
- The Collection Disposal of Waste Regulations, 1988
- The Deposit in Sea (Exemptions) Order 1988
- Control of Pollution (Special Waste) (Amendment) Regulations 1988
- Control of Pollution (Amendment) Act 1989
- The Control of Pollution (Landed Ship's Waste) (Amendment) Regulation 1989
- Town and Country Planning Act, 1990
- The Environmental Protection (Prescribed Processes and Substances) Regulations, 1991
- The Environmental Protection (Applications, Appeals and Registers), Regulations,

1991

- The Disposal of Control Waste (Exceptions) Regulations, 1991
- The Environmental Protection (Duty of Care) Regulations, 1991
- The Controlled Waste Regulations, 1992
- The Public Health (Waste) Regulations, 1995
- The Transfrontier Shipment of Waste Regulations, 1994

Transposition of Directive 91/689/EC

FRANCE:

- Décret n. 97-517 du 15 mai 1997 relatif à la classification des déchets dangereux

GERMANY:

- Verordnung zur Bestimmung von besonders überwachungsbedürftigen Abfällen (Bestimmungsverordnung besonders überwachungsbedürftiger Abfälle – BestbüAbfV), 10/9/1996

ITALY:

transposition measures adopted for Directive 91/156

UNITED KINGDOM:

- The Waste Management (Licensing) Regulations, 1994
- The Special Waste Regulations, 1996
- The Special Waste (Amendment) Regulations, 1996
- The Public Health (Amendment) Ordinance, 1997

Transposition of Directive 94/62/EC

FRANCE:

Décret n. 96-1008, 18/11/1996

GERMANY:

transposition measures adopted for Directive 91/156

ITALY:

transposition measures adopted for Directive 91/156

UNITED KINGDOM:

no reference available

A final area of environmental regulation to be taken into consideration concerns **general control systems aiming at the implementation of the prevention principle**, and namely prevention of major accidents connected with some dangerous

substances, environmental impact assessment (EIA) and integrated pollution prevention and control (IPPC) (Table 2.6). In general terms, also in this field, the introduction of new framework Directives implies a rather undefined scenario within the Member States. The point is that the new regulation of EIA on one hand, and the introduction of IPPC on the other hand, should bring to a new and more harmonised framework of environmental licensing system of industrial activities. The target is nevertheless difficult to be reached: the new EIA and particularly the new IPPC procedure are to be coordinated with the significant number of existing control procedures, and again there exist critical differences among Member States that create a very complex scenario.

Until now, the best results have been reached by the EIA system, due to recent improvements of Member State legislations, as well as to improvement of general quality of EIA reports (EC COMMISSION, "Evaluation of the Performance of the EIA Process"). Even in this area, a number of suggestions for legislation improvement are still on the ground, and namely: a) introduction of a formal scoping requirement; b) adoption of a formal EIA report quality control mechanism; c) accreditation of EIA consultants; d) preparation of EIA guidelines; e) strengthening of competent authorities expertise; f) EIA training for various participants in the EIA process; g) provision of national EIA report and environmental information databases.

Table 2.6 -

- **PREVENTION OF MAJOR ACCIDENTS CONNECTED WITH SOME DANGEROUS SUBSTANCES**
- **ENVIRONMENTAL IMPACT ASSESSMENT (EIA)**
- **INTEGRATED POLLUTION PREVENTION CONTROL (IPPC)**

Prevention of Major Accidents, EC Directives:

- **Directive 82/501/EC**, Risks of Major Accident Hazards of Certain Industrial Activities
- **Directive 96/82/EC**, Control of Major Accident Hazards connected with some dangerous substances (time limit for national transposition: 3/2/1999)

No reference available as to transposition measures in the Member States

EIA, EC Directives:

Directive 85/337/EC amended by Directive 97/11/EC

IPPC, EC Directive:

- **Directive 96/61/EC**, pollution prevention and integrated control (time limit for national transposition: 30/10/1999)
-

3. The Performance of the European Chemical Industry

3.1 Foreword

The analysis of the European chemical industry performance is crucial, given the weight of this sector within the European manufacturing industry, and its strategic relevance for the international competitiveness. In the worldwide context, the European chemical industry is the largest producer (30%), just ahead the United States (28%). It should also be said that the chemical industry is highly forward linked with other industries both in terms of economic and technology impact and in terms of environment prevention, thus giving it a crucial role within the manufacturing industries. In addition, the chemical industry is strongly affected by technological innovation and environmental regulation, both of which may influence its short and medium-long term performance.

This paper would like to compare the performance of the chemical industry in Europe and in the United States. This comparison is crucial for the role of these industries in worldwide production and trade, and because of their relative homogeneity. It is worth noting that Japan plays an important role within the world chemical industry (being the second single Country). However, compared to other industrial sectors it is less important, as the Japanese chemical industry is strongly oriented to the internal market. Indeed, Japan's balance of trade surplus in chemicals is quite small compared to that of Europe and the United States.

The European and American chemical industries, however, compete with emerging producers in Asia (China, Korea, Taiwan in particular) brought about by the increase of international trade after the WTO agreements, and by the crucial role played by the chemical industry in the growth processes (infrastructure, health, the environment, durable and non-durable consumer goods). It is worth underlining that Asia is already the world's largest producer of fibres and that an increasing flow of foreign investment was directed toward this area. Unfavourable environmental regulation and other competitiveness factors (labour cost) may, therefore, increase the delocalization process, which is also affected by demand factors.

In this framework the performance of SMEs may be crucially affected, for they play an important role within the European chemical industry, and, particularly, within the downstream of basic chemicals. For this kind of companies, the potential threat deriving from the *environmental dumping* of Asian companies is more difficult to fight, because they are more constrained to produce in Europe.

Thus, a detailed comparison of the performance of the European and American chemical industries is crucial to explain the gap between the European and American companies and linking this analysis to the effects of environmental regulation in Europe on firms' performance.

3.2 Production and Employment Trends

The available information and indexes used for evaluating production trend do not show a straightforward picture. In particular, in terms of physical evolution, the output of chemicals seems to have increased more in Europe than in the United States. Both data provided by CEFIC (Facts and Figures, 1998), and a recent British study by the Chemical Industries Association (CIA, 1999) show a growth rate of production between 1979 and 1997 of 2.6%, in Western Europe compared to a growth rate of 2% in the USA.

In terms of sub-periods the result is much the same, whilst a country by country analysis in Europe shows very different situations, with Belgium, France and the Netherlands above the European average, and Germany and Italy well below both the average and the American performance.

Looking at real value added implies different considerations, with a growth in Europe of 2.7% between '79 and '95, compared to 3.3% in the USA. (National Institute of Economic and Social Research, 1998). However, it is worth underlining that the use of value added time series, particularly those of the STAN-OECD database, involves problems of data reliability (for example, data for Italy at the beginning of the '80s are totally unreliable).

The chemical industry is a heterogeneous sector, with high differences between sub-sectors (for example, the differences in the manufacturing processes and products in the petrochemical industry, in cosmetics and pharmaceuticals).

In the pharmaceutical industry, the growth rate between '90-'97 was 3.9% in Europe and 4.5% in the USA, compared to a growth rate of 2.5% and 1.8% respectively in the chemical industry (excluding pharmaceuticals) as a whole (ESCIMO database, CEFIC).

To sum up, production data do not give a clear picture, showing, however, a decrease elasticity in the industry to changes in GDP (the so-called chemical premium, which in the '50s and '60s was extremely high due to the ability of chemicals to replace other materials, and to meet new company and consumer needs) both in the United States and in Europe. Only the pharmaceutical industry shows a high long term growth, both due to increasing demand and competitive factors within the advanced countries.

Over the past decades there has been a decline of employment, particularly in Europe.

In the last decade ('87-'97) when output followed a similar trend in both areas, employment remained fairly constant in the United States (+0.9%) but fell by 11.5% in Europe (Tab. 3.1).

The chemical industry is moving towards a situation in which the growth rate of demand is not sufficient to maintain steady employment levels, particularly within economic framework crucially affected by trade and production globalization.

Table 3.1
Total Employment Growth in EU and USA Chemical Industry

	thousands	
	EU	USA
1987	1898	1025
1988	1896	1057
1989	1916	1074
1990	1911	1086
1991	2025	1076
1992	1932	1084
1993	1834	1081
1994	1770	1057
1995	1737	1038
1996	1704	1034
1997	1679	1034
Growth rate		
1987/97	-11,5	0,9

Source: CEFIC

One of the actions which followed the European Commission Report on the chemical industry was the use competitiveness benchmarking, particularly with the United States.

