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Green Paper on Innovation

(presented by the Commission)

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GREEN PAPER ON INNOVATION

I INTRODUCTION:

The objective of this Green Paper is to identify the factors - positive or negative - on which innovation in Europe depends, and to formulate proposals for measures which will allow the innovation capacity of the Union to be increased.

In the context of this document, innovation is taken as being a synonym for **the successful production, assimilation and exploitation of novelty** in the economic and social spheres. It offers new solutions to problems and thus makes it possible to meet the needs of both the individual and society. There is a wealth of examples, including the development of vaccines and medicines, improved safety in transport, (ABS, airbags), easier communications (mobile phones, videoconferencing), more open access to know-how (CD-ROM, multimedia), new marketing methods (home banking), better working conditions, more environment-friendly techniques, more efficient public services, etc.

According to the dictionary, the opposite of innovation is “archaism and routine”. That is why innovation comes up against so many obstacles and encounters such fierce resistance. It is also why developing and sharing an innovation culture is becoming a decisive challenge for European societies.

1. Innovation, the firm and society

Innovation has a variety of roles. As a driving force, it points firms towards ambitious long-term objectives. It also leads to the renewal of industrial structures and is behind the emergence of new sectors of economic activity. In brief, innovation is:

- the renewal and enlargement of the range of products and services and the associated markets;
- the establishment of new methods of production, supply and distribution;
- the introduction of changes in management, work organisation, and the working conditions and skills of the workforce[1].

The innovative firm thus has a number of characteristic features which can be grouped into two major categories of skills:

- **strategic skills**: long-term view; ability to identify and even anticipate market trends; willingness and ability to collect, process and assimilate technological and economic information;
- **organisational skills**: taste for and mastery of risk; internal cooperation between the various operational departments, and external cooperation with public research, consultancies, customers and suppliers; involvement of the whole of the firm in the process of change, and investment in human resources.

It is this **global approach** which lies behind, for example, the success of Swatch watches. In practice, this amounts to four simultaneous innovations in:

- conception (reduction in the number of parts);
- production (assembly of the housing in a single part);
- design (new concept for the presentation of the watches);
- distribution (non-specialised sales outlets).

Research, development and the use of new technologies - in a word, the **technological factor** - are key elements in innovation, but they are not the only ones. Incorporating them means that the firm must make an organisational effort by adapting its methods of production, management and distribution.

Human resources are thus the essential factor. In this respect, initial and ongoing training play a fundamental role in providing the basic skills required and in constantly adapting them. Many studies and analyses show that a better-educated, better-trained and better-informed workforce helps to strengthen innovation. The ability to involve the workforce to an increased extent, and from the outset, in the technological

changes and their implications for the organisation of production and work must be considered a deciding factor.

There is no hermetic seal between the innovative firm and its environment, by which it is influenced and which it helps to transform. It is the sum total of firms in an industry, the fabric of economic and social activities in a region, or even in society as a whole, which makes up the "innovation systems", whose dynamics are a complex matter. The quality of the educational system, the regulatory, legislative and fiscal framework, the competitive environment and the firm's partners, the legislation on patents and intellectual property, and the public infrastructure for research and innovation support services, are all examples of factors impeding or promoting innovation.

2. Innovation and public action

The Commission has clearly identified - first in the White Paper on Growth, Competitiveness and Employment, and then in its 1994 communication on An Industrial Competitiveness Policy for the European Union - that firms' capacity for innovation, and support for it from the authorities, were essential for maintaining and strengthening this competitiveness and employment. This Green Paper makes use of, adds to and extends that work with a view to arriving at a **genuine European strategy for the promotion of innovation**. While respecting the principle of subsidiarity, it will propose the measures to be taken at both national and Community levels.

"In exercising their responsibilities, the authorities must promote the development of future-oriented markets and anticipate changes rather than react to them (...). The European Union must place its science and technology base at the service of industrial competitiveness and the needs of the market more effectively. Greater attention must be paid to dissemination, transfer and industrial application of research results and to bringing up to date the traditional distinction between basic research, precompetitive research and applied research which, in the past, has not always allowed European industry to benefit from all the research efforts made."[2] The Commission has paid attention to this aspect of updating in the new arrangements on research aid adopted in December 1995.

This responsibility of the authorities is particularly important as regards technological innovation and the creation of businesses - fields in which the situation in Europe remains worrying compared with its competitors

> *In the Commission's opinion, Europe's research and industrial base suffers from a series of weaknesses. The first of these weaknesses is financial.* ***The Community invests proportionately less than its competitors in research and technological development*** *(...). A second weakness is the* ***lack of coordination at various levels*** *of the* ***research and technological development*** *activities, programmes and strategies in Europe. (...) The greatest weakness, however, is the* ***comparatively limited capacity to convert scientific breakthroughs and technological achievements into industrial and commercial successes****.* (White Paper "Growth, Competitiveness, Employment. The Challenges and Ways Forward into the 21st Century", Chapter 4, European Commission, 1994).

Strengthening the capacity for innovation involves various policies: industrial policy, RTD policy, education and training, tax policy, competition policy, regional policy and policy on support for SMEs, environment policy, etc. Ways must therefore be found of identifying, preparing and implementing - in a coordinated fashion - the necessary measures covered by these various policies.

Thus as regard SMEs, the Commission has outlined a new policy strategy in its report, "Small and Medium-sized Enterprises, a Dynamic Source of Employment, Growth and Competitiveness in the European union", which has been presented to the Madrid European Council in December 1995. These priority policies and measures to be undertaken, both by the European Union and the Member States, will form the basis of the next Multiannual Programme in Favour of SMEs and the Craft Sector for the period 1997 to 2000.

First and foremost, the authorities must establish a **common strategy**. This is a matter of ongoing **monitoring and consciousness-raising**. The Green Paper is contributing to these two objectives through the wide-ranging debate which it aims to encourage amongst the economic and social, public and private players.

It touches upon the following:

- the **challenges of innovation** for Europe, its citizens, its workers and its firms, against a background of globalisation and rapid technological changes;

- a **review of the situation** of innovation policies and **the many obstacles to innovation**;

- **proposals or lines of action**, while respecting the principle of subsidiarity, for government, regions and the European Union, aimed at removing these obstacles and contributing to the campaign for a more dynamic European society which is a source of employment and progress for its citizens.

The Commission wishes to receive the opinion of the interested parties on the analyses presented, the measures proposed and the questions raised.

This document is part of a consultation process. Interested parties, researchers, associations, workers and employers, organisations and governments are thus invited to make their positions known. The Commission suggests that all Member States organise the debate, possibly through thematic seminars, to take into account the wide variety of areas considered. Comments and responses - even if limited to a few questions - should be sent to the following address **by 10 May 1996**:

Directorate XIII/D - European Commission
“Dissemination and Exploitation of R&TD Results, Technology Transfer and Innovation”
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L-2920 Luxembourg

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At the end of the consultation, the Commission will draw up in June 1996, a synthesis report together with, if necessary, an action plan which will be submitted to other institutions.

Innovation: a multi-faceted phenomenon

The term "innovation" is somewhat ambiguous: in common parlance it denotes both a process and its result. According to the definition proposed by the OECD in its "Frascati Manual", it involves the transformation of an idea into a marketable product or service, a new or improved manufacturing or distribution process, or a new method of social service. The term thus refers to the process. On the other hand, when the word "innovation" is used to refer to the new or improved product, equipment or service which is successful on the market, the emphasis is on the result of the process. This ambiguity can lead to confusion: when referring to the dissemination of innovation, does one mean the dissemination of the process, i.e. the methods and practices which make the innovation possible, or to the dissemination of the results, i.e. the new products? The distinction is important.

In the first sense of the term ***(innovation process)****, the emphasis is on the manner in which the innovation is designed and produced at the different stages leading up to it (creativity, marketing, research and development, design, production and distribution) and on their breakdown. This is not a linear process, with clearly-delimited sequences and automatic follow-on, but rather a system of interactions, of comings and goings between different functions and different players whose experience, knowledge and know-how are mutually reinforcing and cumulative. This why more and more importance is attached in practice to mechanisms for interaction within the firm (collaboration between the different units and participation of employees in* ***organisational innovation****), as well as to* ***the networks*** *linking the firm to its environment (other firms, support services, centres of expertise, research laboratories, etc.). Relations with the users, taking account of demand expressed, and anticipating the needs of the market and society are just as important - if not more so - than a mastery of the technology.*

In the second sense ***(result of the innovation)****, the emphasis is on the new product, process or service. A distinction is made between* ***radical innovation*** *or breakthrough (for instance the launch of a new vaccine, the compact disk) and* ***progressive innovation****, which modifies the products, processes or services through successive improvements (e.g. the introduction of 32-bit chips to replace the 16-bit ones in electronic equipment, or the introduction of airbags in cars).*

New products, processes or services can appear in ***all sectors of activity****, whether traditional or high-tech, public or market, industrial, agricultural or tertiary. Innovation may also concern services of general interest, such as public health, administrative procedures, the organisation of postal services or public education. It is largely forced along by changes in social behaviour and lifestyles, which it helps to modify in return (e.g. the large number of new products or services flowing from the development of sports and recreation activities: Club Méditerranée[4], skiboarding, mountain bikes, etc. and, conversely, the extension or modification of sporting practices or performances flowing from the development of equipment in cycling, mountaineering and sailing, in particular).*

Nor is innovation necessarily synonymous with (high) technology, although this is increasingly involved in equipment, materials, software (incorporated technology) and methods. Many innovations stem from new combinations of familiar elements (e.g. video recorders, the sailboard) or new uses (the walkman), or creativity in the design of the products. Bang & Olufsen (DK) got itself out of the red thanks to innovation. Its turnover was stagnating between 1990 and 1993, and there had been 700 lay-offs out of a workforce of 3 000[5] The slogan chosen to counter these difficulties was "One major innovation every two years in support of growth". The innovative approach is not just technical: at B&O, design takes precedence over engineering. "Design" is one component of the "intangible investment" which can make all the difference, particularly for expensive "up-market" products..

Nevertheless, the technological component is normally present, if not the determining factor, in the creation, manufacture and distribution of the products and services. A mastery of the scientific and technical skills is essential from two points of view

- *to generate the technical advances (in this respect, the creation and development of new high-tech firms is a major factor in perfecting and disseminating them);*
- *and, just as important, to understand and use the new technologies, whatever their origin*

II THE CHALLENGES OF INNOVATION

The context of innovation has changed profoundly over the past twenty years, and the increasingly rapid dissemination of new technologies, the constant changes which require ongoing adaptation, are a challenge for society as a whole. Innovation is an essential precondition for growth, maintaining employment and competitiveness. However, the situation of the European Union in terms of innovation appears to be unsatisfactory, despite some first-rate scientific achievements. The Union also needs to maintain rules on competition and legal protection, which are effective and adapted to the needs of innovation.

1. The new innovation context

The generalisation of markets and the increasing importance of strategic alliances, the emergence of new competing countries in the technological field, the growing internationalisation of companies and of research and innovation activities, the interpenetration of sciences and technologies, the increase in the cost of research, the rise in unemployment and the increasing importance of social factors such as the environment - all these are phenomena which have radically changed both the conditions under which innovations are produced and disseminated and the underlying reasons for intervention by the authorities in this field.

In this new context, the capacity of institutions and firms to invest in research and development, in education and training, in information, in cooperation, and more generally in the intangible, is now a determining factor. It is necessary to work simultaneously in the medium and long term and to react very rapidly to the constraints and opportunities of the present.

2. The "European paradox"

This mobilisation is all the more necessary as Europe suffers from a paradox. Compared with the scientific performance of its principal competitors, that of the EU is excellent, but over the last fifteen years its technological and commercial performance in high-technology sectors such as electronics and information technologies has deteriorated. The presence of sectors in which the scientific and technological results are comparable, if not superior, to those of our principal partners, but where the industrial and commercial performance is lower or declining, indicates the strategic importance of transforming the scientific and technological potential into viable innovations[6].

One of Europe's major weaknesses lies in its inferiority in terms of transforming the results of technological research and skills into innovations and competitive advantages.

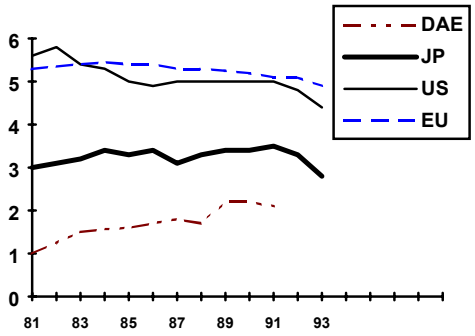
This inferiority is all the more damaging that is applies to a global research effort smaller than our competitors'. The gap between our efforts - measured by the percentage of total research and development expenditure as a share of European GDP (2% in 1993) - and those of our main partners, i.e. the United States (2.7%) and Japan (2.8%) has not narrowed over the last few years. Expressed in absolute terms, the size of this continuing gap appears critical for a cumulative and long-term activity such as research. European firms and governments must therefore redeploy their efforts, improve their capability to translate into commercial successes and better fund intangible investments which are a deciding factor for the future of competitiveness, growth and employment[7].

Over the last ten years, Europe has devoted most of its efforts to increases in productivity, which have assumed what amounts to cult status. However, these increases can be negated if they are used in conjunction with a technology which is obsolete or obsolescent. (...) Innovation must be the driving force behind the entire business policy, both downstream and upstream of the actual production of goods and services. (...) Innovation can be successful if all the skills in the firm are mobilised. Conversely, it can fail when this cohesion is lacking. (Edith Cresson, Compiègne, 6 September 1995.)

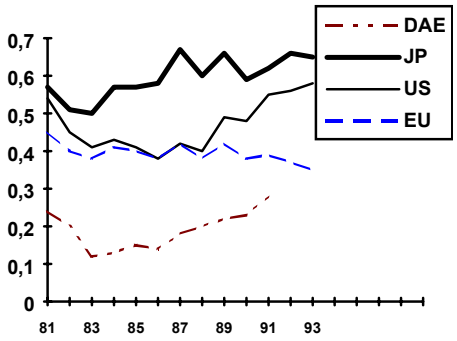
Some of the factors explaining the American and Japanese successes	
United States	**Japan**

Propensity of the EU, US, Japan and the DAE to produce results 6

a. Scientific performance (number of publications per million ecus, at 1987 US prices, non-BERD),



b. Technological performance (number of patents per million ecus, at 1987 US prices, BERD)



Source: First European report on science and technology indicators, summary, EUR 15929, 1994

• A more important research effort	• idem
• A larger proportion of engineers and scientists in the active population	• idem
• Research efforts better coordonated, in particular with regard to civilian and defence research (in particular in the aeronautic, electronic and space sectors).	• A strong ability to adapt terchnological information, wherever it comes from. A strong tradition of cooperation between firms in the field of R&D
• A close University - Industry relationship allowing the blossoming of a large number of high technology firms.	• An improving cooperation University / Industry, especially via the secondment of industrial researchers in Universities
• A capital risk industry better developped which invests in high technology. NASDAQ, a stock exchange for dynamic SMEs.	• Stable and strong relationships between finance and industry fostering long term benefits and strategies.
• A cultural tradition favourable to risk taking and to enterprise spirit, a strong social acceptation of innovation.	• A culture favourable to the application of techniques and on going improvement.
• A lower cost for filing licenses, a single legal protection system favourable to the commercial exploitation of innovations	• A current practice of concerted strategies between companies, Universities and public authorities
• Reduced lead time for firms creation and limited red tape	• A strong mobility of staff within companies.

3. European industry: improved but fragile competitiveness

As pointed out in the first report of the Consultative Group on Competitiveness (Ciampi report[8]), the concept of competitiveness involves those of productivity, efficiency and viability. However, the competitiveness of a country, region or firm now depends predominantly on its capacity to invest in research, know-how, technology and the skills which allow maximum benefit to be derived from these in terms of new products or services.

Like its partners, European industry is facing new challenges: an increasingly intense international competition; emergence of new technologies that upset traditional paradigms and impose a review of methods of organisation; new requirements of environmental protection, etc.. The Commission is preparing a report on competitiveness, which will strive to identify to what extent industry has in fact adapted itself to this changing situation in terms of international competitiveness. The question of innovation will be one of the major topics of this report.

A brief analysis of the current situation leads to the following conclusions:

- European industry has recently improved its competitiveness, particularly *vis-à-vis* its major competitors, the United States and Japan. Its trade deficit with the former had practically vanished in 1993, except in the high-technology sectors, while its structural deficit with the latter had fallen. The financial structure of European firms has become healthier, their capacity for financing productive investment has grown and their methods of production, distribution and organisation have improved markedly.

- Nevertheless, major and disquieting weaknesses remain: a lower degree of specialisation in both high-tech products and sectors with high growth rates; a lower presence in geographical markets which show strong development; productivity which is still inadequate; a research and development effort which remains disparate and fragmented; insufficient capacity to innovate, to launch new products and services, to market them rapidly on world markets and, finally, to react rapidly to changes in demand.

***Innovation** is an important factor in competitiveness in several respects:*

- ***Innovation in processes** increases the productivity of the factors of production by increasing production and/or lowering costs. It provides room for flexible pricing and increased product quality and reliability. Competition makes this quest for productivity an ongoing activity: successive improvements are a guarantee of not falling behind. Replacement of equipment is increasingly accompanied by changes to and improvements in **methods**, i.e. in organisation. Radical changes, which are rarer, completely transform the methods of production and sometimes pave the way for new products.*
- ***Innovation in terms of products (or services)** makes for differentiation vis-à-vis competing products, thus reducing sensitivity to competition on costs or price. Improved quality and performance, better service, shorter response times, more suitable functionality and ergonomics, safety, reliability, etc., are all elements which can be strengthened by innovation and which make all the difference for demanding customers. Here again, progressive innovation is predominant. **Radical innovation** in products, for its part, opens up new markets. Properly protected and rapidly exploited, it confers for a certain time a decisive advantage for the innovator. **In association with business start-ups** (and the subsequent development of the businesses), it gives a country or a supranational group temporary domination of the growth markets, thereby ensuring **a renewal of the economic fabric**.*
- ***Innovation in work organisation** and the exploitation of human resources, together with the **capacity to anticipate** techniques and trends in demand and the market, are frequently necessary preconditions for the success of the other forms of innovation.*
- *Since the life-cycle of products and services is becoming ever shorter, and generations of technologies are succeeding each other at an ever faster rate, firms are often under pressure to innovate as fast as possible. **The time of entry into the market** and the moment of introducing a new product onto it are becoming crucial factors in competition. Finally, it is **the dissemination of new techniques, products and services** to the whole of the economic fabric which allows full benefit to be gained in terms of competitiveness.*

Index of industrial specialisation for high-, medium- and low-tech industries[9]						
OECD = 100	Japan		United States		European Community	
	1970	1992	1970	1992	1970	1992
High technology	124	144	159	151	86	82
Medium technology	78	114	110	90	103	100
Low technology	113	46	67	74	103	113
Source: OECD, STAN database						

The overall conclusion must undoubtedly be put into perspective, as emphasised in the recent *Commission communication on a policy for industrial competitiveness*, but the threat of relative decline still hangs over European industry.

4. The macroeconomic conditions conducive to innovation

The setting-up and development of Economic and Monetary Union, in accordance with the Maastricht Treaty, appear to be essential elements in a macroeconomic policy conducive to the promotion and dissemination of innovation. A policy of monetary stability is essential so that European firms can make better long-term plans for industrial and technological investments, since any monetary disorder prevents an assessment of their long-term viability and encourages enterprises to favour short-term projects. The recent Commission communication on the impact of monetary fluctuations on the internal market highlights this phenomenon which has a negative effect on investments and jobs. Strengthening international monetary cooperation is also necessary in order to eliminate distortions of competition produced by monetary phenomena. This has a very negative effect on the competitiveness of European enterprises in world markets, and it especially penalises innovative SMEs which generate a significant share of their turnover outside their own country.

The high level of real interest rates is detrimental to investment, especially intangible investment. The globalisation and deregulation of the capital markets mean indeed that this type of long-term investment is facing increasing competition from investments which are less risky and more profitable in the short term. A gradual reduction in interest rates - in particular long-term rates - is thus the second major pillar of a macroeconomic policy favourable to innovation. Alongside price stability and an improvement in public finances (criteria for accession to the Economic and Monetary Union), the development of long-term saving would also seem necessary. These three factors together would allow interest rates to be reduced to a level which encouraged productive long-term investment. Stabilisation of exchange rates, combined with a reduction in real long-term interest rates could have a major positive effect on the tendency of businesses to take the short-term view.

Unless there is a sharp reduction in European interest rates, public funding should continue to play a strategic role in the financing of technological investment. It is therefore desirable that the budgetary appropriations devoted to innovation should not be reduced during the next few years, particularly in those Member States which are having to adopt more restrictive budgetary policies with a view to Economic and Monetary Union. Improved coordination of national policies at European level could also help to improve the effectiveness of the activities and results.

The development and liberalisation of trade and direct international investment are preconditions for improved dissemination and the more effective incorporation of innovations into the national and regional economic fabrics. It is, however important that this trade be conducted under conditions of fairness and respect for

intellectual and industrial property rights. If this is not done, there is a risk of admitting "stowaways" or "free riders" who take advantage, at no cost to themselves, of costly technical advances[10].In order to defend its firms, the European Union must continue striving to incorporate technological innovation related factors into international trade negotiations.

5. Innovation, growth and employment

The new theories of growth (known as "endogenous") stress that development of know-how and technological change - rather than the mere accumulation of capital - are the driving force behind lasting growth.

According to these theories, the authorities can influence the foundations of economic growth by playing a part in the development of know-how, one of the principal mainsprings of innovation. The authorities can also influence the "distribution" of know-how and skills throughout the whole of the economy and society, for instance by facilitating the mobility of persons and interactions between firms and between firms and outside sources of skills, in particular universities, but also by ensuring that competition is given free rein and by resisting corporatist ideas.

The relationship between **innovation** and employment is complex. In principle, technological progress generates new wealth. **Product** innovations lead to an increase in effective demand which encourages an increase in investment and employment. **Process** innovations, for their part, contribute to an increase in productivity of the factors of production by increasing production and/or lowering costs. In the course of time, the result is another increase in purchasing power, which promotes increased demand and, here again, employment.

However, it is true that the rapid incorporation of these innovations into the productive system may result, in the short term, in job losses for certain types of qualifications which become obsolete. The reason may be slow or ineffective adaptation of the system of education and training to take account of technical and industrial changes, or the rigidities of the labour market in general. It is possible that job losses in some sectors may be offset by the creation of jobs in other fields, such as services. Innovation can also help curb the decline of traditional industries by boosting productivity and introducing more efficient methods of work.

The White Paper on Growth, Competitiveness and Employment consequently referred to a structural "technological unemployment". It offers several strategies for adaptation. These include cutting tax rates and employment contributions (thereby saving and also creating jobs), together with increases in taxes on the improper use of natural resources with the dual aim of encouraging more efficient production processes and protecting the environment. Economic history shows that changes take place sooner or later and that employment and collective well-being are usually improved as a consequence, provided that businesses continue pursuing their efforts to adapt and innovate.

The rapidly expanding field of environmental protection provides an example of how innovation and enhanced efficiency can generate new jobs. This industry, involved in producing equipment and technology to reduce pollution and improve the energy efficiency of manufacturing processes, already generates annual production figures of 200 billion ecus in the OECD countries, with an annual growth rate of 5-8%. It is estimated that the industry employs one and a half million people and that jobs in the sector are growing twice as fast as in the rest of the economy (Report on employment in the European Union, 1995).

Innovation may succeed if all the expertise in a company is harnessed. If such cohesion is not achieved, innovation may fail, as demonstrated by RCA, the major US electronics group. At the end of the 1970s the group's research department designed some new products. The marketing department did not share its enthusiasm and marketed the products reluctantly. Even though it was in the lead from a technological point of view, particularly with the video disk and the video tape recorder, the RCA group did not survive this internal conflict.

6. Innovation and enterprise

Innovation is at the heart of the spirit of enterprise: practically all new firms are born from a development which is innovative, at least in comparison to its existing competitors on the market. If it is subsequently to survive and develop, however, firms must constantly innovate - even if only gradually. In this respect, technical advances are not themselves sufficient to ensure success. Innovation also means anticipating the needs of the market, offering additional quality or services, organising efficiently, mastering details and keeping costs under control.

However, one of the weaknesses of European innovation systems is the inadequate level of organisational innovation. This serious shortcoming makes it impossible to renovate models which are now inefficient and which are unfortunately still being applied in a large number of businesses. The same applies to effective innovation-oriented formulae for businesses management.

Towards innovation management

Innovation and technology management techniques such as the quality approach, participative management, value analysis, design, economic intelligence, just-in-time production, re-engineering, performance ratings etc. - give the firms concerned an undeniable competitive advantage. There are endless examples of this. These methods, which need to be adapted to the specific circumstances and different cultural backgrounds of European firms, are not yet adequately used in the European Union. Moreover, specialist training in these disciplines and their dissemination, particularly in educational programmes, could be expanded.

The efforts required remain considerable, although there are very great differences between the countries, or even between different regions within the one country. Some sectors, although they are innovative and create jobs, go unrecognised.

Innovative but unrecognised sectors

Innovation is not confined to the manufacturing sector, however. The **service sector** is playing an ever-increasing role in innovation and dissemination.

Firstly it accounts for the majority of salaried employees and a growing proportion of the gross national product of the countries in the European Union and is itself growing steadily, and secondly because it is the main macro-economic user of new technologies. Moreover, one very market-oriented part of this sector (distribution, logistics, transport, finance) introduces innovation to the manufacturing sector (such as zero stock requirements, fast delivery, easy transport, the ubiquitous bar code, etc.). Another factor is that products now incorporate more and more (information) services, and it is often hard to dissociate the two (e.g. in all areas involving information and communication technologies). Lastly, a growing proportion of this very heterogeneous sector is providing the intangible services which now dominate investment and innovation (training, research, marketing, counselling, financial engineering, etc.). However, the priority given to it in analyses and innovation policies is far from commensurate with its influence[11].

Innovation does not simply create jobs. It also provides increasing opportunities for self-employed activities (or semi-self-employed, such as teleworking). The "tertiarisation" of jobs is also changing relations between staff and employers (with greater responsibility, autonomy, etc.). This fairly recent phenomenon is also stimulating the creative abilities of employees themselves.

Lastly, it can be seen that a product or process innovation can achieve a higher profile - thus providing access to new markets - if it acquires a "green" label or if enterprises carry out "environmental auditing".

The information society

The advent of the information society is a major event for innovation. It is creating new occupations and innovative products, such as distance learning services and remote services in medicine or the development of new software and applications. It must be pointed out in this connection that the Commission has set up a research-industry Task Force with, inter alia, the aim of encouraging the production of educational software (see Annex 1).

It is, by itself, a basic tool for boosting innovative ability in Europe, whether by bringing together enterprises and research centres or universities, developing systems of education and training, emphasising the local and regional level, fostering mobility among students and research workers or disseminating "technology watch" results.

7. Innovation and society

Innovation is not just an economic mechanism or a technical process. It is above all a social phenomenon. Through it, individuals and societies express their creativity, needs and desires. By its purpose, its effects or its methods, innovation is thus intimately involved in the social conditions in which it is produced. In the final analysis, the history, culture, education, political and institutional organisation and the economic structure of each society determine that society's capacity to generate and accept novelty. It is an additional reason to take the greatest care of the application of the subsidiarity principle in the policies promoting innovation.

Innovation can and must offer a response to the crucial problems of the present. It makes possible an improvement in living conditions (new means of diagnosis and of treating illnesses, safety in transport, easier communications, a cleaner environment, etc.).

