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THE FUTURE OF INDUSTRY IN EUROPE

(FINE Project)

Synthesis Report by IAT

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Synthesis Report

The Future of Industry in Europe

Final Draft

Fast

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Executive Summary

Driven by fast changes in global dimensions, industry in Europe has to master difficult transition processes. It has

* to regain and to secure competitiveness and to further proceed to technology intensive and knowledge-based production;
* to strive for environmental sustainability and to develop economic solutions for environmental and social problems;
* to develop existing markets in new directions and create new markets in order to secure employment and growth in Europe.

Competitiveness means more than labour cost and exchange rates

Competitiveness of industry is dominating debates on European economic development. In the past this notion has been defined by factors like growth of GDP, labour costs, trade balances and exchange rates. Meanwhile it has turned out that competitiveness also includes a number of other factors such as:

* motivation, education and values;
* quality of management, skilled labour and social organization of industry;
* technology-intensive and knowledge-based production;
* quality of interaction of politics, business and interest organizations.

Economic development is no longer a matter of single enterprises or industries but rather a joint venture of society as a whole. Setting favourable trends and reversing unfavourable trends needs strong cooperation of political and economic actors with a long-term orientation to solve problem of future sustainability.This also demarcates a new philosphy of growth: **Instead of speculating about the limits of growth we have to aim towards problem-solving growth.** This philosophy applies to environmental problems as well as to social problems.

Problem solving growth can only be achieved by making use of the best technology available. Complexitiy of knowledge and its conversion into new products needs a continuous process which not only challenges science but also the social organization of the innovation process.

Strategies of problem-solving growth also have a global aspect. A major goal of industrial policy and of industrial activity in the advanced countries must be to enhance a type of global production which guides investments and technological knowledge to the developing countries.

Active policies to encounter exhaustion

Europe´s advanced industrialized societies are threatened by the exhaustion of their economic opportunities. To turn the tide an active approach is necessary.

Exhaustion, i.e. an unbalanced relationship between production capacities and demand is not only due to the maturity of markets. Today, the situation is aggravated by the rapid growth in newly industrializing countries and rationalization processes in the developed economies.

The findings of the FINE-studies suggest that this will lead to structural unemployment opening up a vicious circle: Long term unemployment imposes increasing social costs on the economy and result in declining demand, in turn enlarging the gap between the production potential and market volumes.

In order to create new economic opportunities, a strategy of diversification is needed, where enterprises use their potentials, particularly their know-how and technological competence and the skills of their workforce, to develop new products for new markets. This opens up chances to transfer labour from declining to new business.

Technology-led diversification is a strategy which follows the logic of capitalism. It attempts to develop new products on the basis of the technological knowledge and

competence of a firm and its personnel. Success of technology-led diversification strongly depends on companies' ability to translate problems, needs and demand, which so far have not been satisfied economically or for which better economic solutions may be developed, into new products. This is what we call the socio-technological approach to diversification.

Yet, diversification remains a difficult, costly and risky undertaking. Major barriers are:

* to combine creative marketing with long-term R&D;
* to reorganize firms´ structures and collaboration between firms;
* to orientate financial strategies at long-term goals;
* to enlarge the time horizon of firms' planning;
* to introduce new dimensions of enterprise culture which give up the narrow definition of enterprises.

Given these problems, support by public policy is important. So far, public policy in Europe has a strong tendency to react on the decline of nationally relevant firms and industries in terms of protectionism. Little attempt is made to mobilize their potentials for the development of new products and markets and to turn to a "new" **quality production:**
For industry in Europe, the important strategic problem is to develop a competitive edge in a quality economy. This means to combine:

* high quality of goods in response to customers´ demands;
* low degree of standardization and high degree of customization of goods;
* fast adjustment of products to diversified and changing demand;
* a fast adjustment of products to the highest state of science and technology;
* inclusion of a strong service component.

The conclusion of all this is simple: It is crucial to be quick in translating needs into demand and to be highly fexible in product as well as process development.

VIII

Technology plus organisation makes productivity

As we are moving towards a knowledge-intensive economy, new market structures and organizational paradigms, there are enormous creative potentials to be mobilized. Successful strategies have been developed in the context of anthropocentric production systems (APS), that is of **advanced production systems** which combine computer-based technology with intelligent organization and skilled work.

Education and training programmes are essential to modernize work. Advanced production systems put new demands on human qualifications and the development of new skill profiles. It is a **mangement problem** then, to keep the balance between technological innovation, organisational design and the resulting transformation of skill profiles.

The ability of modern production systems to adjust to changing demands and to switch to new value-added business is also dependent on the successful management of external relationships. The use of **interfirm cooperation** offers two advantages: firms stay "lean" and flexible, and they have access to scarce resources which enables them to deal with highly complex requirements. This is of particular importance for small and medium sized enterprises.

Innovating the innovation system

European industry is used to apply the best available technology to their products and to adjust their products to the new and better technological solutions. This kind of technological competence does not necessarily mean that Europe is also leading in the development of technology. European industry does not have a leading position in the most important technologies, particularly in the so-called core-technologies. Beside this weakness in core-technologies strategic shortcomings are to be seen in:

* deficits in systematically building up on technological linkages;

* a technological "fundamentalism" rating the scientific quality of technological solutions as an end in itself;
* an inefficient innovation management resulting in long lead-times and commercialization problems.

Development and application of technologies is not only a scientific or technological problem, but just as well an organizational one. It requires **close collaboration** between scientists, producers and users.

In Europe, networking and collaborative research is only poorly developed. European innovation management is often technology-centered and neglects economic and social dimensions of innovation. Approaches to new technologies are based on specialization and competition of individual firms. They are biased towards technological breakthrough and neglect synergies.

This requires a **new pattern of innovation, which combines technological breakthrough and the fusion of different technologies** in a process of continouous improvement. The crucial point is to organize cooperation across whole production chains i.e. across, different fields of research and different branches.

For future competitiveness in Europe it will be important to develop an innovation regime which organizes the entire process - from basic research via the development of new technologies to application in products - in a way, that societal needs can be quickly transformed into new products and markets. This has a number of implications e.g. :

* the scarcity of resources requires a more efficient setting of priorities;
* R&D projects must be embedded in any long-term strategies and cooperative arrangements;
* R&D has to go along with qualification of the labour force and organizational development.

National policies and regulatory differences, regional disparities and cultural diversity have consequences for the "environment" of innovation in Europe. National achievements by themselves are not sufficient to remain competitive in a globalized economy. An innovative climate within the Community needs cooperation and a high degree of flexiblity.

Strategic concepts for the future of industry in Europe have to reconsider the notion of growth and competiveness. Growth will not be achieved by more of the same, but by new products, contributing to the solution of societal needs. Competitiveness will not be achieved by strategies of automation but by reorganizing production structures. Endeavours to regain a competitive edge will have to focus on the potentials of social organization.

What is required in the end is a new understanding of division of labour and cooperation of social, political and economic actors to overcome the mismatches between growth and employment, societal needs and economic rationality, isles of growth and a sea of poverty.

The following *policy recommendations* can be formulated as a result of the research:

Reshaping the welfare state

The European social charta has to be decided very urgently in order to secure an adequate social framework for industrial development. Working conditions should not be applicable as a competitive arguement.

European initiatives for high productivity

The Commission of the European Communities and governments of the member states of the communities should promote a joint initiative of employers and unions to increase productivity in European industry.

An initiative for intelligent production systems

The commission of the European Communities should further enhance development of anthropocentric production systmes and combine this with a systematic effort to design and

implement in European industry intelligent production systems with open and flexible boundaries. This should be combined with a systematic effort in vocational and professional training.

Centers of excellence

The Commission of the European Communities should establish centers of excellence for research which necessitate broad interdisplinary approaches and integration of scientific knowledge and practical experience.

Centers of excellence should be established for a limited period (probably 10 years) and be organized as joint ventures of public research institutions and private firms. Private firms should be involved by delegating staff and by actively participating in pilot projects.

Regulations should be made which define intellectual property rights of participants and still secure openess to participation at any time. Competing centers of excellence should be admitted and even enhanced.

Reorganizing the Communities RTD policy

The Community programmes for research and technical development should be forcefully shifted to the establishment of networks for fast development and wide application of new technologies in widely defined fields. Goals and activities should be openly defined.

R&D programmes could center around certain technologies, such as opto-electronics. In this case, they should consider the whole technological "food-chain". Programmes could also center around certain problems, such as recycling of automobiles, and they should include all relevant technologies.

In such programmes should not only deal with technical, but also with economic and social aspects of the relevant technologies or problems.

XII

Initiating a new techno-culture

In order to improve development and application of new technology, the Commission of the European Communities should initiate a society wide discussion on technology.

The aim of the discussion should be to design efficient regulation and an efficient security system for the development of new technologies, particularly of bio-technology.

The discussion could be organized by intensive hearings of the Commission with industry, unions and the relevant social interests. It could be convened by an independent committee.

Introducing dynamic regulation on environment

The Commission of the European Communities and national governments should develop a dynamic form of environmental regulation. For a longer period of time, regulation should in advance define rising environmental standards. This should be continuously perpetuated. The basis for the definition of standards should be the projections of technological development.

Environmental targeting of public procurement

The Commission of the European Communities and national governments should support trigger development of capacious markets for environmental products by means of public procurement.

More specifically, European and national regulations should determine that public procurement projects have to meet high environmental standards. These standards should be dynamic in order to induce a technology push.

A European R&D-programme for an environmental industry

The Commission of the European Communities should initiate a large-scale R&D programme on environmental technology and development of relevant markets. The programme should support networks and centers of excellence focusing at major environmental problems, such as recycling and waste reduction for major industrial products.

Three measures to support diversification

In order to support diversification of industry to new activities and new markets, The Commission of the European Communities should introduce the following measures:

1 Financial support for declining industry should only be given under the condition that the relevant firms offer a programm for the development of new business and the creation of new jobs for the workers. National subsidies should be subject to the same condition.
2 Public support for development of technology should be linked to the condition that R&D activities are combined with activities for development of new products and new markets.
3 The Commission should create a programme for financial support of development of new markets by means of venture capital and long-term loans. Preferably, such a programme should be performed as a joint venture with the European banking industry and thus, stimulate development of new banking business.