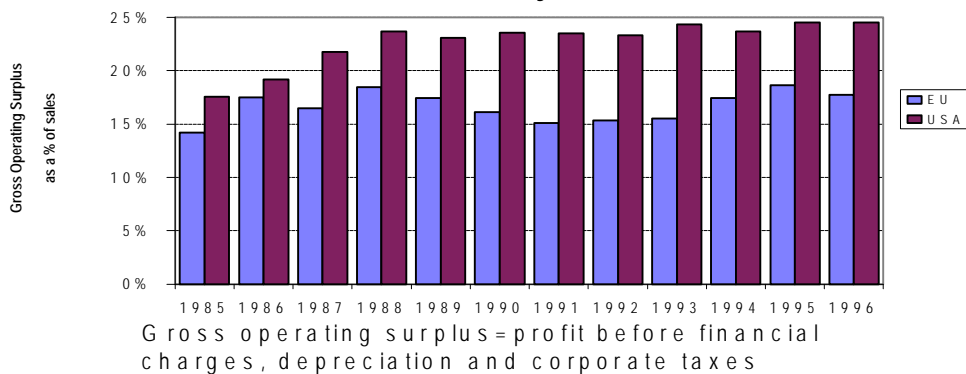
CEFIC (*Barometer of Competitiveness, 1996-97-98*) and then the DGIII-NIESR (*The comparative competitiveness of the EU chemicals and rubber and plastics*)

industries, 1998) used the same methods and came to the same results in comparing the European chemical industry with the United States. The following paragraphs mainly refer, but not exclusively, to these studies.

3.3 Profitability

Whilst growth in production has been similar in Europe and the United States, profitability has not. The European chemicals industry (Tab. 3.2) was less profitable (in terms of gross operating surplus as a ratio to sales) than the United

Table 3.2
EU - U S profit gap in the Chemical Industry



Source: CEFIC

States by an average of about 6% in the period 1985-96 (CEFIC, 1998). In addition, the European chemical industry is strongly affected by the fluctuations in raw materials prices. The profitability index shows a higher volatility in Europe than in the United States, where it has been stable since 1988.

Given the available data set, the relationship between gross operating surplus and value added (NIESR, 1998), can be used (Tab. 3.3). In order to evaluate the performance of the major European countries, the evidence shows considerable differences between countries as in the United Kingdom, for example, the average rate of profitability growth is higher than in the United States, while in Germany it is lower.

Table 3.3
Growth in Profits' Share of Value Added (% per annum)

	1979-1995	1979-1984	1984-1989	1989-1995
USA				
Chemicals	1,37	0,45	4,09	-0,13
Manufacturing	0,98	1,44	1,92	-0,19
WEST GERMANY				
Chemicals	-0,81	-2,67	0,62	-0,45
Manufacturing	-0,10	-1,32	1,07	-0,06
UNITED KINGDOM				
Chemicals	1,58	4,08	1,12	-0,12
Manufacturing	2,18	2,15	3,71	0,94
FRANCE				
Chemicals	0,75	-1,94	6,96	-2,19
Manufacturing	1,81	0,53	6,77	-1,26
ITALY				
Chemicals	1,18	3,53	-0,26	0,43
Manufacturing	1,13	1,51	1,28	0,69

Gross operating surplus as a % of Value Added

Gross operating surplus = profit before financial charges, depreciation and corporate taxes

Source: NIESR

The profitability of the chemical industry compared to the profitability of manufacturing as a whole also looks unsatisfactory. The average growth rate of profitability within the European chemicals companies was slower than in the manufacturing sector as a whole (and, recently, diminish faster).

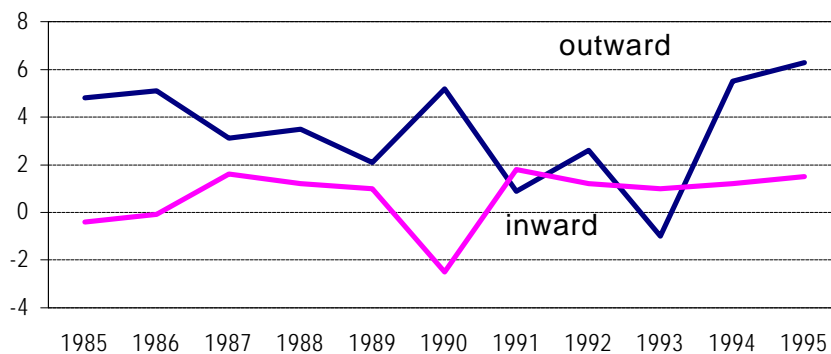
Between 1979-95, in Europe, only the United Kingdom out-performed the United States, while Germany profitability declined.

3.4 Foreign Direct Investment

In recent years, the process of globalization involved the chemical industry both because of the need to be close to customers and to faster growth areas, and to take the most competitive advantage in a framework of growing competition and lower prices. These factors, together with the low profitability of the European chemical industry, brought about in the decrease in the attractiveness of investments in Europe.

The recent Barometer of Competitiveness (CEFIC, 1998) shows that during the second half of the '80s the flow of direct investments abroad by the EU chemical industry was always higher than the inward investment corresponding flow. From 1990 on, after an initial phase of low investments linked to the recession of the early '90s, outward investments picked up steadily, reaching 6.3 billion ECU in 1995 (Tab. 3.4). The cumulative value of outward investments in the period from 1985-95 reached 38 billion ECU, which corresponds to 20% of domestic investments, while inward investments were 1/5 of this figure.

Table 3.4
Extra-EU direct investment flows by/in the EU Chemical Industry (billions of ECU) - 1985-1995



Source: CEFIC

The comparison with the United States shows that the European chemical industry is in a position of relative weakness, because the ratio outward/inward investments in the two areas is very different (Tab. 3.5). For Europe the ratio is 2.92, meaning that Europe invested about three times more in the rest of the world than the rest of the world in Europe. In the United States this ratio is 1.19. Germany is a special case within Europe, as this ratio is 11. The comparison with the United States is particularly important, as the net flow of investments towards this country was about 25.5 billion ECU during the period 1985-1994.

Table 3.5
Direct Investment Flows by/in Chemical Industry:
an International Comparison. Average Values in Period 1993-97

	outward/inward
USA	1,19
EU*	2,92
Germany	10,94
France	1,25
UK	1,71
Italy	2,03

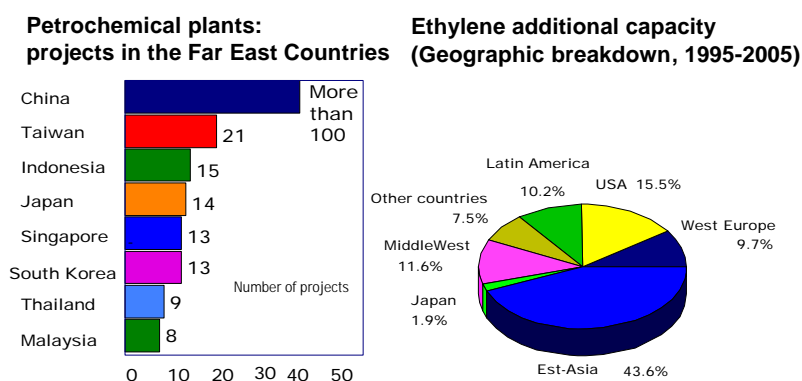
(*) average value in the period 1993-95

Note: Direct investment flows exclude reinvested earnings

Sources: our computation on CEFIC and VCI data

The scenario over the coming years looks even less favourable, despite the recent financial and economic crisis in Asia. For example, in 1996 more than 150 new petrochemical plants were planned (many of them involving European companies) and estimates relating to the ethylene additional capacity (the principal *building block* in organic chemistry) up to 2005 indicate a gradual shift towards production in Asia, only partially offset or postponed by the current problems (Tab. 3.6).

Table 3.6



Source: Oil & Gas Journal, 1996

Source: Chem Systems

3.5 The European Chemical Industry in the International Trade

The European chemical industry plays a crucial role in world trade. It generates a significant trade surplus (40 billion ECU in 1997); it is the world's leading exporter (in 1997 Europe had an export share (excluding intra EU) of 35,4% compared to 22,9% in the USA) and have a relevant share of the European trade surplus (27,4% in 1997). Using these figures as a benchmark it is worth verifying whether international trade has weakened due to competitiveness, delocalization or industry regulation issues.

The information available for sub-sectors do not help much. The chemical industry contains heterogeneous sectors and products. "Organic chemicals", for example, include both basic and fine chemicals. The analysis of the trade performance (both in absolute values and in normalized indexes) between 1990 and 1998 shows that the European chemical industry maintained its strength: the normalized trade balance rose, infact, from 19.9% to 23.1%. (Tab 3.7). The analysis of sub-sectors shows that:

- fine and specialty chemicals for industrial use and for final consumption show the best performance in terms of normalized trade balance.
- basic chemicals under performed, with significant losses.

In particular, inorganic products have a negative normalized trade balance, fertilizers continue to be negative, and in chemical fibres the trade balance deficit significantly increased.