An example of an innovative service: the Club Méditerranée

A highly innovative concept in its day in the field of leisure activities, it has no intrinsic technological content. Nevertheless, its development benefited greatly from advances in electronics and aircraft engineering. It is also closely linked to the trend in disposable household incomes.

It also makes it possible to improve working conditions and safety, protect the environment (new production processes which avoid or reduce polluting waste), save natural and energy resources, respond to the challenges of demographic ageing, contribute to the reintegration of handicapped persons (application of new technologies for use by the blind and the deaf) and, finally, promote new forms of work. An example is teleworking which, while it can occasionally have repercussions in social and health terms or be a means of out-sourcing, is also a means of urban decentralisation and of creating jobs in rural areas. While innovation generally improves living and working conditions, care has to be taken that new methods of organising work (such as just-in-time working) do not jeopardise jobs.

Finally, by its nature innovation is a collective process which needs the gradual commitment of an increasing number of partners. In this respect, the motivation and participation of employees is critical for its success. Moreover, as can be seen from the current difficulties facing most national systems of social protection, the social sector and public services in general are in urgent need of major innovations.

Re-engineering: hospitals too

Sweden's biggest hospital, the Karolinska, also embarked on a huge re-engineering project: the hospital was redesigned from a patient's point of view, patient flow was monitored by type of pathology, bottlenecks were removed, taking waiting time as a performance indicator, and multifunctional medical/surgical centres were set up. The results announced are 15-20% cost savings and 25-30% more patients treated.

From: La Tribune, 1 June 1994

At an international level, solving the problems of underdevelopment, malnutrition and health, not to mention tackling the negative effects of climatic change, calls for major innovations and well-targeted technology transfer.

Ongoing changes are required to meet the challenges posed by the dissemination of innovations: employment/training match, institutional reforms, regulatory and legal changes, rearrangement of working hours, etc. At the same time, these changes have to be perfectly assimilated if we are to avoid social division and an excessively brutal assault on the value systems which are the basis of the social bond. There is a vital role to be played here by the social partners, who in many Member States have reached important and often innovative agreements on the organisation of work in connection with the introduction of new technologies.

Another effect of innovations is to accelerate the obsolescence of knowledge and know-how. In a “knowledge-based society”, this means that education and training must be ongoing. Setting up a system of lifelong interactive education and training, removing the barriers between teaching, research and industry, allowing creative talent to blossom, and exploiting all the possibilities of the information society are elements indispensable for innovation.

8. Innovation and cohesion

Innovation is particularly important for the regions which are lagging behind in development. The SMEs, which make up virtually the entire economic fabric encounter special difficulties there, particularly with regard to financing (e.g. actual interest rates are often 2-3 points higher than in the more developed regions) but also with regard to cooperation opportunities, access to sources of technical or management skills, etc. The handicaps mount up, which indicates shortcomings in the operation of markets which can justify intervention by the authorities.

The effort channelled towards developing innovation as part of the Community's regional policy needs to be seen as an opportunity for two reasons. On the one hand, it is an effort targeting regions and fields which have a special need, and this therefore has to be seen as a priority in innovation development. On the other hand, it is a means by which the laggard regions can move immediately alongside the developed regions, not by attempting to imitate what the latter have already achieved but by trying to lay the groundwork, in accordance with their own features and requirements and together with the developed regions, for adapting to the conditions of competitiveness of a global economy.

9. Effective rules of play

If there is going to be innovation, there is a need for a set of "rules" to encourage it. This concerns competition, powerful force behind innovation as well as means of combating abuses of dominant positions, which requires constant vigilance. It also concerns legal rules for the protection of intellectual property, a decisive factor in stimulating individuals to innovate which needs to be encouraged and constantly adapted to the changes in technology and society.

a) maintaining effective competition

Community policy plays an important role here by prohibiting concerted practices, combating abuses of dominant positions, preventing sectoral monopolies and providing strict rules on government aid. It thus safeguards fair competition, conducive to the introduction of new products and manufacturing processes.

cooperation agreements

Competition among independent enterprises is the driving force of innovation. It is also competition which makes European firms more competitive in an economy which is increasingly global. There is thus a need to distinguish as clearly as possible between restraints on competition which make innovation less likely, because they involve less pressure on the parties to the agreement in question, and competition restraints which are vital for the promotion of innovation and the dissemination of technology.

Moreover, the Community rules on cooperation agreements, mergers and government aid also cater for the special characteristics of markets and activities in the research and innovation fields.

An initial feature is the globalised competition in many sectors. Whether the field concerned is information technology, biotechnology, aerospace technology or new materials, the field of competition is at times becoming less and less national or European. The market in question, in which European firms are up against US and Asian companies, is worldwide. The Commission is already aware of this perspective.

Secondly, research and innovation have well-known features which are catered for in competition law. These activities are marked in particular by the extent of their external repercussions and the difficulty, for firms, of securing the results of their efforts. Apprenticeship processes and economies of scale which may be better exploited jointly also play a part here. Article 85(3) of the Treaty of Rome allows, under certain circumstances,

agreements which contribute to technical and economic progress; for example, when certain conditions are satisfied, a group exemption may be given to research agreements between firms.

Since Europe files only a third as many patents as its rivals, preferential treatment is also given to technology transfer agreements. This type of agreement makes it possible to exploit patents or know-how more fully and can provide innovative SMEs or independent inventors the rewards they deserve. For this reason there is exemption for this type of agreement.

Assessment of an agreement (or merger - see below) takes into account a series of criteria and is not normally based solely on the concept of market share.

merger control

Particularly where research and innovation are concerned, it is important for the dynamic effects[12] on the development of markets to be taken into account when merger plans come up for discussion. The Commission could, for example, assess the trends in demand and the short-term appearance on the market of new participants.

Mergers which create or reinforce a dominant position, with, as a consequence, the significant impediment of real competition in the market(s) are forbidden. The Commission will take several factors into account when assessing merger transactions, including the evolution of economic and technical progress, in as much as consumers benefit from it and as it does not constitute an obstacle to competition.

The Commission has consequently been keen to take account of the dynamic effects stemming especially from research and innovation in assessing the impact on competition of mergers. The Commission's constant practice has been to interpret the provisions of Article 2 of the "merger" regulation, especially the requirement of a significant obstacle to competition, as meaning prohibition only of dominant positions which are lasting, and not those which are going to disappear rapidly, either because markets are opening swiftly to competition from other parts of the world or because they are being affected by a strong tide of innovation.

state aid

As pointed out in the Commission communication on an industrial competitiveness policy for the European Union, the system of Community monitoring of government aid rests on a set of rules accumulated over the years, with an accompanying build-up of complexity. It includes, for example, sectoral provisions originally brought in to deal with serious short-term or structural economic crises (textiles, car industry, etc.). It is based on criteria which are sometimes heterogeneous and focus, among other things, on the criterion of "excess capacity", the definition and the application of which are gradually enhanced in order to take ino account the specific characteristics of the market concerned such as its level of globalisation and the evolution of the production techniques[13]. The relevance of this criteria can be questionable as regard aid to intangible investment. The Commission is examining the criteria for a horizontal approach encouraging intangible investment.

In addition, coping with or even shortening the time taken considering the applications for government aid is particularly important in connection with innovative projects where speed in marketing is one of the keys to success. This is why preference is given to two mechanisms which give more effective expression to the Commission's support for research and the dissemination of results:

- A clear distinction between State aid and general measures, so as to establish criteria which are more transparent to companies and government. Government schemes for promoting innovation and research horizontally, without favouring specific companies or production (e.g. tax relief for intangible investment, applicable to all businesses; horizontal training schemes for researchers or engineers, etc.) constitute general measures. These measures then do not have to be reported to the Commission and can be implemented without delay. The Commission is preparing a communication on this, which will in particular clearly indicate that the tax deductions applicable to all firms for intangible assets (including research and development) do not constitute aid under Article 92(1) of the Treaty.

- A revision of the research aid provisions has just been adopted by the Commission, with the aim, inter alia, of allowing the Member States to pursue innovation policies equal to the challenge of international competition. By adopting rules closely aligned with those laid down in the WTO code on subsidies (definitions of types of research, wider margin of manoeuvre in terms of intensity ceiling, etc.), the Commission has adapted the interpretation of its rules to bring greater convergence of international rules on competition, while preventing aid from distorting trade within the common market.

All in all, the Commission is particularly anxious to attain one of the objectives of competition policy, namely improving the international competitiveness of Community industry and thereby contributing to the attainment of the objectives listed in Article 130(1) of the Treaty. The competition rules are thus applied constructively in order to foster cooperation which encourages the development and dissemination of new technologies in the Member States, in compliance with rules on intellectual property. State aid is thus monitored to ensure that resources are made available to sectors which contribute to improving the competitiveness of Community industry, without distorting trade, for instance in the environmental field.

b) *promoting effective and suitable legal protection*

Effective legal protection is a vital incentive for innovation. It offers innovators the guarantee of a rightful profit from their innovation. There is also a need for existing rules to be constantly adapted to the new circumstances introduced by technological innovation. This is particularly crucial in the field of new technologies.

The various systems for giving legal protection to innovation are, over and above their protective function, of growing economic importance in conquering export markets, combating piracy and in valuing a business (in the event of takeover or acquisition of holdings, for example).

For many countries licensing and technology transfer agreements now represent a substantial portion of foreign trade, although this trade is concentrated in the three major economic powers and mainly involves large companies.

After the progress achieved through the Uruguay Round, efforts have to continue on **harmonising protection systems**, even among OECD member countries, and on guaranteeing property rights in the rest of the world.

It would, for example, be beneficial to the European Union if the United States were to adopt a patents policy closer to that of the other OECD countries. The priority given to the "first to invent" over the "first to file" engenders a longer legal process and, apparently, a far greater number of disputes which are eventually settled only at the end of an interminable series of lawsuits: 14 years in the case of Hughes Aircraft versus NASA, and more than ten years in the case of Polaroid versus Kodak[14].

The stakes for the European Union are threefold:

- to arrive at a system of intellectual and industrial property rights in Europe which, in a context of strong development (especially in the fields of life sciences and the information society), continues to provide individual incentive to innovate while at the same time providing for the widespread dissemination of innovations;

- to carry through, as much as necessary, the harmonisation of the various national systems while ensuring compatibility with the objective of competitiveness and continuing to guarantee a high level of protection;

- to ensure that in international trade negotiations the legitimate interests of EU citizens are not harmed, either by imposing unsuitable rules or by failing to comply with existing agreements (piracy and copyright infringements).

In order to meet these objectives the Commission has launched new proposals concerning the legal protection of designs and models as well as the protection of plant protectants. A new proposal on the protection of biotechnological inventions is currently being drafted. In addition, two Green Papers - on the

information society and on the protection by the utility model - are being prepared[15].

III THE SITUATION IN EUROPE: DIVERSITY AND CONVERGENCE

The situation in Europe is mixed. Performance in terms of innovation varies greatly amongst the countries, regions, firms and sectors. This is why regional or national policies in support of innovation have recently been introduced. The Community is not standing still and is making consistent efforts in favour of innovation. However, it is not enough.

1. Great diversity

The situation in Europe as regards innovation is very mixed. Industrial structures and specialisations are extremely varied. The levels of technology vary greatly, as do performance and the resources devoted to it. Expenditure on research and development varies from country to country by a factor of 1 to 11. The proportion of national R&D carried out by businesses varies from 30% to 70%. Some countries with a sophisticated financial system and strong research potential have many large firms, some of which are world leaders in their particular sector. Others are technological laggards, with an economic fabric made up essentially of SMEs, a support infrastructure only now emerging and a large public sector.

Each country in the Union has its own solutions. In the case of Italy, **industrial "districts"** have successfully been set up based on close cooperation links between small businesses in the same industrial sector which have pooled resources to solve technical or commercial problems - as in Sassuolo for ceramics and in Prato for textiles. Denmark has set up an interesting scheme involving **networks of SMEs**. Its "Network Brokerage Scheme" has enabled contacts to be established between more than one-third of the country's SMEs, and this scheme is now being exported to the United Kingdom, Spain and the United States.

Baden-Württemberg has a comprehensive technical support infrastructure and, with the Steinbeis Foundation, a much-envied system of cooperation between teaching and research establishments and SMEs based on networked and decentralised structures, the direction of whose work is largely determined by the user businesses themselves. Sweden, and the Nordic countries in general, have wide experience in the promotion of worker participation in businesses, as well as in the field of evaluating technology policies.

Positive experience abounds, therefore, but it is often difficult to transpose, as it is closely linked to the specific conditions under which it was acquired. However, knowledge of this experience and its dissemination are very inadequate, and there is a need for rapid progress in comparing it. The Commission's recently-established INNOVATION programme should contribute to this dissemination of good practice.

2. Genuine convergence

Nevertheless, a certain convergence of trends within the Member States in innovation policy is beginning to become apparent, albeit with different rythms of development. One can note the following tendencies:

- Greater priority given , in national policies on science and technology, to the development of industrial research (funded or undertaken by businesses) and to cooperation between public or university research and businesses;
- The resolve to work towards a simplification of administrative procedures, deregulation and a strengthening of competition;
- The importance attached to setting up basic infrastructures (in particular information highways) and information society applications;
- Increased **forward planning**, to highlight the technological choices available and to identify the possible conditions for exploiting the different technologies (e.g. the recent campaign by the British Technology Foresight programme and its French and German counterparts). These forward planning studies must take place very early on in the research process, so as to reduce lead times (cf. the Dutch "constructive technology

assessment" or the activities of bodies such as the British CEST - Centre for Exploitation of Science and Technology);

- The interest devoted to **innovation financing**, as regards both the creation of technology firms (seed capital) and their development (venture capital, NASDAQ-type markets). There are growing efforts at national level to create a regulatory and fiscal environment which promotes the mobilisation of private capital towards innovation (creation of venture capital trusts in the United Kingdom). The United Kingdom has also introduced a number of measures to attract private wealth - "business angels" - towards innovation investment. The Netherlands and Belgium have networked banks and technology innovation agencies with a view to arriving at a "technology rating", while France prefers the establishment of regional networks of innovation financiers, etc.;

- A growing (but still patchy) awareness of the importance of supporting the **dissemination of technologies**, which is reflected in greater attention to the **stimulation of demand** and awareness and demonstration measures. This approach takes various forms: involvement of users in cooperative research and development projects, creation of demonstration centres for specific technologies, programmes of visits to businesses (United Kingdom, Germany, Spain, France), in-depth measures to unearth the latent demand of SMEs (technology and strategic audits in businesses, efforts to translate into technological terms questions expressed in terms of functions, setting-up of permanent listening posts, etc.);

- A growing interest in SMEs and regard for their diversity;

- Greater importance attached to the regional level.

3. The Increasingly important role of SMEs and the regional level

SMEs are a reservoir for the creation of jobs and a source of diversity in the industrial fabric. At the same time, the weaknesses of these firms in terms of finance, human resources and commercial contacts are a source of concern:

- 99.8% of Community firms have fewer than 250 employees (and 91% fewer than 20), whereas the United States has a higher percentage of large and medium-sized companies (firms with more than 100 employees account for 1.7% of all enterprises and 60.8% of all employees, compared with figures of 0.6% and 43.2% respectively in Europe). SMEs account for 66% of jobs and 65% of turnover in the European Union. In the between 1988 and 1995 net job creations in SMEs exceeded job losses in large companies. Enterprises with fewer than 100 employees account for virtually all new jobs, at a net rate of 259 000 per year. They export and innovate, but they have specific problems to overcome. However, many public innovation schemes still appear to be tailored to large firms;

- Depending on the country, SMEs often suffer from both financing difficulties, at least in certain critical stages of their development, and structural weaknesses in their management capacity: the head of a firm is sometimes virtually alone in assuming on management functions, and under-staffing at management level is common;

- Access to the know-how and information needed to reduce the level of uncertainty is far more difficult and proportionately more expensive for SMEs than for large businesses;

- SMEs are generally reluctant to turn to existing services and schemes for aid, assistance or advice. They are less open to cooperation;

- Lastly, they are the linchpins of the local economy. The vast majority of small enterprises operate within a radius of 50 km. In some areas they are practically the only industrial activity.

An Andalusian car industry subcontractor

The company, which has 65 employees and a turnover of ECU 6.25 million, was set up in 1979 in Andalusia, one of the least developed regions of the European Union. From the outset, it has been making components for the car industry. Despite its strenuous efforts to diversify, its main customer remains a multinational concern in this sector, located in the same region. Moreover, increasingly strict regulations are being applied to its waste.

At the start of the nineties, the business is faced with an over-dependence on its main customer. It must also choose, from a wide and complex range, the technologies which it is likely to incorporate into the business.

As a result of a promotion campaign carried out by the regional development agency for the Community initiative for the incorporation of new technologies (INNOVATION Programme), this business calls in experienced experts to establish a diagnosis for the desirable use of the most suitable existing technologies, taking into account its strategy and its skills.

A plan of action is drawn up. The new equipment proposed (incorporating CAD/CAM, numerical control, etc.) must allow this business to produce clean products and widen its market. The introduction of new management methods (value analysis and functional analysis, in particular), is recommended with a view to the problem-free incorporation of the new equipment, taking into account stricter environmental regulations.

These characteristics explain the growing interest in these firms on the part of the Member States. This is reflected in:

- Efforts to promote the creation and development of new technology-based firms;

- Consistent efforts to **strengthen the technology absorption capacity** of SMEs. This involves facilitating the processes of learning and accumulating knowledge and strengthening skills in the firms. This is why measures aimed at making it easier to recruit or temporarily second engineers or technicians to SMEs are frequently encountered (Germany, Denmark Ireland, United Kingdom, France). They are aimed at creating, within the firm, a nucleus of receptive persons who understand technical developments and are capable of talking with researchers. The same goes for the dissemination of innovation management techniques such as quality, business re-engineering or value analysis (see box opposite). Finally, to an increasing extent, some of the public efforts are directed towards promoting the incorporation of SMEs into clubs, networks or "clusters". In Finland, for example, an original initiative aims at getting experienced senior executives of large firms to act as mentors to high technology SMEs.

- Determination to **simplify access by SMEs** to the various support measures or outside sources of skills. The fact is that many of them get lost in the labyrinth of procedures or support services, the latter of which have mushroomed over the last few years. Even more (60-80% of SMEs depending on the country) do not take advantage of these facilities;

- Efforts to adapt support measures to the various categories of firm (distinguishing, in particular, those which are heavily involved in research and development and those which - although they undertake only occasional research - are technologically developed, and those which have only limited internal research resources and whose absorption capacity must be strengthened);

- Recognition of the specific nature of the services sector;

- Renewed interest in micro-firms (i.e. those with less than 10 employees)[16].

A group of Dutch SMEs in the building industry join together to diagnose their innovation capacity

The Innovation Centre of the Southwest Netherlands wanted to assist schemes aimed at innovating SMEs in the building industry. These SMEs have between 20 and 100 employees and use traditional and craft "rules of the art". However, new "off-the-peg" products are providing fierce competition. Meeting changes in people's tastes and the new town planning standards involves extra costs. Most of these SMEs make only modest profits.

Thanks to the pilot project for the incorporation of new technologies implemented by the Dutch Innovation Centre with the support of the Commission (INNOVATION Programme), a group of 18 firms in this sector agreed to take part in a series of workshops chaired by specialised consultants and to undertake a bilateral diagnosis of their financial situation, their strategy and their organisation. Trends in the sector were highlighted, and each firm's performance was ranked anonymously on a scale.

A rather mixed panorama emerged after the discussions and workshops. Despite the fact that the staff of these SMEs were working flat out, the absence of methodical and structured plans of action prevented the enormous individual efforts from bearing fruit. After a critical review of the necessary functions, new methods were recommended for the procurement and reception of material (75% of costs), quality, computer applications, communications, etc.

Finally, these recommendations are in the course of implementation, and this has already helped to increase the motivation of the staff in these firms.

This recognition of the importance of SMEs is directly reflected in the increased interest at regional level. This level is more suitable for assessing the role of SMEs and for promoting innovation within them.

Moreover, the movement towards decentralisation has strengthened the role of the regions in disseminating information and supporting innovation. During the 1980s, public or private bodies to help businesses sprang up throughout the regions (science parks, demonstration centres, transfer agencies, etc.). These support structures vary in number and quality. They frequently involve local partnerships between the private sector and the authorities. They differ greatly from one Member State to the other, since they reflect the national situations. They are paralleled by the development of new crafts whose qualifications, organisation and training are not yet firmly established.

To tackle this situation, many countries have recently made major efforts to set up networks of decentralised interfaces (the British "business links", the technology dissemination networks in 13 regions of France, the 18 innovation centres in the Netherlands, etc.). These local services are intended to serve as "one-stop shops" for SMEs, where they can make an initial diagnosis of companies' needs and abilities and point them towards sources of specialised support. However, they must remain open to the outside and, in particular, to Europe.

4. Economic intelligence

The corollary of the overall approach to innovation adopted throughout this Green Paper is "economic intelligence" as a strategic tool for decision-making against a background of globalised trade and the emergence of the information society.

Economic intelligence can be defined as the coordinated research, processing and distribution for exploitation purposes of information useful to economic operators. It includes the protection of information regarded as sensitive for the company concerned.

Paradoxically, the growing supply of data, thanks to information technologies, is not reflected in a greater awareness of the technological and economic stakes nor in greater clarity with regard to strategic options.

No economic operator, least of all an SME, has access to all the necessary information or even the means of collecting, processing and interpreting it[17]. A high proportion of the information concerned is held or produced by public authorities, universities, research centres, etc. It is also increasingly easy to access, thanks to the development of databanks, communications networks and information highways. However, multiple

sources and access paths also increase the risk of leakage.

Japan has quite deliberately made information management one of its strategic advantages. The United States is working on coordinating the exploitation and protection of their information potential via joint government/industry initiatives. The Community, for its part, is making major efforts, primarily through the IMPACT programme and shortly INFO 2000, to improve the operation of the European Information market. However, Europe as a whole is still a long way behind its main rivals.

These practices are, of course, fairly widespread amongst large firms and multinationals. There are consultants concentrating on this corner of the market and accumulating methods and experience. Firms may also join forces to pool their information via either local or activity-related clubs (exporters' clubs, for example) or representative organisations (employers' associations, chambers of commerce and industry, etc.). Some governments in Europe, such as those of France and Sweden, have set up consultative bodies for this purpose.

The Commission has carried out numerous analyses and financed studies to this end. It possesses a fund of often very specific expertise. Nevertheless, these technology or market information resources and know-how could be exploited more systematically and placed at the disposal of companies and national or regional governments.

A definite effort needs to be made towards raising enterprises' awareness and understanding of economic intelligences and its methods, together with the development of easy-to-access data supply.

Determined collection, sharing (cooperation between firms, pooling of resources with public authorities) and protection of strategic information are still too rare in Europe. Social and professional divides, fear of competition and deliberate secrecy make collaboration between firms and authorities a difficult matter. Individual and collective attitudes therefore need to change if economic intelligence is to gain a foothold.

5. Europe is not standing still

At Community level, over the last few years, a number of measures have nevertheless been taken to strengthen and supplement the national or regional efforts. The following are only a few of the most significant examples:

- The research effort has increased considerably. Including the research support from the Structural Funds, nearly ECU 5 billion is now devoted to research each year, 10 years after the launch of the first framework programme.

- Research/industry cooperation, coordination and the targeting of efforts have been strengthened, and this is also the thinking behind the establishment of the **Task Forces** (see following box and Annex 1).

The Community task forces on joint projects of industrial interest

The Commission has decided to set up, for specific subjects, Task Forces between the departments involved on joint projects of industrial interest.
This move is in line with the recommendations in the White Paper on Growth, Competitiveness and Employment, which underlined the need for greater coordination of research and technological development (RTD) activities and policies and a strengthening of the capacity - as yet insufficient - of Europeans to transform their scientific breakthroughs and technological achievements into industrial and commercial successes. Through this initiative an attempt is being made to stimulate the development of technologies which will have an effect on the quality of life in our societies and on the environment as well as on Europe's industrial competitiveness.
It is a matter of mobilising all the expertise necessary and of concentrating the budgetary resources available, so that industry can respond more effectively to international competition and the constraints of innovation.
The main tasks entrusted to the Task Forces are as follows:

- *to define the research priorities and any obstacles to innovation, in common with industry - including SMEs and the users;*
- *to improve coordination and implementation of the work to be done and the resources available, particularly in the implementation of the fourth framework programme, and to improve coordination of national efforts in this field;*
- *to encourage the emergence of a favourable environment through using supplementary financial resources and promoting cooperation between interested businesses.*

These Task Forces cover the following topics:

- the new-generation aircraft;
- the car of tomorrow;
- multimedia didactive software;
- vaccines and viral illnesses;
- the train of the future and railway systems;
- intermodality in transport;
- the ship of the future;
- environment-friendly water technologies (planned)

- The measures in favour of SMEs (see following boxes) and the simplification of the standard contract for participation in the activities under the Fourth Framework Programme of research and development (see Annex 3).

Technology stimulation measures for SMEs

After successful testing in the Brite-Euram programme in 1991-1994, the measures aimed at promoting and facilitating the participation of SMEs in Community RTD programmes are being implemented in most of the programmes under the fourth framework programme. The total budget earmarked for them is more than ECU 700 million.

The measures are as follows:

- a procedure for submitting and assessing proposals in two stages; applicants whose draft proposals have been selected in an initial stage receive an "exploratory premium" intended to cover 75% of the cost of drawing up a full proposal and looking for partners;
- a new type of project: cooperative research projects (CRAFT) which allow groups of SMEs with few or no R&D resources to resort to third parties to carry out the research;
- an ongoing open call for proposals for CRAFT premiums and projects;
- a network of intermediaries (CRAFT network) to inform and assist SMEs at national, regional and local level.

- The establishment of the Institute for Prospective Technological Studies in Seville, which has been given a very precise remit for technological monitoring. It is in close liaison with the various national institutes active in this field, and its setting-up should help the Community and national authorities in reaching their decisions (see following box).

EXTRACT FROM THE PROGRAMME OF WORK OF THE INSTITUTE FOR PROSPECTIVE TECHNOLOGICAL SURVEYS IN SEVILLE

*The first mission, the **technology watch**, is the priority task which will allow rapid and reliable access to up-to-date reports on technological information, including company organisation and the repercussions on employment, whatever the sectors concerned*

It requires an inventory of resources - both internal and external - and the establishment of an international network headed by an observatory set up by the IPTS[18]

Since it involves technological and economic intelligence, the task of this observatory will be the rapid collection of the relevant information and its processing into a codified format for subsequent use. This service, which is intended to meet the Commission's demands, must be horizontal in nature.

A methodology will have to be developed to gradually cover the entire spectrum of technologies, starting with fields in which the IPTS already has a comparative advantage (environment, energy, transport, information technologies, etc.). At present, it is thus not for the IPTS to produce new studies, but to channel and exploit the information available (Commission, OECD, national centres, etc.) on the situation in the Member States and our major industrial rivals.

This mission will produce a monthly digest intended for the member of the Commission responsible for Research, Education and Training.

*The second mission, **viz. the actual research**, will initially be directed towards the topic of **technology-employment-competitiveness**.*
Based largely on networking with the bodies dealing with this topic at national level, it is a question of summarising the experience of all the technologically-advanced countries as regards the impact of the technological factor on employment, and of identifying the technologies which look promising over a timescale of some ten years and the stages necessary in order to proceed from the present to the future situation. Account will also have to be taken of the associated major problems and economic and societal challenges.

Digests intended for the Community authorities, industry and European scientific circles will be published.

- Strengthening of university/industry partnerships for training, thanks to the Leonardo programme, and in the field of technology transfer (specific research programmes).

- Support for the development of the information society, particularly through the establishment of the necessary infrastructures (e.g. trans-European networks) and for the development of socially useful applications and joint experiments.