Networks for socio-technological diversification

In order to develop new markets and new economic opportunities, The Commission of the European Communities should establish networks for socio-technological diversification.

One type of network should be oriented at development and wide application of core-technologies and should be organized along technological chaines and potentials for technology fusion. Particularly important technologies are bio-technology, new materials, microstructure technology and communication technology.

Another type of network should focus at economic solutions of environmental and social problems and should include actors from a variety of different fields in knowledge and technology. Particularly they should include experts in technology, organization and regulation. Major targets should be material flows, recycling, emmissions and waste.

Initiating collaborative efforts

The Commission of the European Communities should strongly support collaboration among SMEs and SMEs with large enterprises. For this purpose, RTD programmes as well as other

programmes offering financial assistance to firms should, if possible, have a rule for inclusion and collaboration of SMEs.

Creation of nuclei for regional economic expansion

The European Commission should initiate collaborative networks as a nuclei for the development of poor regions. The task of the network should be to design and implement a programm which supports investments of large and strong international corporations in lagging regions by heavy subsidies and combines this with measures to build an adequate infrastructure and a network of domestic SMEs around this investment.

Part 1:

The Future of Industry in Europe
Main Results

The economic and social foundations of the European societies are threatened by two developments, namely high structural unemployment and deterioration of environmental conditions. These developments also endanger the viability of industry in Europe.

In order to successfully cope with these problems and to secure its viability, industry in Europe has to undergo fundamental change. Most importantly, it has

* to develop new economic opportunities,
* to shift to an environmentally sustainable production, and
* to implement new production systems.

This requires new technological solutions and a high degree of innovation. Far-reaching changes in European innovation regimes are nessecary.

Not less important is high competitiveness and adaptability of industry. However, short-termed and short-sighted concern with competitiveness may encourage action which endangers of long-term viability of industry.

Competitiveness and adaptability of industry in Europe are closely related to the welfare system. Important aspects of this system, the relationship of work and welfare in particularly, need to be scrutinized.

Fundamental change in industry and development of strategies and structures needs strong support by public policy. This is hardly possible without developing new forms and strategies of industrial policy.

Economic opportunities: The key issue

To develop economic opportunities is the major challenge to advanced industrialized societies. Economic opportunities, that is opportunities for profit, growth and above all employment, are shrinking both in industry and services. These problems may not yet be manifest in all

sectors of industry, but nevertheless they need careful attention. Developments leading to exhaustion of markets can already be observed in a number of industries. Reversing these trends and building up alternatives will take time.

Box 1.1: Economic opportunities: The issue in a nutshell

Economic opportunities are likely to shrink on a global scale. The major challenge for industry in Europe, thus, is

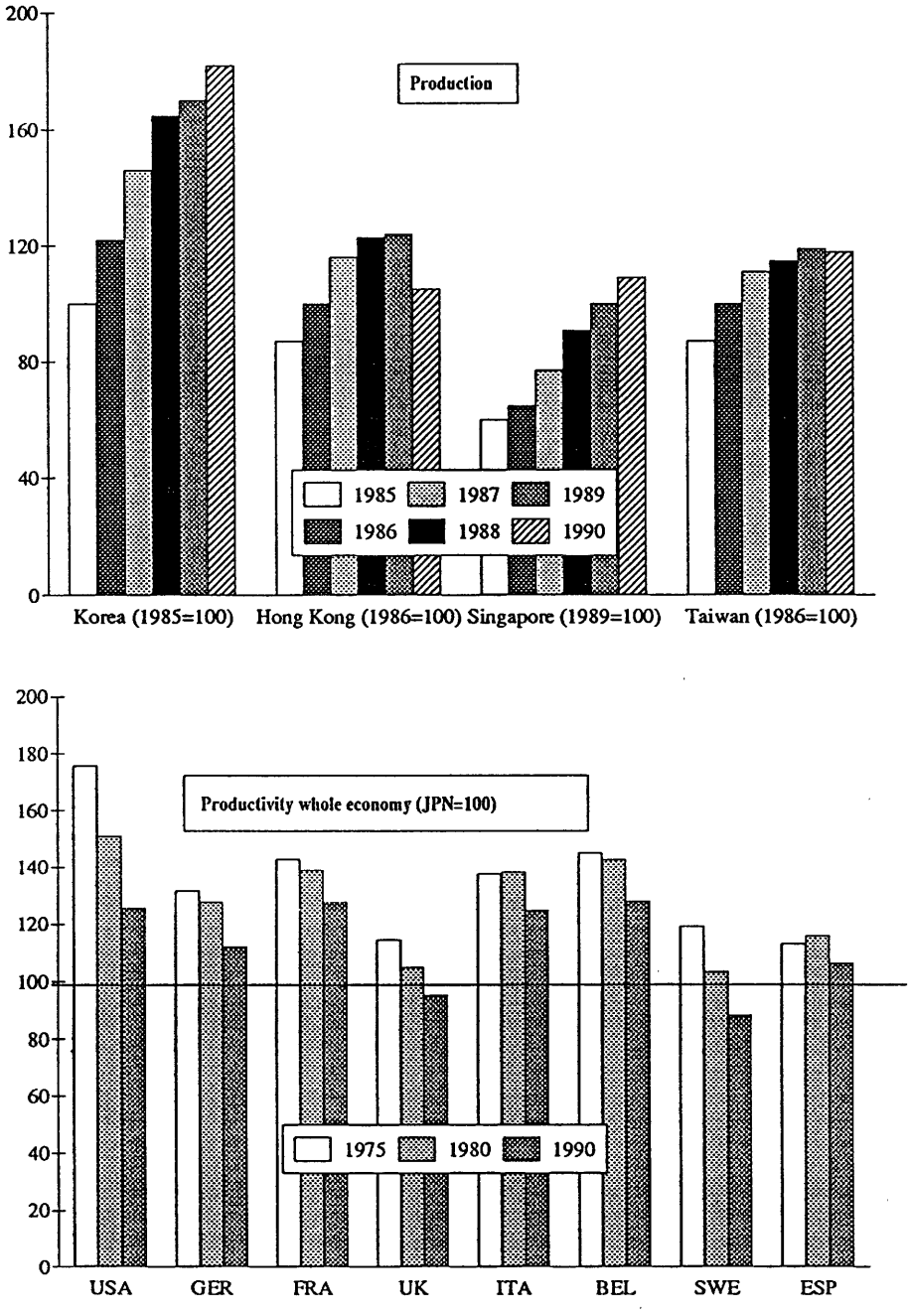
* to develop markets in new directions and to create new markets,
* to develop new economic solutions to social and environmental problems in order to secure a sustainable and vital economy and,
* to rapidly develop and exploit a new technological base for these purposes.

In the past, exhaustion of economic opportunities primarily has been associated with mature markets, that is markets with stagnating demand and low technological innovation. While this is the case in some areas, exhaustion is increasingly due to the growth of world-wide capacities in industry and services, which is often not matched by corresponding growth of absorbing capacities of markets. This is aggravated by newly industrializing countries, where mass income and domestic markets grow much slower than production capacities (OECD; 1988b, 1991a; United Nations, 1990). This is why they push forward on foreign markets, mass markets and quality markets alike.

Exhaustion is already evident in a number of industries. In plastics, steel and air transportation, for example, global production capacities already exceed global demand. Computers are another prominent example which demonstrate that exhaustion is not confined to traditional industries or to low-tech industries, but hits modern high-technology industries as well.

We assume that more industries are facing similar developments. Accordingly, losses of economic opportunities in some industries are unlikely to be compensated by corresponding gains in other industries.

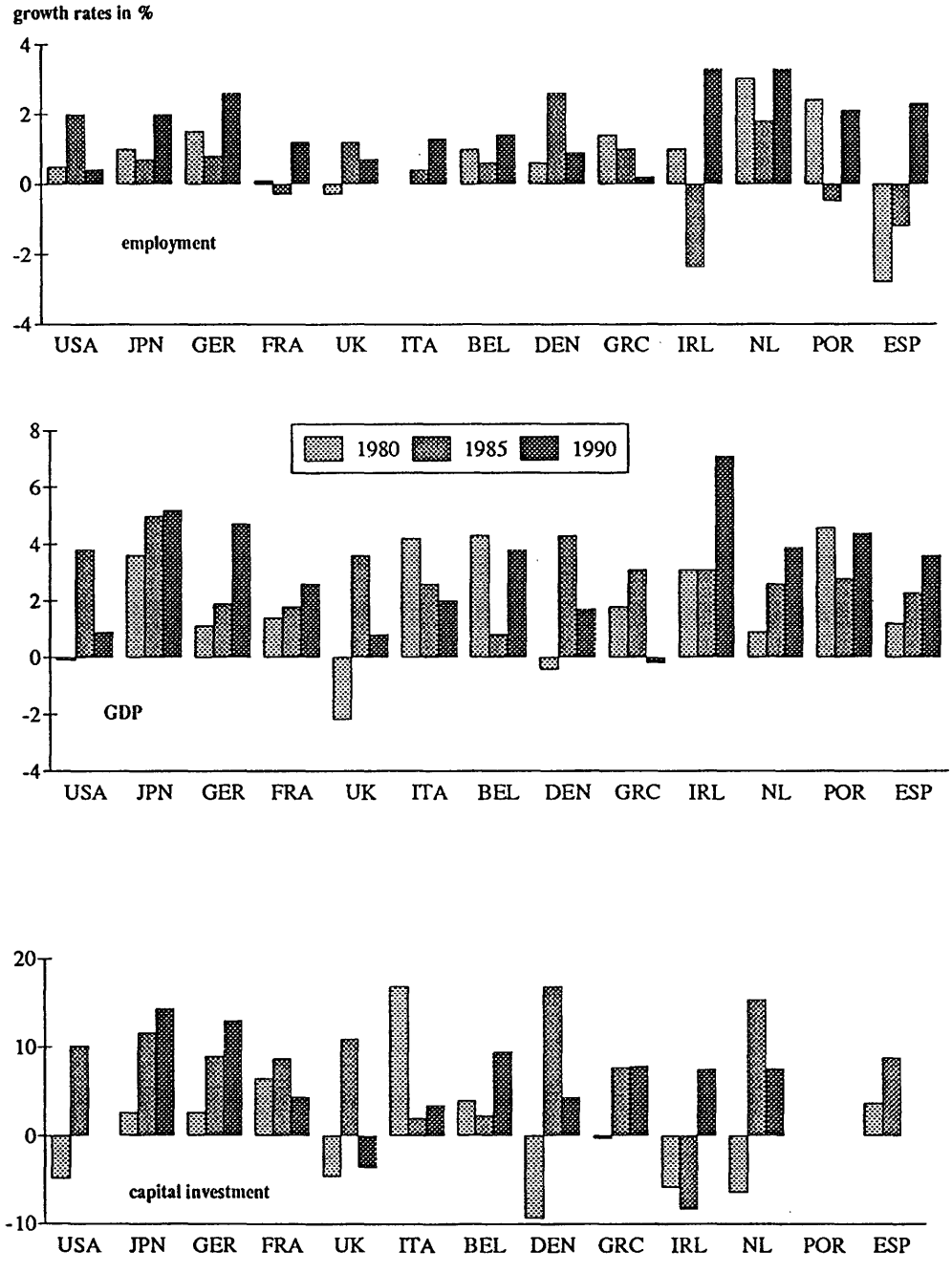
Fig. 1.1: Sources of exhaustion



Source: OECD 1991; Japan Productivity Center

In a worst case scenario, we have to assume that this will lead to massive unemployment in Europe. Since many years already, employment in the industrialized countries is growing much slower than GDP and capital investment. Excessive capacities and exhaustion of economic opportunities may dramatically alterate the decline of employment.