Table 3.7
Normalised Trade Balance*
of European Chemical Products

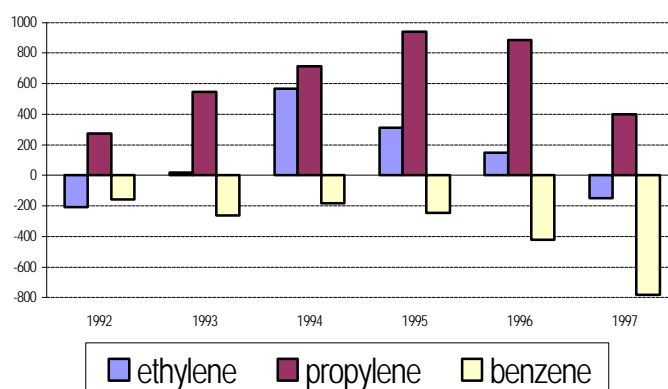
	1990	1995	1998
Chemical products	19,9%	23,7%	23,1%
<i>Inorganics</i>	4,9%	-1,7%	-8,5%
<i>Organics</i>	8,2%	12,8%	11,1%
<i>Paints and Inks</i>	42,5%	41,0%	37,6%
<i>Pharmaceuticals</i>	35,5%	41,9%	42,4%
<i>Perfumes and cosmetics</i>	56,9%	54,4%	54,7%
<i>Soaps and Detergents</i>	60,4%	51,7%	50,9%
<i>Fertilizers</i>	-38,8%	-38,7%	-26,4%
<i>Plastics</i>	11,4%	16,0%	7,7%
<i>Specialty chemicals</i>	26,9%	32,0%	31,0%
<i>Man-made fibres</i>	-12,4%	-10,9%	-42,9%

(*) trade balance as a % of imports plus exports flows
Source: Eurostat - CEFIC

During 1998 the devastating effects of the Asian crisis further weakened the position of these products. As stated above, organic chemicals include very different products, so the good performance of this sector as a whole the individual sub-sectors dynamics. Looking at three important basic chemicals, it can be seen that the trade balance in ethylene became negative (in weight) in 1997, propylene deteriorated considerably in recent years, and benzene deepened its position of structural deficit (APPE, 1997/98) (Tab. 3.8).

Table 3.8
Western European Trade Balance
of Petrochemicals Derivatives - 1997

KT/Year (calculated in ethylene, propylene, and benzene equivalents)



Source: APPE

Trade difficulties are emerging in the area of basic chemicals. Due to their nature, these products are more sensitive to industry regulation than others, although competitive factors associated with energy and labour costs are also important.

4. The Competitiveness of the European Chemical Industry: a Comparison with the United States

The analyses carried out in recent years to develop a *benchmarking* approach (CEFIC and NIESR) reach similar conclusions about the competitiveness of the European and United States chemical industries. In the following sections, the competitive performance of the European chemical industry will be analyzed taking into account two important competitive factors: labour cost and labour productivity.

4.1 Labour Cost

In Europe unit labour cost at the end of the '70s were considerably higher than in the United States both in the chemical industry and in manufacturing as a whole.

The appreciation of the dollar at the beginning of the '80s eroded the American advantage until the mid-80s when the weakening of the dollar restored a competitive advantage to the United States. In 1995 unit labour cost in the European chemical industry was almost 50% higher than in the United States (Tab. 4.1).

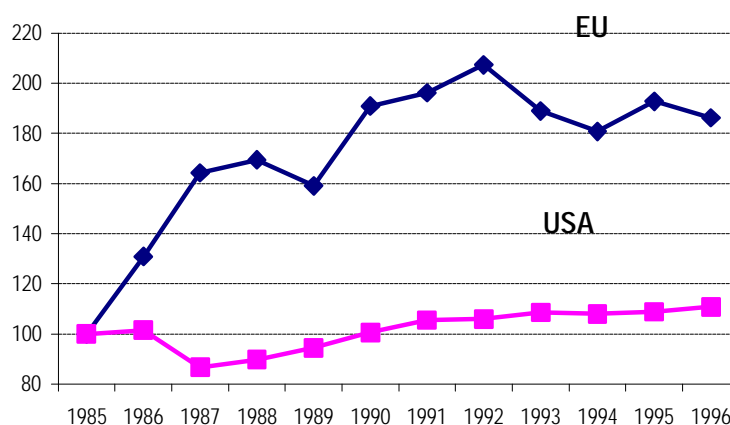
Table 4.1
Unit Labour Cost, hourly Labour Cost and Labour Productivity
in the EU Chemical and Manufacturing Industries - Selected years, 1979-1995

USA=100	1979	1984	1989	1995
Unit labour cost				
Chemicals	143	85	146	148
Manufacturing	143	86	131	163
Hourly labour cost				
Chemicals	90	55	81	95
Manufacturing	89	54	88	105
Labour productivity				
Chemicals	63	64	55	63
Manufacturing	61	66	67	68

Source: NIESR

These results are substantially confirmed by most recent data CEFIC (1998) (Tab 4.2). Unit labour cost began to fall in Europe from 1993, but this gradual fall was not sufficient to significantly reduce the gap with the United States.

Table 4.2
Unit Labour Cost in the Chemical Industry:
an EU and US Comparison (1985=100, in US dollars)

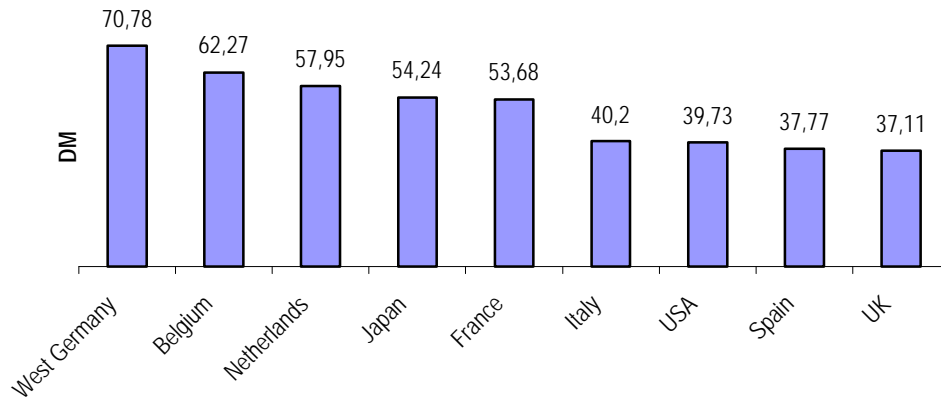


Source: CEFIC

The result does not depend so much on the difference in the labour cost in Europe and America: NIESR's analysis in fact shows that throughout the period from 1979-1995 hourly labour cost in the European chemical industry is below that of the United States), as in the large labour productivity gap, which we will analyze below.

However, international comparisons of hourly labour cost are difficult to assess and the use of OECD data by sector is not always correct. Table 4.3, drawn from a German source (VCI), shows hourly labour cost in German currency for different countries. It appears that in 1997 only the UK had a hourly labour cost lower than in the US.

Table 4.3
Hourly Labour Cost in the Chemical Industry:
an International Comparison -1997



Source: BAVC

4.2 Labour Productivity

In the European chemical industry labour productivity (defined as the ratio of value added to man/hours worked, adjusted to enable comparisons between countries¹) is much lower than in the United States. This difference is also systematically larger in the chemical industry than in the rest of manufacturing. It is interesting to note that the European productivity level shows no tendency to converge to the American level; the gap between these areas was about 37% throughout the period 1979-1995 (Tab 4.1).

This aggregate figure for Europe hides substantial differences in productivity levels between the main European countries; France has a lower gap (about 20%), whilst Germany and the UK are in line with the average for Europe. Italy, on the other hand, is below the European average, with a level of productivity under 50% of that of the United States, despite great improvements since 1979.

¹ Two methods are used conventionally to make international comparisons between industrial value added, and hence to compare labour productivity in different nations.

The first is based on national accounts figures, in order to compare purchasing power in different countries and in different industrial sectors (proxy PPA). With this method, the factors used for conversion refer to final expenditure (consumer, companies and government spending) for manufactured goods, rather than to a specific industry (Bureau of Labour Statistics).

The second method uses a country's output and employment figures to estimate production costs for different types of product (Broadberry, Maddison/van Ark, Groningen University; Nicholas Oulton and O'Mahony of the NIESR).

For products of the same type, in each country the unit value (given by the ratio of the overall value of production to the number of units produced) is compared to that of the United States. Thus, this ratios (UVRs) are used as conversion factors. When products are too dissimilar to be compared, the proxy PPA method is used.

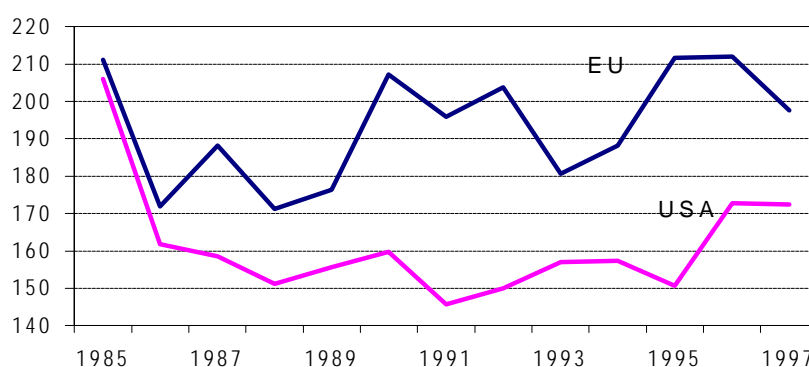
In the manufacturing industry as a whole there has been a slight reduction in the gap in productivity, which remains high (around 32% in 1995 compared to 39% in 1979). The less intensive use of capital in the European chemical industry, compared to the United States, partly explains lower performances in terms of productivity.