- Increased emphasis on the dissemination and exploitation of research results. These two objectives are being attained by using a minimum share of 1% of the budget which has to be devoted to the specific programmes of research and the INNOVATION programme. Through this programme the Commission is also supporting the establishment of contact points for innovation activities and information on the European Union's research and development activities. The list of these Innovation Centres is given in Annex 2.

- The pilot projects aimed at stimulating venture capital under the Action Plan for SMEs, the Structural Funds and the INNOVATION programme. The latter also promotes regular exchanges in the field of innovation financing through workshops and conferences which bring together financiers, academics, public agencies and national administrations.

- Support for the regions to enable them to draw up innovation strategies and rationalise their infrastructures and support measures for SMEs.

- Support for rural development by promoting as part of LEADER II, strategies gathering local partners and aiming at fostering innovation in terms of methods, product process or market. This Community initiative also includes the setting up of a European innovation and rural development monitoring system with the mission of identifying and disseminating good practice in that area.

- The launch of the SOCRATES (education) and LEONARDO (vocational training) programmes. These place the emphasis on improving the quality of the education, the mobility of students and teachers, the use of new communications technologies, the promotion of apprenticeship and recognition of the need for ongoing training throughout

one's life. Support for training or education initiatives with a view to innovation will be strengthened. A European observatory of innovative practices in vocational training will soon be set up.

- A policy for the harmonisation, adaptation and promotion of intellectual and industrial property rights[19] in SMEs.

- the concerted efforts being undertaken with the Member States with a view to simplifying administrative formalities, in particular for SMEs.

Despite all these efforts, there still remain obstacles and weaknesses.

"BIOMERIT" pilot project - European network in the field of biotechnology (COMETT programme)

Located in Cork, Ireland, BIOMERIT is a transnational network comprising some 33 partners in seven different countries. During its first three years of activity, BIOMERIT organised more than 14 workshops for training in biotechnology attended by about 900 participants. One of BIOMERIT's original approaches is that they have managed to take account not only of the needs of the students, who are familiar with working in European networks, but also of those of the businesses, so that they can introduce biotechnological innovations into agricultural holdings and SMEs.

In Brescia in Italy, for example, an agricultural firm in difficulty, employing seven people (non-viable agricultural holding despite its 265 hectares, etc.), decided to change and modernise its plant. It was faced with the need to produce foodstuffs free of chemical products and additives which satisfied consumers' needs. The firm therefore had to turn to biotechnology.

The operators attended a workshop on crop protection organised for farmers in Ireland. Thanks to the quality of the workshop design, within barely a week the Italian operators had received the training they needed to meet the demands of the market and had established the international contacts which allowed them to develop this technology upon their return and disseminate it throughout their region.

Quality system (Force programme)

A consortium of Irish, Portuguese and Spanish businesses has set up a training programme aimed at meeting the needs of European SMEs in the field of implementing quality programmes. The training programme aims to give an understanding of quality as an integral part of strategic management and as a tool for the management of human resources. The project has also helped to disseminate the application of the ISO 9000 quality standards in several regions of Europe.

The project's target audience is those responsible for quality in the businesses belonging to the consortium. A set of distance training material and case studies on video have been produced. These case studies show how businesses have successfully used and practised quality in their organisations.

IV. INNOVATION IN A STRAIT-JACKET

Traditional Europe is suspicious and its enterprises tend to shy away from risk. Innovators are seen as a nuisance. Innovators are not only vulnerable at the outset but are faced with an interminable series of obstacles to creativity. Fighting one's way through the existing red tape often feels like running the gauntlet. The main handicaps and obstacles are those affecting the coordination of efforts, human resources, private or public financing and the legal and regulatory environment.

1. Orienting research towards innovation

Research and development are an essential component of innovation. Europe is faced with four severe handicaps:

- **Inadequate input**. Europe devotes less of its GDP to R&D than its main rivals: 2% in 1993 compared with 2.7% in the United States and Japan. The gap between Japan and Europe is now three times what it was in 1981. If defence related research is excluded, the gap with the United States narrows but increases with Japan.

> The Community also has proportionately fewer researchers and engineers: 630 000 (4 out of every 1 000 of the working population) compared with 950 000 (8 per 1 000) in the USA and 450 000 (9 per 1 000) in Japan. (White Paper on Growth, Competitiveness and Employment: the challenges and ways forward into the 21st century, Chapter 4, European Commission, 1994).

- **Fragmented efforts**. It would be better in the present economic climate to concentrate financing on a limited number of priorities essential to competitiveness. The United States and Japan are already doing this; Europe, in the meantime, is wasting its resources on too wide a range of fields. When priorities are identified, they tend to be reactions to moves by our competitors rather than genuine choices.

> *The European Union is obviously not making full use of all the instruments it has at its disposal as a result of the Treaty on which it is founded. Even if cooperation has increased, coordination is still lacking. At the very time public expenditure by the Member States on research is dwindling, this coordination is an absolute necessity if we are to avoid frittering away our resources, cut out duplication and identify joint priorities. This is a major concern of mine.* (Edith Cresson, Compiègne, 6 September 1995)

- **Too little industrial research**. Industrial research carried out and financed by businesses is on a smaller scale than that of our main rivals. In-house expenditure by enterprises on civilian research and development (in other words research actually undertaken within firms, independently of its source of financing) amounted in 1992 to about 1.3% of GDP in Europe, compared with more than 1.9% in the United States and Japan. 12.2% was funded by the State in Europe, compared with more than 20% in the United States and barely 1.2% in Japan (see Table 11a in Annex IV).

- **Lack of anticipation.** Europe fails to anticipate trends and techniques sufficiently well, nor does it predict the constraints and conditions connected with exploiting new technology.

- Some progress has, however, been made recently in these fields at both national and Community level:

  - Certain countries (Germany, the United Kingdom and France) have recently set up large-scale forecasting schemes (Delphi, Foresight) with the help of experts, the aim being to predict technologies which are just over the horizon, plus their potential applications. Some countries have also put in place mechanisms for promoting social dialogue on the major technological

options or for maximising the chances of exploiting research results .

Dual use of technologies.

For several years, the technology needs of defence were specific or in advance of those of the civil sector. The separation between civil and defence research did not make the diffusion of technology developed for defence purposes easy.

It appears necessary nowadays to go beyond the separations between these two domains, as a number of technologies can have two uses (the so called dual technologies)

There is increasingly an overlap or convergence between the technological requirements of the civil and defence sectors. Technological flows even tend to reverse: civilian markets increasingly play a driving role in the development of dual use technologies and the defence sector is led to use technologies with civil origins.

The United States has fostered for several years a strategy of dual use in terms of technologies, components and production. Actions aimed at promoting technological and industrial synergy between civil activities and those related to defence are beginning to be implemented within some member states. These efforts can be carried on, reinforced and extended. They are necessary to reducing the duplications of research efforts, to better valorise knowledge and technology and facilitate the restructuration, the diversification or the reconversion of defence related industries. The Commission has just launched for that matter a reflexion on the possibilities for action at European level in order to strengthen the competitivity of defence related European industries.

- At Community level, efforts at focusing and coordination and technology watch have just been re-launched. Examples of this are the task forces which have been set up and the founding of the Institute for Prospective Technological Studies in Seville and the ETAN network (European Technology Assessment Network). Moreover, as announced in its recent communication on international research cooperation, the Commission is to increase the number of scientific advisers posted to foreign delegations by internal redeployment.

Progress is still needed, however. Impact on innovation and the transfer of results to a wider circle than those directly involved in the research ought, along with social benefits, to be one of the main permanent criteria for monitoring and assessing research and development projects.

Formulas creating a more flexible link between project-funding and the obligation to produce results, tailoring the level of public support to the economic and social importance of the results, will have to be explored. (White Paper on Growth, Competitiveness and Employment: the challenges and ways forward into the 21st century, Chapter 4, European Commission, 1994).

2. Human resources

a) Poorly adapted education and training systems

Considerable efforts are being made by teachers in schools and universities and by training personnel to adapt education to the needs of a changing world.

Education and training establishments are having increasing difficulty in coping with an ever-growing number and variety of target groups. One of the reasons for this is a severe lack of flexibility in the structures of such establishments and their approach to change. This rigidity prevents them from adjusting and reformulating their programmes. Even if establishments and curricula experiment with renewal, they are still too isolated from each other.

Education systems still tend to place excessive stress on academic knowledge, even in science, or to provide highly-specialised technical training. Courses which are still too compartmentalised do not help to convey the idea of innovation in education and training. Lastly, the concept of lifelong education and training has still to be developed.

The level and dissemination of **technical education**[20] is still inadequate in Europe. There are several reasons for this:

- Science and technology are inadequately covered in basic teaching.
- Technical disciplines are rarely given the recognition they deserve, since they are not regarded as "academic". As a result, they are usually relegated to fallback status.

- There is too little technology content in the teaching of scientific disciplines; teacher training fails to keep up with advances in the sciences; there are too few women involved in science and technology courses.

- Teaching approaches which leave too little space for personal research, experimentation and discovery, the acquisition of key lateral skills (project work, teamwork, communication) and training in the new production environment in industry (understanding markets and demand, preparations for becoming an entrepreneur, quality research).

- Difficulty in rapidly supplementing training courses with hybrid subjects relevant to new vocations.

- Lastly, the relational and communication skills essential to teamwork and exchanges with partners in different fields are still too often ignored.

The White Paper on Education and Training in the European Union

The White Paper on Education and Training, "Teaching and Learning: Towards the Knowledge-based Society", follows on from the White Paper on Growth, Competitiveness and Employment, which stressed the importance for Europe of intangible investment, particularly in education and research. This investment in knowledge plays an essential role in employment, competitiveness and social cohesion. The Cannes European Council noted in its conclusion the Commission's intention to submit a White Paper by the end of the year and stressed that "training and apprenticeship policies, which are fundamental for improving employment and competitiveness, must be strengthened, especially continuing training".

There are two major issues at stake: first, immediate action is required to meet our current needs for education and training. Secondly, we must prepare for the future by adopting a ***combined approach*** *in which both the Member States and the European Union may invest their efforts, each within its sphere of competence. The White Paper "Towards the Knowledge-based Society" takes the view that in today's modern Europe the three essentials of social integration, enhanced employability and personal fulfilment are not incompatible, should not be brought into conflict and should, on the contrary, be made to dovetail.*

The internationalisation of trade, the global context of technology and, above all, the arrival of the information society have given individuals better access to information and know-how, but at the same time demand a different set of skills and working systems. The developments taking place have increased uncertainty all round; for some they have brought an unbearable sense of exclusion.

The new opportunities open to individuals will require each person to make an effort to adapt and, above all, to build up his or her own qualification by combining elements of basic know-how acquired from various sources.

Given the diversity of national situations and the inadequacy of global solutions in this context, proposing a model is definitely not the answer. The White Paper, bearing in mind the subsidiarity principle, lists a number of initiatives to be taken at Member State level and support measures to be implemented at Community level. It outlines the types of response which will enable Europeans to adapt to the changes taking place: giving general culture the recognition it deserves; developing employability by, for example, making mobility easier; exploiting the potential of the information society, and giving the knowledge acquired in a lifetime its full value.

The principal objectives for implementation on a European scale in 1996 are:

- ***to encourage people to acquire new skills**. Example of recommended action: a trans-European project for know-how accreditation (validation of know-how units, personal skills cards);*
- ***to bring schools and the business sector closer together**. Example of recommended action: a programme for developing apprenticeship in Europe (based on the Erasmus model) under the Leonardo vocational-training programme;*
- ***to combat exclusion.** Example of recommended action: existing establishments in deprived areas to be turned into "second-chance schools", or support to be provided for setting up new ones;*
- ***proficiency in three European languages.** Example of recommended action: definition of a school quality label and networking of those establishments which are best at language teaching;*
- ***equal treatment for material investment and investment in training.** Example of recommended action: an enlightened accounting and fiscal approach to such investment.*

These objectives provide a clear framework for the debate the Commission intends to launch by presenting this White Paper in 1996, dubbed by the European Parliament and the Council as the ***European Year of Lifelong Learning***.

Continuous training of employees at the workplace is dogged by the same difficulties: too few businesses regard it as a worthwhile investment. Also, as in educational establishments, training schemes are still too technical and ignore the working environment, particularly social skills and general culture.

The emergence of the information society should nevertheless provide new methods of approach, such as computer tools for decentralised continuous training (educational software, multimedia distance learning, etc.). SMEs could benefit from this either by entering into subcontracting partnerships with large firms or by regrouping their resources with the help of chambers of commerce, for example. The experience gained through Community programmes such as FORCE and COMETT, now taken over by the Leonardo vocational training programme, shows that this type of partnership between firms can be fostered very easily (see box).

A medium-sized company invests in training for innovation

Allevard Aciers (F), the leading European producer of spring steel and the only steel making company specialising in such products, supplies 20% of the European market. The company is also looking to develop new products. To consolidate its position, however, it has to increase its share from 20% to 30% of the European market and so become an unassailable brand leader. It has to develop its production capacity, which is saturated, by seeking to improve productivity by introducing automated manufacturing processes, for example. It has therefore set up a FF 40 million-per-year investment programme for modernising its installations. This process is to take place without undermining the competitive advantages the company has acquired: flexibility and quality. Its directors therefore decided to intensify its training activities so that the new technologies and processes can be introduced without interfering with manufacturing schedules or quality levels.

Allevard Aciers thus succeeds over the years in building up a coherent human-resource development policy, using highly empirical methods. Its internal social relations improve, it engages in a partnership with a German firm, involves itself in European programmes such as FORCE and EUROTECNET and brings together local SMEs over training questions. In short, it takes a pragmatic path, innovates and gets involved in Europe.

During the summer of 1992 the company finds itself overloaded with orders and gets into difficulties. It is obliged to cut back on all its expenditure headings and consider temporary layoffs. Its human-resource management policy remains very fragile, and the assets built up over several years are under threat. Nevertheless, the company's ability to withstand fluctuations in the economy is strengthened, thanks to its better individual skills, its flexibility and its overall dynamism.

From " Les Entreprises face à l'Europe" P. Morin & J. C. Riera. 1993

b) Too little mobility

Innovation thrives on exchange, comparison, interaction and mixing. Cross-fertilisation of ideas and personal mobility, particularly between the research world, universities and industry, are important for creating and disseminating new discoveries.

Europe is not well placed in comparison with its main competitors. Despite the progress made in setting up the single market, there are still many obstacles to personal mobility and the transfer of ideas. This is one of Europe's most remarkable paradoxes: goods, capital and services move around more easily than people and know-how.

To quote just a few examples:

- In the European Union the need for an overall approach to taxation and social security contributions is particularly apparent in border regions where worker mobility can often be hampered by the lack of coordination between tax and social security schemes. The combination of high taxation in the country of residence and high social security contributions in the country of employment is a real obstacle to the free movement of highly skilled workers, i.e. those who contribute most to spreading innovation.

- The administrative inflexibility of educational systems makes it far more difficult in Europe to change schools or universities in mid-year (because of different scheduling of academic years, enrolment fees) and do not always make it possible to attend training schemes in another Member State. Some progress has been made at Community level in recognising academic qualifications thanks to the ECTS system devised as part of the Erasmus programme. The experience of mobility between universities and enterprises as part of the COMETT programme has improved matters in this field. There is still a lot to be done, however, with regard to the recognition of vocational qualifications. There are only a few isolated sectoral instances.

- The predominance of the diploma as the means of recognising individual skills blocks

any genuine mobility both between and within companies. There is as yet no real recognition of the know-how accumulated by an individual throughout his career. New ways of recognising skills need to be introduced.

- The lack of a real mortgage market means that the process of selling and buying accommodation when moving from one region or country to another is slow and difficult. In the USA this problem can be dealt with in a few days.

- Researchers wishing to work in different Member States encounter a wide variety of tax and social problems which block their mobility within the EU. This is paradoxical in view of the consistent efforts being made elsewhere to promote mobility, especially through the programme for the training and mobility of researchers. Moreover, with a few exceptions such as Germany, transfers between universities, public research and industry are difficult not only for cultural reasons, but also because of professional rules and social or tax systems.

- Even within firms, recruitment of managerial staff is very much a closed shop in many Member States, and job mobility (particularly of the lateral variety, i.e. moves from one job to another in the same firm) is limited. In Japan, on the other hand, the job mobility which is systematically organised within large companies is often quoted as one of the main factors in their ability to adapt and to exchange information internally - two major competitive assets.

3. Problems with financing

a) Financial systems which avoid innovation

The Community's ability to innovate depends largely on the effectiveness of its **innovation-financing system**. It is companies themselves and their potential partners in the financial system (banks, collectors of long-term savings, pension funds[21], retirement funds, venture-capital firms, stock exchanges etc.) which have to provide the bulk of innovation finance. **Self-financing** is naturally the main source of this risk investment, particularly in the early stages. Firms often have to resort to **external financing** when development, industrialisation or commercialisation are at stake, when a very steep growth in turnover is expected, or when a **new company is founded**. External investors often do more than merely provide funds: they may give new firms valuable support in terms of management and contacts, particularly international ones. Financing is the obstacle to innovation most often quoted by firms, whatever their size, in all Member States of the European Union and in virtually all sectors.

The unpredictability of innovation means that financing arrangements are up against **intrinsic difficulties** which have been further exacerbated by recent trends:

- The intangible component raises the problem of the increasing disparity between the guarantees demanded by investors for risk projects and the ability of firms to base these guarantees on solid foundations.

- The globalisation and deregulation of financial markets over the past 15 years facilitate a better liquidity and competition in the capital markets that can lead to better financing conditions. They have however also given holders of funds a wider choice of placement. These trends not only exert continued pressure on interest rates, but favour short-term, high-return investments to the detriment of the longer-term risk, so doubly penalising innovative SMEs.

The trend in venture capital in Europe illustrates this state of affairs. The growth of venture capital over the past ten years has been spectacular (funds raised quadrupled over eight years to some ECU 40 billion in 1994, and investments of some ECU 20 billion in over 15 000 companies). It has nevertheless gone hand in hand with a worrying relative fall-off in high-technology investment (34% of investments in 1985, 16% in 1992 and less than 10% in 1994, despite an upturn). Start-up investment shows a similar decline (25% of funds invested in 1985 compared with only 6% in 1994, although there has been a slight reversal in the trend recently)[22]. Less risky investments (staff buy-outs, development capital, medium-tech or low-tech sectors) predominate. Small-scale investments are

refused on the grounds of being too expensive. Finally, the geographical distribution of venture capital is still unequal, with the United Kingdom in the strongest position (more than half of the funds invested) and France and the Netherlands next in line. Venture capital is still in its infancy in the other Member States.

Venture capital is of course just one form of innovation financing open to companies. In general, however, the results of SME surveys show that the European innovation financing system is full of holes, such as:

- A neglect of innovation on the part of institutional investors holding long-term savings (retirement funds and pension funds, far less well-developed in Europe than in the United States). This is linked in many cases to an absence of information, a lack of market transparency and liquidity and, in many countries, excessive prudence in the choice of placement.

- Less tendency for individual investors ("business angels") to consider companies not listed on a stock exchange, despite interesting schemes for mobilising them in the United Kingdom and Denmark, for example. Collectively in Europe they represent an investment volume which is deemed to be several times that of risk capital funds. A favourable tax system in the USA, particularly under the legal form of the **Research Development Limited Partnership**, means that these individual investors provide half the seed capital needed by young high-technology companies.

Silmag, *set up in 1991 by researchers at LETI (the electronics and instrumentation technology laboratory at the French Atomic Energy Commission [CEA]), is having to cope with severe financial constraints: it has invested FF 40 million in the manufacture of its new-generation computer "read-heads", and it is planning to spend a further 100 million on equipment. Silmag will also have to keep up its portfolio of 30 international patents and a substantial working capital, needed primarily for building up its stocks of raw materials (silicon). This year the company is expecting a turnover of some FF 50 million.*

Silmag has adopted a two-pronged public-private strategy involving logistic and material support from the CEA, technical collaboration with the Italian Olivetti group, funding from EUREKA, ESPRIT and ANVAR and investments from three risk-capital companies.

Silmag expects the shares of its financial partners to be issued progressively on the stock market, particularly NASDAQ. According to its management, Silmag is, in fact, better known in financial circles in the USA than in Europe. Most of its customers are US-based. A solid core of technical expertise has grown up there around the computing sector; Europe does not yet possess enough investors able to follow up a company's growth potential over several years.

Adapted from Les Echos, 6 September 1995

- The lack of an electronics sector stock market specialising in growth or high-tech enterprise securities, similar to NASDAQ in the United States. This market enables dynamic firms to be recapitalised and offers venture capital companies an investment exit mechanism, thus constantly replenishing the flow of funds to this type of firm. Despite the recent launch of several competing projects, European firms do not yet have access to equivalent services. Despite the forthcoming entry into force of the Directive on financial services, there are still many obstacles preventing such a market from functioning harmoniously (no pan-European market-regulating authority, too few professional analysts and market-makers, etc.)[23].

- The major commercial banks in most countries are reluctant to get involved in innovation financing. Their ability to assess the technical risks of innovation and their

relationships with organisations specialising in technology or innovation are still largely underdeveloped. This is all the more regrettable in the light of the successful experiments which show that getting involved in financing innovative projects and networking with innovation agencies may well be profitable for the banks concerned.

- Lastly, there is under-capitalisation of SMEs. This is linked to national tax systems which privilege debt financing to the detriment of long-term financing and is aggravated by the frequent unwillingness of entrepreneurs to yield some say in their business and some of the financial fallout of success to partners who provide venture capital.

  These problems are slowly but surely being recognised, and steps are being taken at national level to remedy them. Several pilot schemes (such as the Edinburgh Facility for cutting the cost of bank loans to SMEs, run by the European Investment Bank) have been launched at Community level, with due regard for the subsidiarity principle. There have been pilot schemes to promote seed capital, risk capital and the financing of investment in "clean" technologies (see insert) . The Commission recently confirmed its support for the efforts being made to set up a capital market for growth enterprises in Europe.

Pilot project "Growth and environment"

This pilot project was set up at the request of the European Parliament and ECU 9 million were set aside for it in the 1995 Community budget. The funds are used to finance loan guarantees. These loans are for projects with beneficial effects for the environment. The initiative widens the coverage of banks providing loans to include enterprises which would not otherwise have found sources of financing for their development.

The "Growth and environment" initiative is geared to enterprises investing in measures with beneficial effects for the environment (e.g. energy savings). Although the amounts are modest, this financial incentive points the way for SMEs. Together with other Community funds, it offers direct practical aid which should make it possible to improve their performance in the areas of environmental protection and to introduce clean technologies.

Much remains to be done in this area in Europe, at both national and Community level.

b) Uncertainties and limits of public financing

Public funds devoted to innovation include expenditure on education and vocational training, innovation assistance to SMEs, infrastructure building and research. The available statistics primarily cover public funds allocated to research. Budgets are dwindling, and the future is being mortgaged as a result of cutbacks in public spending.

Because less public aid is devoted to research in Europe than in the USA, European industry finds itself at a disadvantage in some sectors. Firms in the USA receive three times the total volume of research funding provided in the EU, and twice the average amount. A figure provides a good illustration: the US federal government has injected into industrial research about 100 billion ecus more than the total of Community funds (second and third framework programmes, Structural funds) and the budgetary credits of the twelve member states paid to companies within the 1987-1993 period[24].

As well as giving support in the form of public funds, the United States and Japan make greater use of tax incentives than do the EU Member States. From 1986 to 1990, on average, tax concessions represented 88.8% of aid, all categories included, in the USA compared with 16.8% in France, 0% in the United Kingdom, Italy and the Netherlands, and 43% in Germany, according to the OECD[25]. Both the USA and Japan take advantage of the absence of ceilings to public aid in order to concentrate the funding on sectoral priorities. Japan regularly finances industrial research programmes to the tune of 100%. Industrial defence related research in the USA is 100% funded, as are certain basic research programmes involving industry. The share of public funding in the financing of research is very heavy in sectors such as aerospace (63.6% in 1991), electronics (30.3%) and the car industry (16.9%)[26]. One should note however a tendency to a decrease in public expenditures. This trend is translated both in terms of research budget and in an increased concentration of budgetary efforts as well in a search for an improved efficiency regarding the impact in terms of innovation. The debate is not finished, but, if this tendency was confirmed, it

could have strategic implications in the area of technological innovation.

c) An unfavourable tax environment

The European tax environment as a whole is not particularly beneficial to innovation. This is reflected in the ways in which companies, natural persons, savings and consumption are taxed. These questions, naturally, are primarily matters for Member States. However, it is desirable to analyse whether or not the USA and Japan have introduced more suitable mechanisms which ought to be used as sources for inspiration. In fact, ways of reducing the burden of tax incentives on real estate, consumption and speculative investments and increasing tax measures favouring intangible investments are being sought in the USA[27]. One must therefore reflect upon ways to correct possible disparities so as to avoid penalising European firms more heavily than their competitors, to draw on the lessons of mutual experience and to examine how to bring about a readjustment of taxation to favour intangible investment in Europe.

Taxation is an important factor in innovation. Tax rules and procedures strongly influence how enterprises act. The Member States have already introduced several measures designed to promote innovation by means of tax incentives. A comparative analysis of these various schemes of the measures adopted by our main competition, such as the United States and Japan, is nevertheless still needed in order to identify those which could be considered "best practices".

More basically, given that intangible investment has a high employment content (which is highly skilled in most cases), it is more readily affected than tangible investment by constant increases in tax and social security deductions. This trend, which has had a detrimental effect on employment but also on competitiveness and growth, needs to be reversed. This was indicated in the White Paper on Growth, Competitiveness and Employment, which recommends substantial cuts in non-wage costs of about 1-2% of gross national product.

Personal taxation

Tax systems do not as a general rule encourage investment by individuals in unlisted companies (taxation of reinvested capital gains, small or non-existent tax deductions, etc.). Moreover, fiscal transparency (i.e. the fact that all capital gains are attributed directly to the investor to avoid double taxation) is not *de rigueur* in all Member States (still less between them, in the case of transnational investment). Expenditure by private persons on education and training is rarely deductible from income tax.

Company taxation

- Three different approaches to company taxation relating to innovation can be identified in the EU Member States:

  - countries which opt for low company tax, based on the theory that innovation will blossom in a favourable climate; this approach is systematically applied by the United Kingdom;

  - countries which tax companies fairly leniently while using a variety of measures for boosting certain strongly research-oriented sectors; these include Spain, France, Italy, Ireland and Portugal;

  - countries with some of the highest company tax rates in the European Union, but offset by a large number of specific incentives; Belgium is one example.[28]

There are nevertheless certain common features:

- Tax systems in Europe tend to favour financing from borrowings rather than from capital. In order to stimulate self-financing, the Commission has formulated precise recommendations (Commission Recommendation of 25 May 1994 concerning the taxation of small and medium-sized enterprises[29]) which need to be implemented.

- The **tax treatment** and accounting of **intangible investments** are generally less advantageous than the treatment of tangible investments.

- Europe has a wide range of risk-capital tax systems, making for complex and costly legal

procedures which obstruct transnational investment[30].

4. The legal and regulatory environment

A suitable legal and regulatory environment would nurture innovation. The rules designed to protect and disseminate innovation (intellectual and industrial property rights and standards) need to be fully utilised. Cumbersome administrative formalities curb enterprise formation. Current legal forms do not really facilitate enterprise cooperation and development at the European level.

a) Too little use of protection rules

The filing of patents provides a genuine measure of technological activity. But the fact is that in the last ten years or so they have been levelling off to a worrying extent in Europe (between 85 000 and 90 000 patents per year), whereas there has been considerable growth in the number of patent applications from abroad (United States and Japan).