Fig. 1.2: Growth of GDP, capital investments and employment in industrialized countries



Source: OECD, Historical Statistics.

We are not speaking here of cyclical changes in employment, but of considerable structural unemployment. A declining number of highly skilled workers produces an increasing amount of goods and services, whereas a growing part of the population is excluded from regular paid work (CEC, 1989).

The threat of massive unemployment often motivates policy makers to take refuge to publicly finance jobs and training activities as a bridge back to regular employment. Yet, this is a strategy to cope with cyclical unemployment but not with substantial structural unemployment.

In view of a severe threat of exhaustion and related structural unemployment, an active approach to economic opportunities is necessary. A set of strategies ranging from product innovations or changes in design which significantly improve the functional, social or aesthetical value of products to development of new products and new markets have to be implemented. The aim of industry in Europe must be to rapidly diversify in new businesses and markets.

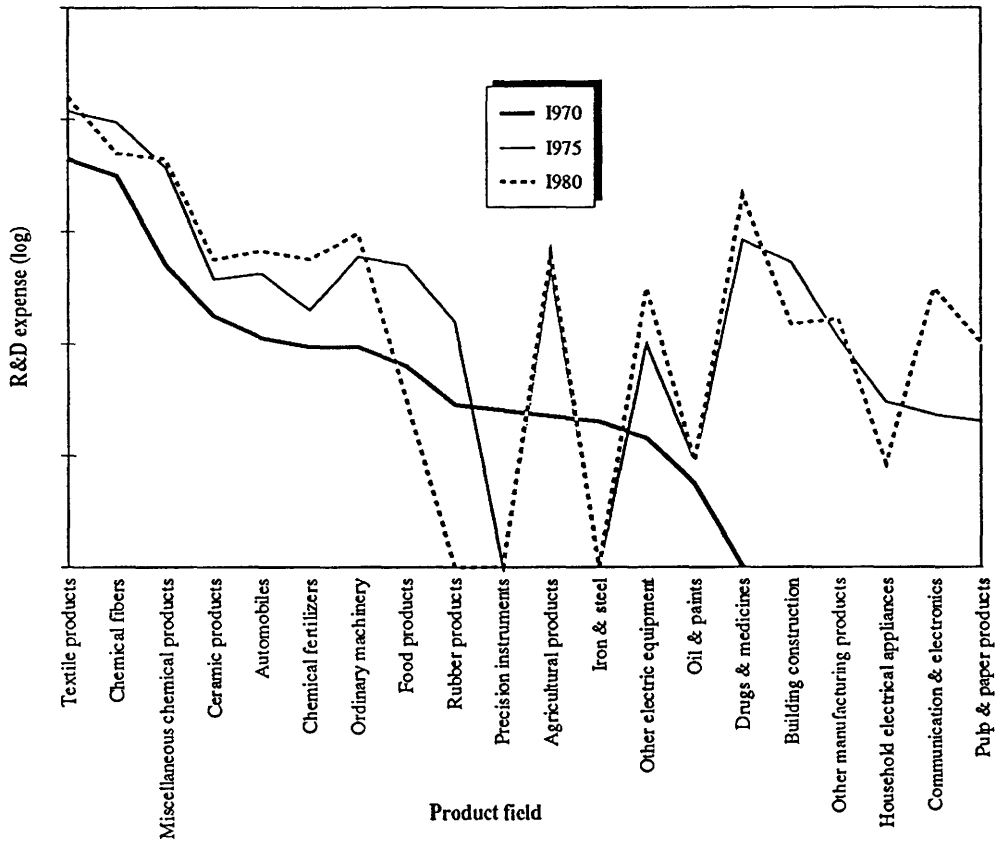
In Europe and the United States, enterprises usually diversify in a particular way. They buy other firms and use theses acquisitions to develop business activities in other markets. With few exceptions, this strategy is simply a reshuffling of assets from one enterprise to another.

In order to create real new economic opportunities, a different type of diversification is needed. Enterprises have to use their potential, particularly their know-how and technological competence and the skills of their workforce, to develop new products for new markets. Along with this, the workforce has to be transferred from declining to new business.

This type of diversification is successfully applied by a number of Japanese companies. They have developed a type of diversification which is technology-led and attempts to develop new products on the basis of the technological knowledge and competence of a firm and its personnel. This may be confined to new applications of existing technology, but usually includes broadening and development of the technological base. An illustrative example for this case is the development of R&D in Japanese textile industry. (Kodama, 1991)[1].

[1] Interesting cases of such a diversification strategy are firms like Nippon Steel and Kobe Steel which have managed to reduce their traditional business considerably and to secure employment and returns by developing new business.

Fig. 1.3: R&D profile of diversification in Japanese textile industries



Source: Kodama, 1991.

Success of technology-led diversification strongly depends on companies' ability to identify problems, needs and demands which so far have not been satisfied or for which better economic solutions may be developed. This may be called the socio-technology approach to diversification.

A socio-technology approach to diversification combines two strategies:

* A systematic exploitation and development of companies' technological base, and know-how of human resources, and
* a systematic orientation towards social needs and societal problems which are hitherto not satisfied by economic measures.

The aim is to develop a technological solution for such needs and problems which may be translated into a marketable product. This requires

* a combination of a creative marketing with long-termed R&D;
* to overcome organizational impediments, such as segmented structures or a lack of collaboration across firms;
* to handle high uncertainty concerning the application of technology and the translation of needs into demand;
* high investments in both marketing and R&D;
* to think far beyond the usual time horizon of firms' activities; and last not least
* a reorientation of European and American enterprise culture and the related definition of enterprises.

European industry has its stronghold in traditional markets, and fails to invest timely in new fields of business and technologies. Accordingly, only few have developed new products and markets[2].

This is evident when you look at patent data. European industry has problems to catch up with the leaders in new technologies, particularly in data processing and in semiconductors, but also in biotechnology and new materials. Their patents concentrate in traditional industries and technologies.

There is, thus, a considerable discrepancy between

* the growing need for industry in Europe to develop new products and new markets and to diversify accordingly, and
* the reluctance and inability of European industry to invest and innovate outside established fields and to develop new products for new markets.

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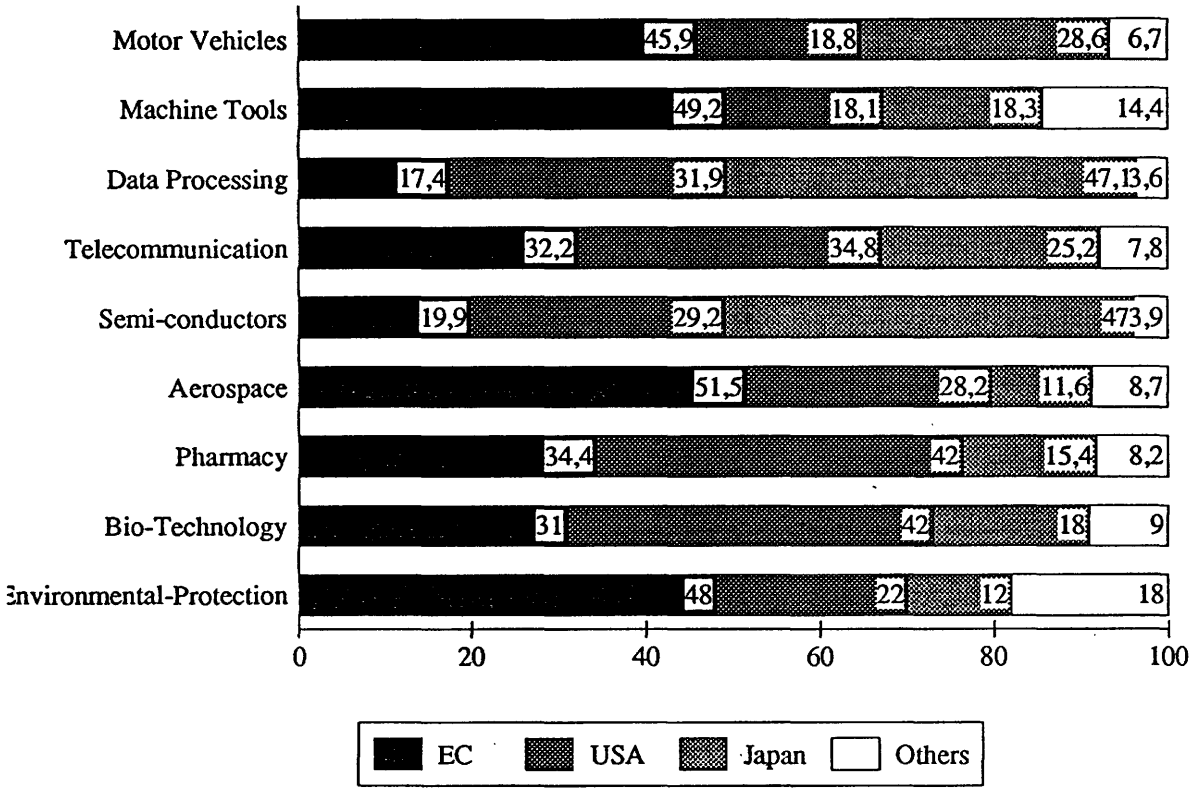
[2] An illustrative case for this situation are developments of new materials, particularly of multi-materials where American and Japanese firms act both faster and more systematic than most of their European competitors.