As it is well known, the ratio of capital stock to hours worked in the chemical industry is the highest in all manufacturing industries. In 1994 capital intensity in the chemical industry was three times higher than in the rest of manufacturing in the United States, and twice as high as the rest of manufacturing in Europe.

In terms of the gap in capital intensity compared to the American economy, the European chemical industry is further behind (54%) than in other manufacturing industries as a whole (33%).

This evidence highlights the peculiarity of the United States chemicals industry, which has a more homogenous and larger market, leading both the chemical industry and manufacturing as a whole to adopt more *capital-intensive* processes able to fully exploit economies of scale and to create a larger quantity of standardized products than in Europe. In the European chemical industry one of the stylized fact has been the widespread diversification towards chemicals with higher value added, i.e. specialty and fine chemicals able to meet customer/consumer needs. This type of specialization does not require the plant size prevailing in the United States; however, in the light of the gap in capital intensity between the European and American chemical industries, the possible effects of industry regulation on investment decisions in Europe's chemical industry should be considered.

Table 4.4
Average Price Of Energy faced by the EU and US Chemical Industries (in USD per toe*, excluding taxes)



Source: CEFIC
(*) tonn oil equivalent

4.3 Energy Cost

One of the central issues in the debate on the competitiveness of the European chemical industry is the cost of energy, which is still too high, about 20% higher than in the United States in 1997. This gap, which was reduced between 1985 and 1986 due to fluctuations in the value of the dollar, varied in the last decade between 13% and 40% (Tab. 4.4).

4.4 To sum up

The most significant evidence of the analysis of the competitiveness of the European chemical industry is the gap in productivity relative to the United States, which is higher than in the manufacturing industry as a whole. This difference causes profitability to be steadily lower in Europe than America and, together with other factors dealing with worldwide demand, causes a large imbalance in the European foreign investments flow.

The causes of this gap, which represents a significant limit to the growth and competitiveness of the European chemical industry, are discussed below.

a) The different capital intensity in the chemical industry in the United States and in Europe.

This refers to the fact that capital investment may determine an increase in labour productivity. This may explain the difference in productivity levels in the United States and Europe, for the manufacturing industry, until the beginning of the '80s (Van Ark and Pilat 1993), although it does not seem, on its own, to explain the gap after that period. Nonetheless, in terms of capital intensity, the United States is further ahead of Europe in the chemical industry than in manufacturing as a whole,. The level of investment in Europe may therefore still be inadequate.

It is worth noting that capital spending (as a ratio to sales) increased during the last years in the US, after a short decrease during the recession of the early '90s. In Europe, however, this ratio remained low and constant, suggesting a lack of profitability and competitiveness.

b) The different structure of human capital.

Within the framework of economic growth, investment in human capital play a crucial role. This is particularly true for the sectors with high levels of technological innovation, requiring an extremely high qualified work force. In this framework comparisons with other countries are difficult due to the difficulty of measuring human capital. Typically, the level of education is used as a proxy for

human capital, thus ruling out the skills learned informally on the job, or formally, during internal training courses. In addition, formal education courses are not strictly comparable, making it even harder compare international data. Taking into account these limitations, the available empirical evidence (Van Ark and Pilat (1993), NIESR (1998)) shows that the average skill level of an employee in the American chemical industry is higher than in Europe. In particular, in the United States there is a greater polarization of skills, i.e. a considerable proportion of higher level skills and low skills are employed, whereas in Europe there is a greater proportion of intermediate skills.

These differences in human capital endowment may be crucial to explain the productivity gap between the United States chemical industry and Europe.

c) The ability of the sector to innovate.

In the Economic literature the debate on the appropriate measure of the ability to innovate, both at the micro- and the macro-economic level, is controversial. R&D expenditure is only a proxy of this ability and does not reflect the effectiveness of such an expenditures. However the figures for the European chemical industry are extremely controversial, since, in terms of R&D expenditure as a percentage of turnover, they are in line with, if not actually higher than in the United States. There is no direct relationship, therefore, between the intensity of R&D and industry growth, given that the gap in productivity between Europe and the United States does not close.

This may reflect a lower return to R&D investment in Europe, or the fact that R&D intensity is not the correct index to proxy for the ability to innovate, as innovation may derive from other sources, rather than R&D. Despite this limitation, the overall picture is not satisfactory for the European chemical industry, as innovation activities which do not lead to improvements in productivity may in the medium or long term reduce the competitiveness of the European chemicals industry.

d) The different industrial structure.

Differences in productivity may also reflect the different structure of the American chemical industry. A high concentration in low value added activities per hour worked may to some extent explain the difference in productivity levels in the European and the American chemical industries.

e) The different production scale and hence the ability to exploit scale economies.

The different industrial structure is also linked to different production scales in the two areas. The average and median size of European plants is rather small and this may suggest that Europe's production scale is not efficient compared to the

United States, where economies of scale may be exploited more easily.

f) The ability to compete globally rather than locally or regionally.

Another important element affecting chemical firm's performance is its ability to compete in global markets, rather than in local or regional markets. In Europe regional competition relates to the European market, whilst local competition relates to the domestic markets. Global markets are the world's markets and global competitiveness means the ability to compete worldwide.

g) institutional, hence regulatory, factors.

Institutional factors, hence the social and economic environment in which firms compete, may significantly affect their performance. This issue would merit a separate and deep investigation. However, in the framework of the analysis provided in this paper, the most significant institutional effects on competitiveness is regulation. This aspect will be analyzed in greater detail in the next section, where some conclusions may be reached.

It should however be said that the factors outlined above may all be influenced negatively by regulation (for example labour flexibility) and by environmental specifications (delays in product development and in opening a new production facility, which reduce the ability to innovate or prevent a critical mass being reached for scale economies). In addition, in an industry that is so sensitive to regulation, the opportunity to exploit a larger market, represented by the single European market, may be entirely lost if each country retains specific, unharmonized norms.

5. The Impact of Environmental Regulation on the Competitiveness of the European Chemical Industry

The present EU regulatory framework seeks to achieve the completion of the internal market (Article 3 of the Treaty) taking into account environmental protection (Article 6), as well as consumer protection (Article 153(2) of the Amsterdam Treaty) and a high level of employment (Article 127(2)).

As recalled in the Single Market Review volume dealing with the chemical industry², the single market programme had a positive overall impact on the European chemical industry, reducing barriers to trade, increasing competition and allowing for larger economies of scale. This was confirmed in the framework of a recent Commission Exercise assessing single market functioning ("Cardiff I" Report³), to which the chemical unit of DG III contributed.

² Single Market Review, EC 1997, Volume 5 "Chemicals" (KPMG study).

³ Commission's report on the functioning of products and capital markets (1998).

Nevertheless, the analysis of the preceding sections shows a still significant gap in competitiveness between the European chemical industry and its American counterpart, and also identifies the factors behind this gap. Strictly economic factors, such as productivity and the cost of labour, go a long way to explaining the lack of competitiveness of the European chemical industry which, as result, cannot afford additional burdens in terms of industry regulation.

Even if it was recognised that the functioning of the single market was overall satisfactory in the chemical sector, the Single Market Review volume points out the remaining barriers to trade due in particular to inconsistent application of harmonised standards by Member States (as well as lack of harmonisation in some areas e.g. VAT). Based on three case studies (fertilisers, detergents and pesticides) examined for the purpose of the Cardiff I Report, the chemical unit of DG III has identified potential remaining obstacles to the single market that fall into five categories:

1. **Absence of EU regulation** (which is not necessarily negative).
2. **Partial harmonisation**, referring to a situation where Member States have different interpretations of EC Directives or Recommendations.
3. **Exemptions to EC regulation**: these include all cases under (new) Article 95 of the Amsterdam Treaty (former Article 100A, § 4), or exemptions specifically provided for accession etc., on a temporary basis.
4. **National voluntary agreements**.
5. **Use of connected legislation** (that is, Member States may rule on restrictions at some end of a process that prevents the use of particular products covered by EU legislation).

In this framework, it can be therefore of great interest to verify whether regulation pertaining to business, and particularly environmental regulation (see above, § 2), plays a significant role in influencing chemical industry competitiveness and if some differences can be stressed, on this ground, between EU and USA.

There is a widespread agreement on the fact that the improvement of the existing environmental regulation should rely on a cost-benefit analysis. Regulation can be implemented by considering the trade-off between private and social costs and social benefits. Following these considerations, the OECD Council developed the first international standard on regulatory quality. For this purpose, a checklist of regulatory decision-making has been prepared and it contains ten issues concerning regulatory decisions which are appropriate for different decision makers⁴. Some remark on such standard will be developed in the final conclusions of this Report (see § 6).

⁴ OECD/GD(95)95, 9 March 1995.

However, even sharing the need of a wide cost-benefit approach, this paper will mainly emphasize the impact of regulation on industry costs, which are particularly significant in the chemical sector. Indeed, there is a broad consensus on the fact that the chemical industry is one of the most strictly regulated and therefore this sector is likely to show the strongest negative impact on industry costs among all manufacturing sectors. This is a crucial issue as it may affect the potential growth of the chemical industry in the future, if industry costs grow too fast compared with all other factors affecting the growth rate of production (e.g. innovation, labour productivity).