Naturally, not all innovations are destined for patenting. The use of the patent varies, of course, from one industry to another. It appears to be particularly useful in the chemical and pharmaceutical industries, for example, where the European Union is in a strong position. New-molecule synthesis means considerable research and development input into a product which is then easy to reproduce. Patents are used far less often in sectors with a high product-renewal rate, however, particularly now that such rates are constantly accelerating[31].

Part of this reluctance is due to the cost of applying for and maintaining patents[32].

This stagnation is also due to the fact that the protection patents offer innovators is not absolute, and the cost and duration of court proceedings in the event of dispute may be enormous. Two-thirds of the 170 000 European SMEs which generate inventions do not have access to patents[33]. Also, many firms are unaware of the profits they could make from granting licences, and many are likewise unaware of or severely underestimate the technology-watch potential stored in patent-office databases.

Furthermore, and for various reasons, companies do not always make maximum profits from the technologies they develop. According to some estimates, only 20-30% of technologies developed internally are incorporated in products commercialised by firms. There must therefore be a stock of under-used or unused scientific and technological know-how.

b) Standards, certification and quality systems

All innovative products or processes are developed and realised under framework conditions created by regulations, standards, certification and quality systems. Depending on what is involved, these general conditions may either inhibit innovation or promote it. This system of framework conditions is in some respects more favourable to innovation in the United States and Japan.

The very design of a new product will be influenced by the existence or otherwise of standards, whether these are descriptive standards limiting the possible options or performance standards imposing objectives to be met but leaving the means to the discretion of the innovator.

*The **patent** is the most widely-used instrument for protecting inventions. It gives its owner the right to forbid the exploitation of an invention as defined in the patent's "claims". The holder of a patent thus has a territorial and temporal exploitation monopoly (duration: 20 years in general) which he or she may assign, or lease in the case of a licence agreement. Utility models and certificates are little different from patents and give only limited protection for a shorter period, albeit at reduced cost. Industrial designs may be registered in order to protect their aesthetic properties. The granting of a registered design (which varies according to national law) protects the outward appearance of a product, i.e. its visual characteristics, configuration and ornamental qualities. Trade marks are essential for protecting products marketed on a large scale, but also for certain innovative products or processes, in order to identify them with an image of quality and progress. Trade marks are also a weapon against counterfeiting. Copyrights concern original works of art, and are gaining in importance in industry and commerce because they can be used to protect software, databases and masks used in manufacturing microchips, for example.*
Topographies of semi-conductor products are protected by specific exclusive rights for a ten years period. Generally speaking, undisclosed know how can benefit from protection, whether by virtue of commercial secret, or by confidentiality agreeements.

The QWERTY keyboard

The desktop computing revolution has left one element unchanged: the keyboard. The rectangular layout of the keyboard in the qwertyuiop *sequence (*azertyuiop *in French-speaking countries,* qwertzuiop *in German-speaking countries) is the same as that of the first typewriters dating from the middle of the last century. Any ergonomist will confirm that, from the functional point of view, this layout is one of the worst imaginable. Why was it chosen? Its original purpose was to prevent the type bars supporting the characters from colliding and becoming entangled - hence the layout in which adjacent letters on a keyboard are arranged in inverse relation to their frequency in words, thus slowing down the typing process, too fast for the original mechanical transmission technology. Dozens of prototype keyboards better suited to morphology (separation of the hands to avoid muscle fatigue caused by the curled position close to the body, fewer keys, optimised layout based on letter frequency in the language, a 50-70% faster learning process and doubled productivity) have been suggested over more than 50 years. All in vain: even the Minitel, the first prototypes of which had been issued with a keyboard in alphabetical order, was obliged to conform to the standard. Hundreds of millions of people have learnt this system, and the interests of "compatibility", meaning that anyone can use any typewriter, computer or keyboard-driven machinery, win out over the most obvious need for optimisation. Innovation is not impossible, but it is forced to short-circuit the problem by eliminating the keyboard altogether without introducing a new element which has to be learnt (handwriting directly recognised by computer, voice recognition).*

(*Adapted from M. Giget: "L'innovation dans l'entreprise", in* Techniques de l'Ingénieur)

The "new approach" to **product** regulations - which was adopted in 1984 and supplemented in 1989 by an overall approach to assessing conformity - introduced a liberal system favourable to innovation. This no longer makes standards compulsory, but gives any manufacturer the legal option of marketing an innovative product which has no standardisation status. The manufacturer has a choice of the procedures for assessing conformity, the scope of which is fixed by the Council and which depends on the voluntary use of quality instruments. A further determining feature is the establishment of performance standards (which define the performance necessary to comply with essential safety requirements, for example) to replace descriptive standards (which describe solutions regarded as satisfactory and tend to exclude other possible solutions, even if they are more innovative). However, the new approach owes its liberal character to a large measure of self-regulation, which implicitly requires all organisations and persons taking advantage of it to know the principles, stakes, opportunities and constraints involved. However, many firms and institutions are either ignorant of it or wrongly interpret its implications[34].

*The European **Agro food** industry represents the largest sector in terms of turnover and is characterised by a large number of SMEs at the processing stage in addition to farmers and other very small firms. It is a sector in which know how is largely borne of trial and error and where a respect for tradition still constitutes an important element enhancing the value of European production. For that reason, the European quality policy of Agro food products has been embodied by council decisions in favour of traditional production.*

*For example, in terms of industrial property, the regulations for **labels of origin** and geographic indications of agricultural products and foodstuffs, and, in terms of technical rules and norms, the regulations on **certificates of specificity** for those same products allow groupings of producers to ask, through their Member States, for the registration at European level of the specifications of their product. This system includes a European procedure with a possibility for objections to be raised. It permits the avoidance, on a voluntary basis, of unfair competition with products stemming from European traditions.*

With regard to technological aspects, it appears essential to develop and use "soft" innovative techniques likely to allow these products stemming from traditions to retain their essential characteristics, while benefiting from the contribution of technological innovation.

Process innovation is not regulated to the same extent as product innovation. The most important regulations here are those for protecting employees and the environment. Community directives exist, but most regulations are national. There is thus no homogeneous, harmonised concept equivalent to the New Approach, and there are still localised obstacles to innovation. Where there are problems in exporting industrial machinery, for example, innovators in one Member State often have difficulty in negotiating the necessary *ad hoc* compromises with the authorities of another Member State.

Some standards are the result of **voluntary standardisation** and are adopted without regulatory pressure from the public authorities. In innovation, new products must work in parallel or be compatible with existing ones, in order to safeguard consumer confidence. Standards are an advantage to existing products, but innovators often see them as a tool for sustaining mature technologies and mistrust them. Generalised performance standards are thus desirable. Innovation would be helped along if, when an existing product is replaced by a new one complying with voluntary standards and with the same level of performance, the new product were to be regarded as complying with these standards.

There is a need to differentiate between "product or service" standardisation or certification and "quality systems" standardisation or certification (EN ISO 9000) which covers management quality in an enterprise and not the product or service itself. This quality management also uses other tools apart from standards.

The introduction of quality policies encourages innovation, as can be seen in the United States and Japan. The introduction of such policies in enterprises in fact involves implementing strategies fostering innovation, whether in the product or service itself or in the various functions of the enterprise.

Lastly, the dialogue needed between firms, particularly SMEs, technologists and legislators (who determine the essential requirements and binding technical regulations) is still underdeveloped in Europe. Such dialogue is vital if we are to prevent legislators, lacking the right information at the right time, from imposing conditions which are technically unmanageable by European firms[35] and so putting them at a disadvantage vis-à-vis their better-equipped competitors.

The use of voluntary agreements is increasingly recommended. There are two major categories of voluntary agreement: the first aims to define desirable improvements to technological performance and the means of achieving them, as part of a consultation procedure between the public authorities and the industrial sector; the second concerns measures taken by the public authorities to encourage firms to agree on voluntary joint action. Voluntary agreements have the advantage of preventing regulations from becoming excessive. All that remains to be done is to provide a means of monitoring their application.

c) Cumbersome administrative formalities

The regulatory and administrative environment in which companies find themselves is unnecessarily complex. It costs European firms an estimated extra ECU 180-230 billion, renders them less efficient and hence undermines their innovative capacity.

All these formalities place a very heavy burden on companies, particularly newly-founded ones. The time spent on administration is often lost to innovation in a young SME with a small managerial staff.

Moreover, because of a lack of internal coordination, administration often means filling in multiple declarations and producing the same information repeatedly. In most European countries, unlike the USA, the process of setting up a business and recruiting one's first staff is very much like running the gauntlet. It often takes more than a month (other than for sole proprietorships) and costs several thousand ecus.

These obstacles to company start-up are harmful, particularly to new high-technology firms, which are essential creators and disseminators of new products and services and help renew the economic fabric and industrial structures in growth sectors. There are fewer of them in Europe than in the USA, and they have more difficulty in expanding. In addition to start-up problems, they suffer from the fragmentation of the market which in spite of Community competition policy in fact still persists, chiefly for cultural reasons. Gaining access to venture capital and public funds (via the stock market) is harder for such companies in Europe than in other regions. They therefore tend to remain smaller than their US counterparts and fail to take advantage of their full potential for expansion.

The purpose of such administrative formalities appears to be control at all costs, so much so that even well-intentioned schemes may prove a burden in themselves. Several Member States have job-creation schemes which grant new firms exemptions from social charges, which are progressively withdrawn over the first few years of recruitment. However, the firms concerned are still obliged to declare social charges, even if they are zero. Very often an employer cannot take on an employee with full exemption from the social charges levied on recruitment until the relevant authorities have scrutinised the forms and authorised the appointment. The continued requirement to complete pointless declarations thus neutralises many of the benefits of the exemption.

SIX-COUNTRY* COMPARISON OF THE FORMALITIES FOR SETTING UP A BUSINESS (EXCLUDING SOCIAL-PROTECTION DECLARATIONS)

	France				Germany				Greece				Italy				Ireland			United Kingdom		
Type of business	Artisan	SARL /EURL	SA à conseil	SNC	KGT	GmbH	AG	OHG	PE	EPE	AE	OE	Artigiana	SRL/ SURL	SPA	SNC	S.T.	Private LC	ULC	S.T.	Private L.C.	P.L.C
A	Centre de formalités des entreprises (CFE)				Gewerbeamt																Privé	
B	1	1	1	1	1	2	2	2	1	4	4	1	1	5	4	4	2	3	3	2	4	4
C	6	10	14	10	1	6	6	3	5	22	23	10	7	17	18	9	2	6	6	2	4	4
D	4	5	7	5	2	2	2	2	2	2	2	3	4	3	3	4-5	0	0	0	2	4	4
E = total procedures	10	15	21	15	3	8	8	5	7	24	25	13	11	20	21	13-14	2	6	6	4	8	8
F = duration in days	7-49	28-56	49-105	21-42	1	56-168	56-168	56-168	7-14	21-70	21-70	7-21	28-112	28-112	154	14-84	1	14-28	14-28	1	28	42
direct costs ECU	600-2000	700-2100	700-2100	700-2000	10- 25	250-1000	250-1000	250-5000	0	150	150	10-30	150	400	700	500	0	350	350	0	20	1000
indirect costs ECU	500-700	1200 2500	1500 4000	800-2000	0	500 - 1000	500 - 1000	500-1000	0	600-3000	600 - 3000	150 - 300	1000	1800	7000	1200	0	300 - 350	300 - 350	300	300	500
TOTAL COSTS ECU	1100-2700	1900-4600	2200-6100	1500-4000	10-25	750-2000	750-2000	750-6000	0	750-3000	750-3000	160-330	150-1000	400-1800	700-7000	500-1200	0	300-700	300-700	300	20-3000	500-1000

The colour codes allocated to businesses denote similar articles of association.
A = One-stop office
B = Number of government or other departments involved in the registration of a new business
C = Number of documents and/or procedures required for registration
D = Number of procedures required for start-up after registration
E = C+D: Total number of documents and/or procedures required
F = Number of days required to complete all procedures, disregarding overlap
Direct costs: registration fees paid directly to the authorities
Indirect costs: lawyers' and agents' fees. etc.
* Nota: it is plan to extend this comparison to other Member States
Source: European Commission DG XIII-D, Logotech et al. (1995)

**France: SARL/EURL: société à responsabilité limitée, SA à conseil: société anonyme à conseil d'administration, SNC: société en nom collectif. Germany: KGT: Kleingewerbetreibender, GmbH: Gesellschaft mit beschränkter Haftung, AG: Aktiengesellschaft, OHG: Offene Handelsgesellschaft. Greece: PE: Prosopiki Eteria, EPE: Eteria Periorismenis Efthinis, AE: Anonimi Eteria, OE: Omorithmi Eteria. Italy: SRL/SuRL: societa a responsabilita limitata/societa unipersonalle a responsabilita limitata, SPA: societa per azioni, SNC: societa in nome colletivo. Ireland: ST sole trader, Private LC: private limited company, ULC: unlimited company. United Kingdom: ST: single trader, Private LC: private limited company, PLC: public limited company*

Excessive administrative zeal may complicate measures which are simple and effective. In France, for example, aid to unemployed persons setting up a firm was instituted in 1979, enabling a person seeking work to create his or her own job. This scheme was a great success, with tens of thousands of unemployed persons taking advantage of it each year in the mid-1980s. In 1987 the system was reformed with the laudable aim of reducing the number of bankruptcies amongst firms set up in this way. Each case had to go before an administrative committee appointed to test its viability. This added burden and the ensuing delays caused a steep decline in the number of firms and jobs created under the scheme.

True, major efforts are being made to simplify administrative procedures: service vouchers[36] are remarkably successful in several countries and are an excellent example of an innovation with wider application potential. Assistance centres for administrative formalities or "one-stop shops" for completing them are proliferating in certain Member States (France, the United Kingdom and - in telematic form - in Denmark, for example). Germany has set up an independent Federal commission to simplify legislative and administrative procedures. Another rule being adopted in several countries is that authorities set themselves strict reply deadlines, with failure to meet such a deadline implying approval.

The Commission's contribution has been to set up the *Committee on the Improvement of the Business Environment and the Promotion of the Development of Enterprises*, the purpose of which is concerted action with the Member States in this area. A first symposium on the creation of new companies was held in Paris in June 1995.

d) Legal formulae ill-suited to European cooperation

The existing legal formulae do not encourage firms to cooperate or to expand on a European scale:

The EEIG (European Economic Interest Grouping) is the only statutory instrument in force for European cooperation. Its purpose is to facilitate, develop or improve the results of the economic activity of the Community's economic operators. However, it remains a limited or unsuitable instrument for innovation, exploitation of research results and technology development, however. Each member of the EEIG is held personally responsible for the debts of the grouping, and to an unlimited extent; the EEIG may employ no more than 500 persons; its activities may be no more than auxiliary to that of its members; it may take no part or action in a member company and it may not offer shares to the public.

As stated in the Ciampi report, the **European Company** would be the ideal instrument to enable firms to cooperate and restructure beyond frontiers, and a means of bypassing the legislative constraints and practices of fifteen different legal systems which obstruct technological innovation.

A growing number of companies have adopted new strategies and structures so as to be quicker and more flexible in taking advantage of the new opportunities offered by the single market. Unlike US companies, however, these European firms still have to operate through a complex and costly network of subsidiaries established in other Member States. The internal market will never be achieved unless European companies can operate more flexibly and more effectively throughout the Union.

The implementation of the European Company statute is blocked by a disagreement within the Council. One way of getting round this impasse would be to put forward a number of alternative statutes accommodating the various points at issue, such as employee representation, or even simplified statutes specially tailored to new, innovative firms. The way ahead might then be clear, particularly in the light of the recent adoption of the Directive on the establishment of a European Works Council[37].

5. Conclusion

Because of the obstacles listed above, innovation in Europe is marking time. There are not enough new businesses, methods of open and participative organisation and management are not widely enough known, and there is a widespread reluctance to seek information. On top of this, research effort tends to be squandered, formalities are over-complex, a technical “culture” is lacking, research, industry and training are compartmentalised, regulations are sometimes a deterrent, and public initiatives are not always well thought out. All this needs to be changed.

V. ROUTES OF ACTIONS

An improvement in terms of quantity and quality of innovation in Europe - vital for the future - depends primarily on the initiatives of enterprises and individuals themselves. While the role of the authorities is thus by nature limited, it is nevertheless essential, in view of the number of obstacles identified earlier which discourage initiatives and curb their full development.

The Commission therefore proposes to launch a debate on the various actions which it considers necessary to overcome the handicaps and obstacles facing innovation in Europe. Of course, with subsidiarity in mind, there is a need to distinguish clearly between responsibility at Community, national and local levels and how these levels should cooperate. Some measures therefore need to be undertaken at Community level for reasons of efficiency, for example to ensure the exchange of experience and a wider dissemination of good practice. With regard to possible measures supporting and supplementing national actions and actions undertaken by enterprises at Community level, the Commission is keen to point out that they will not require any new funding but may be financed by redirecting existing programmes. Although the actions which are proposed are not particularly numerous, they are nevertheless extremely varied. The debate should allow the validation of these propositions as well as the specification of the most suitable routes and levels of implementation.

Route of Actions 1: Develop technology monitoring and foresight

An initial requirement is the development of "technology watch" which provides reliable access to the best reports on technological information in the world.

It was for this purpose that the Institute for Prospective Technological Studies (IPTS) was founded in Seville. Its activities are permanently linked to the technology watch actions being carried out as part of the specific research programmes under the Fourth Framework Programme. The job of this institute is not to produce new studies. Its purpose is to carry out the prompt collection of the relevant available information and to process it into a codified format for subsequent use. The idea is that the data is then channelled and exploited to illustrate the situation in the Member States and their major industrial rivals.

An approach of this kind will encourage the organisation of exchanges of experience between countries, comparison of work, identification of areas of consensus and disagreement, and lastly the formulation of digests at Community level. These digests will make it possible for the European authorities, and industrial and scientific circles, to arrive at better decisions and policies.

At the same time, regular statistical surveys of technological innovation should be organised in the Member States. The surveys should make it possible to measure also the costs and the benefits stemming from innovative activities and to arrive at a better understanding of the factors which determine innovation.

Actions involving consultation and socioeconomic forecasting could also be launched as part of the ETAN network (European Technology Assessment Network), following a review of recent national initiatives (e.g. Technology Foresight in the United Kingdom, Delphi actions in France and Germany and the Foresight Committee in the Netherlands). They should make it possible to expand and update the knowledge base which decision-makers rely on for launching research programmes and actions.

Actions designed to measure and arrive at a better understanding of the relations between new technologies, their incentives for their introduction and the economic context could also be amplified and put to better use. Such needs are well illustrated by the energy-environment-economy inter-relationship.

Route of Actions 2: Better direct research efforts towards innovation

The debate should focus on actions undertaken *at national level* in order*:*

- to establish ambitious objectives to increase the proportion of gross domestic product devoted to research, development and innovation;
- to encourage national research by enterprises (especially the one financed by enterprises, or

the one financed by governments, within the limits allowed by Article 92 of the Treaty);

- to the extent allowed by cuts in public deficits and statutory deductions, to boost the proportion of government spending on intangible investment (research and development, training) and innovation, especially among enterprises, favouring indirect tools;
- to refine the tools for technological forecasting and the instruments for coordination to facilitate the exploitation of research results;
- to strengthen the mechanisms linking basic research and innovation; focusing on markets with high growth potential, such as prime sectors and "green" markets;
- to introduce systems for monitoring the requirements of SMEs, with the dual mission reinforcing their capability to carry out their own research efforts and their capacity to absorb technologies regardless of origin.

At Community level it appears necessary:

- to prepare the extension of the task forces to cover other themes; a major part of funding allocated to the Fourth Framework Programme should be used for this. Existing or future task forces should allow for clear operational mechanisms to permit SMEs prompt involvement in applying results;
- to bolster the mechanisms which allow SMEs to be involved in and benefit from Community research, by encouraging in particular the management of research and technological development projects by technology-minded SMEs and the incorporation by traditional SMEs of new technologies;
- to boost inter-programme cooperation (in order to develop joint calls for proposals) and, in particular, to launch pilot schemes combining social and technological innovation in fields of specific interest to citizens (health, environment, municipal and local services, etc.).
- to introduce or to reinforce among the parameters for the monitoring and evaluation of research programmes and projects (from the Fourth Framework Programme in the field of research and technological development onwards) the criteria relating to their impact on innovation (including business start-ups) in addition to the direct benefits for those involved;
- to pay better attention to the needs of innovation and the most relevant experience gained from current SME actions in preparing the fifth framework programme. To better take innovation into account within Community policies other than the Framework Programme;
- to reformulate, in collaboration with end users, industry and researchers in the Member States, the methods of defining the content of Community research and development programmes; in order to improve the exploitation of research results and innovation. The Commission would like to see project evaluation increasingly include an enterprise plan for the use of results; this should in practice encourage efforts towards growth, innovation and internationalisation on the part of the most dynamic technological SMEs.

Route of Action 3: Develop initial and further training[38]

1996 is the European Year of Lifelong Learning. The opportunity has to be taken to emphasise the importance of innovation becoming a permanent feature of initial and further training. The debate should concentrate mainly on the following objectives and on the best way to meet them:

at national level:

- a greater effort to instill young people in the education system with the spirit of creativity and enterprise. This could imply the introduction of education syllabuses which include: outline of the operation of an enterprise, knowledge of a market, familiarisation with materials, techniques, products, costs, tuition in the techniques of creativity and experimental methods, etc.;
- surveying more efficiently the new professions (e.g. financial analysts for innovation projects) in line with the needs of the economy with regard to innovation; identifying the new qualifications required by present and likely future technological changes; designing training courses which could be adopted by national education and training systems;
- promoting a general breakdown of barriers between disciplines: introduction of training modules on innovation management and communication into scientific and technical

training syllabuses and technology management courses in business training programmes, etc.;

- stimulating further training, in particular in SMEs; developing and generalising training to new technologies and innovation and technology transfer among enterprises (support bodies for the social partners);
- exploiting the possibilities offered by distance learning and information technologies to stimulate and satisfy the demand for training;
- developing, through cooperation among establishments and companies, the training of engineers and technicians in the tertiary sector which is adapted to activities in the sector and to consumer needs (e.g. maintenance, servicing, repairs, etc.); training provided partly by enterprises could link science subjects with legal and economic studies, communications techniques and psychology;

at Community level, the debate will allow to specify the conditions and modalities of:

- the creation of a European network of new teaching media based on cooperation between industry and educational and training establishments;
- establishing a system of certification for basic technical and vocational skills, based on a cooperative effort between higher education institutions, enterprises, professional bodies and chambers of commerce.
- the possible creation of a European observatory for innovative practices in vocational training in order to disseminate new ideas and best practice for modernisation based on negotiation;
- the mutual recognition of training modules, favouring agreements between teaching and training institutions, as well as between professional branches;
- supporting the creation of sandwich courses in higher education with a view to a better integration of general and vocational training, research and industry along the lines of "campus companies", with training geared primarily to the promotion of innovation and management of technology transfer;

Route of Action 4: Further the mobility of students and researchers

The Member States need to pursue, develop or implement actions to encourage various types of mobility: social mobility, mobility between professions, mobility between research institutes and enterprises, etc.. For its part, the Community has to make every effort to eliminate or reduce the regulatory barriers to mobility and intensify and expand its programmes in this area.

The following actions should be debated:

- adoption of rules (directives) designed among other things to create a mortgage payment market and to facilitate the transfer from one fiscal or social security system to another;
- the development of new ways for skills recognition beyond the diploma and formal education, in the first instance at national and local levels. At European level, a project for a personal skills smart card will be implemented.

- actions designed to encourage the mobility of students, engineers and research workers in connection with the **LEONARDO** and **HUMAN CAPITAL AND MOBILITY** programmes.

It also seems desirable to specify criteria, conditions and modalities for:

- the creation of an association for the recipients of grants awarded to researchers under the training and mobility of researchers programme. It would contribute to the broad dissemination of the experience acquired and to suggest improvements to the existing system; **from 1 January 1996 these awards will be known as Marie Curie scholarships**;
- awarding the label "European research worker" to those who have been significantly involved in Community programmes and the title of "European project leader" to those who have coordinated Community projects involving partners from several different countries, in order to provide recognition which will stand them in good stead in their future career;
- encouraging the mobility of research workers and engineers to SMEs to facilitate the transfer of skills and technologies derived from Community projects;
- increasing the involvement of nationals from other Member States in the management or

policy teams of national or regional research and development centres;

- encouraging transnational partnerships for training in innovation management and the familiarisation of young people with basic technological ideas (ERASMUS and COMENIUS programmes);
- promoting the emergence of transnational apprenticeship partnerships.

Route of Actions 5: Promote recognition of the benefits of innovation

The action undertaken by the Community and the Member States should strive to persuade the general public of the benefits of innovation. The debate should specify the necessary actions. Among them could figure:

- The launching of a project of Community interest covering an initial phase of five years and involving the Member States could be part of this. The project, administered by the Community, would be launched after selection by tender. Its object would be to exploit, at Community level, successfull experiences from the Member States and to produce information programmes using various media (videos, specialist press, CD-ROM, etc.) on the positive repercussions of European innovations and also from other sources. The project would be launched simultaneously in the various Member States.
- The recognition of creative individuals by providing European prizes or distinctions to reward original society in the fields of science, technology, society, design, training, etc.

***Route of Actions 6: Improve the financing of innovatio*n**

The mechanisms are presented below as an indication. One should consider their relevance and concrete modalities, which can vary with member states. The proposed actions for debate cover:

at national level:

- development of mechanisms for innovation risk insurance and/or mutual guarantee, especially for new technology based firms;
- creation of guarantee/insurance systems permitting, for example, an initial referral of newly formed technological enterprises to major clients (government departments, large enterprises, etc.) or encouraging banks to provide long-term loans, including equity loans, to enterprises for investment related to innovation or encouraging the partnering of banks with expert bodies on innovation for project appraisals;
- testing of innovation financing schemes such as the introduction of initial guarantee mechanisms to stimulate the financing of technology transfer based on fees;
- development of sources of long-term investment capital (“business angels”, pension funds) and its channelling to innovation.

at national and Community level:

- creation of outline conditions for the effective development in Europe of stock markets, possibly pan-European, for “growth enterprises”; the Commission and the member States need to ensure that their establishment and operation are facilitated by the removal of any remaining obstacles before the end of 1996, especially by means of the immediate (and precise) transposition of the relevant directives throughout the Member States;
- creation of “one-stop shops” to facilitate access to national and Community financial support for innovation;
- study the existing securitisation mechanisms and the possibility to extend them at national and/or Community level and orienting them towards the financing of innovation.

at Community level:

- development of actions by the European Investment Fund in favour of innovative SMEs by granting guarantees to banking intermediaries and venture capitalists, by possibly acquiring holdings in venture risk intermediaries (implementing the possibility opened to the Fund of investing in equity);
- the possible support to the creation of multi national seed capital funds to facilitate the birth and the European development of new technology based firms;
- study modalities and opportunity of launching of a pilot action to provide low-rate loans for short-term development work undertaken jointly by SMEs from different Member States.