Fig. 1.4: Patent shares in major industries



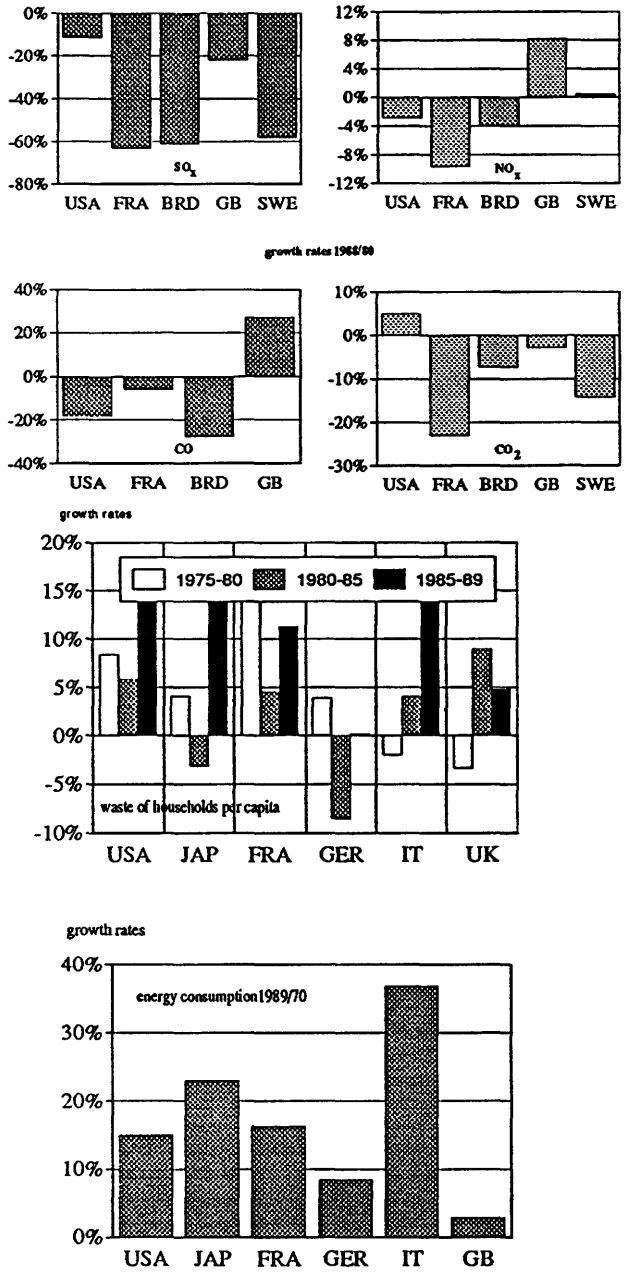
Source: Ifo (quoted in Wirtschaftswoche), 1992; Ifo, 1990.

Creating new economic opportunities requires a new philosophy of growth: got "more of the same" but specific solutions for social and environmental problems. An example for the application of this philosophy is environment.

Environment: A new approach to growth

As various studies demonstrate, environmental problems and concern are sharply increasing in the advanced societies as well as on a global scale. This requires changes of industrial structures and strategies. Strategic atmosphere depletion, greenhouse effect and global spread of air pollution remain critical issues. Moreover, there is a massive increase of waste and in energy consumption (cf. Brown et al., 1991; Burrows et al., 1991; CEC, 1992a; OECD, 1991d; von Weizsäcker, 1990).

Fig. 1.5: Air pollution, waste and energy consumption in OECD countries

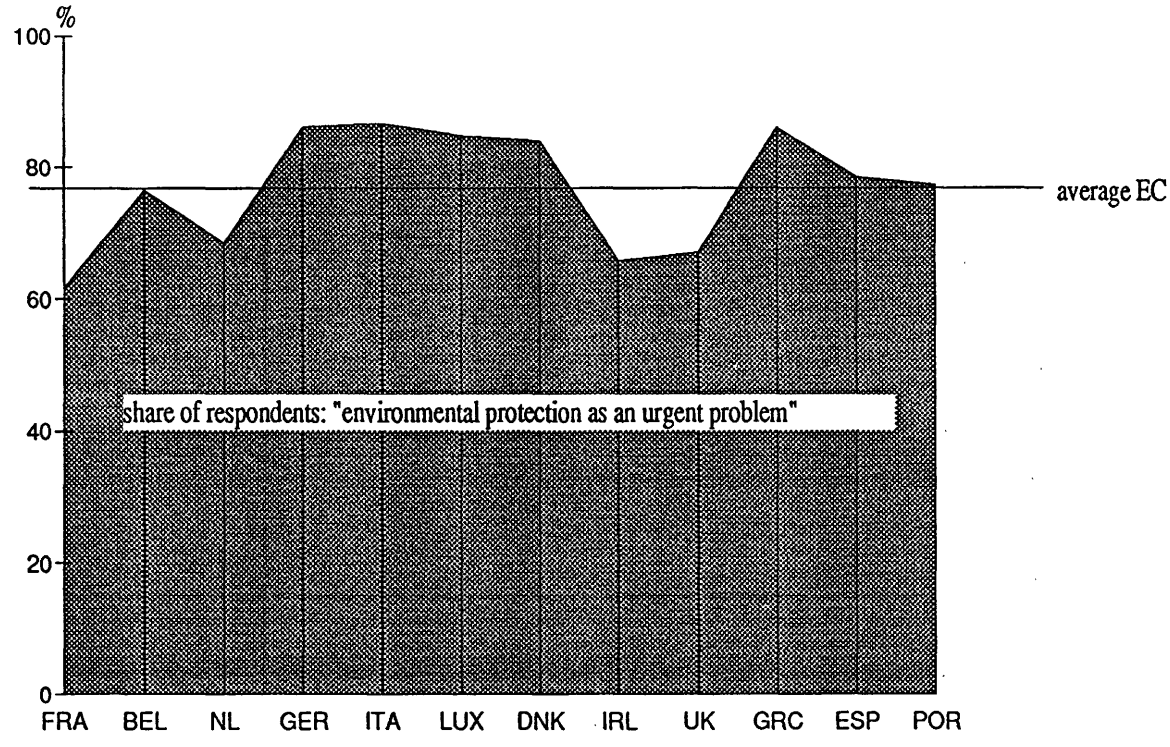


Source: OECD, Environmental Data, 1991; own calculations

Though environment is an extremely critical issue for industry, economic solutions of environmental problems are often missing. Environmental problems are still solved primarily by political rather than economic means. As a result, frictions and contradictions between environment and industrial growth are building up.

Within the population of the member countries of the European Community, there is a high concern for environmental problems. This holds not only for the rich but also for the poor countries. In most of the countries a majority of the population also accepts that environmental protection is a necessary precondition for economic development.

Fig. 1.6: Environmental concern in the European Community

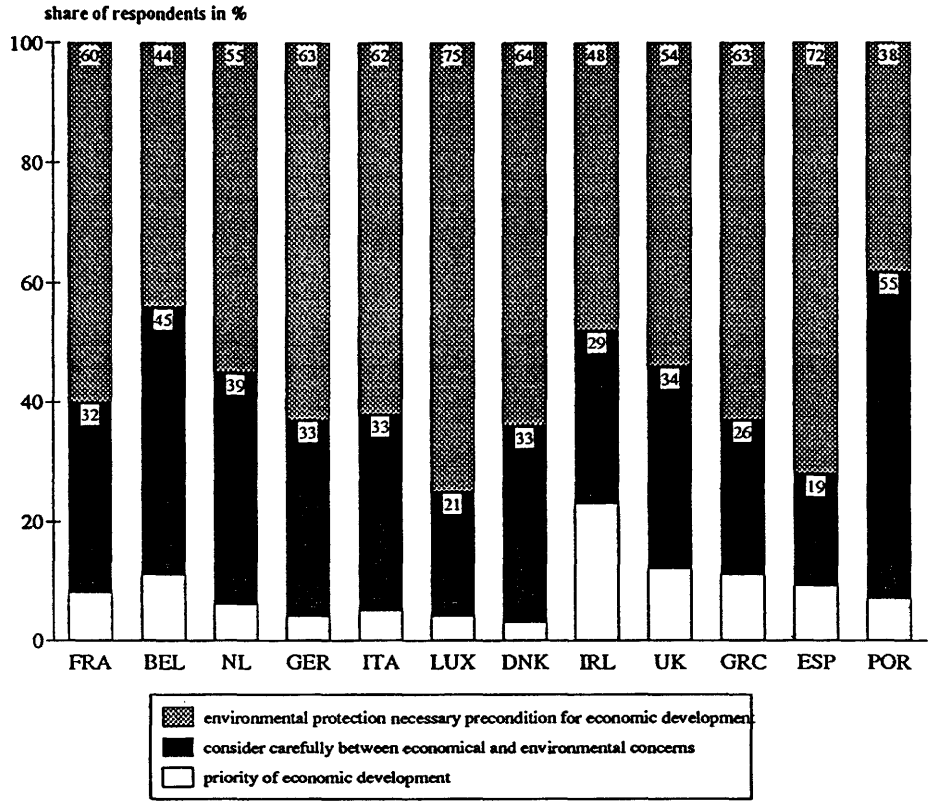


Source: Eurobarometer 29, 1988

These positive attitudes towards environmental issues do, however, not result in much willingness to effectively trade environmental protection against material well-being rather, there are simultaneously high expectations concerning material well-being as well as concerning environmental quality.

As a result, a large proportion of the population in Europe assigns high priority both to a high material living standard and a high non-material quality of life.

Fig. 1.7: Attitudes towards environment and the economy in the European Community



Source: Eurobarometer 29, 1988.