From a general point of view, it can be stressed that the analysis of possible effects of regulation has been developed within the general trend towards the improvement of legislation efficiency in the industrialised countries. In Europe, such trend is well represented by the Molitor Report. In this context, the discussion aiming at developing a methodology for the evaluation of regulation effects has mainly focused on the relationships between regulation, competitiveness and innovation.

On one hand it is nevertheless to stress the difficulty of making a direct comparison between the United States and the European Union, due to the lack of comparable international data, particularly in the area of environmental costs.

On the other hand, existing studies on the relationship between environmental regulation, competitiveness and/or innovation do not give adequate evidence of the actual impact of regulation itself on business, and particularly on chemical industry.

As regards to the studies on the impact of EU regulation on innovation, it has been recently maintained that they "are often neither theoretically sound nor empirically well founded. Most of the studies usually assume that regulation has a linear and mechanistic effect on innovation activities. They are based on a stimulus-response model, which does not take into account the complex interdependencies between policy measure and other parameters of innovative behaviour" (Sorup, Kemp, Fleischer, Majone, Laurencin, Brousseau, 1998). It has been also stressed that "the debate has been characterised by a high anecdotal level; little systematic empirical research has gone into the topic (...). One reason of this is the lack of a theoretical framework about regulation and innovation which recognises the reciprocal and multifaceted nature of the relationship and the myriad of factors that are influencing innovation decisions and output" (Kemp, 1998).

In theoretical terms, there are two different approaches to environmental issues. The traditional view sees environmental regulation as simply a cost, slowing down productivity and preventing the company reaching a competitive position internationally (R. Pethig, 1975; M.C. McGuire, 1982; see also A.J. Barbera and V.D.

McConnell, 1990; F.M. Gallop and M.J. Roberts, 1983; D.W. Jorgenson and P.J. Wilcoxon, 1990).

In this view, the loss of competitiveness of the European chemical industry, compared to countries and industrial sectors which are less regulated, in the short term leads to a loss of exports and an increase in imports. In the long term it leads to production facilities “moving” to less regulated areas.

The second view sees environmental regulation as an opportunity, not only because it does not negatively impact on the structure of costs, but because it also stimulates innovation and, therefore, competitiveness in international markets (M.E. Porter, 1991).

Despite the lack of useful or suitable empirical data, there has been a great deal of debate about these two points of view in recent years, above all in relation to their policy implications. In the chemical industry it has often been said that what is required is homogeneity internationally, since in the first case costs would be the same and in the second the opportunities arising from industry regulation would be for all.

The parameters generally used to measure the effects of environmental regulation on competitiveness are mainly in the area of international trade, i.e. net exports. Since the flow of goods is strongly influenced by relative advantages, the effect of regulation on these advantages can be seen in import and export trends. According to theory, the outcome is a situation in which industrialised and highly regulated economies lose their specialisation in production with high environmental costs, and reduce their exports in these products. Developing countries with less stringent regulatory systems replace them as the leading producers in these fields.

But again, this is not borne out by the facts. There is little evidence that environmental regulation has been responsible for the principal changes in import and export patterns over the last thirty years (Grossman and Krueger, 1993; Low and Yeats, 1992). The relative advantage of a country, compared to another, depends on a number of cost factors (raw materials and energy, labour, transport, etc.) and the technological level reached in the country. But, as Jaffe et al. (1995) observe, the principal shifts in international trade are a result of the more general process of development in the Third World, which does not depend solely on the looser framework of environmental regulation than in industrialised countries.

Overall, even if sector-by-sector (micro) analysis allows various effects of environmental regulation to be identified, such as the effects on investment decisions, on productivity and on technological innovation (see Table 5.1), it does not produce a definite conclusion on the effects of environmental regulation on industry performance. The complexity of economic systems requires a wider empirical evidence on one side, and a better definition of the theoretical and methodological framework on the other side.

The interesting study conducted in 1998 by SOFRES Conseil on behalf of the EC DG XI on the “Impact of EU Environmental Regulation on Selected Indicators of the Competitiveness of the EU Chemical Industry” can be here brought as a good example of the need of widening the approach of studies aiming at the assessment of regulatory impact. The aforementioned Report has brought to the conclusions that the impact of environmental policy and regulation on EU chemical industry competitiveness is either not significant or small, that environmental improvements can rather go hand in hand with an improvement of proactive firms’ competitiveness and finally that environmental policy should therefore be devised and implemented on the basis of its own merit.

Nevertheless, these conclusions do not seem to take correctly into consideration a number of factors which typically characterise the present state of European environmental regulation within the general framework of the EU regulatory system, and which have on the contrary a significant impact on industry, particularly on SMEs.

The “Sofres Conseil Final Report” deals with specific sector examples in which a pro-active policy in relation to environmental concerns has brought to a strengthening of the considered industries. The specific examples taken into consideration are paint industry in EU experience, and industry of titanium dioxide in USA. The paint industry has shown a significant shift of production towards non solvent-based paints in the European market during the last 10 years (from 12% of the market in 1984 to 35% in 1994 with a forecast of 47% for the year 2004). The available data (maintenance of strong exportation flows over the last 20 years) suggest that, by anticipating the stringent environmental standard coming into force, the EU paints sector has increased its competitiveness, particularly through intensive R&D. The same can be said for the USA industry of titanium dioxide. As the aforementioned Report points out, USA industry of this sector has been able to retain its market share as a result either of lower prices of their products and of significant investments on environmentally friendly sulphate processes.

It is clear that the two mentioned case studies give only limited evidence of the possible relationship between environmental regulation and competitiveness. More particularly, they give evidence of the fact that environmental improvements, when considered as pattern of innovation, can represent a competitive advantage. But the point then is: in which conditions can the required environmental improvements actually represent a competitive advantage?

This last question brings directly to take into account the costs associated with the implementation of environmental improvements required by regulation. The “Sofres Report” takes as a ground of analysis of the environmental regulation impact the Pollution Abatement Costs and Expenditures (PACE), and as a general assessment criterion the ratio PACE/value added of the considered sector.

Table 5.1 – EFFECTS OF ENVIRONMENTAL REGULATION OVERVIEW OF MAIN SECTOR-BY-SECTOR (MICRO) STUDIES

The sector-by-sector analysis allows various effects of environmental regulation to be identified, and namely:

- a) the effects of environmental regulation on investment decisions
- b) the effects of environmental regulation on productivity
- c) the effects on technological innovation.

a) The effects of environmental regulation on investment decisions

Environmental regulation can seriously affect investment decisions within companies. To analyse the linkage two broad areas can be used:

- decisions relating to locating plant
- investment flows towards other countries.

Sprenger (1996) has shown that the available evidence does not support the idea of the relocation of German chemical and petrochemical plants. In addition, on the basis of a survey of German industry investigating factors determining investments abroad, environmental regulation was not considered a factor in decision making.

Heerings (1993) has presented a case of relocation in the phosphate fertilizer industry, away from Western Europe and towards developing countries. As a result of increasing environmental pressure against the toxic substances though to be created by the production and use of azotized fertilizers, some European companies, including BASF, closed down their production facilities in Europe, investing only partially in “clean” plant and technology. There has been a tendency to transfer phosphate production to North Africa, especially Morocco, and this has led to an increase in that area of exports in phosphate fertilizers and phosphoric acid.

The tendency of multinationals to transfer production with a strong environmental impact towards less regulated areas is consistent with the findings of **Levinson** (1992). With reference to the 1982-87 period, his analysis shows that environmental regulation had no impact on decision making in terms of relocation in the manufacturing industry as a whole, but had a strong negative influence on the American chemical, plastics and electronic industries.

Gray (1997) analysed a large quantity of information from the census of American businesses in the period between 1963-87 and discovered a strong negative connection between the number of new production facilities and state-level environmental regulations. However, in highly polluting industries, this impact is only slightly larger than in manufacturing as a whole.

Bartik (1990) analysed a sample of small businesses in 19 sectors of manufacturing in America, and concluded that stringent environmental regulations have a slight, but negative, effect on the creation of small companies.

In connection with the effect on the flow of investments abroad, there are fewer studies of the direct effects of environmental regulation.

Zamparutti and Klavens (1993) interviewed a thousand American and European businesses in an attempt to assess the impact of environmental regulation on decisions to invest in central and eastern Europe. The survey concluded that regulation had little impact on long term investments, whilst, in the short term, environmental regulation led to the postponement or even scrapping of a number of projects.

Miller and Hamilton (1995) conclude that in the field of biotechnology, the heterogeneous regulatory framework led European chemical companies to invest abroad, mainly in the United States and in Japan. Nonetheless, it should be said that in the course of the years regulations in industrialised countries have become far more homogeneous, so it is difficult to assess the impact of environmental regulation on investment decisions in large companies like Bayer and Hoechst.

Table following:

Differences in regulations are more marked in the developing countries, such as the Far East. However, there is still insufficient data about how and where European chemical companies have invested abroad.