Route of Actions 7: Set-up fiscal régime beneficial to innovation

The Community must encourage the Member States to adopt tax measures conducive to innovation, especially for venture capital and intangible investment, while bearing in mind the need to control public spending with a view to Economic and Monetary Union. Given the extremely sensitive nature of fiscal policies, any action will have to be taken with care. It is naturally the responsibility of the Member States with regard to tax and social security deductions to devise consistent strategies which reconcile the development of innovation and that of employment. An exchange of information on the benefits of the various systems should be the first stage. However, fiscal incentives have their advantages and drawbacks. **A thorough study is needed** in order to determine a suitable breakdown in the use of the various types of measure. They could cover:

- more equal fiscal treatment of intangible and tangible investment (e.g. possibility of creating depreciation allowances along the lines of those for tangible investments - a study is in progress);
- broadening of tax relief to encourage individual investors towards investment in innovation (e.g. the “research development limited partnership” arrangement which exists in two Member States, or tax rebates);
- promotion of fiscal transparency with regard to venture capital companies (to avoid double taxation), as indicated in the Communication of 25 May 1994[39];
- deductions linked to deposits of industrial and intellectual property titles along the lines of the measures in the United States (“small entity fees”);
- encouragement of further training (for individuals but also for SMEs) through the introduction of tax allowances for training;
- reduction of regulations concerning the transfer of enterprises within the European Union in cases not covered by the "merger directive"[40]; the Commission Recommendation of 7 December 1994 on the transfer of SMEs[41] could serve as a starting point for this study;
- approximation fiscal definitions relating to research and technological development and innovation in use in the Member States.

Route of Actions 8: Promoting intellectual and industrial property

The desirable actions that the debate should allow to better specify and further, include:

at national level:

- ratification by certain Member States of the Convention for the European Patent to allow its entry into force, which has not yet happened in spite of the 1989 agreement;
- encouragement of the use of utility models by SMEs and raising of awareness among enterprises;
- assistance to businessmen in defining a strategy for the protection of intellectual and industrial property, as well as for the acquisition and granting of licences;
- the means of a greater assistance to businessmen and research institutes in combating piracy and copyright infringement;
- reinforcing teaching on intellectual and industrial property as part of training for future research workers, engineers and business executives;

at Community and international level:

- the continuation of the efforts to harmonise arrangements on intellectual property, especially in the field of life sciences and technical fields related to software, telecommunications (information society) and utility models;
- reinforcement of the instruments to combat counterfeiting and copyright infringements;
- promotion of patent information services as a method of technology watch based, in particular, on the information system set up by the European Patent Office.

Route of Actions 9: Simplify administrative procedures

The Commission is trying to streamline the procedures and formalities it requires, especially for access to its programmes, the authorisations it gives or the checks it carries out. With regard to research aid, for instance, following the increase

in the number of Member States and associate countries, general concern has emerged about the delays affecting implementation and payment and about the variety and complexity of Commission procedures. In order therefore to arrive at an objective diagnosis and especially to identify the concrete measures to be taken, the Commissioner in charge of Research, has requested her services to organise a seminar gathering together:

- the administrators and directors of the most industrially oriented programmes in the Framework Programme;
- senior representatives of enterprises involved in projects;
- an audit firm to act as referee and to suggest improvements.

The Commission will publish the operational findings of this seminar during the consultation phase which is proposed by this Green Paper.

Streamlining of administrative procedures is also a priority at national level. For example, whereas the formalities for setting up a business are straightforward in the United States, in Europe it can take several months. This means that, while an American innovator can set up a business the same day in order to exploit a new product, in most of the EU Member States innovators are put off by the time it takes to register a new business and to complete the formalities of all kinds (in some cases the authorities responsible for supplementary pension schemes have to be dealt with even if the company has no management staff).

The Commission thus plans to put to the Member States a proposal for a programme of concerted actions to improve and simplify the business environment, especially with regard to business formation (under discussion) and the growth and transmission of enterprises[42].

The Commission has announced its intention to devise in conjunction with the Member States methods of evaluating performance in the field of administrative simplification and to draft a recommendation to the Member States so that they adopt the best existing practices with regard to the streamlining of administrative procedures. These concerted actions might take the form of a recommendation to Member States:

- rationalisation of structures and formalities relating to fiscal matters and social protection (e.g. forms, declarations, obligation to maintain records);
- establishment of local “one-stop shops” to provide information and help with completing formalities;
- adoption of rules whereby government offices must reply by specific deadlines, failing which their agreement is presumed.

The consultation launched by the Green paper will allow the identification of areas of priority with regard to innovation where simplifications are necessary and urgent.

Route of Actions 10: A favourable legal and regulatory framework

The debate should concentrte, in particular, on the need and means to

company law

- very rapidly adopt the regulation on a European company statute with the aim of removing the obstacles to innovation caused by fifteen different legal systems;
- launch a study for a simplified EEIG and European company statute for innovative new enterprises;

standards

- generalise the system of performance standards emphasising innovation in compliance with the constraints of safety and environmental protection;
- support the establishment of voluntary agreements between enterprises and the authorities with the aim of achieving, at National or Union level, through technological innovation, high performance levels in economic, environmental and energy terms, while speeding up the introduction of ways of monitoring their application;

public contracts

- analyse and discuss means of stimulating demand for innovative products by existing means in the directives on public contracts;

competition rules

- continue the efforts to liberalise markets, in particular in the service sector
- continue taking into account the globalisation of markets and of the features of technological

and innovation activities in assessing cooperation agreements and concentrative operations;

- publicise the new Community arrangements for research aid adopted in December 1995, which takes into account the new WTO code, encourage intangible investment, takes into account the financial aspects of innovation and allow the inclusion for SMEs of the cost of filing and maintaining licences among the expenses eligible for national or Community aid for research and technological development;
- examination of a system of horizontal control for regional aid to major investment projects which would introduce inter-sectoral discipline;
- continue to facilitate the transfer of technology with respect to competition rules (block exemption regulation of technology transfer agreements).

labour legislation

- examination and possible adaptation of current rules concerning working conditions and employment, especially in the fields of home working, teleworking, protection of workers' privacy.

Route of Actions 11: Develop "economic intelligence" actions

It appears desirable to specify ways and means for:

at national and regional level

- intensifying the efforts to make enterprises, especially SMEs, more aware of the need for and methods of “economic intelligence”. These efforts could also aim at government departments, so that they are aware of their powers and responsibilities in this area;

- creating an environment favourable to the emergence of private-sector services offered to enterprises in this field;

- including in higher training for future managers, engineers, researchers and senior marketing staff familiarisation with economic intelligence to encourage ongoing motivation for this subject among enterprises;

- establishing up consultation bodies along the lines of what has been done in Sweden, France and the United Kingdom;
- encouraging a reflexion at regional level on this area (if necessary, and if applicable, with the help of the Structural Funds, by using the lessons gained from experience with Regional Innovation strategies in Article 10 of the ERDF and the Innovation Programme);

- highlighting the successful experience of enterprises or groups of SMEs;

at Community level

- facilitating the possible interlinking of national bodies for consultation and guidance in this field and exchanges of good practice between regions and countries;

- reinforcing the scientific expertise of some of the Commission's delegations in third countries, in order to accomplish a mission of technology watch and to provide to the Union analyses on the evaluation of research conducted abroad;

- launching pilot actions of assistance for SMEs using existing programmes (e.g. the SME initiative in the Structural Funds or the Innovation Programme); this pilot action could include encouragement of joint action in this field or specific support for new enterprises offering innovation in the field of information on world markets; some of these actions introduced as part of the SME Initiative could, for example, be enhanced by organising exchanges of experience and cooperation schemes between regional or local bodies in different countries which provide help to SMEs on innovation;

- Increasing its efforts so that internal information sources and resources are put to better use and made more widely available.To that effect an invitation to tender could be organised in order to launch a project to compile an inventory of what exists, to define the specifications of a multilingual expert guidance system for large stores of information through the use of multimedia techniques, to assess feasibility and costs; this project would be based on a prior study of national practice in the Community and elsewhere, with an emphasis on concrete methods and procedures for collection, management, processing and pooling of information.

Route of Actions 12: Encourage innovation in enterprises, especially SMEs, and strengthen the regional dimension of innovation

The local or regional level is in fact the best level for contacting enterprises and providing them with the necessary support for the external skills they need (resources in terms of manpower, technology, management and finance). It is also the basic level at which there is natural solidarity and where relations are easily forged. It is therefore the level at which small enterprises can be encouraged and helped to pool their strengths in partnerships in order to compete with bigger enterprises with greater resources or to make the most of the opportunities which these enterprises can offer. These issues are of special importance in the less favoured regions.

The Green Paper would therefore offer a good opportunity to debate the suitability and the necessary conditions in order to:

at local, regional or national level:

- fostering cooperation among enterprises (large and small) and strengthening groupings based on technology or sector in order to realise the potential of local know-how (in traditional activities as well as for top-of-the-range products);
- encouraging an internationally-minded approach among enterprises (in liaison with research centres and support services), facilitating acceptance of foreign investment with high value added and introducing procedures to absorb technology from other countries;
- improving or adding to business support structures by introducing:
  - tools for analysing the stated or unstated needs of enterprises;
  - "one-stop shops" for access to information and services;
  - mechanisms to facilitate dialogue between the various local partners involved in innovation and the follow-up and monitoring of aid measures;
  - networks to link and rationalise support services (like the Nearnet and Supernet networks in the United Kingdom or the technology dissemination networks in France);
  - reinforcing University Industry cooperation in order to facilitate transfers of technology, knowledge and skills.

at Community level:

- launching a pilot action designed to encourage the formation of new technology-based firms (NTBFs), especially by researchers and engineers from research institutes and universities;
- facilitating the dissemination of good practice, especially by:
  - strengthening inter-regional cooperation networks for the promotion of innovation (including the services sector) and for help for researchers or engineers setting up innovative businesses;
  - supporting innovation projects based on cooperation between enterprises at a European level, laboratories, intermediaries, financiers, etc., illustrating new approaches to innovation (in terms of technology, society, organisation, etc.), especially in order to take a much advantage as possible of the potential offered by the information society;
  - developing support for regional innovation strategies and inter-regional technology transfer (joint actions involving regional policies - Article 10 of the ERDF - and the INNOVATION Programme);
  - strengthening the role of the Business and Innovation centres (BICs) in identifying assistance requirements with regard to modernisation, help in carrying out modernisation plans for SMEs and their guidance towards specialist bodies which are best placed to help in their innovation efforts;
  - introducing training for those responsible in national, regional and local government for innovation policy, investment planning, etc., if need be with the support of the Structural Funds for the eligible regions (see also Route of Action 13);

Route of Actions 13: Update public action for innovation

In most fields the role of the authorities is changing: they have to teach, persuade, involve,

stimulate and evaluate rather than order. Public action also needs to be modernised and become simpler. According to the Ciampi Report, the State should become a moderate but effective regulator. This is also true in the case of innovation. If it is to be fully effective, public action also needs to be stable (involving regulations, but also financial support, especially for research and training where efforts need to be long-term) and it needs to be geared to satisfying collective needs. The authorities must also contribute, through forecasting and consultation, to indicating the path forward for those involved and to facilitating the emergence of common if not consensus views.

The promotion of innovation also requires the coordination and alignment of the efforts of many people, and especially the consultation of the social partners. The authorities and government need to develop new thinking with greater emphasis on consultation and partnership with the private sector.

Also, the pressure on public spending means that new solutions have to be devised, especially the move from direct to indirect support in the use of public intervention. Better results have to be achieved with fewer resources.

In the Member States, as at Community level, innovation policies are usually the responsibility of several ministries, official bodies or services, which can result in some problems. It is often hard to find the right forum for discussion and even harder to find one which can provide the necessary overall view and ongoing coordination. In addition, public support for innovation still suffers in some cases of problems such as difficulties in taking into account needs and demand; difficulty to differentiate measures in function of the targeted beneficiaries and, accordingly, their lack of transparency; still inadequate information regarding "good practices"; the difficulty in carrying out evaluations because of the lack of suitable indicators; a dilatory adaptation of structures and procedures to changes in the economy, technology and society.

In order to improve the innovation environment - in line with the principle of subsidiarity and bearing in mind the variety of local, regional and national circumstances in order to make the environment more conducive to innovation the debate should allow the better definition of:

◆How to make the environment more favourable to innovation

at regional, national and Community levels, by:

- limiting regulations to the strict essentials, encourage liberalisation as much as possible and promote a modern approach to competition, i.e. competition which takes account of the beneficial horizontal effects of innovation;
- accelerating the streamlining of administrative procedures by simplifying them and making them clearer;
- providing basic information by supplying the forecasts and analyses which public and private operators need (forecasting, technology watch, economic intelligence, ex-ante evaluation);
- ensuring coordination and consistency of public actions and private initiatives (like the Community task forces), mobilise the range of available instruments in accordance with a coordinated and measured approach (regulations, public contracts, fiscal measures, incentives, etc.) and facilitate dialogue, training and consensus;
- developing, where appropriate and in order to reach SMEs in language they understand, the use of private operators (as is now customary in the United Kingdom or Germany) to administer business support procedures on behalf of the authorities;
- developing and apply criteria making it possible to adapt measures to different needs and different targets;
- identifying and disseminate good practice, facilitate experiments and encourage the use of evaluation methods.

◆To better ensure concertation between decision makers and that those involved are consulted:

at Community level:

- identifying the best forum for dealing effectively with innovation policies (e.g. “jumbo” Council bringing together the ministers of research, industry, and social affairs and appointment by each government of a minister responsible for innovation, similar to the situation with regard to the information society);

- initiating an inter-institutional dialogue on the means of better organising consideration of the horizontal nature of innovation policies;
- improving the pooling of resources for analysis and forecasting at Community and national levels (Institute for Prospective Technological Studies in Seville, programme of targeted socioeconomic research, European Innovation Monitoring System, Eurostat, etc.);
- organising a dialogue at European level between decision-makers on successful cases of innovation, in order to implement concerted actions and the dissemination of good practice; on the basis of those exchanges, the Commission could draw up periodic reports on the state of innovation within the European Union, identifying the evolution and the weaknesses of the policies carried out; such a report would permit to encourage favourable policies in the Member States;
- developing the practice of evaluating public action, especially with regard to innovation, among local or regional authorities.

In addition, improving the process of policy formulation can only result in greater effectiveness if the implementing procedures are also suitable and flexible. There is a need for "sound" administration (just as there is "lean" production).

The debate should indicate whether or not it would be appropriate **to streamline administrative procedures** as follows:

at Community level:

- by facilitating information and access by enterprises to support measures; this involves rationalising the various Community information sources and strengthening their linkages to arrive at "single entry points";
- by increasing, in the light of the experience of the industrial task forces, cooperation between programmes, especially in the fields of research, vocational training and regional action; this should lead to more joint calls for proposals;
- by significantly increasing efforts to simplify formalities and shorten times required for consideration, reply and payment (e.g. by extending the principle whereby failure to reply by a fixed deadline indicates acceptance or agreement in principle, especially in the case of State aid);
- by providing follow-up for enterprises, especially SMEs, which have been involved in Community research projects, thus enabling them to obtain advice and assistance in making the most both of the results and of the international contacts and experience acquired;

at Member State level:

- by systematically identifying the administrative procedures and rules of various official bodies which are likely to hinder or delay public or private initiatives in the field of innovation[43];
- by continuing the reforms to modernise administrative structures and by extending them to regional and local level in order to ease the obstacles facing all those in industry regardless of size, especially innovators and those forming companies.

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Notes

1. It happens frequently that innovatory firms set up projects teams or networks made up of persons with various skills, coming from different departments, and these innovation projects (and teams) are then integrated into the strategic management process of the firm.

2. An Industrial Competitiveness Policy for the European Union, Communication from the Commission, 1994.

3. The most recent **definition** of **technological innovation** is that contained in the **Oslo Manual** adopted in 1992 by the OECD, and the thoughts set out in this box are based on it. It has served as the basis for the compilation of statistical data on innovation, in particular the national studies undertaken for the Community Study on Innovation supported by the Commission (DG XIII and Eurostat), which produced comparable data on some 40 000 firms in 15 countries. Some initial results are given in the Annex. The Oslo Manual is currently being revised, and the Commission is playing an active part in this work. Practical application of the manual revealed weaknesses or inadequacies, particularly as regards **social or organisational innovation**, or innovation in the **services sector**, which now plays a leading role in the production of wealth, employment and the use of new technologies.

4. Cf. other illustrative examples in “Innovation, technologie, emploi”. R. Lattès & D. Blondel. Report produced for the Applications Council of the Academy of Sciences (CADAS), 1995.

5. Cf. "l'Expansion" 26 June 1995 No. 504.

6. The European electrical engineering industry, for instance, sometimes has difficulty in transforming, sufficiently rapidly, its excellent theoretical skills into new products. In this respect, the activities of these firms in pre-industrial development is of crucial importance and calls for consolidation of the links with equipment users. In particular, this should lead to an analysis of the pertinence of the research topics to the needs of the industry. The direction of the research also has an impact on innovation capacity and the exploitation and dissemination of its results.

7. The authorities have other means of action. The White Paper on "Growth, Competitiveness and Employment" (Chapter 4, paragraph 4.3.b.i) points out that *"in view of the current constraints on research budgets and to ensure the most effective action possible in cost/benefit terms, **priority must be given to the indirect regulatory instrument**s under the control of the Member States"*.

8. “Improving European competitiveness” - First report to the President of the Commission and the Heads of State or Government - Consultative Group on Competitiveness - June 1995.

9. The index of specialisation (or revealed comparative advantage) for a certain type of industry is equal to its share of the country’s total exports of manufactured products divided by the same ratio for all countries of the OECD. An index of more than 100 for a given country in a certain category of industries indicates that the country is relatively specialised in exports by these industries.

10. This does not of course preclude an active policy of partnership with the countries of Central and Eastern Europe and the transfer of technologies to developing countries. Furthermore, by concluding international agreements with third countries, the Community has allowed European researchers and engineers to better access scientific and technological results from those countries. International cooperation also permits Community RDT teams to carry out innovative projects with a better cost and efficiency ration.

11. Several studies have highlighted the role of the service sector in innovation and its dissemination. One such study shows that the sector is the main acquirer of incorporated technology (sophisticated equipment and machinery, particularly in information and communications technology) and its use of technology is higher than is suggested by its economic weight. A further study analysing the engineering consultancy sector in Europe shows that firms in the sector are crucial carriers of innovation and advanced technologies to the manufacturing industry (which represents 40% of their global market, estimated at ECU 52 billion). Finally, an analysis of the most innovative service sectors - knowledge-intensive business services - stresses the specific nature of their innovation processes and development.

12. Such effects play an important role as illustrated in two recent cases: Shell/Montecatini and Glaxo/Wellcome

13. With regard to State aid to enterprises, the data collected since the introduction of the arrangements in 1986, and particularly those for the period 1990-1992, show that notifications of aid primarily for industrial research and development activities represented less than 5% of the total amount of State aid.

14. The minimalist approach adopted by the USA in the TRIPS copyright agreement, explicitly excluding protection for the moral rights covered by Article 6(b) of the Berne Convention, is of little advantage to the creators of original works who should be the beneficiaries of this rapidly-expanding right (inventors of computer programs, databases, multimedia applications, etc).

15. Documents COM(93) 342 fin., COM(95) 456 fin., COM(95) 382 fin. and COM(95) 370 fin. respectively.

16. See Commission communication of 26 October 1995 on the craft industry and small enterprises, keys to growth and employment in Europe, COM(95) 502 final.

17. However - and this may seem worrying - most European firms do not regard the lack of access to information as a serious obstacle (according to the Community innovation survey, only 15% saw it as a barrier). The three main sources of innovation information named by firms in most Member States were internal sources, clients or users and equipment suppliers.

18. Institute for Prospective Technological Studies in Seville, World Trade Center Building, Isla de la Cartuja, s/n, E-41092 Sevilla, Tel.: (34) 54 48 82 73.

19. Cf. Green Papers on copyright and related rights in the information society and on utility models, (1995).

20. A study by A. Schliefer, K. Murphy and R. Vishny, covering several countries, has estimated that if 10% of university students were to transfer to engineering studies, the growth rate of the economy concerned would increase by 0.5% per annum (*Business Week*, 12 december 1994).

21. At the end of 1993, the total assets held by pension funds in Europe amounted to ECU 1 100 billion, concentrated almost exclusively in the United Kingdom, the Netherlands and Ireland. Only a tiny proportion is invested in innovation.

22. According to EVCA, private funds invested in the start-up and initial growth of enterprises fell from ECU 432 million to ECU 200 million between 1988 and 1993 (including a 28% drop from 1992 to 1993; as a result of the recession, the venture-capital industry invested 15% less in 1993 than in 1992). Source: **Seed Capital**: Fourth Progress Report on the Community Pilot Scheme, DG XXIII, February 1995.

23. Cf. the recent Commission communication reporting on the feasibility of the creation of a European capital market for smaller, entrepreneurially-managed growing companies (COM(95)498).

24. *"Le soutien public de la R&D: éléments de comparaison internationale"* Working document of the European Commission services (DG XII), 1995.

25. cf. OECD "*Main Science and Technology indicators",* May 1995.

26. The statistics used are based on OECD data on government financing of R&D which include subsidies (but not fiscal incentives), contracts and public procurement allocated to industry (including defence and aerospace industries).

27. Cf. “Saving More and Investing Better”, fourth report to the President and Congress, Competitiveness Policy Council.

28. *“La fiscalité comme facteur d'incitation à la recherche”*, A. Cazieux, F. Fontaneau, *Cahiers fiscaux européens* 1992, No 3.

29. COM(94) 206 of 25 May 1994.

30. Cf. White Paper of the European Venture Capital Association (EVCA) 1995.

31. The first European report on S&T indicators shows, for example, that, for the same R&D outlay, 7 and 3 times more patents are granted on metal products and instruments respectively than the manufacturing industry average. The automobile and aerospace industries respectively apply for 3 and 15 times fewer patents than average. These data confirm that the wide variations between sectors in the use of patents are less a measure of R&D activity than of the opinion of the innovators on the usefulness of patents for preventing imitation.

32. The cost of being granted and maintaining a single European patent in all 15 Member States of the European Union for the full period of protection amounts to about ECU 35 000 in official fees, whereas in the United States the total cost is only $7 500, or about a sixth for comparable protection. In 1994 European industry had to pay out about ECU 1.8 billion in patent application and maintenance fees in Europe, with a similar amount going on legal or out-of-court proceedings for the defence of patent rights.

33. This is one reason why the Commission has published a Green Paper on utility models, a form of protection for technical inventions which is particularly well-suited to SMEs.

34. Only 20% of SMEs can correctly name the European directives applicable to their products, and fewer than 30% can correctly quote the corresponding European standards. They know their national standards somewhat better, but do not know that these are identical to the European standards and hence that the entire European market is open to them without the need for any technical adaptation of their products to other standards (AFNOR 1994: Survey of 842 SMEs). This ignorance can culminate in economic decisions which are totally without foundation, such as relocations (O'Connor 1995).

35. Fewer than 21% of SMEs interviewed as part of *Euromanagement Qualité* were taking part in standardisation work (a result positively biased by the sampling). AFNOR (op. cit.) regards this as worrying, since "standardisation committees cannot cater for the needs of and constraints placed on SMEs, and SMEs then have difficulty in applying the standards".

36. Pre-paid service vouchers can be exchanged for certain services and cut out many of the formalities involved.

37. See the Commission communication on informing and consulting workers, adopted on 14 November 1995.

38. Cf. the proposals in the White Paper on Education and Training (COM (95) 590).

39. COM(94) 206 of 25 May 1994, OJ C 187 of 9 July 1994.

40. Directive 90/434/EEC.

41. 94/1069/EC. See also Communication 94/C 400/01.

42. Proposal presented at the Madrid summit as one of the measures in favour of SMEs.

43. Like the German Federal Ministry of Economic Affairs, which states in the report "The Future of Germany as a Site for Industry" that the German Government will ensure that existing and planned legal provisions and administrative acts are checked to see if they hinder innovation efforts and to avoid in the future any legislation resulting in such an effect.

EUROPEAN COMMISSION

Green Paper on Innovation

ANNEXES

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ANNEX 1 - DESCRIPTIONS OF TASK FORCES

TASK FORCE "THE CAR OF TOMORROW"

The purpose of the task force is to facilitate the research and demonstration work required for the speedy design of the "car of tomorrow" (2003-2005) which will be safer, clean, smart/easy-to-drive and competitive.

The Commission action should make it possible to coordinate the work which is currently being done in too piecemeal a fashion to design vehicles with zero and/or very low emission levels. The emphasis is on the major technological factors which limit the speedy development of such vehicles.

Progress to date

Consultation of industry and users

. Two Members of the Commission, Mrs Cresson and Mr Bangemann, met representatives of the industries concerned in Strasbourg on 14 June. They approved in general terms the objectives of the task force and stressed the need not to arrive at premature conclusions regarding the technological choices to be taken.

. Informal meetings have been held with representatives of the car industry and parts suppliers - including small enterprises - and power production and supply companies, together with those in the transport industry and official bodies representing users.

. Representatives of all the sectors concerned have taken part in mini-workshops with a view to joint formulation of the scientific and technological content of the action plan.

. The task force is preparing an information bulletin.

Research requirements

. For industry, the choice of technologies must remain open, even though early focusing is essential. The small and medium-seized enterprises are concerned that they cannot commit resources unless the results of research are clear in market terms. The likely results will have to be established with the enterprises involved in the light of user needs and traffic circumstances.

. The authorities and the carriers are keen to take measures - which has already been done in some cases - for cleaner transport in city centres. In the medium term, vehicles running on compressed natural gas will have a major role. Electric vehicles, including hybrid vehicles, are also felt to have a role to play. In the long term, vehicles using fuel cells seem to offer a desirable option, provided that the economic and technical problems can be solved. Also, it is necessary to carry out a comparative assessment and establish links with regulations and standards.

. The following technologies will be particularly useful

- advanced technologies for energy storage and propulsion;
- related vital technologies (electronics, lightweight materials, data transmission, etc);
- integration of propulsion technologies and related techniques in zero-emission or hybrid vehicles, in close collaboration with the car industry;
- development of new car concept, flexible and compatible with available propulsion systems;

- devising methods for the comparative assessment of traditional and alternative technologies.

Coordination with the Fourth Framework Programme

. Initial findings indicate that achieving the objectives of the task force will require close cooperation concerning various elements (relating to vehicles) of the specific programmes on industrial technologies and materials, energy (JOULE, THERMIE), transport and transport data transmission and information technologies, including a joint approach on demonstration activities.

. The projects of interest to the task force which have been selected from the various specific programmes have started to be classified in early autumn.

Links with national programmes

To be decided shortly.

Probable thrust of the supplementary project proposals

To be decided shortly.

Schedule

The task force plans, drawn up after consulting all the sectors concerned is being adopted. The implementation of the action plan will start in January 1996.

Director: Mr Ezio Andreta, DG XII, Science, Research and Development (fax +32 2 2966882).

TASK FORCE "NEW GENERATION AIRCRAFT"

. The purpose of the task force is to identify the priority industrial and technological objectives and to foster synergy between Community and national programmes. It will therefore have to make the best possible use of the resources offered by these programmes, improve the exploitation of results, formulate concrete applications as part of the information society, investigate the potential of supplementary programmes and recommend actions for a fifth framework programme.

Progress to date

Consultation of industry and users

. The task force has introduced measures to ensure suitable coordination among Commission departments, a key matter for the competitiveness of the aircraft industry.

. There have been regular meetings with industry (17 March, 8 June, 29 June and 11 July). Regular meetings have taken place with managers from industry.

. The task force thus offers the industry a unique interface which brings together the representatives of all the Commission's major research programmes of relevance to the aircraft industry.

Research work

. The industry has reassessed its priorities and identified three fields of action which in practice can be investigated only at European level and which are likely to have a real impact on competitiveness:

. Arranging technical partnerships (aircraft industry network): the application of advanced technologies offers significant opportunities for cutting the production cycle, improving the efficiency of the supply chain, reducing the launch costs of new and derived products and thereby increasing competitiveness.

. Improving aircraft efficiency: R&D work is needed for the testing and approval of technologies which improve the overall efficiency of aircraft, thereby increasing the competitiveness of all those involved in this sector while complying with the demands of passenger safety and mobility.