This results in a contradictory situation. On one side, societal values support strong and even increasing pressure for political solutions to environmental problems. They also create strong restrictions and problems of acceptance for industry. On the other side, they render it very difficult to solve environmental problems at the expense of material living conditions. Political solutions to environmental problems face severe restrictions concerning their effectiveness.

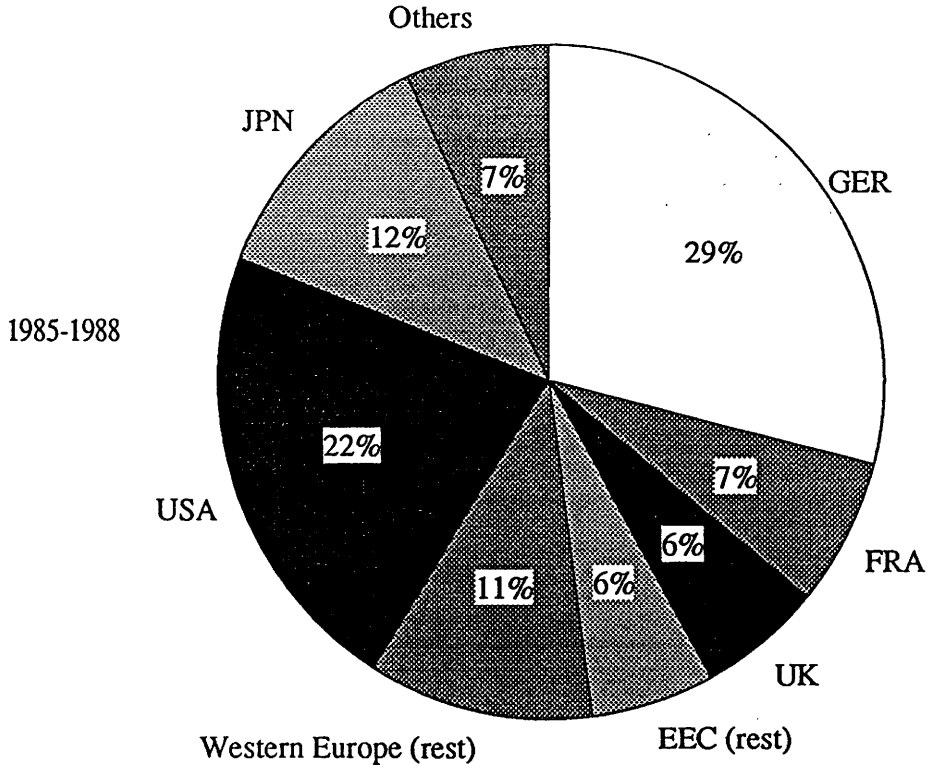
In order to resolve this multiple dilemma, new economic solutions to environmental problems have to be found. Rather than being a restriction to growth and competitiveness, the solution

of environmental problems should be used as a motor to open up new economic opportunities and to enlarge the scope of market solutions[3].

As a memorandum of the Commission of the European Community shows, economic solutions to environmental problems bear high growth potentials for many industries. It is, therefore, realistic to use the solution of environmental problems as a means to develop new economic opportunities and to overcome exhaustion (CEC, 1992a).

Industry in Europe, Germany in particularly, is in a good starting position for environment-based growth. It has already significantly invested in relevant R&D and holds a high share of international patents.

Fig. 1.8: Patents in environmental technology



Source: Ifo, 1990.

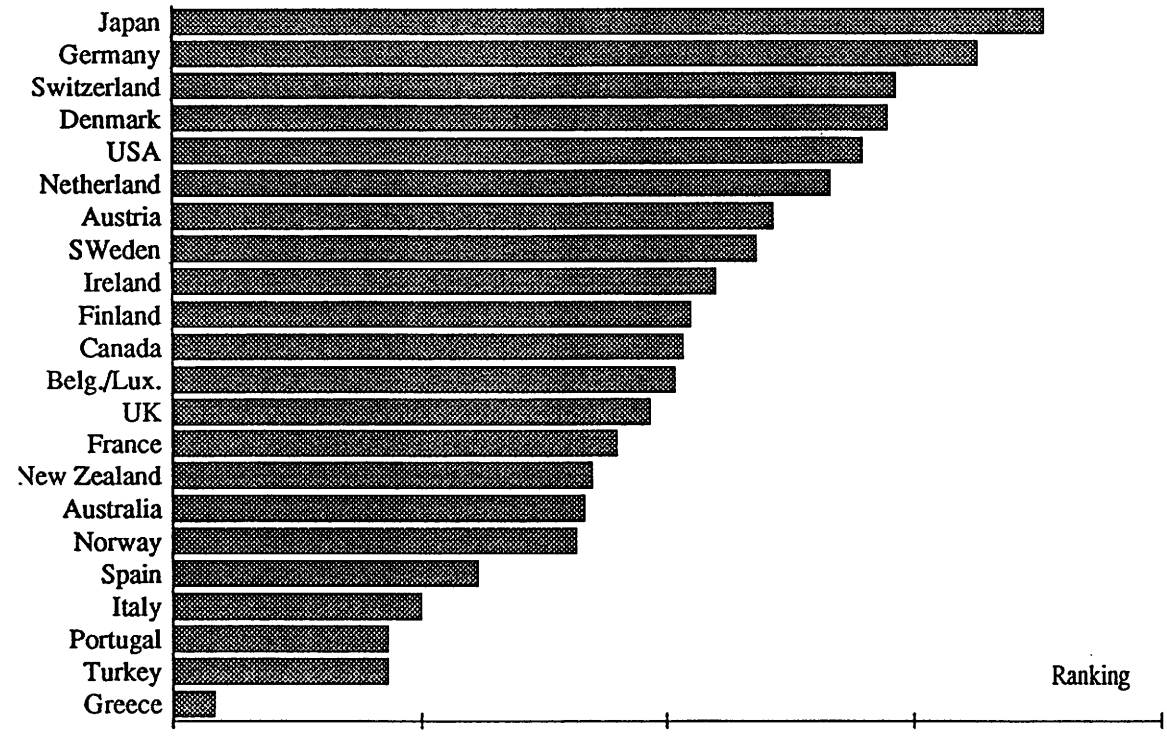
[3] There is a broad discussion on economic instruments for environmental policies. This discussion, however, is strongly concentrating on issues of regulation and often neglects issues of technology and product development. - Cf. CEC, 1992a, 1992b; OECD, 1989b, 1991e; Scherp, 1992; von Weizsäcker, 1990).

Obviously, neither market forces nor governmental regulations are likely to produce sufficient incentives for the ecological restructuring of industry. The strategic issue, thus, is that industry in Europe may miss the chance to use the solution of ecological problems as a motor to develop new economic opportunities.

Competitiveness: Is European industry loosing ground?

Current debates on industry in Europe are dominated by concerns about failures in competitiveness. The arguements are often exaggerated. As the *World Competitiveness Report 1992* shows, the overall picture is not necessarily discouraging, yet there are a number of factors which need careful attention.

Fig. 1.9: The World Competitiveness Scoreboard/Executive Opinion Scoreboard



Source: World Competitiveness Report, 1992.

Some of the European countries, namely Germany, Switzerland, Denmark and the Netherlands rank high on most factors. A number of countries, e.g. the United Kingdom and France, perform rather modestly. Only few countries, particularly Spain, Italy, Portugal and Greece seem to have general difficulties with respect to competitiveness.

It is important to keep this broad picture in mind, because debates on competitiveness are often one-sided and short-sighted. This in turn leads to strategic choices, which

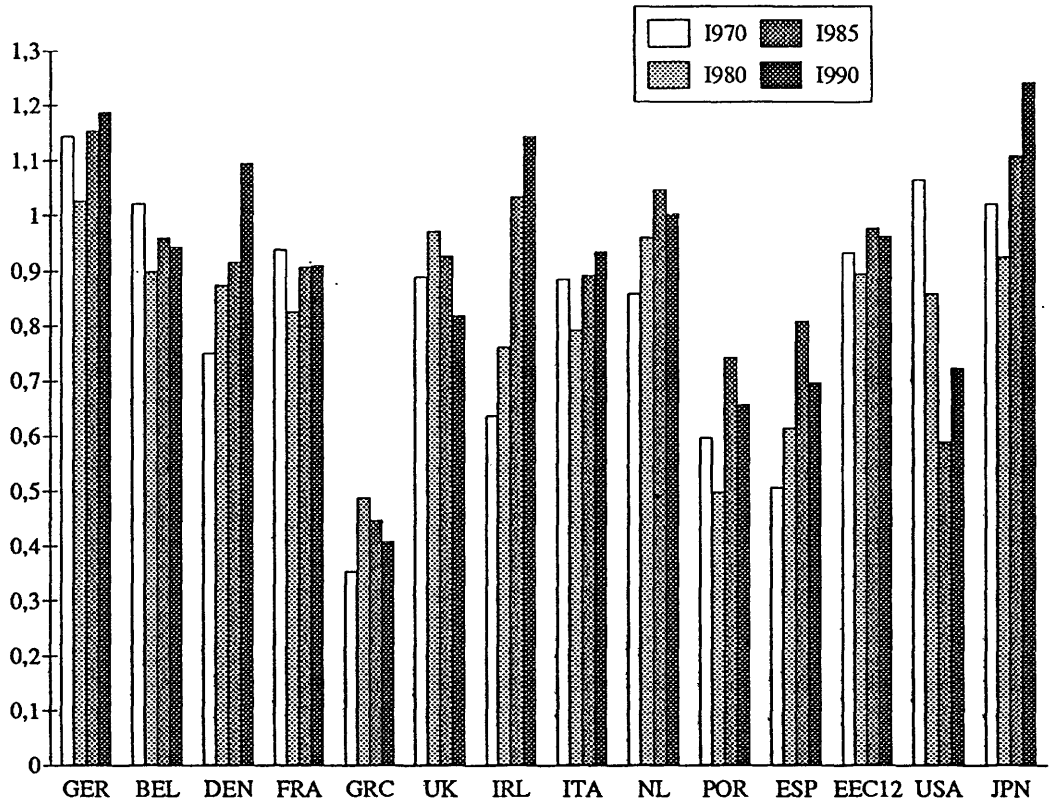
* improve a particular aspect of competitiveness, but create new or increased problems concerning other aspects e.g. by reducing wages and creating a loss of purchasing power;
* solve problems in short-term, but endanger vitality of industry in the long run e.g. by protectionist politics;
* promote competitiveness of certain industries in some parts of Europe, but hinder development in other regions e.g. fostering care technologies which are dependent on a highly sophisticated infrastructure.