In the United States, a study carried out by **Leonard** (1988) was unable to back up the theory that tight environmental regulation affects investment decisions in the chemical industry. The study shows that in the period between 1973-85 American chemical and mining companies increased their investments in foreign countries from a percentage of 25.7% of all manufacturing industries to 26.5%. In relation to investments solely in developing countries, manufacturing as a whole increased its investments in these areas, whereas the chemical industry slowed them down.

b) The effects of environmental regulation on productivity

From a theoretical standpoint, if a company is efficient, the introduction of environmental regulations reduces productivity, because further input factors are required in production (labour, capital, energy) to produce additional environmental quality which is not a standard parameter of productivity.

Empirically, the evidence is not always clear. In the American economy a number of studies analysed the effect of environmental regulation on total factor production in the '70s, i.e. in a period of strong recession and downward price pressure in raw materials (**Denison**, 1979; **Gray**, 1987). These studies showed that environmental regulation could not be considered the principal cause of the slow-down in production growth in the manufacturing sector, because only a small percentage (8-16% overall, 10% in the chemical industry) of the reduction could be attributed to regulations.

Conrad and Wastl (1993) present a slightly different picture in pollution intensive German industries, including the chemical industry, in the period between 1975-1991. This study shows that environment related costs had a large impact on the slow-down in overall factor productivity growth, especially from the second half of the '80s on. The parameters used for productivity, however, did not include the reduction in harmful emissions, so it is likely that the study and other investigations with the same parameters tend to overestimate the negative effects of environmental regulation on economic growth (**Repetto**, 1996).

c) The effects on innovation

Concerning this issue, it should be firstly mentioned that a consortium of EU universities is preparing a Green Paper on Innovation in the Chemical Industry, in the framework of the Targeted Socio-Economic Research Programme of the Commission and with the purpose of analysing the strategic aspects of innovation and related technological policy.

As concern previous literature, few empirical studies have been carried out on the impact of environmental regulation on the ability of a company to innovate. **Porter's** hypothesis (1991) that it would stimulate innovation is not sufficiently borne out by the facts. Some authors (**Jaffe and Palmer**, 1994; Jaffe et al., 1995) have shown a positive correlation between expenses incurred for adapting plant to regulatory norms (compliance costs) and expenses for research and development, in the period between 1976-89, in the framework of a selected group of American manufacturing businesses. Nonetheless, they did not provide any evidence that the increase in expenses for environmental regulation stimulated technological innovation, as measured by successful patent applications.

There is some evidence, indeed, that tight environmental regulation acts as a brake in the European chemical industry, slowing technological innovation down. **Fleischer** (1998) shows that between 1984-93 nine of the largest chemical companies in Europe reduced the number of innovations from 290 to 202, and the Community Innovation Survey (CIS), carried out for 1992/93 on all European manufacturing businesses, reported that 17.7% of chemical companies considered regulations a severe obstacle to innovation. The same survey reported that 38.6% of chemical companies considered the high cost of innovation a significant obstacle.

The perception of the impact of regulation on innovation does not seem very different in the United States. A study carried out by the **Council on Competitiveness** (1996) examined the effect of

Table following:

regulation on Research & Development, and on innovation, in a number of strategic sectors. The study shows that regulation impacts differently in different sectors. In the chemical industry, the data compiled by the Chemical Manufacturers Association (CMA) show that in the period between 1975-1992 expenditure for pollution abatement went up fivefold after the Clean Air Act and, according to CMA forecasts, will continue to grow, drawing resources away from R & D.

This evidence does not explain the linkage between regulation and innovation but suggests that the implementation of regulations does produce linkage as costs increase.

This aspect is crucial in the context of European regulation in the chemical industry. Specifically, the norms regarding the notification of new substances (EEC directive 67/548) are extremely tight, when compared to the American equivalent, the Toxic Substances Control Act (TSCA). They require, for example, any chemical substance used or marketed by a company for the first time to be considered "new" (and therefore subject to a lengthy approval procedure) even if it is already used or marketed by other companies.

Unfortunately, the length of time required for approval of new products and plant often discourages innovation, rather than stimulating it. This is an important factor in all sectors, such as the chemical industry, in which innovation is vital for growth. In this context some data from the Italian chemical industry is of interest, albeit related to only one country. This data sheds light on a more general situation, on the ability of chemical companies to innovate (in connection also with environmental technology) and on the innovation gap which exists with other countries and which tight industry-wide regulation in Europe is likely to widen.

A survey of technological innovation in industrial companies in the period between 1990-92 (ISTAT 1998), shows that 50.5% of innovative chemical companies in Italy (i.e. companies which, during the period under investigation, introduced at least one new product or process or both) were involved in 1992 in investment projects for new materials technology and technology for the environment. The commitment to new technology is very different in different sectors of the chemical industry. Whilst companies in basic chemical were equally involved in new materials technology and technology for the environment (57.5% and 59.8% of innovative companies, respectively), in the synthetic and artificial fibres sector, no less than 69.2% of companies declared that it was involved in new materials technology, but only 30.8% in technology for the environment.

Companies in the pharmaceuticals business appear to be less sensitive to the development of new technology both for the environment (39.6%) and for new materials (27.9%), whilst 34.2% of pharmaceutical companies declared that they had made investments in biotechnology (16.1% if the whole of the chemical industry is included).

As far as the PACE criterion is concerned, it is to be stressed, on one hand, that the "Sofres Report" itself clearly shows that most of existing empirically-based studies on the relationship between environment and competitiveness relates to USA, while only few studies concern the European countries. According to the same Report, this is mainly due to the availability in USA of much detailed data on pollution abatement costs and expenditures at different sectoral level. On the contrary, Europe is characterised by a significant lack of data on a coherent multi-country basis. This does not seem to be a small problem: it simply means that the European PACE taken into account by the Report is rather incomplete, therefore representing a weak ground of demonstration.

Furthermore, the PACE criterion itself does not seem sufficient to represent the whole costs faced by industries in the compliance of environmental regulation.

Going back again to the “Sofres Report”, it is clearly stressed that the utilised PACE criterion takes mainly into consideration: a) end of pipe investments, and b) integrated investments aiming at the same time at cleaning industrial processes and at rationalising them (with a possible global gain in firm-level competitiveness). Starting from this methodological approach, it is probably very easy to reach the conclusion – as the Report does – that the compliance cost of environmental standards is of limited significance if compared with other costs of the chemical sector, such as raw materials, energy and labour costs. But the question is that the aforementioned PACE criterion does not cover the whole costs connected with the application of environmental regulation, since it does not take into consideration two main conditions:

- the efficiency of the applicable regulatory system
- the structure of the industrial system.

In other words, to assess the actual costs of environmental regulation compliance, it is not enough to answer the question: “which is the amount of investments in cleaner goods and services?”, being necessary to quantify also the costs connected with the functioning of the regulatory system in a given industrial scenario.

The two above mentioned conditions - regulatory system efficiency and structure of the industrial scenario - must be considered as potential sources of additional (indirect) costs, as well as the key factors to translate environmental improvements into competitive advantages.

5.1. Efficiency of EU Environmental Regulatory System

In Europe, during the last 10-15 years, it has become increasingly clear that regulation, if not carefully designed, can bring negative impacts on business - particularly on SMEs -, citizens, trade and investments, as well as on technological change and global market opportunities.

Many regulations are not necessary or too complex. Moreover, standards vary too widely between countries. Regulations change too frequently and they are enforced inconsistently.

More generally, there are problems associated with the overall regulatory framework. On one hand, the impact of the regulatory system as a whole can be often greater than the sum of specific burdens imposed by each sectoral regulation, e.g. the environmental regulation. This is particularly true for SMEs. On the other hand, sectoral regulation, such as environmental regulation must be read as a part of the general regulatory framework and therefore considered as affected by the same

structural and functional problems.

The most evident defects of EU environmental regulation have been already stressed in § 2. They can be briefly summarised as follows:

- EC Directives and Regulation are often **too complex**. This aspect is nowadays emphasised by the fact that many significant EU Directives have come to their second “generation” (e.g. Seveso Directive, EIA Directive, Waste Framework Directive), requiring therefore a strong implementation effort by Member States;
- enforcement of EC Directives is **inconsistent among different Member States**. This aspect gives origin to different state of application of environmental regulation from country to country. Water protection and waste regulations give an example of such situation;
- EC Directives and Regulations have generated a control system characterised by a significant number of **too complex and long formal proceedings**. This is particularly true for the **administrative licensing system**, which represents one of the most relevant burden for chemical industry. Also from this particular point of view, significant differences can be registered among Member States. As a matter of fact, some EU Member States have started or realised a regulatory reform aiming at rationalisation and simplification of substantial rules and procedures. Germany is one of the clearest examples, having put in place a broad regulatory reform applicable also to environmental regulation. As it can be easily understood, the trend towards national regulatory reforms brings even more complexity into the European scenario.

Going back to the general need for a wide cost-benefit analysis - including the analysis of social benefits of regulations - it is interesting to stress that the growing trend towards the use of command and control means in the field of environmental protection at the EU level has not brought, until now, a significant improvement of environmental quality in Europe. The problem had been already pointed out in the first appraisal of the state of the environment in Europe, made by the European Environment Agency in 1995 (Dobris Assessment), and has been newly outlined by the Second Assessment of the same Agency (1998 and 1999, state of the environment and evolution until 2010).