. Environment-friendly aircraft: emission and noise levels are major concerns of the public; Europe needs to cooperate to achieve through research a leading position in the field of clean air transport and to ensure that rivals do not make use of legislation to gain an advantage.

Coordination with the Fourth Framework Programme

. The task force will ensure that the Fourth Framework Programme is fully exploited by means of formal and informal preselection operations and recommendations for updating work programmes and making full use of the opportunities which are available to the aircraft industry through the various specific programmes in question (industrial and materials technologies, information technologies, transport, data transmission applications). Measures will be introduced to maximise the overall effectiveness of the projects selected from the first set of calls for proposals relating to the specific programmes, thanks to the grouping method.

. It is essential in the short term to undertake actions in the fields of cooperation, dissemination and exploitation at international level in order to meet the future challenges. Supplementary coordination measures will be taken for this purpose.

Links with national programmes

. Through its existing research programmes, the European Union can support the efforts of enterprises to respond to competition. There are some shortcomings, however, especially with regard to the coordination of related activities with the Member States.

. The Member States acknowledge that the best possible use has to be made of the limited resourcesav available, and that this can be achieved only through better coordination. It is true that some Member States have made efforts at national level, but the potential benefits will be even greater if there is coordination at Community level.

Probable thrust of the supplementary programme proposals

. Supplementary programmes covering fields which are not currently dealt with in a suitable fashion are needed to consolidate the progress of recent years, e.g.:

. The demonstration and application of key technologies through an integrated programme at European level are essential to confirm the results of research and to transform them into a competitive advantage, as happens in the United States.

. Good practice needs to be transferred as widely as possible throughout the aircraft industry chain of supply, in order to convert knowhow into production capacity, improve efficiency and flexibility and reduce as much as possible the effects of air transport on the environment.

Schedule

. The task force started work on 1 March 1995. A general progress report will be published in February 1996.

Director: Mr Paul Weissenberg, DG III Industry (fax +32 2 2961125).

TASK FORCE "MULTIMEDIA DIDACTIVE SOFTWARE"

. The task force will perform an analysis of the supply (publishers, media, distribution networks) and demand (individuals, schools, universities, enterprises and vocational training centres) in the case of multimedia didactive software. It will look at the measures taken by the Member States of the European Union and their main competitors with the aim of promoting and supporting the production, dissemination and use of multimedia didactive software.

. In its action plan the task force will propose recommendations designed to coordinate the instruments available to the European Union and its Member States for promoting innovation research and development and the dissemination and financing of innovation.

Progress to date

Consultation of industry and users

. Three hearings have been organised by the task force, bringing together 56 representatives of suppliers and users.

. A call for expressions of interest was published and has attracted more than a thousand replies.

. A document describing the market and providing proposals for a European action plan was completed on 13 September 1995.

Research work

. The main research priorities include:

- design and testing of experimental multimedia services for education and training, at local and trans-European levels;
- research into methods of use and related innovations in educational systems and services;
- design of software platforms and development tools for multimedia didactive products.

. Existing joint networks (for research and training) will be used to encourage the dissemination of best practice and to strengthen links between suppliers and users.

Coordination with the Fourth Framework Programme

. The research programmes in the Fourth Framework Programme relating to didactive multimedia include data transmission applications, information technologies, targeted socioeconomic research, human capital and mobility.

. There are other Community initiatives which cover education and training, such as Socrates, Leonardo da Vinci and programmes in the fields of information and culture, such as Media II and the proposals for the Raphael and Info 2000 programmes.

. Possibilities include the creation of a single user-friendly interface and the opportunity to submit unsolicited proposals when allowed by the provisions of the various Community programmes.

Links with national programmes

. The development of multimedia didactive software is supported in most European countries by a variety of local and regional initiatives. While ambitious overall policies are common in the United States and Japan, in Europe policies in this field tend to be fragmented and poorly coordinated.

. The Member States have already been informed of the activities of the task force by the relevant programme committees as part of the Fourth Framework Programme. At the end of 1995 the task force has also reported on its work to the Leonardo-Socrates committee, the education committee, the advisory committee on vocational training and the advisory committee for the Media programme.

Probable thrust of the proposals for supplementary programmes

To be decided at a later date.

Schedule

. The task force started work in March 1995.

. The task force's working document outlining initial thoughts on multimedia didactive software has been widely distributed. It is available on the Internet (ECHO Sera).

. The task force's final report is currently being finalised.

Director: Mr Michel Richonnier, DG XIII Telecommunications, Information Market and Exploitation of Research (fax +32 2 2968362).

TASK FORCE "INTERMODALITY OF TRANSPORT"

1. Background

- The considerable increase in the volume of goods and passenger transport over the last years and demands for rapidity, safety and environmental compatibility, have led to the development of the "intermodal" transport concept.

- This term covers system, mechanisms and technologies needed to integrate road, rail, air and maritime transport and to ensure optimum transfer of goods and passengers from one transport mode to another. Two examples of intermodal transport are combined rail/road passenger transport systems and standardized containers transportable by boat, cargo plane, train and lorry.

- The spread of intermodality in transport presupposes a number of developments in the field of standardisation, Telecommunications and telematics, and research on a broad range of subjects.

2. Situation in Europe

- The development of intermodal transport is of particular importance in Europe. Europe is interlinked by closely meshed transport networks of various types. For the internal market to function efficiently and harmoniously, these networks must be interconnected and the conditions created to enable passengers and goods to travel smoothly in good conditions across these different networks from one end of the continent to the other.

- The development of trans-European transport networks is included among those activities emanating from the White Paper on Growth, Competitiveness and Employment endorsed by the Heads of State and Government in 1993. The overall vision for the development of these networks is one of multimodality.

- Initiatives to promote intermodality have been taken at national level: development of transhipment techniques; development of infrastructures and transport media specially designed for intermodal freight traffic in the Netherlands, France and Spain and for passenger transport in the UK, France and Germany, etc. However, it cannot be said that there is a European intermodal industry today. Likewise there is no intermodal organization representing all the players.

3. Community interest

- Implementation of a truly intermodal transport system will improve Union cohesion and reduce environmental impacts such as noise, emissions into the air, and contamination of soil, with wide benefits across the Member States.

- Economies of scale in the manufacture of equipment for transport transfer points will enhance employment opportunities through a more competitive European position in world markets and the development of a European intermodal transport sub-system industry offering opportunities to small and medium sized enterprises;

- More efficient use of resources will benefit transport operators, and industry across the European Union countries, as will improved logistic systems operating within the "Information Society".

4. Tasks

- The aim of the Task Force is to contribute to the development of technologies, systems, innovative concepts and strategies which improve intermodal transport operations in the field of passenger and freight transport. It will be necessary not only to focus on ports, airports, inland terminals, stations, etc. where freight or passengers change transport mode, but also on other aspects of the intermodal system, such as transfer technologies and telematic tools.

- The Task Force will be responsible for identifying the needs, priorities and actions to be taken at European level in the area of RTD, innovations and demonstration. Attention, is devoted to technological bottlenecks in each of the associated transport modes, and to the best way of ensuring interconnection and interoperability.

- The initial focus will be on assessing and demonstrating these different aspects in an integrated and comprehensive way on the basis of RTD activities of the Framework Programme and other EU or nationally supported research activities.

5. Progress to date

Consultation with industry and users

Following informal, meetings with representatives of many of the European organisations and international associations concerned with intermodal transport, Commissioner Kinnock invited senior figures in these organisations, in major companies operating on an intermodal basis, in freight forwarding companies and in equipment supply companies, to a meeting on 29 September. At this meeting the work of the Task Force was explained, and the terms of reference and action plan guidelines endorsed. A Press Notice is being issued to provide information more widely and invite the submission of contributions from any interested party.

Research tasks

- In both passenger and freight sectors, research on information provision and exchange and the design of transfer points are priority themes.
- In the freight sector, research, demonstration/experiment on the basis of existing RTD results may be more important than new research; **improvement of service quality, market conditions and competitiveness is vital. Transfer technology, with an emphasis on inexpensive equipment, will also be addresses. In the passenger sector, multimodal ticketing will be addressed.**

FP4 coordination actions

- The specific programmes on Transport, Industrial Material Technologies and Telematics Applications are relevant to the task Force. A first evaluation leads to a proposal aiming at reorienting the next calls for proposal. The Task Forces priorities can not be implemented, however within this action only.

Relation to national programmes

- New dedicated infrastructures and transhipment techniques are being developed in many Member States. This Task Force will consider possibilities for developing convergence between Community and national research activities in these areas.

Likely focus of proposals for supplementary projects.

- Immediate priorities for freight transport improve the efficiency of the terminal, intermodal networks, Information Systems, for passenger transport, physical and information interchange systems and the theme of the transport for the millennium city.

6. Timetable

The Task Force aims to prepare a diagnosis report specifying the problems in more detail, and an inventory of relevant RTD activities; a detailed outline of proposed priority projects by the end of 1995; and recommendations for the Fifth Framework Programme of RTD by 29 February 1996.

Director responsible: Mr Wilhelmus Blonk - DG VII - Transpo rt (Fax: 32-2.296.83.50)

TASK FORCE "TRAIN OF THE FUTURE"

1. Background

The relative importance of rail transport vis-a-vis road has steadily declined over the last few years. In Europe, it accounts for only 20% of passenger traffic and 10% of goods traffic. It is too expensive and inflexible in the eyes of users. However, rail transport continues to be one of the safest means of transport and the least costly in energy and environmental terms, and its potential is very great. The development of high-speed trains and combined road and rail transport is also helping to revive interest in this form of transport and should give it fresh impetus.

2. Situation in Europe

European industry is very advanced in the field of rail transport. Europe has a very strong technological position in high-speed trains with the French TGV, the German ICE and the Italian ETR 500. Although research spending is lower than in other sectors, it is still significant: the member states plan to spend ECU 1 billion provided for related research activities in the fourth framework-programme (1994-1998), including ECU 38 million in the "Transport" programme alone. However, relevant activities are going on practically everywhere in Europe and are scarcely co-ordinated at all.

Greater standardisation is required if the cost reductions required in a more competitive market are to be met. Standards are required for complete systems rather than for components; and need to be performance based rather than, as until now, based on technical specifications.

The national structure of the railway administration is a major handicap in the development of a European railway system and railway equipment industry.

3. Community interest

Improvements to the trans-European rail network will have a significant impact on Union cohesion and will improve communications with the countries of Central and eastern Europe.

Reduce environmental impacts with regards to noise, emissions into the air, and contamination of soil, will have a wide benefit across the European Union, especially in urban areas.

Economies of scale in the manufacture of equipment for both long-distance and urban rail systems will enhance employment opportunities through a more competitive European position in world markets.

4. Tasks

The objective of the Task force is to help Europe co-ordinate development activity in order to improve the service offered to all rail users. The aim is to promote research at European level on improvements in the following areas:

- business journeys returning on the same day (up to 1000km in 3 hours);
- leisure trips;
- public and suburban transport;
- freight transport.

The Task force will therefore endeavour to identify the priority technological and industrial developments; to create the conditions in which the European Union's research effort can serve as a catalyst; and to stimulate cooperation between the large European industrial groups.

5. Progress to date

Consultation with industry and users

Following informal meetings with representatives of most of the international organisations with a close interest in railways, Commissioner Kinnock invited senior figures from national railway administrations, some major public transport organisations, the transport user organisations, trade unions, and leading supply companies to a meeting on 29 September. At this meeting the work of the Task force was explained and the terms of reference and action plan guidelines endorsed. A press notice is being issued to provide information more widely and invite the submission of contributions from any interested party.

Research tasks

The work envisaged will cover the following priority issues:

- new generation of high-speed trains;
- light-rail system of the future;
- Europe-wide system for train protection, traffic management and integrated logistics;
- cargo systems of the future;
- new manufacturing concepts.

FP4 coordination actions

Possible complementarities have yet to be discussed.

Relation to national programmes

The member States will be kept informed through the medium of the appropriate programme committees of the Fourth Framework Programme. Briefing have been given to Industrial and Materials technologies Committee (28 June), the Transport Research Committee (20 September) and at the BRITE '95 Conference in Vienna (12 October).

Likely focus on proposals for supplementary projects.

Immediate priorities: European traffic and logistic integrated management systems, virtual factory, the urban railway network of the future for the citizen.

6. Timetable

The Task Force aims to prepare a diagnosis report specifying the problems in more detail, and an inventory of relevant RTD activities; a detailed outline of proposed priority projects by the end of 1995; and recommendations for the Fifth Framework Programme of RTD by 29 February 1996.

Director responsible: Mr Wilhelmus Blonk - DG VII - Transpo rt (Fax: 32-2.296.83.50)

PROPOSED TASK FORCE "ENVIRONMENT-FRIENDLY WATER TECHNOLOGIES"

The subject of water raises complex problems for which the scientific and technological solutions are closely linked to organisational and administrative procedures, industrial structures, pricing and environmental regulations, etc.

The task force will focus its work on research needs in the field of water technologies by means of wide-ranging consultation of the various parties involved, a review of existing public and private research inside and outside the European Union, and a thorough analysis of the various factors which influence innovation with regard to water supply and consumption.

Progress to date

The task force has only recently commenced work. This outline therefore gives an idea of the method which will be used and the activities which are likely during the initial phase.

Consultation of industry and users

. In view of the lack of dialogue between the various parties involved, consultation will proceed in stages. Initially, established research bodies (e.g. EURAQUA, Techware, UKWIR and CEMAGREF) will be consulted, along with EUREAU (Union of water supply associations from the countries of the European Communities) and representatives of water supply industries and main users.

Research requirements

. Based on the information which is currently available to the Commission, research requirements in the field of water technologies could cover:

- development of other sources of water supply, especially through the use of desalination techniques;
- optimisation of innovation procedures with regard to the treatment of water and waste water (recovery, decontamination);
- reduction of demand (recycling), water loss and excessive use;
- *in situ* rehabilitation of aquifers.

Given the variety of interaction between technology development and management methods, it will be necessary to consider research requirements in the light of non-technical factors and application circumstances.

Coordination with the Fourth Framework Programme

. Initial information indicates that water technologies will involve research projects relating to the following specific programmes: industrial and materials technologies, environment, dissemination and optimisation, together with international cooperation. Other specific programmes such as agriculture and fisheries or energy might also prove relevant.

Links with national programmes

. To be defined shortly.

Probable thrust of the supplementary project proposals

. To be decided shortly.

Schedule

. To be decided.

Director: To be appointed at a later date.

TASK FORCE "VACCINES AND VIRAL DISEASES"

The task force has a twofold task: firstly to review the situation of European research in the field, and secondly to propose an action plan with the aim of improving the position of Europe's industry and making the best possible use of initiatives at European level.

The task force has begun - and will continue - to consult all the industry's operators and partners with a view to identifying obstacles, requirements and technical priorities. It will coordinate the projects identified in the research programmes of the Fourth Framework Programme, and it will subsequently propose initiatives bringing together the industry, national and Community bodies and the scientific and medical community for joint projects of industrial interest.

Progress to date

Consultation of industry and users

. The task force has contacted in writing 90 potential industrial partners, major industrial concerns, research institutes and members of the scientific community.

Research activities

. The response to this consultation revealed consensus on the following research priorities:

development of new vaccines and improvement of existing vaccines and immunisation programmes, with an emphasis on the newborn and the elderly;

better understanding of the pathogenicity of microorganisms (e.g. new viruses) and of how the immune system works (e.g. mucous immunity);

improvement of knowledge about the mechanisms of immunisation and its harmful effects, and creation of new systems for vaccine distribution;

. Also, European collaboration with regard to the research infrastructure is vital for the development of key scientific resources, such as animal model and clinical testing centres; it is also possible to develop strong worldwide partnerships, using traditional European institutes involved in R&D work in the vaccine field.

Coordination with the Fourth Framework Programme

The specific programmes concerned by research on vaccines are as follows: biotechnology (e.g. molecular immunology and distribution systems), research on biomedicine and health (e.g vaccines against AIDS and other viral diseases, epidemiological studies on vaccination), agriculture and fisheries (oral vaccines) and international cooperation (e.g. international vaccine research). There is scope for linking programmes and for joint calls for proposals.

Links with national programmes

. Relevant national programmes are currently being examined. The representatives of the Member States in the relevant programme committees have been informed and many of them have expressed willingness to collaborate.

Probable thrust of the supplementary financing proposals

. Research could involve the following initiatives: new strategies for the development of vaccines capable of inducing mucous immunity, new approaches with regard to immunotherapy against AIDS and other viral diseases, creation of European clinical testing centres and establishment of a European monitoring system for contagious diseases which can provide a rapid response to new viral diseases and other outbreaks of disease.

Schedule

. A final report presenting the task force's recommendations and priorities will be drawn up following wide consultation of enterprises and universities. This consultation will take the form of meetings on specific topics, to be arranged from September.

. Proposals will subsequently be made to group existing projects, launch new projects of industrial interest and to collaborate with specific programmes carried out by the Member States and industry.

Director: Mr Bruno Hansen, DG XII Science, Research and Development (fax +32 2 2991672).

Annex 2: European Network of Innovation Relay Centres

European network of Innovation Relay Centres

List of Relay Centres

Austria	**Bureau for International Research and Technology Cooperation (BIT)** Wiedner Hauptstrasse 76 A-1040 Wien	**Mr Manfred HORVAT** Telephone : 43158116160 Fax : 431581161616 E-mail: klamm@bit.ac.at
Belgium	**Ministère de la Région Wallonne (DGTRE)** Avenue Prince de Liège 7 B-5100 Jambes (NAMUR) **Technopol Brussel-Bruxelles (A.S.B.L)** Rue Gabrielle Petit 4 Bte 12 B-1210 Bruxelles **IWT Brussel** Bischoffsheimlaan 25 B-1000 Brussel	**Mr Jean Claude DISNEUR** Telephone : 3281321269 Fax : 3281306600 **Mr Jacques EVRARD** Telephone : 3224220021 Fax : 3224220043 E-mail: jacques.evrard@technopol.be **Dr. Lieve VAN WOELSEL** Telephone : 3222230033 Fax : 3222231181 E-mail: 100420.2670@compuserve.com
Denmark	**Erhvervsfremme Styrelsen EuroCenter** Gregersenvej Postbox 141 DK-2630 Taastrup	**Mr Soren KIELGAST** Telephone : 4543504902 Fax : 4543504925 E-mail: snk@dit.dk
Finland	**Technology Development Centre (TEKES)** Malminkatu 34 P.O. Box 69 SF-00101 Helsinki	**Mr Matti SUPPONEN** Telephone : 358069367200 Fax : 358069367794 E-mail: matti.suponen@tekes.fi
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	Bretagne Innovation 18, place de la Gare F-35000 Rennes	**Mr Michel KERVOAS** Telephone : 3399674200 Fax : 3399676022
	Chambre Régionale de Commerce et d'Industrie de Rhône - Alpes (ARIST) 75, cours Albert Thomas 6° Avenue F-69447 Lyon Cedex 03	**Mr Claude SABATIN** Telephone : 3372114321 Fax : 3372114323 E-mail: pheyde@serveur.dtr.fr
	Chambre Régionale de Commerce et d'Industrie de Bourgogne (ARIST) 68, rue Chevreul BP 209 F-21006 Dijon	**Mr Ludovic DENOYELLE** Telephone : 3380635266 Fax : 3380638558 E-mail: arist.bourgogne@pobox.oleane.com
	Chambre de Commerce et d'Industrie de Paris (BRIST) 2, rue de Viarmes F-75040 Paris Cedex 01	**Mr Gilles WURMSER** Telephone : 33145083539 Fax : 33145083979 E-mail: wur@dnsccip.ccip.fr
	Route des Hautes Technologies (RHT) Espace Colbert II 8, rue Sainte Barbe F-13231 Marseille Cedex 01	**Mr Christian DUBARRY** Telephone : 3391140560 Fax : 3391140570 E-mail: rbt@rht.cr-paca.fr
	Association Inter-Régionale sur la Recherche Européenne (AIRE) RN-25 Lieu dit Le Ramponneau F-80260 Poulainville (Amiens)	**Mme Nathalie GERARD** Telephone : 3322437218 Fax : 3322437202
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	VDI/VDE Technologiezentrum Informationstechnik GmbH Rheinstr. 10 B D-14513 Teltow/Berlin	**Mr Wolfgang GESSNER** Telephone : 493328435173 Fax : 493328435216
Greece	**National Documentation Centre (NHRF)** **Hellenic Innovation Relay Centre** 48 Vas. Konstantinou Ave GR-11635 Athens	**Mrs Lela POULAKAKI** Telephone : 3017249029 Fax : 3017246824 E-mail: hvrc@apollon.servicenet.ariane-t.gr
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	ENEA Via Don Fiammelli I-40100 Bologna	**Mr Massimo GAZZOTTI** Telephone : 39516098378 Fax : 39516098255 E-mail: lesca@risc990.bologna.enea.it
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	Tecnopolis CSATA Novus Ortus S.P. per Casamassima Km3 I-70010 Valenzano (Ba)	**Mr Francesco SURICO** Telephone : 39808770366 Fax : 39808770247 E-mail: iride@vm.csata.it
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The Innovation Relay Centres are coordinated by the Commission Services in Luxembourg (DG XIII/D/3). The general address is given below:

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ANNEX 3: SIMPLIFIED RESEARCH CONTRACT FOR THE FOURTH FRAMEWORK PROGRAMME

Annexe 3

SIMPLIFIED RESEARCH CONTRACT FOR THE FOURTH FRAMEWORK PROGRAMME

Every Community shared-cost research project requires a research contract signed by the Commission and the project contractor(s). The contract lays down the main administrative, financial and technical arrangements for the management of the project. The contract also stipulates ownership rights with regard to the results of the project, together with the arrangements for their dissemination and exploitation.

The standard contract used for the projects under the Fourth Framework Programme is simpler and about half the length of earlier models. These changes should make it easier, especially for SMEs, to participate in the programmes. In practical terms, the standard contract includes the following arrangements:

Administration

- appointment of a coordinator to provide liaison between partners and with the Commission;
- submission of annual reports;
- implementation of a plan for the exploitation of the results;
- reference to Community support in all communication with third parties.

Financial aspects

- Community contribution paid to the coordinator (in ecus);
- Community contribution paid in instalments (including an advance payment of approximately 30% of the total);
- project accounts to be kept and made available to Commission officials;
- reimbursement by the Commission of VAT on invoices exceeding ECU 2 500.

Intellectual property

Who do the results of Community research belong to? The standard contract offers those involved in research projects guarantees with regard to the protection of their inventions and the exploitation of results. The main features are:

- the contractors own the intellectual property rights and the results produced within the framework of the project (patents, copyright, etc.);
- contractors are required, before the end of the project, to prepare a “technological dissemination plan” stating the contractors' intentions with regard to the dissemination and exploitation of results;
- all the contractors involved on the same project are entitled, in principle, to make free use of the project results, i.e without paying royalties; if commercial interest is involved, the contractors may deny access to the results to third parties;

- the results are to be published, so that other interested bodies can apply for licences for the technology which has been developed; if a contractor is not in a position to exploit the results himself, he may also grant a licence to third parties under appropriate terms (in particular terms of payment).

The complete text of the simplified contract may be obtained from:

Mr Rocco Tanzilli, Director DG XII/AG, “General Administrative Matters”, European Commission, Office SDME R2/10, 200 rue de la Loi, B-1049 Brussels.

ANNEXE 4 : TABLES AND STATISTICAL DATA

NB. The data provided does not always cover all Member States. This could be due to the fact that the relevant statistical surveys have not been carried out or that it has not been possible to collect or compare particular data. This is the case, in particular, for the Community Innovation Survey (CIS) which allowed for the collection and comparison of data on 10,000 companies in thirteen countries. However, some Member States did not participate and some countries used questionnaires which were not entirely similar. Another reason could relate to the pilot nature of some of the surveys which did not cover the whole of the Union territory. The Commission Services will seek to find a remedy during the debate opened by this Green Paper.

The Commission expresses its thanks to Member State organisations and individuals who would assist in the completion or correction of the information presented in this document.