Many countries of the European Communities show unfavourable terms of trade. Between 1980 and 1990, only in Germany, Ireland and the Netherlands terms of trade have developed positively. Belgium, Portugal, France and Italy have improved their position, but values have remained negative. The other countries of the European Community have declined.

This picture reflects well-known conditions of the European economies but there is also reason for new concern:

1 the significance of labour costs as a factor of competitiveness is changing,
2 "soft factors" of competitiveness are gaining importance; and
3 technological competence is becoming an even more critical issue.

Fig. 1.10: Terms of trade of OECD countries



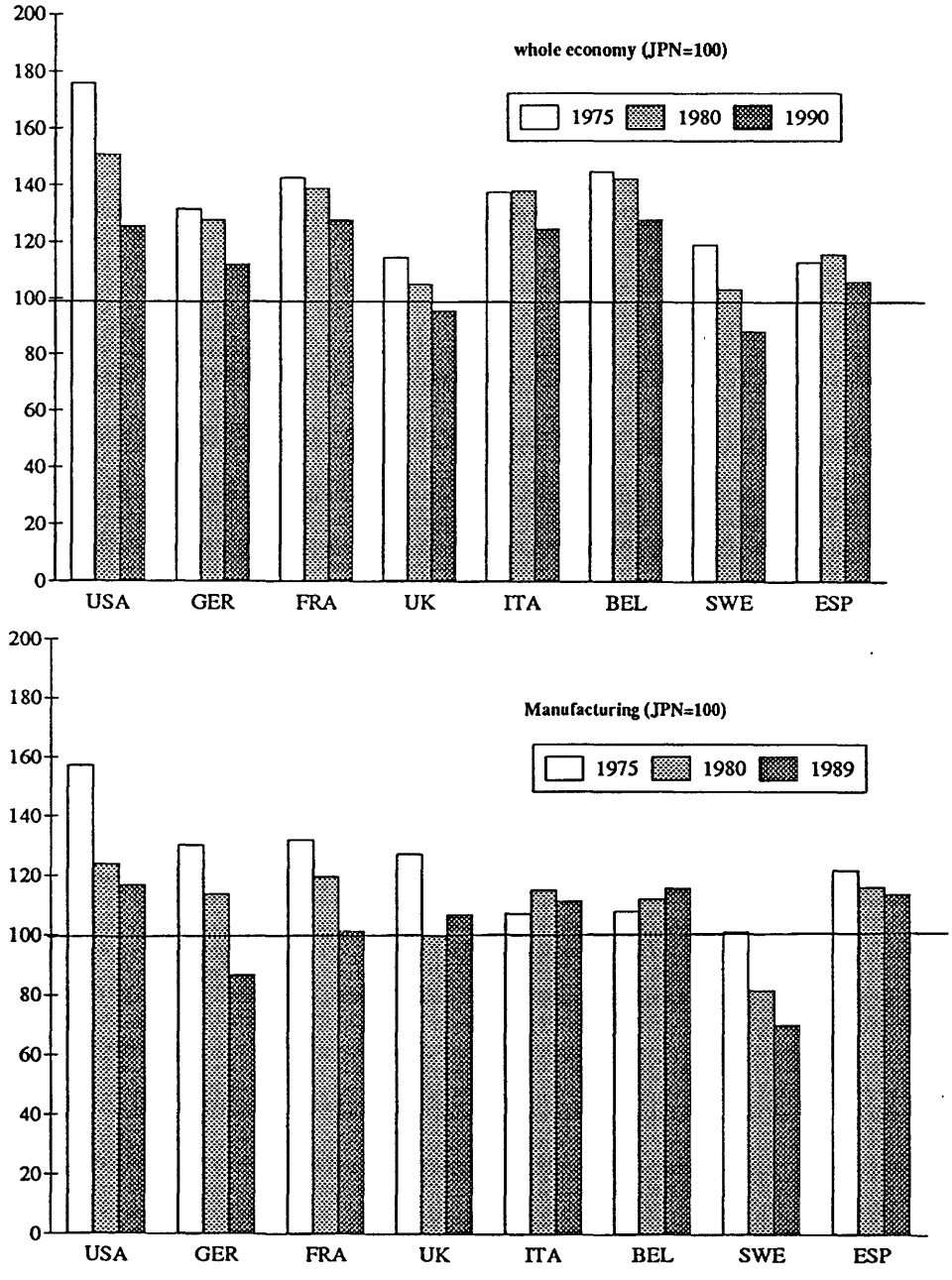
Source: Statistisches Bundesamt 1992; Statistisches Jahrbuch für das Ausland, 1992; own calculations

Both Japan and North America are, as is Western Europe, surrounded by countries with much lower labour costs. However, as labour costs in Asian and, in Latin American countries are rising faster than those in Central and Eastern Europe, Western, Europe is facing stronger competition from its "cheap labour neighbours"[4].

If we analyze labour cost problems carefully, we often find that the real issue is productivity originating from wrong or delayed adjustment to structural change. The European economies on the average show comparatively high labour productivity. Yet this is mostly due to the performance of the service sector. In manfacturing Europe scores low (Lehner et al., 1993; OECD, 1991a, 1991b).

[4] Saying this, we do not wish to support calls for protectionism towards Eastern Europe. Rather, we want to point at the need to support institutional change and rapid development in Eastern Europe. (See Jochimsen, 1991).

Fig. 1.11: Labour productivity in the whole economy and in manufacturing



Source: Japan Productivity Center, 1992.

Data from the Japanese productivity centre measuring productivity in purchasing parity power point at a rather negative position for Europe. It demonstrates that in the 1970's and 1980's, productivity in total manufacturing, including core industries, has declined in Germany in relation to the United States. Japanese industry generally reaches better results. Interestingly

enough, this holds particularly for chemical and steel industries where Germany is considered to have a strong position.

This illustrates that industry in Europe has a productivity problem rather than a labour cost problem. This is the result of faults and delays ^@n the development of organization of industrial production. The relevant issue, thus, is modernization of production rather than reduction of labour costs.

Factors like management abilities, workers' skills and enterprise culture as well as networking of firms, public private partnership or social organization of technology have turned out to be the critical issues to improve productivity (cf. Clark & Fujimoto, 1991; Reich, 1991; Thurow, 1992; Warner, Wobbe & Brödner, 1990; World Competitiveness Report, 1992).

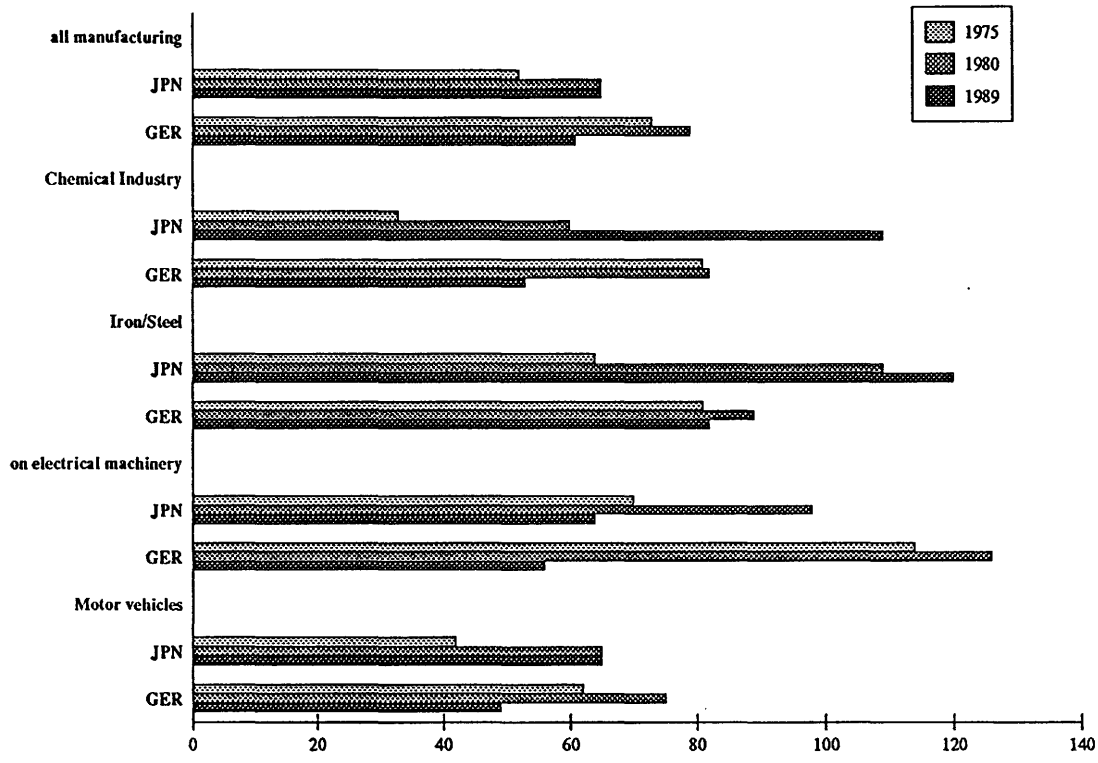
The superior position of Japanese industry in global competition is based

* not only on lower labour costs, but on better organization of production,
* not only on shorter lead time, but on a better innovation regime,
* not only on more high technology, but on better social organization of technology.

Critical issues are to be found both on the "hard" and the " softer" side of competitiveness. Europe does not keep pace in major technological developments and has difficulties to build up an adequate social organization of technological development and innovation (Cf. Lehner et al.,1993; Roussel et al., 1991; van Tulder & Junne, 1988; de Woot, 1990).

Empirical evidence shows quite well that the position of European industry in the development of new technology is not particularly strong. Data on patent flows in the Triade between 1981 and 1988 point at a dominance of the United States and Japan.