According to the European Agency assessment, the 25 years old and from many points of view successful EU environmental policy has not yet produced satisfactory results in terms of environment quality in Europe. In many of the analysed areas improvements are still insufficient (acidification, chemical substances, water protection, urban environment), and in most of them a negative development has been verified (climate change, ozone depletion, waste, sea water, soil protection). The excess of complexity of the European regulatory framework - with the consequent high level of compliance costs for industries - is therefore not counterbalanced by significant performance of the control system on the ground of environment quality.

In other words, the social benefits of the control system seem to be rather low.

Taking into account the main aspects of the inefficiency of the EU environmental regulatory system, it is now possible to identify the costs associated with industry compliance. In general terms, the distinction introduced by the “UNICE Regulatory Report” of 1995, seems to be particularly correct. According to such Report, regulations affect: a) cost levels within a company; b) the flexibility with which a company can operate; c) the level of capital expenditure within a company (and the opportunity cost of that capital); d) the speed of decision-making within a company; e) the use of scarce management time. Issues at points a) and c) correspond to the PACE criterion adopted by the “Sofres Report”, while issues at points b), d) and e) identify the costs associated with efficiency-inefficiency of the regulatory system.

Possible costs associated with environmental regulation compliance by industry (including capital spending – investments, and current expenditures) can therefore be identified as follows:

- **pollution abatement and control expenditure** (PACE, to be defined as *expenditures for goods and services that are used to produce cleaner air and water and to dispose of solid waste*), including:
 - pollution abatement costs (investments in cleaner technologies, with regard to processes and products);
 - control functioning costs (current expenditures for: a) administrative proceedings for plant and activity licenses; b) technical control by public competent authorities during the ordinary functioning of plants);
- **environmental damage costs** (cleaning up; environmental damage compensation; criminal or administrative sanctions; legal proceedings connected with the solution of civil, criminal and administrative litigations);
- **damages to third parties caused by accidental or non-accidental pollution** (damage compensation; criminal sanctions; legal proceedings connected with the solution of civil or criminal litigations);
- **environmental taxes and charges;**
- **risk prevention;**
- **energy saving;**
- **indirect costs**, including:
 - inefficiency of administrative control system (excess of bureaucratic burdens; complexity of licensing system; long time needed to obtain licenses);
 - social impact (e.g. NIMBY syndrome).

5.2 Environmental Regulation and SMEs

The second aspect to be carefully considered while assessing the impact of environmental regulation on competitiveness is the size of enterprises. The inefficiencies of the regulatory system have a bigger impact on small and medium-sized enterprises. In comparison with larger-scale enterprises, SMEs are in fact less equipped to deal with complex regulations and with excessive bureaucratic burdens. SMEs have fewer managerial resources - and therefore the impact of diverting management time can be significantly more severe; they have also less turnover to absorb increases of fixed costs. SMEs rely more upon flexibility and speed, and have fewer financial resources. Particularly the diversion of scarce managerial resources, caused by the need of dealing with regulatory issues, can be seen as the most damaging effect of regulations on SMEs competitiveness (UNICE Regulatory Report). Regulations can also have a negative impact on flexibility, which represents one of competitive advantages of SMEs. Of course, also fixed costs of SMEs can be disproportionately increased by too complex regulatory systems of control.

5.3 Preliminary Conclusions on Possible Links between EU Environmental Regulation and Competitiveness of Chemical Industry

On the ground of the preceding analysis, it is possible to get to some preliminary conclusions:

- the assessment of the effects of environmental regulation on industry performance, and particularly on chemical industry performance, is still a **difficult and controversial issue**. This is due, on one hand, to the fact that micro and macro performances depend on a complex combination of factors, each of which contributing in accordance with the social and economic scenario at a given time. On the other hand, the lack of precise identification of possible regulation effects is nevertheless also due to present situation of studies, that can be improved in view of producing better results especially with regard to the European situation;
- the analysis of possible regulation effects must be based on a **wider evidence** with specific regard to the **European situation**. As far as environmental regulation is concerned, a better understanding of its possible effects on industry performance could be based on the analysis of the implementation of single area of legislation, such as plant administrative licensing. And infact, the chemical unit of DG III has undertaken the approach of case studies based on specific pieces of environmental legislation⁵. The aim is to assess the impact of such legislation on

⁵ At least four pieces of legislation should be examined concerning e.g. marketing and use of dangerous substances, plant protection products, waste.

the competitiveness of the corresponding chemical activities relative to the US and Japan, taking the case studies down to the level of the firm.

To this purpose, a good example of this sectoral approach can be found in the recent "Comparison of Regulatory Requirements for the Notification of New Chemical Substances in the European Union, the USA and Japan" realised by the Institute for Prospective Technological Studies in August 1998. The same approach could be applied to verify the different impact of administrative authorisation system on chemical plants and activities within the European and the USA context;

- the analysis of possible regulation effects must be also based on a **better theoretical and methodological approach**, taking into account, on one hand, the complexity of factors generally influencing competitiveness and innovation, and, on the other hand, the total amount of direct and indirect costs connected with environmental regulation compliance. Indirect costs must be strictly connected with the overall efficiency level of different legal systems;
- even in the present situation of indefinite results of the existing literature on the issue, there is sufficient evidence on the fact that **chemical companies are faced with high and growing environmentally related costs**. There is evidence that the costs sustained by the chemical industry due to environmental regulation have increased in all industrial countries since the '80s. In Germany environmental costs (total capital and operating environmental expenses) against turnover increased from 2.3% in 1985 to 4% in the '90s. In the United States the ratio went from 1.75% in 1985 to 2.2% in 1992. CEFIC estimates that for the European Union environmental spending (capital spending and operating costs) in the period from 1990-1996 represent between 4-5% of turnover. Unfortunately, these costs often do not include the purchase of integrated technology which increasingly replaces the installation of end of pipe control equipment. The parameters currently used for measuring environmental costs do not always include, or include in the same way, the cost of environmental controls linked to the acquisition of new processes or the reformulation (integrated technology) of new products, which therefore cannot be deducted from the overall costs. However, it can be estimated that in most countries costs relating to the environment, health and safety have risen to 15-20% of overall outlay;
- to make a complete evaluation of the economic impact of environmental regulation in Europe, it should be necessary to calculate the benefits that such regulation has brought in terms of pollution prevention and control. Until now, the general assessments realised at the European level have not shown a particular improvement of environment quality as a consequence of the enforcement of environmental regulation. To reach better results, a specific area should be nevertheless analysed in connection with specific industrial sectors (e.g.: state of

water in a given geographical area vis-à-vis chemical production in the same area);

- it is necessary to suggest **solutions for the general improvement of the efficiency of environmental regulation** and control system, in order to reduce the indirect costs connected with regulation compliance. The specific solutions will depend on the results of a regulation impact assessment responding to the aforementioned needs of wider evidence and better theoretical and methodological framework.

6. Summary Conclusions and Recommendations

- In recent years the specific features of the chemical industry have prompted the European Commission to carry out a detailed analysis of this industrial sector, with the Communication "An Industrial competitiveness policy for the European Chemical industry" recommending industry-wide benchmarking.
- The interest in the chemical industry is due to its importance in quantitative terms, its role in forward-linked sectors, its capacity to innovate, its complex relations with the environment and, more specifically, to the importance for the chemical industry of a possible improvement of the regulatory framework, identified by the EC Commission as one of the guiding principles for an industrial competitiveness policy.
- There is a broad consensus, not only within industry, on the need to modify the regulatory framework with specific attention to chemicals. This consensus is based on the key-principle as to which regulatory reform should be "the simplest and the least costly ... which ensures a high level of health and environment" (Communication on Chemical Industry).
- A recent study (*Chemicals and long term economic growth*, A. Arora, R. Landau, N. Rosenberg - 1998) analyses a number of factors in economic development, and focuses its attention on the chemical industry. The authors stress two aspects in terms of "the chemical industry and regulation":
 - *"Government also affects the conditions for business through tax policies, fiscal and monetary policies, antitrust, patent law, environmental regulation and trade policies, and a variety of other policies that set the ground rules of finance, disclosure, and competition in an economy. It is broadly agreed that certain constellations of these laws, practices, policies, and attitudes and their interactions are more conducive to long-term economic growth than others. If firms do not do well, the country's overall economy suffers, growth can slow, and trade will falter. But if the country does not do well, neither can the firms"*.
 - *"Firms create the growth and the wealth in a capital society, but governments and societies create the business climate, the conditions, the boundaries, within which*

firms must act. For new knowledge to contribute to economic well being, it must be complemented and realised commercially by investment. The investment and commercialisation decision of firms are, however, affected by macroeconomic and institutional conditions such as the availability of saving (investible funds), the rate of interest, and government legal and regulatory policies".

The importance of regulations in the chemical industry, in particular, those related to the environment, health and safety, is connected to the nature of the industry itself, its processes and products, but also to the consequences of an excessive or inefficient regulatory system on competitiveness and long-term growth, as the following links point out.