Table 1

Size distribution of enterprises and employment share

	Percentage of Firms		Percentage of Jobs	
	EU-12	USA	EU-12	USA
Base (Millions)	15 780	5 074	95 000	93 469
Micro entreprise (0-10 employees)	93.2	78.3	31.9	12.2
Small enterprises (11-99 employees)	6.2	20.0	24.9	20.0
Medium enterprises (100-499 employees)	0.5	1.4	15.1	14.4
Large enterprises (500 and up employees)	0.1	0.3	28.1	46.4
Total	100.0	100.0	100.0	100.0

Data: EU-12 (1990) - European Network for SME Research, 1994

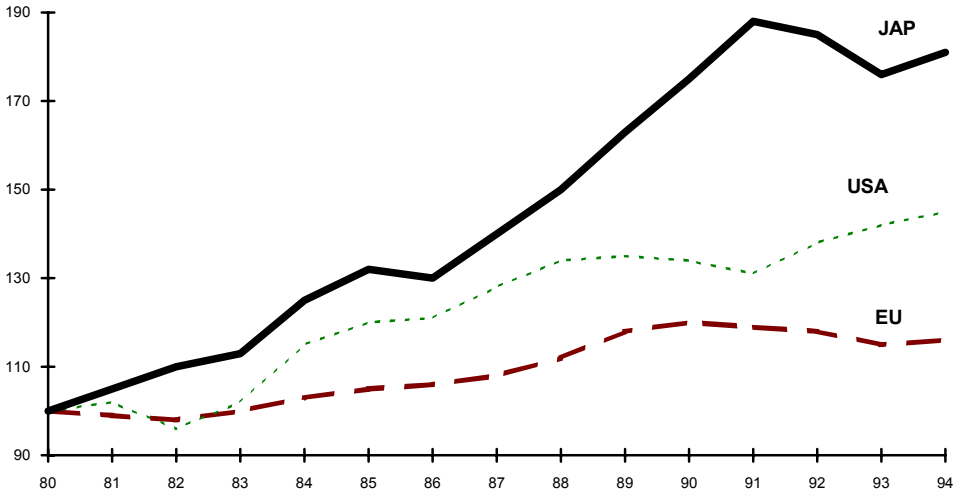
USA (1990) - U.S. Small Business Administration, 1993

Source: OECD (1995)

Table 2

Output in manufacturing, 1980=100

(gross value added at 1985 prices)

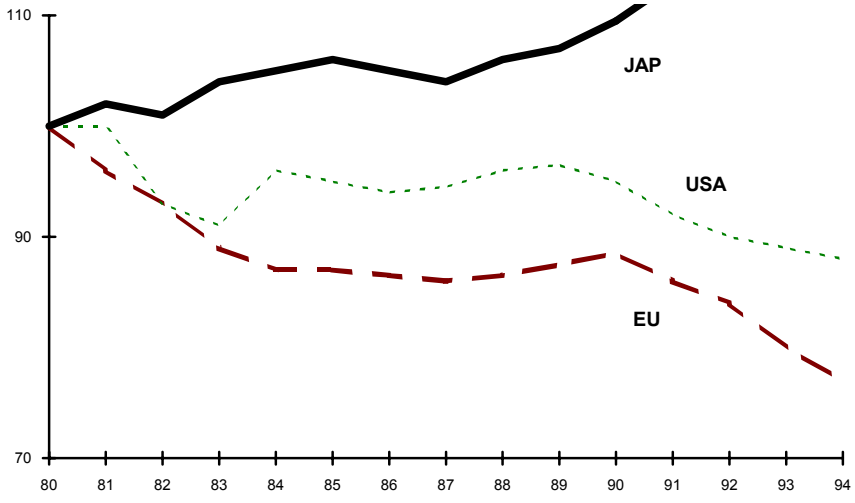


Source: European Commission

Table 3

Employment in manufacturing, 1980=100

(at 1985 prices)

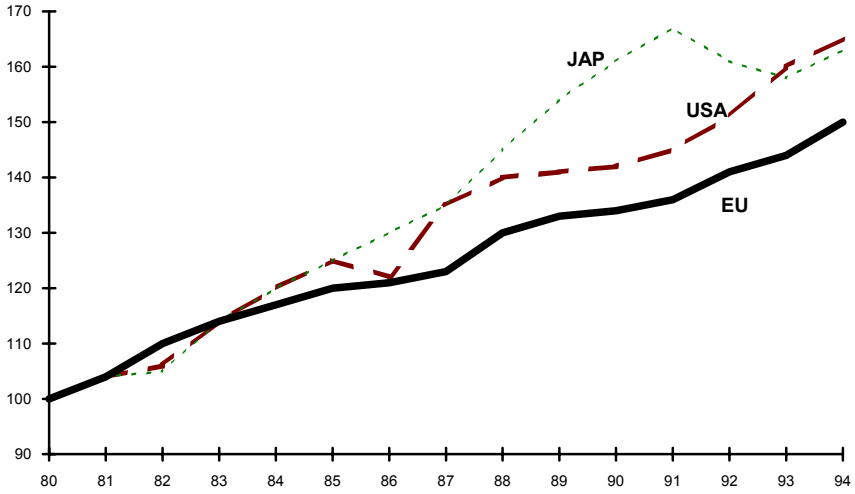


Source: European Commission

Table 4

Productivity in manufacturing, 1980=100

(gross value added at 1985 prices per person employed)

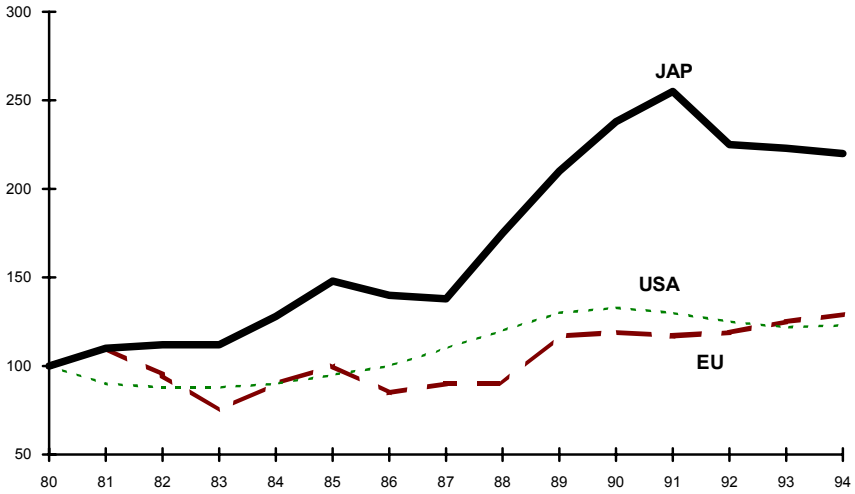


Source: European Commission

Table 5

Investment in manufacturing, 1980=100

(at 1985 prices)



Source: European Commission

Table 6

Technological production under a European patent in the fifteen countries of the European Union

	Share / World (%)		
	1987	1993	1993 en base 100 pour 1987
Germany	21,9	19,6	89
France	8,6	8,4	97
United Kingdom	7,4	5,6	76
Italy	3,5	3,9	111
Netherlands	2,8	2,5	90
Sweden	2,0	1,5	75
Austria	1,2	1,1	89
Belgium/Luxembourg	1,1	1,0	92
Finland	0,4	0,7	168
Denmark	0,5	0,6	106
Spain	0,3	0,5	158
Irland	0,1	0,1	90
Greece	0,0	0,0	163
Portugal	0,0	0,0	83
Total European Union	49,9	45,4	91
World	100,0	100,0	100

Data/ INPI/EPO (EPAT) processed by OST

Source: OST

Table 7

Technological production under a European patent in 1987, by field in 1987

	Share / World (%)-year 1987						
	Electronics/ electricity	Instrumenta-tion	Chemicals/pharma-ceuticals	Industrial proces-ses	Machinery /mecha-nical eng./trans-port	Consump-tion of house-holds	Total
European Union	41,4	45,0	42,4	52,6	61,0	64,8	49,9
United States	29,6	30,5	32,7	25,8	19,2	17,2	26,6
Japan	24,7	17,2	18,6	13,3	11,6	5,6	16,2
Rest of world	4,3	7,4	6,3	8,3	8,2	12,4	7,3
World	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Data INPI/EPO processed by OST

Source: OST

Table 8

Technological production under a European patent in 1993

	Share/World (%) - year 1993						
	Electronics/ electricity	Instrumenta-tion	Chemicals/pharma-ceuticals	Industrial proces-ses	Machinery /mecha-nical eng./trans-port	Consump-tion of house-holds	Total
European Union	34,2	37,8	40,3	50,1	58,5	64,0	45,4
United States	30,0	32,4	33,7	25,6	19,2	16,9	27,3
Japan	31,8	23,4	20,0	16,6	15,5	8,0	20,9
Rest of world	4,0	6,4	6,0	7,6	6,7	11,0	6,4
World	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Data INPI/EPO processed by OST

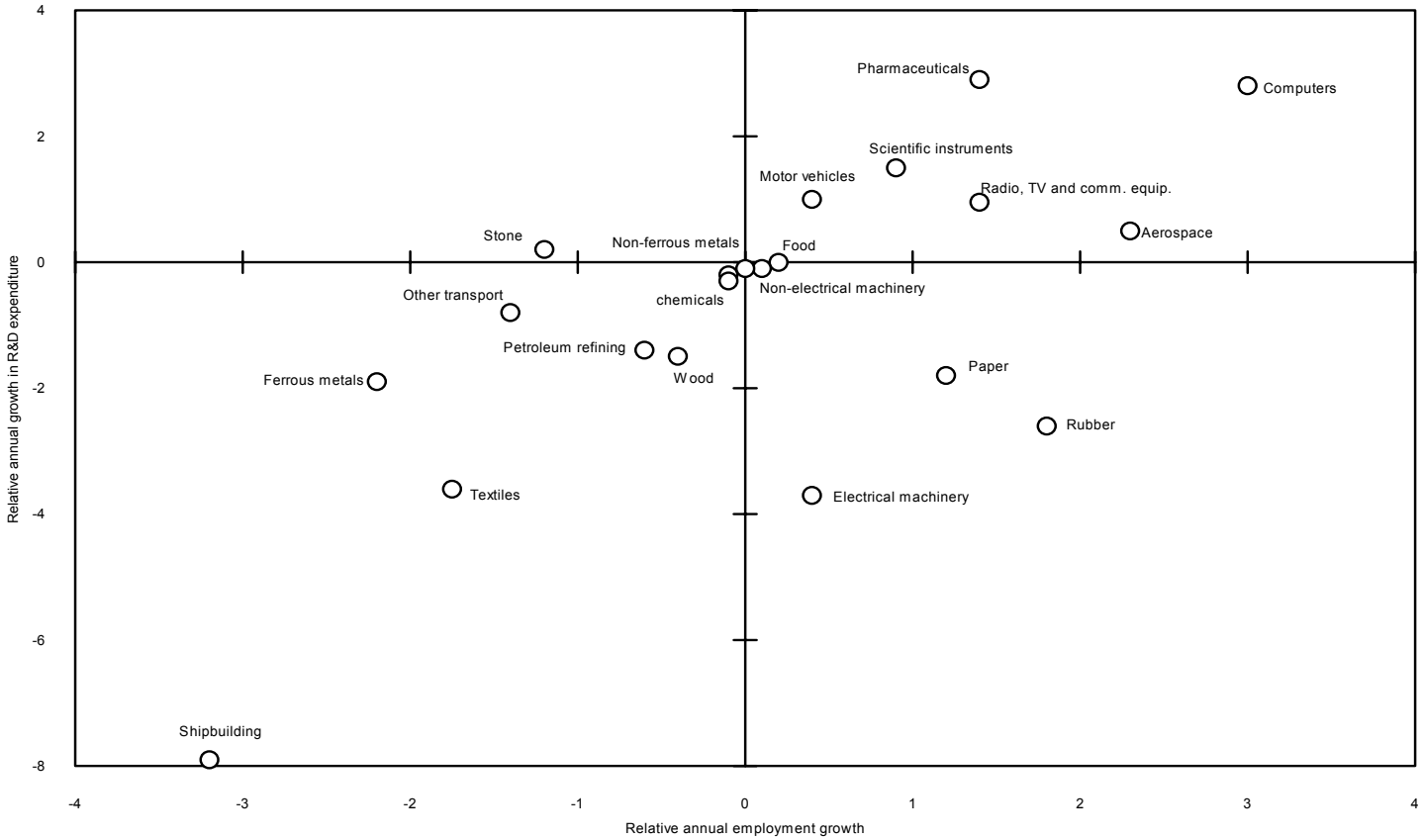
Source: OST

Table 9

R&D expenditures and employment growth, 1973-90

Average percentage growth rates by industry relative to total manufacturing growth for 13 OECD countries[i]

[i]Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, United Kingdom, United States



Source: OECD STAN database

Table 10

PUBLIC BUDGETARY APPROPRIATIONS FOR R&D

AS % OF GDP

	1983	1986	1989	1992
EUR 12	1.01	0.98	0.95	0.92
B	0.61	0.57	0.65	0.60
DK	0.52	0.61	0.80	0.69
D	1.14	1.11	1.06	1.03[ii]
GR	0.20	0.25	0.32	0.24
E	0.27	0.34	0.52	0.52
F	1.38	1.36	1.37	1.27
IRL	0.40	0.43	0.38	0.46
I	0.60	0.72	0.73	0.80
NL	0.96	0.94	0.91	0.85
P		0.27	0.31	0.42
UK	1.23	1.11	0.90	0.87
A		0.58	0.58	0.64
FIN	0.61	0.72	0.77	1.15
N	0.78	0.81	1.04	1.18
S	1.32	1.20	1.19	1.28
EEA/EEE		0.97	0.95	0.93

Source: EUROSTAT

[ii] Including the new Länder

Table 11a

Overview of indicators for comparing research financing (million US$ at current PPP)

INDICATORS			UNITED STATES	JAPAN	YEAR
GROSS DOMESTIC EXPENDITURE ON R&D(BERD)	*IN MILLION US$ AT CURRENT PPP*	123308	167 122	75 047	1992
	AS % OF GDP	1.96	2.81	3.00	1992
GROSS DOMESTIC EXPENDITURE ON CIVIL R&D	*AS % OF GDP*	1.8	2.2	3.0	1992
IN-HOUSE BUSINESS EXPENDITURE ON R&D (BERD)**	*IN MILLION US$ AT CURRENT PPP*	77 042	122 000	49 431	1993
	AS % OF GDP	1.22	1.95	1.93	1993
	AS % OF GIPmp	1.64	2.34	2.30	1992
STATE-FINANCED BERD	*AS % OF TOTAL BERD*	12.2*	20.3	1.1	1992
	AS % OF TOTAL SECTOR				
	-MANUFACTURING	12.6	25.4	1.2 (1989)	1991
	- ELECTRONICS	20.4	55.9 (1990)	0.3 (1989)	1991
	- AEROSPACE	48.1	90.8	9.0 (1989)	1991
	- AUTOMOBILE	1.3	117.7 (1985)	0.04 (1989)	1991

* If Community funding is taken into account, the corresponding figure would be approximately 14%. This being the case, funding from different States should be taken into account for the United States: ultimately the difference would not be reduced.

** It concerns expenditure for research carried out within companies (excluding research subcontracted to an external contractor) wherever the financing comes from

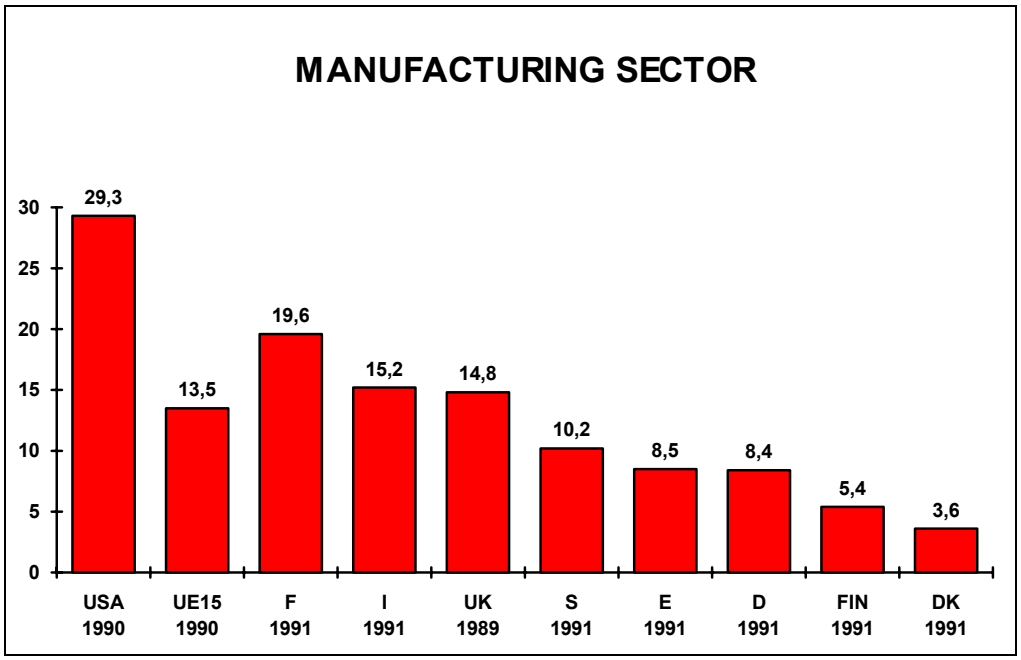
BREAKDOWN OF CURRENT GOVERNMENT R&D EXPENDITURE AS A FUNCTION OF MARKET PROXIMITY	*AS % OF BASIC R&D*	25.9	15.8	12.7 (1989)	1991
	AS % OF APPLIED R&D AND DEVELOPMENT	74.1	84.2	87.3 (1989)	1991

Note: Some of the values for EU12 are estimates

Source: Commission services from OECD data and national sources

Table 11b

SHARE OF INDUSTRIAL R&D EXPENDITURE
FINANCED BY THE STATE, AS %



Source: Estimates of Commission services from OECD data & national sources

USA = United States	UE15 = European Union (15 countries)
F = France	I = Italy
UK = United Kingdom	S = Sweden
E = Spain	D = Germany
FIN = Finland	DK = Denmark

Table 12

INTERNATIONAL DIFFERENCIES IN THE USE OF DIFFERENT STATE AID INSTRUMENTS

AVERAGE 1986-1990, as %

State aid instruments	USA	JP	S	D	F	UK	IRL	I	NL
Subsidies	6.8	22.6	37.0	37.3	42.3	55.4	84.0	} } }	90.5
Soft loans	3.5	21.8	18.2	1.0	3.1	-	-	} }94.0 }	7.3
Guarantees	0.9	17.0	9.8	15.3	21.8	15.3	2.1	4.0	0.6
Equity financing	-	-	1.1	1.5	15.8	24.0	-	-	1.0
Tax relief (tax credits)	88.8	19.0	15.0	43.0	16.8	-	11.8	-	-
Mixed instruments	0.1	19.7	19.0	1.9	1.0	5.3	2.0	2.0	0.3
TOTAL	100	100	100	100	100	100	100	100	100

Source: DG XII working document, 1995

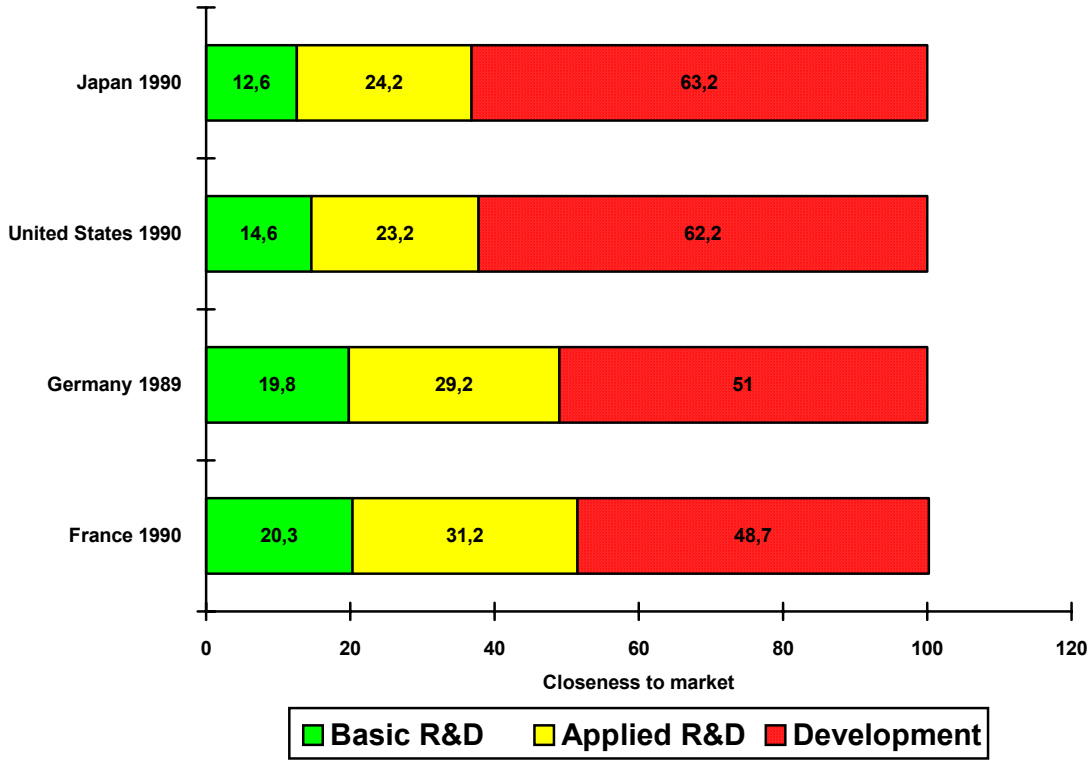
USA= United States JP= Japan S= Sweden D= Germany
F= France UK= United Kingdom IRL= Ireland I=Italy
NL= Netherlands

Compared with the other instruments, subsidies are the most visible and most easily-calculated state aids, and subsidies are the form of public aid most used in the countries of the EU. An international comparison based only on subsidies undoubtedly favours the United States and Japan, which use more complex and more difficult-to-assess public financing instruments to a greater extent than European countries.

N.B The above figure relate to all the categories of support measures to enterprises, and not only to support to research.

Table 13

DISTRIBUTION OF TOTAL EXPENDITURE BY CLOSENESS TO MARKET: BASIC R&D, APPLIED R&D AND DEVELOPMENT



Source: DG XII working document, 1995

R&D expenditure in Japan and the United States is concentrated more in activities close to the market than in the major countries of the European Union.

Table 14

R&D scientists and engineers

Total R&D scientists and engineers (RSE) or university graduates, full-time equivalents (000s)	Total RSE or university graduates per thousand labour force				
	1991	**1971**	**1975**	**1981**	**1991**
Belgium	18.1	1.7	2.3	3.1	4.3
Denmark	12.0	1.9	2.1	2.5	4.1
Germany (1)	240.8	3.3	3.8	4.4	6.1
Greece	6.1	-	-	-	1.5
Spain	41.7 (2)	0.6	0.6 (3)	1.4	2.7 (2)
France	137.6 (2)	2.8	2.9	3.6	5.5 (2)
Ireland	5.8 (2)	1.7	2.1	2.1	4.3 (2)
Italy	74.4 (2)	1.5	1.8	2.3	3.0 (2)
Netherlands	26.7 (4)	2.9	3.1	3.4	4.0 (4)
Austria	8.8 (4)	1.3 (5)	1.8	2.1	2.5 (4)
Portugal	5.9 (6)	-	-	0.6 (7)	1.2 (6)
Finland	15.2 (8)	2.0	2.6	-	6.1 (8)
Sweden	26.5	2.5	3.6	4.1	5.9
United Kingdom	135.0 (2)	-	-	-	4.8 (2)
EU 15 (9)	1581.1 (2)	-	-	-	4.5 (2)
Norway	14.8 (8)	2.3 (5)	3.3	3.8	6.9 (8)
Iceland	0.7	1.5	2.3	3.1	4.8
Switzerland	18.2 (2)	2.7	3.4	-	5.1 (2)
Turkey	12.6 (2)	-	-	-	0.6 (2)
Canada	65.2	1.9	-	3.4	4.7
Australia	42.8 (6)	-	-	3.5	5.0 (6)
New Zealand	4.8	-	-	-	2.9
USA	960.5	6.1	5.5	6.2	7.6
Japan (adjusted)	526.5 (8)	3.7	4.6	5.4	8.0 (8)
Nordic countries	66.7	-	-	3.5	5.4
North America	1034.3	-	-	5.9	6.1

Source: OECD

Notes:

(1) The data in respect of Germany for 1991 refer to unified Germany

(2) Year of reference is 1992

(3) Year of reference is 1974

(4) Year of reference is 1989

(5) Year of reference is 1970

(6) Year of reference is 1990

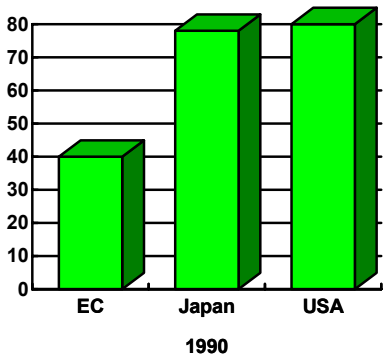
(7) Year of reference is 1980

(8) Year of reference is 1993

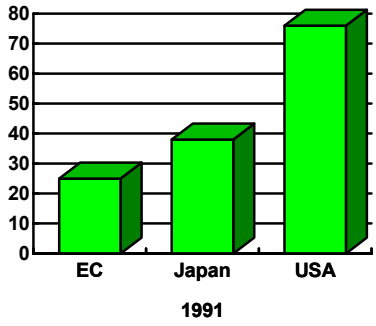
(9) The EU15 total has been estimated for 1992. Luxembourg (G.D) is not included.

Table 15

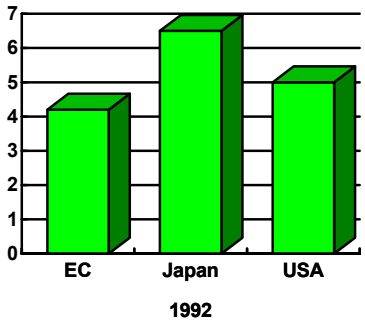
Technical Students
(per 100.000 population)



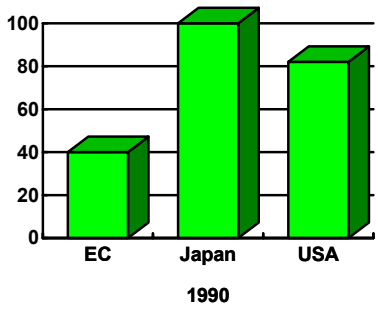
R&D Scientists employed in industry
(Share of total R&D scientists)



Research Co-operation
between firms & universities (Out of ten)



Research Co-operation
Firms in other regions (Japan=100)
(Adjusted for scale)



Source: UNICE 1994 "Making Europe more competitive"

Table 16

Establishment transitions and their distribution by employment status

Annual average over the period

	Canada[1] 1984-91	Denmark 1984-89	Finland 1986-91	France 1984-92	Italy[2] 1984-92	New Zealand 1987-92	Sweden 1987-92	United Kingdom [3 4] 1987-91	United States[4] 1984-91
1. New establishements	19.1	14.2	11.2	14.3	11.8	13.7	16.8	9.2	13.6
2. Closing establishments	16.3	13.6	9.8	13.2	9.9	14.5	14.6	8.5	9.2
3. Continuing establishments	83.7	86.4	90.2	86.8	90.1	85.5	85.4	91.5	90.8
4. *of which expanding*	45.0	29.3	29.9		23.8	19.4	24.1	20.9	15.0
5. contracting	38.7	25.9	60.3		19.8	21.9	24.7	8.8	10.3
6. unchanged		31.2			46.5	44.2	36.6	61.7	65.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net birth (1 less 2)	2.8	0.5	1.4	1.1	1.9	-0.8	2.2	0.8	4.4
Net expanding (4 less 5)	6.3	3.4	-30.4		4.0	-2.5	-0.6	12.1	4.7
Number of establishments (thousands)									
At the beginning of the period	651	146	142	1166	1002	92	203	905	4823
At the end of the period	780	150	163	1334	1180	88	274	948	6217

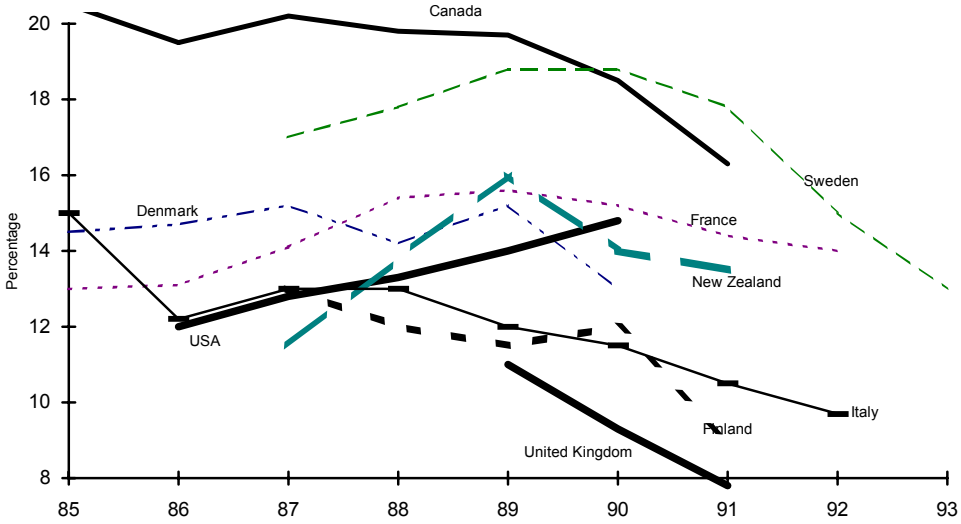
1. Sampling months/periods vary across countries
2. Data refer to enterprises

3. Since these establishments are born during the year they are not included in the number of establishments of the start of the year, and hence their propor
4. These data should be treated with caution.

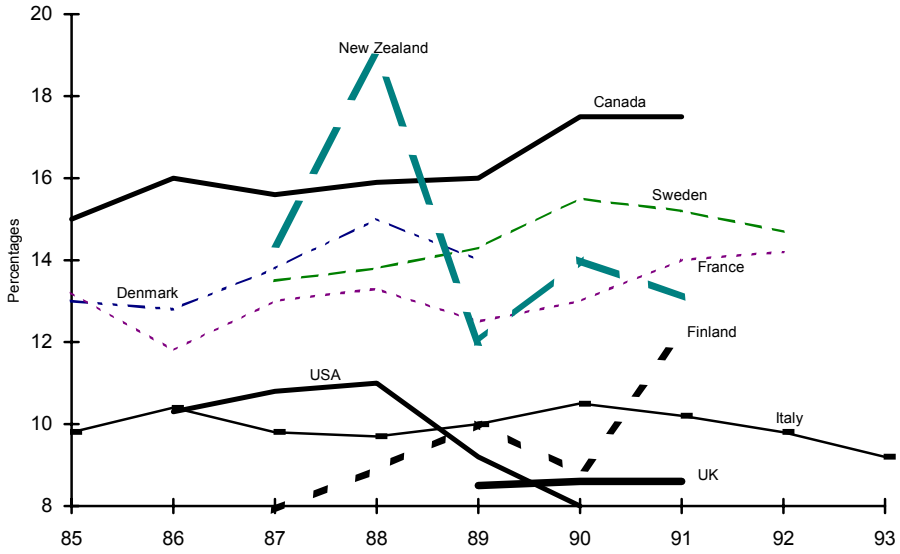
Source: Services de la Commission, à partir des données de l'OCDE et des sources nationales

Table 17

A. Establishment birth rates[1]



B. Establishment death rates[2]



Source: OECD, Employment outlook, 7/1994

Comments:- Establishment birth rates decline in most countries, except in the USA, where they increase steadily since mid-1996.