Fig. 1.12: Development of labour productivity in Germany, the United States and Japan



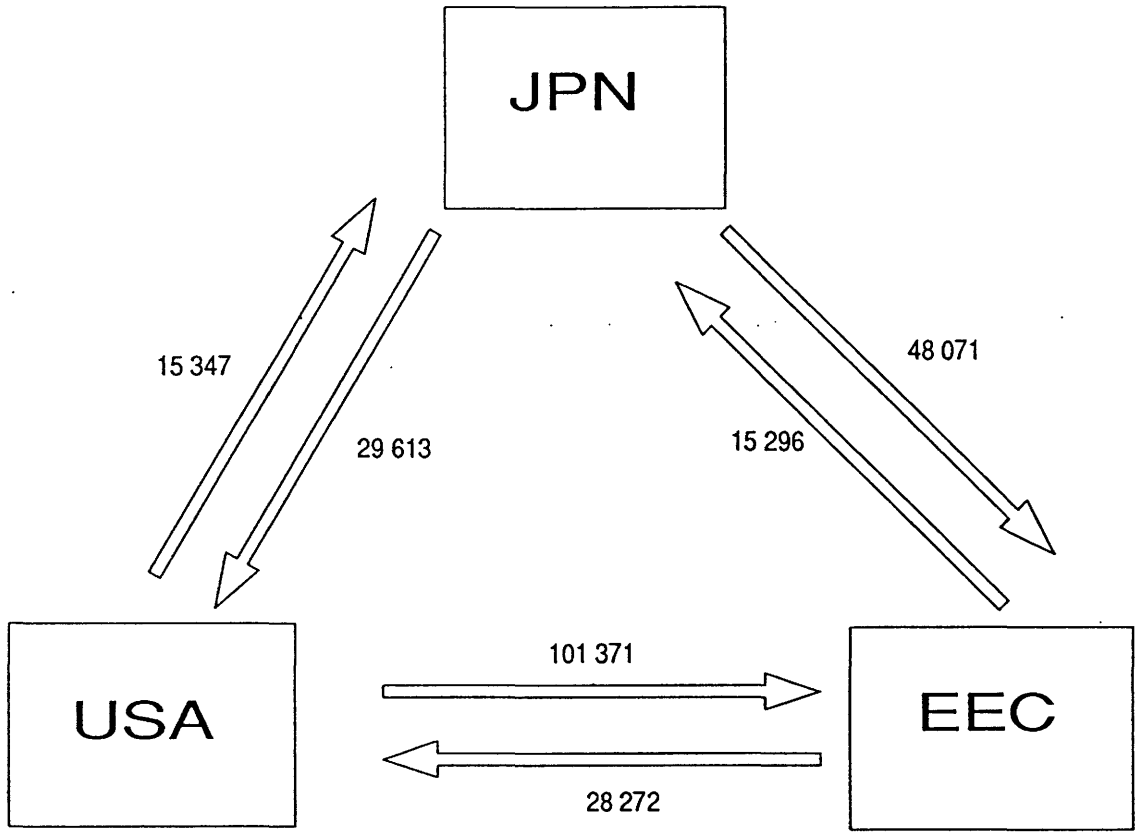
Source: Japan Productivity Center, 1992.

Box 1.2: Challenges of technological competence

There are at least three problems that may lead to a significant decline of technological competence in European industry, namely

* the weak position concerning key-technologies,
* deficits in systematically building up technological linkages, and
* a technological "fundamentalism" instead of a market oriented management of innovation.

Fig. 1.13: Patent flows in the Triade

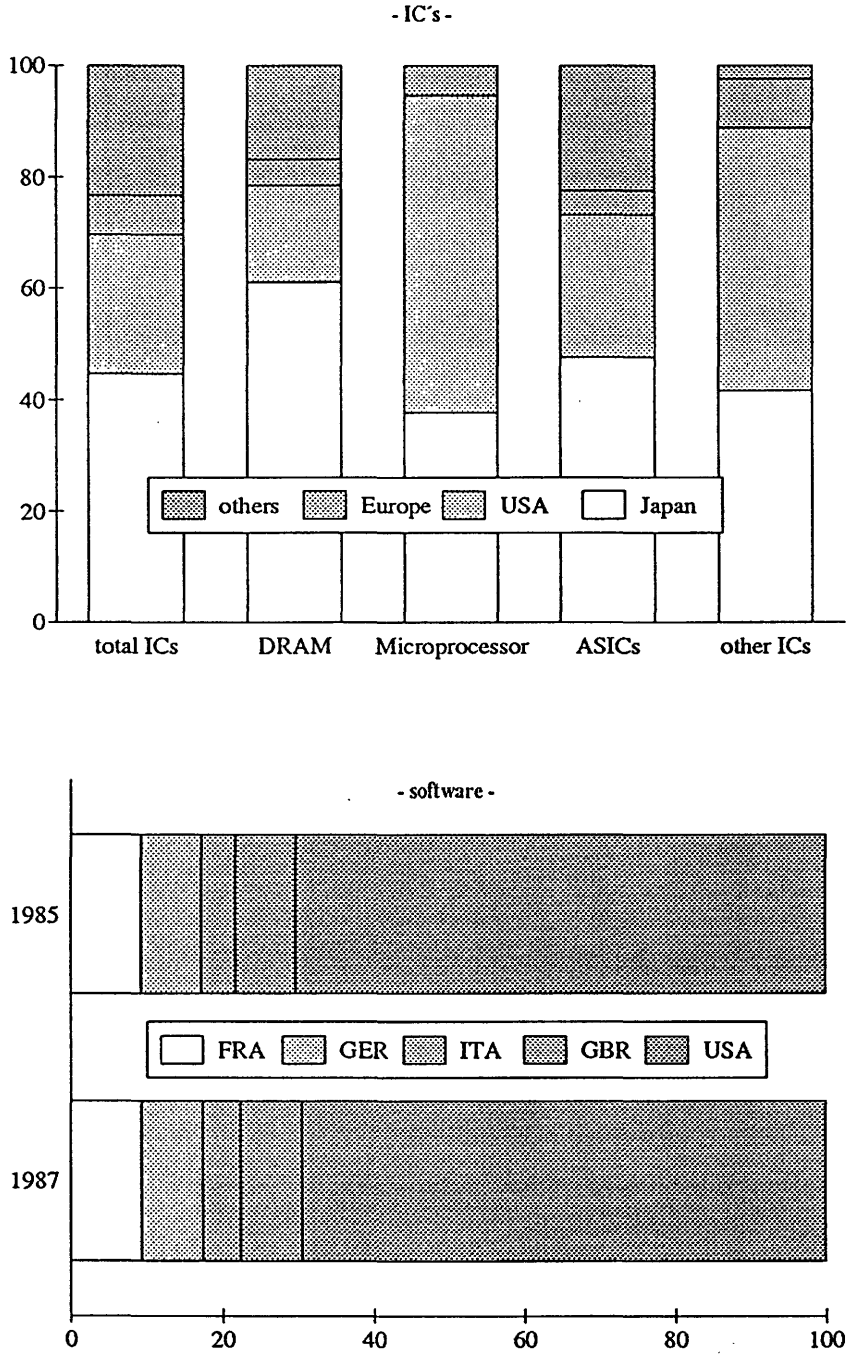


Source: OECD, Science and Technology Indicators, 1991; own calculations

In particular Europe has a weak position in information and communication technologies. The development situation is somewhat better for software where the United States dominate, but Europe has secured a rather good position (BMFT, 1993; OECD, 1992; van-Tulder & Junne, 1988; de Woot, 1990).

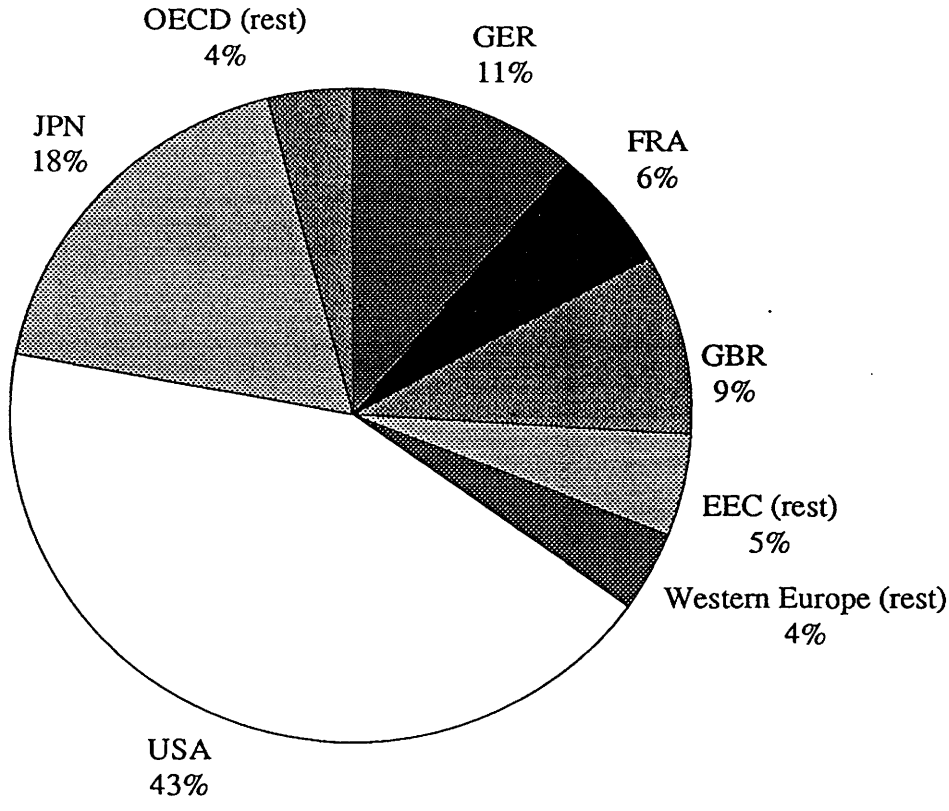
A similar situation can be observed for biotechnology. Patent activities are again dominated by the United States and Japan, whereas in Europe only Germany, France and the United Kingdom participate in the game.

Fig. 1.14: Shares of Europe, the United States and Japan in IC and global software markets



Source: Beldschacher/Klodt, 1992.

Fig. 1.15: Patent activities in biotechnology



Source: Gerstenberger, 1990.