- The chemical industry produces intermediate products, and due to this, the need to be close to customers and the importance of logistics costs for many products, the industry is involved in substantial globalisation. This process must develop according to competitive forces in the marketplace, undisturbed by compliance costs related to regulation or by environmental dumping by countries less sensitive to environmental issues. Otherwise, the process of globalisation would simply be a process of delocalisation, and would penalise production in Europe.
- The importance of the chemical industry is closely related to the processes of technology transfer it causes in downstream sectors. Regulatory restrictions, in terms of costs, time and negative flexibility, would impact on these sectors and cause a loss in competitiveness, due to the lack of availability of innovative European chemical products meeting their precise needs.
- The mission of the chemical industry is to supply industrial and consumer products which meet new company and individual needs, transferring the results of industrial research and chemical science into its products.
- In this sense the chemical industry continues to be a pioneering, science based industry, under constant pressure to change and innovate. Delays (due, for example, to the lengthy periods needed to build and operate plant, or to market new products), uncertainty and regulation related costs extraneous to industrial needs, make it more difficult for Europe's chemical industry to fulfil its mission.
- An increasingly important component in the competitiveness of the chemical industry is the efficiency of the transport system and of logistics, in general. In a market where internal factors tend to become homogeneous, external factors become increasingly important.

The European chemical industry would suffer from a costly and distorting regulatory system and taxation (for example the energy tax) penalising the European transport system and at the creation of infrastructure.

- One aspect the regulatory framework fails to take into due consideration is the importance of SMEs (companies with less than 500 employees represent 30% of employment in Europe's chemical industry), heavily concentrated in sectors close

- to the downstream. The failure to understand the fundamental role of these companies (within the chemical industry but also in terms of technology transfer downstream) has created a complex European regulatory framework which is not only a cost, as it is for larger companies, but actually restricts the growth of SMEs.
- A recent investigation carried out on behalf of DGIII (To improve the framework for SMEs in the chemical, plastic, rubber and related sectors, Bipe Conseil/Stratorg, 1998) stresses the importance of these businesses and the restrictions imposed by environmental regulation.
 - Complying with legislation is an arduous task for chemical SMEs, and as many as 44% say this is a major area of investment (the percentage citing the launch of new products or the raising of production capacity is only slightly higher). This should not suggest that companies limit their effort to observing the law, but that simple compliance is an expensive activity which limits compliance for growth.
 - For 55% it's too expensive to keep up with the changes in regulations and standards; for 60% the rules are changed too often; for 48% it's hard to really know the legislation; 41% have problems with differences in national regulations; and 32% have problems with the public administration.
 - The last aspects which link regulation and the chemical industry are the dangers and excessive costs regulation could create for one of the few advanced technology sectors of industry in which Europe is world leader. The European chemical industry produces 30% of the world's chemicals, ahead of the USA (28%) and is the world's largest exporter (35.4% compared to 27.9% from the USA, net of intra-trade). The European chemical industry has a strong balance of payments position (40 billion ECU in 1997) contributing significantly to Europe's overall trade surplus (27,4% in 1997).
 - However, there are competitiveness related problems with emerging Asian countries and with the American chemical industry. In the last ten years, with similar production growth, Europe has shed 11% of its workforce in the chemical industry, whilst employment in its American counterpart has remained constant. Some basic chemical products now produce a trade deficit or experience a very strong drop in their surplus.
 - Studies carried out by CEFIC and for DGIII by NIESR demonstrate a loss of profitability (on average 6 points in terms of gross operating profit on sales) compared to the USA. Labour productivity is well behind the United States (-37%) and this gap is higher in the chemical industry than in manufacturing as a whole.

The European chemical industry also pays higher energy costs than its American counterpart.
 - The European chemical industry invests far more abroad than others invest in Europe, with a cumulative value of outward investments in the period from 1985-

95 of 38 billion ECU. The net flow of investments towards the United States was 25.5 billion ECU from '85 to '94.

- The difficulty of establishing precise linkage between bureaucratic costs, growth and competitiveness, particularly in relation to other systems, is due to:
 - the lack of reliable data and of a definite methodological approach;
 - the inability of environmental statistics to represent the real impact of regulation on businesses (for example, delays and uncertainty cannot be entered into the accounts);
 - the fact that direct and indirect effects cannot be separated (labour productivity may explain a lack of competitiveness but may itself be affected by regulation costs).

The type of analysis mentioned above has produced few academic results and many over-simplified versions of the facts.

- In the chemical industry, the direct costs alone of environmental spending and investments have a serious impact. If the costs of delays and uncertainty caused by regulation or the inefficient implementation of regulations are added, it becomes clear that all-round improvement in this area would be a strong stimulus to the recovery of competitiveness by the European chemical industry.
- The problems of competitiveness faced by the European chemical industry, compared to its American counterpart, should lead to greater efficiency in the environmental regulations sector and how it is implemented. This is all the more urgent in the light of the efforts over recent years of the American administration, in particular the EPA (Environment Protection Agency), to considerably reduce the time needed to comply with its regulations.
- A regulatory reform aiming at a better efficiency of environmental regulation might reduce the general compliance costs and therefore improve chemical industry competitiveness in the European scenario. Of course, a lower protection of environmental and health interests is not in question. The main point - and objective - is rather to improve the efficiency of the present regulatory framework in order to reduce the costs of excessive bureaucracy, i.e. to reduce (better: eliminate) costs which do not contribute to create a better quality of environment and health, rather representing a mere burden for industries (and therefore for citizens). As first objective of such reform a simplification and rationalization of present legislation should be mentioned. This is true either at the EU level, and at the Member States level. As it has been frequently mentioned in this Report, the European Institutions have several times and positively expressed the exigence of such regulatory simplification (EC Treaty, art. 118A, § 2 and art. 130; White Paper on "Growth, Competitiveness and Employment" 1993; Fifth Environmental Action Program; "Report of the group of independent experts on legislative and administrative simplification - Summary and Proposals" 1995, EC Commission Recommendation 97/344/CE). It is particularly the "Report of independent

experts" of 1995 - June 21, 1995, COM (95) 288 final - to give the main lines for a better quality of European legislation. As a first step, all unnecessary regulations, as well as regulations that might be usefully substituted by economic and voluntary instruments, should be eliminated; on the other hand, existing and necessary regulations should be simplified and harmonised in order to obtain that public intervention create benefits rather than burdens for competitiveness and employment. The goal should be to implement a common strategy of the European Union and the Member States. In the specific field of environment protection, the introduction of new regulation should be supported, either at the EU and and the national level, by a cost and benefit analysis of its general impact (RIA, Regulatory Impact Assessment). To this regard, it is also interesting to remember the general principles that have been outlined by the OECD Recommendation on Improving the Quality of Government Regulation of March 9, 1995, and that should be taken into consideration by regulators when adopting new rules or reviewing existing one. Such principles are deduced by the following questions: 1) is the regulated problem correctly defined? 2) is government action justified?; 3) does regulation represent the best form of government intervention? 4) is there a legal basis for regulation? 5) what is the appropriate level (or levels) of government for the considered action? 6) do the benefits of regulation justify the costs? 7) is the distribution of effects across society transparent? 8) is regulation clear, consistent, comprehensible and accessible to users? 9) have all the interested parties had the opportunity to present their view? 10) how will compliance be achieved? – Considering the general objective of regulation improvement, a better harmonisation of national transposition measures is also to be mentioned, in order to avoid the existence of big differences in the functioning of control systems among the Member States. Member States themselves should introduce adequate enforcement mechanisms of EC regulations. Furthermore, the second main objective of the necessary regulatory reform should be the rationalisation of the control systems and the reduction of bureaucracy. Administrative procedures, and namely notifications and licenses, should be simplified, in order to reduce costs and time needed for regulation compliance. Companies, and particularly SMEs, should be supported in regulation compliance. To this purpose, a deeper simplification of regulatory measures should be realised for SME's. Following this direction, it is urgent to make clear the correct relationship that must be created – within the regulatory systems of control - between the procedure of environmental impact assessment and administrative procedures for pollution control, particularly during the national transposition of the new IPPC system. If such relationship will not be clear in the next years, there is a high risk that, in some Member States (e.g. Italy), the national transposition of IPPC may bring even more complexity and bureaucracy to the already difficult and heavy network of administrative control. In addition to a better functioning of

regulatory instruments, also non regulatory instrument should be promoted, such as voluntary agreements, self-regulation, codes of conducts and economic incentives. The basic idea should therefore be to develop the present regulatory system by enriching it with new approaches. Within this context, a closer cooperation between industries and public administration in the definition of environmental targets and their implementation is nowadays perceived as a diffused necessity. The EC Commission has expressed its positive attitude towards non regulatory and voluntary instruments in the 5th Environmental Action Program (1992, environmental policy to be achieved through regulatory, market-based, horizontal supporting and financial instruments). In a more recent Communication (CEC, 1996b), the Commission has stated that environmental agreements “can offer cost-effective solutions when implementing environmental objectives and can bring about effective measures in advance and in supplement to legislation”. In Europe the experience of voluntary agreements in the environmental field is recent, but it is becoming more and more a massive reality. Until now, different types of agreements have been implemented, their main distinction being the degree of public intervention in the scheme. Only few information is still available on the actual efficiency of voluntary approaches for environment protection purposes. In general, parties involved in negotiated agreements outline some significant positive effects: voluntary agreement improve communication and trust, rise awareness of environmental problems and are consensus building. An effort to create a general and solid legal framework for voluntary agreements in the European scenario should be therefore made.

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