---

1 New establishments during the year as a per cent of the total number of establishments present at the beginning of the year

2 Closing establishments during the year as a per cent of the total number of establishments present at the beginning of the year

- Death rates stabilise in general or increase slightly except for the USA, where there is a steady decline since 1988.

Table 18

Adjusted Percentage Numbers and Value of Technology Investments
(i.e. excluding MBOs/MBIs in Europe and LBOs/Acquisitions in the US)
by Venture Capitalist Enterprises

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
EUROPE*										
Technology % N° Total Investments	n.a	n.a	n.a	n.a	38.9	38.1	36.6	31.4	30.3	32.5
Technology % Value Total investments	n.a	n.a	37.7	35.9	33.7	37.0	31.2	24.6	26.6	28.3
USA										
Technology % N° Total Investments	n.a	n.a	79.3	75.8	75.9	77.3	81.3	80.0	80.6	77.8
Technology % Value Total investments	n.a	n.a	87.0	79.5	85.5	85.2	85.1	82.9	82.9	70.8

Source: EVCA Annual Statistics 1984-93, NVCA Annual reports 1990-1992 in (MURRAY, 1995)

* EVCA statistics aggregate sixteen European countries including the UK

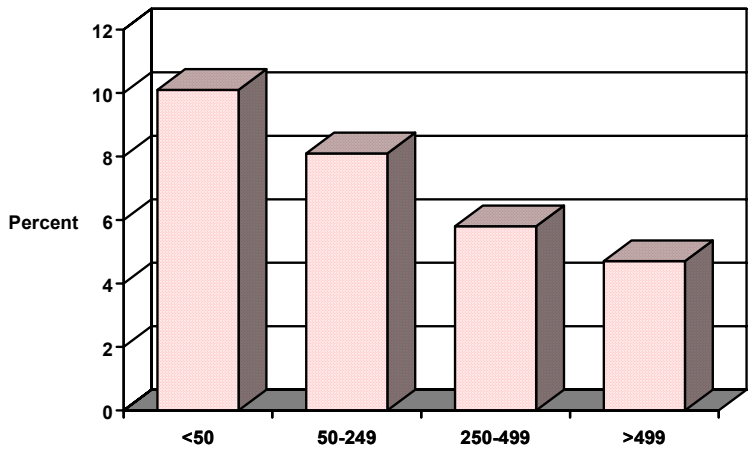
First results of the Community Innovation Survey (CIS)

(Tables 19 to 29)

Table 19

Innovation intensities across enterprise size for a given group of countries in 1992.

Total innovation expenditures divided by turnover. Percent.



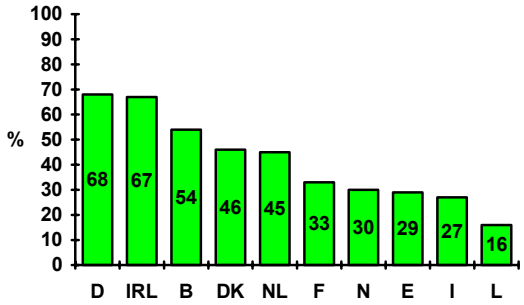
Note: Figures are calculated for Belgium, Denmark, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Norway and Spain.

Innovation intensities= Estimated total current expenditures on innovation activity in 1992 + Estimated total capital expenditures spent on investment in plant, machinery and equipment linked to new product innovation in 1992/ Turnover in 1992.

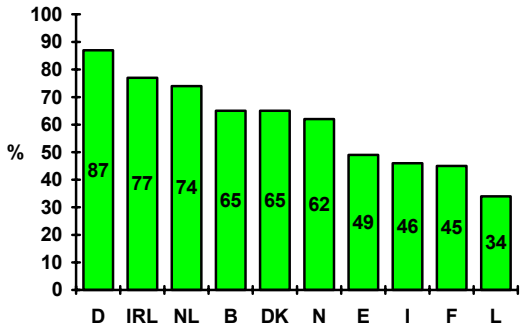
Table 20

Share of innovative enterprises in various size classes and countries in 1992. Percent

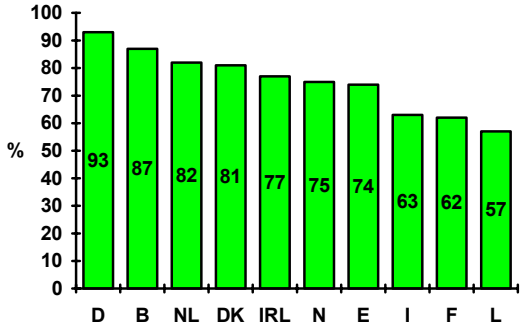
< 50 Employees



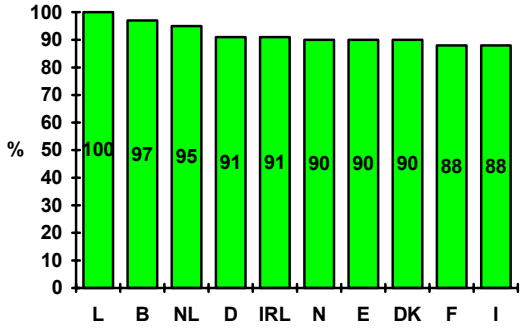
50-249 Employees



250-499 Employees



500 + Employees


100
90
80
70
60
%
50
40
30
20
10
0
100
97
95
91
91
90
90
90
88
88
L
B
NL
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IRL
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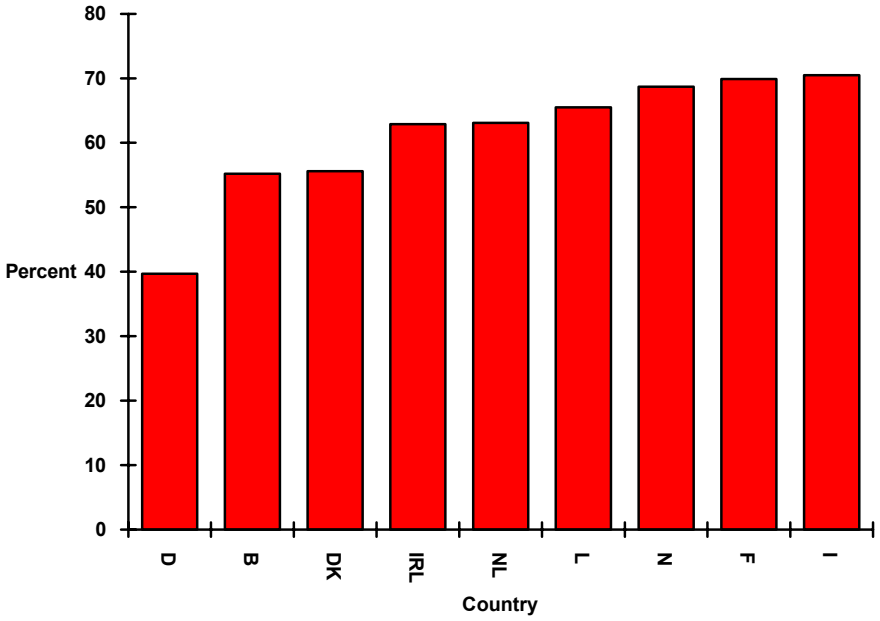
E
DK
F
I

Table 21

The percentage share of products in total sales of innovative enterprises that were essentially unchanged in 1992 in various countries.



Note: an innovative enterprise is one that declares having developed or introduced technologically changed products and process during 1990-1992.

Table 22

The average share (in total sales of innovative enterprises) of products which include incremental changes obtained with (and without) technical cooperation with external partners, in 1992, in various countries

	ENTERPRISES WITH TECHNICAL COOPRATION %	ENTERPRISES WITHOUT TECHNICAL COOPERATION %

B	82	18
DK	77	23
F	97	3
D	91	8
IRL	56	44
I	42	58
NL	72	28
N	55	45
E	70	30

In most countries a large share of the sales from innovative companies comes from improved products, (incremental innovation) due in particular to a technical cooperation with an external partner.

Table 23

SHARE OF NEW PRODUCTS IN SALES

- DATA FOR SELECTED COUNTRIES AND INDUSTRIES - (1992)

	B	DK	E	D	IRL	I	NL
Food & beverages	55	24	45	30	27	24	37
Textiles	48	70	44	43	38	43	45
Wood	17	37	52	39	35	35	26
Basic metal	21	42	34	42	48	1	37
Pulp and paper	25	36	38	18	NA	36	39
Chemicals	37	45	30	36	41	28	30
Rubber and plastic	41	34	45	62	54	38	56
Motor vehicles	48	71	70	88	45	43	32
Other transport	66	87	93	81	33	47	76
Fabricated metal	54	29	49	40	49	35	36
Machinery	62	64	50	49	66	44	42
Office equipment	40	94	58	53	66	76	78
Electrical machinery	49	45	53	55	NA	47	50
Radio, TV & COm	69	56	80	69	NA	51	76

Instruments	46	47	47	52	51	48	51

NA= Non available

– ***This output indicator shows that industries usually classified as low technology intensive can be highly innovative . Industries with low R&D expenditures have nevertheless a high share of innovative products in sales.***

– ***The share of new products in sales differ considerably inside an industry, which indicates various national innovative abilities.***

TABLE 24

BARRIERS TO INNOVATION DURING 1990 - 92

MAIN OBSTACLES LISTED BY ENTERPRISES

PERCENTAGE OF ENTERPRISES THAT HAVE ANSWERED THAT THE BARRIER IS VERY IMPORTANT

-DATA PER COUNTRY, FIRM SIZE GROUP AND TYPE OF OBSTACLE-

Country / **Barriers**	Firm size	B	GR	L	DK	D	IRL	I	NL	N	UK	E
1) Lack of Finance	1	52	83	43	53	58	60	68	17	56	83	77
	2	53	67	22	53	61	50	63	36	50	63	80
	3	55	39	30	56	62	63	56	45	41	57	73
	4	69	64	21	60	64	60	61	59	45	58	84
2) Lack of Competence	1	43	18	27	32	46	52	37	14	41	59	62
	2	34	13	7	36	49	34	33	29	54	44	66
	3	32	14	17	28	55	55	26	28	48	48	53
	4	26	14	11	26	48	35	25	33	36	32	76
3) Lack of Information	1	26	40	2	23	33	45	33	7	25	37	52
	2	32	40	3	22	36	36	29	16	25	27	54
	3	24	29	NA	17	33	36	24	16	22	43	43
	4	23	14	NA	16	34	39	20	21	21	21	48
4) Lack of Technological Opportunities	1	35	16	16	31	37	38	40	NA	31	39	46
	2	40	16	28	28	42	28	38	NA	30	27	44
	3	28	7	17	24	37	41	36		26	22	36
	4	29	14	30	22	38	36	38	NA	28	16	44
									NA			

5) Problems with IPR	1 2 3 4	29 28 23 24	61 48 29 45	10 8 23 NA	27 19 15 16	43 54 55 45	39 26 22 27	38 32 27 28	NA NA NA NA	7 6 11 5	34 23 35 16	44 46 36 51

Note: 1 less or equal to 49 Employees; 2 = 50 - 249; 3 = 250 - 499; 4 greater than or equal to 500 - Question not included in the French survey

Data for Greece, and UK are not weighted

NA= non available

– ***The most important barriers are finance related and hold for most countries and size class. The second main strand of barriers are related to the internal competence of the enterprises and their ability to handle the innovative process.***

TABLE 25 A

TECHNOLOGY ACQUISITION DURING 1992 FROM DOMESTIC SOURCES

- DATA PER COUNTRY, FIRM SIZE GROUP AND TYPE OF SOURCE. PERCENT OF INNOVATIVE ENTERPRISES THAT HAVE INDICATED ACQUISITION.

Country / Type of Source	Size	B	GR	L	DK	F	D	IRL	I	NL	N	UK	E
1) The right to use other's inventions	1	8	0	0	9	11	10	7	7	6	17	27	33
	2	2	13	3	12	11	10	4	7	6	15	17	25
	3	6	13	0	10	10	15	0	8	6	15	22	14
	4	8	0	0	17	18	26	10	11	5	10	42	23
2) Results of R&D contracted out	1	9	NA	2	5	40	15	4	6	18	10	16	NA
	2	14	NA	6	9	46	19	5	9	31	15	19	NA
	3	27	NA	NA	8	60	26	4	15	32	6	22	NA
	4	45	NA	NA	39	57	38	NA	22	48	20	37	NA
3) Use of consultancy services	1	10	NA	20	26	11	61	20	29	34	29	30	42
	2	26	NA	3	29	13	56	14	34	29	42	44	35
	3	13	NA	0	32	19	58	15	43	29	44	39	32
	4	21	NA	10	46	13	68	14	52	24	36	53	28
4) Purchase of equipment	1	43	NA	22	47	32	72	33	66	33	54	62	NA
	2	33	NA	7	48	34	55	14	66	24	45	65	NA
	3	25	NA	0	49	35	50	12	67	19	53	48	NA
	4	24	NA	38	35	35	53	18	64	11	44	68	NA
5) Communication with specialist services from other entreprises	1	22	0	33	23	NA	82	13	21	36	21	54	NA
	2	13	0	6	28	NA	70	14	22	29	22	56	NA
	3	10	0	0	20	NA	58	21	26	25	9	43	NA
	4	13	5	10	20	NA	66	14	31	23	41	63	NA

6) Hiring of skilled employees	1	48	NA	5	30	31	45	37	33	15	14	54	NA
	2	43	NA	20	34	28	60	27	42	24	21	65	NA
	3	35	NA	0	31	46	69	8	49	25	38	74	NA
	4	36	NA	32	36	40	81	18	45	27	25	84	NA

Note: 1 less than 49 Employees; 2 = 50 - 249; 3 = 250 - 499; 4 greater than or equal to 500

Data for Greece and UK are not weighted

NA = Non available

TABLE 25B

TECHNOLOGY ACQUISITIONS DURING 1992 FROM DOMESTIC AND EU SOURCES

- DATA PER COUNTRY, FIRM SIZE GROUP AND TYPE OF SOURCES. PERCENT OF INNOVATIVE ENTREPRISES THAT HAVE INDICATED ACQUISITION

Country / Type of Source	Firm size	B	GR	L	DK	F	D	IRL	I	NL	N	UK	E
1) The right to use other's inventions	1	19	99	4	17	13	10	23	10	10	21	41	45
	2	25	82	10	20	16	13	19	12	14	23	25	47
	3	17	78	15	22	17	18	17	15	15	32	30	41
	4	38	38	10	32	27	36	28	21	14	20	68	52
2) Results of R&D contracted out	1	15	NA	9	7	43	16	6	7	20	10	19	NA
	2	30	NA	49	11	50	20	9	11	35	16	19	NA
	3	38	NA	15	10	64	29	18	18	37	12	22	NA
	4	58	NA	NA	48	64	47	15	27	62	27	37	NA
3) Use of consultancy services	1	10	NA	38	31	12	62	22	30	34	31	32	54
	2	31	NA	25	33	13	59	23	36	31	45	46	53
	3	22	NA	13	41	21	63	29	44	33	56	48	43
	4	37	NA	21	54	16	72	14	55	30	41	53	58
4) Purchase of equipment	1	69	NA	53	78	45	75	61	73	46	70	76	NA
	2	71	NA	53	76	49	62	61	73	39	70	79	NA
	3	55	NA	76	82	44	57	66	74	34	76	65	NA
	4	61	NA	90	71	47	59	86	72	33	64	79	NA
5) Communication with specialist services from other enterprises	1	38	NA	42	34	NA	84	29	24	43	24	68	NA
	2	29	NA	38	44	NA	77	32	27	41	28	62	NA
	3	36	NA	36	39	NA	66	34	31	41	26	48	NA
	4	38	52	71	43	NA	78	38	42	37	45	68	NA

6) Hiring of skilled employees	1	50	NA	7	30	32	47	38	33	16	14	57	NA
	2	55	NA	23	35	29	61	38	42	26	21	69	NA
	3	42	NA	25	32	46	70	17	49	26	38	74	NA
	4	43	NA	32	41	43	84	29	45	31	27	84	NA

Note: 1 less than 49 Employees; 2 = 50 - 249; 3 = 250 - 499; 4 greater than or equal to 500

Data for Greece and UK are not weighted

NA = Non available

- ***Domestic technology sources are in general more important than European sources, especially for SMEs.***
- ***Small countries seem to source technology outside the domestic base to a higher degree.***
- ***The most widely used form of technology aquisition is communication with specialists and contract research.***
- ***There are some variation between size classes.***
- ***The hiring of skilled employees is still mainly done within national boundaries***

Table 26

THE PERCENTAGE SHARE OF R&D AND NON - R&D IN TOTAL INNOVATION EXPENDITURES IN 1992

- DATA FOR 9 COUNTRIES, BY FIRM SIZE -

Country	Firm size	R&D expenditures %	Non R&D expenditures %
B	1	40	60
	2	31	69
	3	52	48
	4	64	36
DK	1	13	87
	2	32	68
	3	41	59
	4	56	44
D	1	NA	NA
	2	17	83
	3	34	66
	4	41	59
GR	1	45	55
	2	38	62
	3	47	53
	4	44	56
IRL	1	34	66
	2	27	73
	3	45	55
	4	16	84
I	1	30	70
	2	40	60
	3	56	44
	4	71	29
L	1	7	93
	2	69	31
	3	34	66
	4	42	58
NL	1	NA	NA
	2	58	42
	3	57	43
	4	61	39
E	1	28	72
	2	39	61
	3	42	58
	4	47	53

Note: 1 less or equal 49 Employees; 2 = 50 - 249; 3 = 250 - 499; 4 greater than or equal to 500

Non-R&D includes (acquisition of patents, product design, trial production, training, tooling-up, market analysis and other)

- Data for Greece are not weighted

NA = non available

- ***Non R&D costs are an important component in overall innovation cost and amount on average to approximately 50 percent.***
- ***Non - R&D and R&D costs vary between countries and size classes***

Table 27

The share of enterprises that have reported R&D activities in 1992.

	enterprises regularly performing research %	enterprises usually not performing research %
B	73	27
DK	72	28
D	56	44
IRL	85	15
I	57	43
L	57	33
NL	60	40
N	60	40
E	57	43
Average	58	42

Even companies which are not usually involved in research can have significant activities in this area.

Table 28

Expenditures spent on trial production, training and tooling-up

as a percentage of total innovation expenditures in 1992 for various countries

COUNTRY / NACE	B %	DK %	E %	D %	IRL %	I %	NL %

FOOD AND BEVERAGES	25	26	20	47	27	17	14
TEXTILES	31	20	15	37	55	27	50
BASIC METAL	7	24	31	39	42	24	NA
PULP AND PAPER	32	29	37	45	NA	25	11
CHEMICALS	10	8	1	22	20	6	8
MOTOR VEHICLES	34	21	6	14	22	8	20
MACHINERY	13	6	5	21	42	18	13
RADIO, TELEVISION AND COMMUNICATION EQUIPMENT	7	12	2	17	NA	6	12
INSTRUMENTS	6	17	0	29	30	12	22

NA = non available

Table 29

The importance of various innovative sources

Percentage of enterprises that have rated the source to be very important

	1 - 49	**50 - 249**	**250 - 499**	**≥500**
Internal sources	51	58	62	72
External Sources	85	83	82	85
Universities and research establishments	21	21	27	32

Note: Internal sources include: Sources within the enterprise and within the group of enterprises. External sources include: Suppliers of materials, components, equipment, customers, competitors and consultancy firms. Universities and research establishments include: universities, higher education, government laboratories, technical institutes.

Table 30

The importance of technical knowledge obtained from six sources. Percentage among 400 largest manufacturing enterprises that have rated one or more of these sources to be very important

	AFFILIATED FIRMS %	JOINT VENTURES %	INDEPENDENT SUPPLIERS %	CUSTOMERS %	PUBLIC RESEARCH INSTITUTES %	TECHNICAL ANALYSIS %
INDUSTRY	37	33	37	37	32	47

Source: PACE Study for DG XIII/D, 1994

Table 31

CATEGORIES OF ENTERPRISES

Example 1 - Machine , portfolio and networks enterprises

Styles	Machines	Portfolios	Networks
Technology and strategy	Focus on the basic technological craft	The technology comes almost exclusively from the field of R&D	An overall strategic view based on technology
Styles of management	A rigorous and self-centred style of management	The relations between technology and strategy are limited, and technological diversification remains rare	A complete range of internal and external relations in the field of technology
Technological information	Traditional, intensive and focused information processes	Importance of the financial variables and information systems on markets and the environment	Dominant role of technological information and communications systems
National correlation	FRANCE	UNITED STATES (ITALY)	JAPAN

Source: Allouche and Pogorel (1990)

Exemple 2 - Enterprise types according to their technological capabilities

Research Performers	• Research department or equivalent • Able to take long run view of technological capabilities
Technological Competents	• Multiple engineers • Some budgetary discretion • Able to participate in technology networks
"Bootstrap" Stage	• One engineer • Able to adopt/adapt packaged solutions • May need implementation help

"Peasants"	• No meaningful technological capability • No perceived need for this • May be no actual need

Source: K. GUY & E. ARNOLD, 1993

Table 32

Nature and technology of the firm:

The five business behaviours

Type of business	General definition	Technological strategy	Representatives businesses
I Business with an optimum stationary technique	Single-product business using a technique which is simultaneously unchanging and flexible, closely linked with the production function and standardised amongst competitors	Strategy for adopting a modal technique, the best at the moment, by reference to the branch of activity (adaptation to the market)	Producers (SMEs) in craft activities with slow technical progress, limited profits and not very attractive
II Growing business profiting from implicit technical progress	High-performance business which purchases technical progress without really managing or inspiring it, and without really being aware of the implications of the technological choices	Strategy based on extrapolation of past choices, without an overall view and forward planning	Business of the 50s and 60s borne by the period of expansion and technical progress
III Innovative business	Business marked by its strong capacity for technological innovation and its strong spirit of enterprise, offering new products which themselves lead to the creation of new markets (businesses frequently developing towards type IV)	Technological innovation strategy based on the assumption that supply creates its own demand	Independent innovative SMEs (e.g. packaging, dried flowers) or specific networks (e.g. Minitel) or branches of concerns (e.g. Saint Gobain)
IV Concern with an integrated technological strategy	Large business, not dependent on a specific innovation but closely incorporating the technological dimension into its strategic choices	Strategy based on exploitation and management of know-how, skills and technical information	Large multinational concerns possessing rare technical know-how (e.g. Essilor, L'Oréal, IBM, etc.)
V. Variable-geometry technological enterprise	Business skilled at contractual know-how, particularly at the level of technological skill, through seeking and exchanging skills within specialised networks which both disseminate and create information, skills and new technical know-how: challenging the classical frontiers and the growing immateriality of the business	Strategy for technological partnerships and alliances based on the concept of the skill block within the framework of networks which generate new technologies	Businesses belonging to one or more networks through agreements, alliances, subcontracting with other businesses or public or private laboratories (e.g. IBM and its alliances with several laboratories)

Source: in Allouche et Schmidt, 1995

Table 33

FOUR STATIC GENERIC STRATEGIES FOR HUMAN RESOURCES

	BASIC LABOUR	DIVERSIFIED LABOUR
RECRUITMENT	**Localisation and delocalisation** Minimising labour costs purely and simply in order to obtain supplies of low-skill work **-->** strategies of partial or total delocalisation *Example: Hoover*	**Differential salary advantage** Attracting labour through salary bonuses by following or going beyond the market price **-->** strategies of salary incentives *Example: oil platforms*
RETENTION	**Paternalism and the Ford attitude** Stabilise the labour force/minimise the turnover through various advantages (salaries: paternalism, etc.) **-->** strategies involving fixing salaries through the creation of an internal market *Example: Ford (19th century), Le Creusot*	**Stabilisation of the collective and planned careers** Stabilising the labour force/minimising turnover through career progress advantages **-->** strategies of retaining staff through the creation of an internal market *Example: Schneider*

FOUR DYNAMIC GENERIC STRATEGIES FOR HUMAN RESOURCES

	INDIVIDUAL EXPLOITATION OF INVESTMENT	COLLECTIVE EXPLOITATION OF INVESTMENT
EXTERNALLY-BASED PROFESSIONAL CAREER	**Specialisation/recycling** Adapting the labour force to changes through a high degree of transferability of specialisations **-->** recycling strategies *Example: German businesses* *(apprenticeships)*	**Districts and networks** Moving labour around from firm to firm while exploiting the collective potential **-->** strategies involving networks of businesses *Example: Italian districts*

INTERNALLY-BASED PROFESSIONAL CAREER	**Skill model** Promoting the individual progress of the workforce in order to retain them **-->** strategies involving skill models or customised plans (for careers, remuneration, workings hours, etc.) *Example: French businesses (1980s)*	**Rotation/versatility** Promoting the versatility of the workforce in order to rotate them **-->**Strategies involving the accumulation of collective skills through constant learning *Example: Japanese firms*

Source: ibid.

Table 34

FIELDS OF APPLICATION OF REENGINEERING AND ITS CHARACTERISTICS

AN OVERVIEW

Fields	Characteristics after reengineering
1. Operational processes in the undertaking	*Integration of the operational processes* Maximum grouping of posts and tasks Responsibilities concentrated in the hands of a case manager or case team *Integration of decision-making at work* Vertical compression of processes and decentralisation of decisions *Delinearisation of the processes* Abandonment of the linear succession of tasks in favour of a natural order of work priority Establishment of simultaneous tasks or operations *Destandardisation of processes and tasks* Existence of multiple versions of one and the same process according to situation, market requirements, inputs, etc. *Relocalisation of work according to natural logic* Establishment of new relations between processes and the organisation Redistribution of work across organisational frontiers Minimisation of tasks involved in integration of processes between independent units *Reduction of inspections, checks, clocking in and out* Grouping of checks and/or establishment of off-line checks Relaxation of clocking in and out *Reduction of inspections, checks, clocking in and out* Optimum exploitation of new information technologies Specialisation of divisions according to fields of skills
2. The working environment	Evolution of *working units*: from functional departments to teams responsible for a process Evolution of *posts*: from simple tasks to multidimensional work Evolution of *roles*: from supervised posts to posts with autonomous responsibility Evolution of *crafts*: from training to education Evolution of the criteria for *remuneration and performance*: from the activity to the results Evolution of the criteria for *promotion*: from performance to aptitude Evolution of *values*: from perfectionism to versatility Evolution of *managers*: from supervisors to encouragers Evolution of *establishment plans*: from hierarchical to flat Evolution of *top management*: from referees to leaders

3. Information technologies	Information is available simultaneously wherever it is needed (*shared databases*) Generalists can do the work of specialists (*expert systems*) Businesses profit from the combined advantages of centralisation and decentralisation (*telecommunications networks*) Field staff can send and receive information at any time (*radio transmission of data, portable computers*) The only good contact with clients is effective contact, and no longer necessarily personal contact (*interactive video disk*) Things say themselves where they are without the need for supervision (*recognition technologies, automatic monitoring*) Plans are reviewed immediately on an ongoing basis (*powerful computers*)

Source: ibid.