These deficits in key-technologies should not be underestimated, since they have severe consequences for industries in which these technologies are applied. Based on technological interdependencies, a technological "food-chain" (see fig. 1.3O below) links the development of different industries to these key-technologies (cf. Carlsson, 1989; Fransman, 1990; Kodama, 1991; OECD, 1992; United Nations, 1990).

An important element of long-term competitiveness of industry in Europe is its ability to manage the shift to quality production. In the context of global change, industry in the advanced economies has to turn to technologically sophisticated, high value-added production (Lehner, 1992; Ozawa, 1988; Peters & Waterman, 1982; Reich, 1991; Thurow, 1992).

Box 1.3: Quality production

Modern quality production is characterized by the following elements:

* a high quality of goods,
* a low degree of standardization and high degree of customization of products,
* a fast adjustment of products to diversified and changing demand,
* a fast adjustment of products to the highest state of science and technology, and
* a strong service component.

Modern quality production constitutes a severe challenge to industrial performance. It requires a synthesis of traditional concepts of quality production and of mass production. This results in a new and complex production system which implies far reaching changes in the organization of enterprises (cf. Beer et al., 1990; Kanter, 1989; OECD, 1991a; Shetty & Buehler, 1987; Warner, Wobbe & Brödner, 1990).

Again results of the *World Competitiveness Report 1992* indicate that industry in a number of member countries of the European Communities have considerable difficulties to meet these requirements:

* In quite a number of countries, price/quality-ratio of domestic products is on the average inferior to foreign competitors,
* quite often customer-orientation is rather weak, and
* in some countries, production technologies are outdated in comparison to foreign competitors.

These difficulties illustrate only part of the problem of quality production. What is even more alarming is the insufficient organization and integration of technology, human resources and management.

Tab. 1.1: Industry in transition

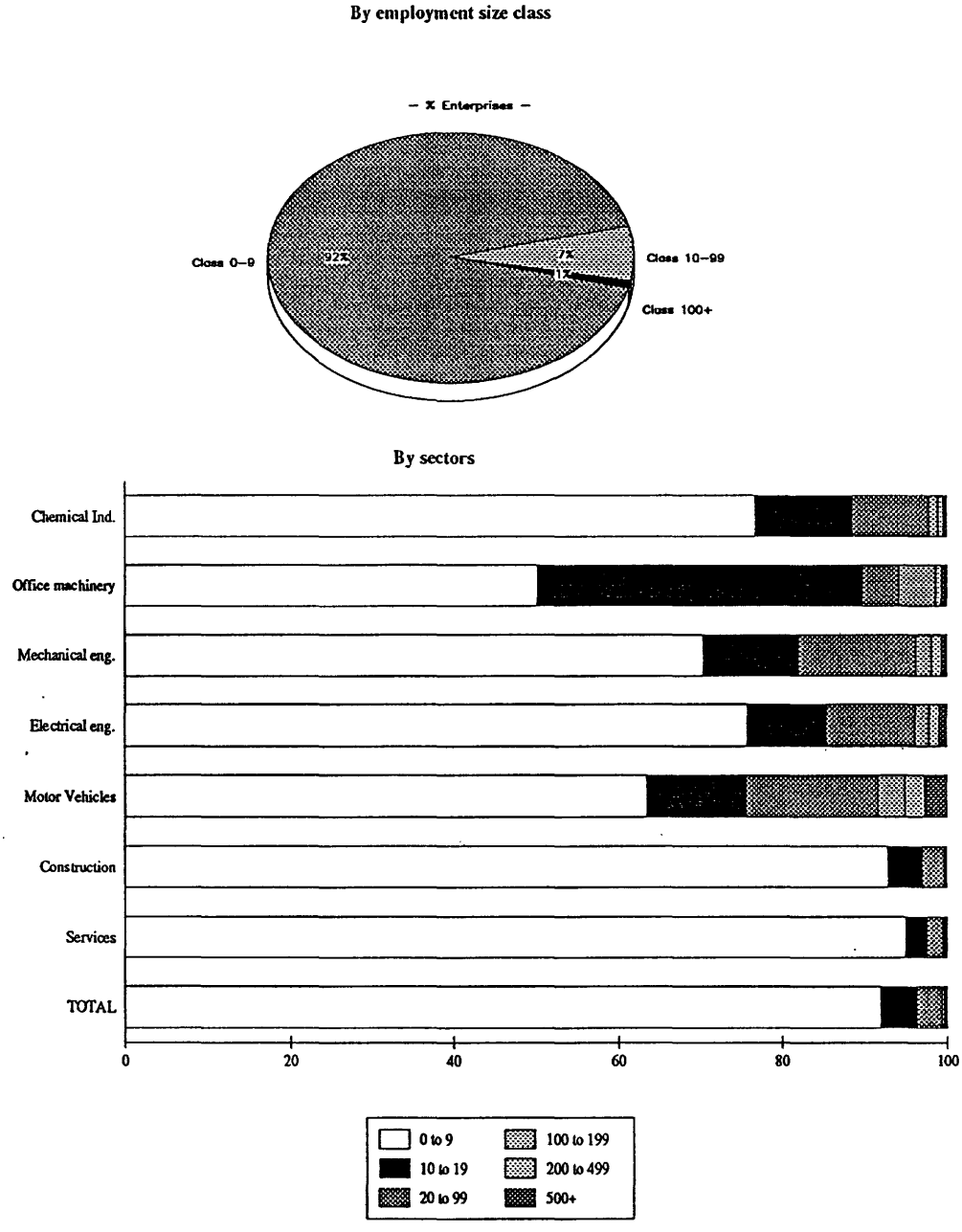
Yesterday	Tomorrow	Aims/ potential results
Product strategy:		
Long series, undifferentiated products	Short series, specific products	Personalised products
Product, price	Solutions, services	Price premium for qualitiy, reliability,performance
Quality control	Performance audits	Equal priority given to design, production, delivery
Manufacturing strategy:		
Volume, scale	Speed, response time	Rapid new product introduction
Throughput	Flexibility	Multi-use equipment
CIM, robotics	Logistics, flow dynamics, design	Design to reduce handling, movement, transport
Organisational strategy:		
Complexity	Organisation	Avoid diturbance, disfunction, breakdowns
Hierarchy	Autonomy, responsability	Better solution because close to problems
Market entry and direct investment strategy:		
Local, national markets	World markets	Target and differentiate products, services, markets
Sub-contracting	Partnership	Spread risks, share gains
Low labour-cost suppliers	Direct investments in key markets	Directly enter new markets

Source: OECD, Industrial Policy in OECD Countries, 1991

Small and medium enterprises: A case for concern

A considerable part of the European economies is made up by small and medium sized enterprises (SME). Speaking in sheer numbers, more than 90% of all enterprises in the European Communities have less than 10 employees while only slightly more than 1% of the firms has more than 100 employees. These shares vary considerably between the member states of the community and within different industries. Firms with less than 500 employees hold a share of 70% of total employment and approximately the same share of total turnover.

Fig. 1.16: Distribution of enterprises in the European Community



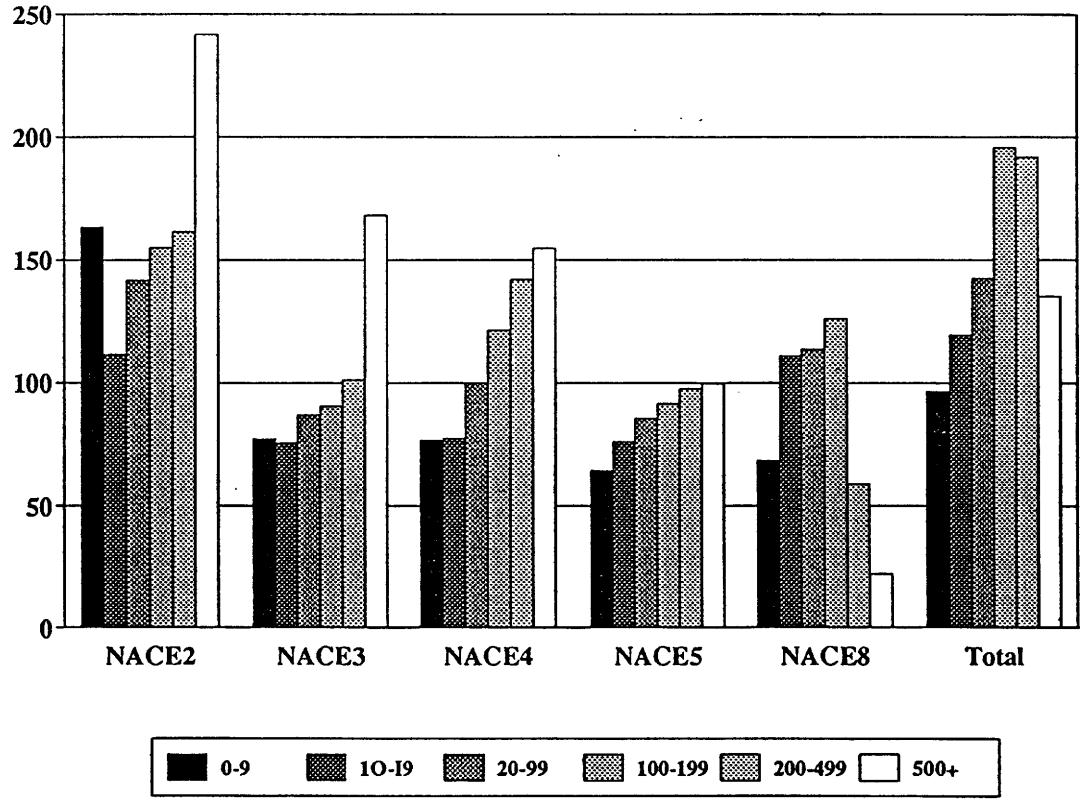
Source: Eurostat 1992; own calculations.

Many small and medium sized enterprises face an uncomfortable future. In particular, they are confronted with:

* increasing competition in their traditional market niches by large enterprises with decentralized and flexible organization;

* increasing financial and organizational burden in keeping pace with rapid innovation and structural change;
* increasing problems and costs of marketing, sales and services in volatile and globalizing markets.

Abb. 1.17: Turnover per employee by firm size in selected sectors



Source: Eurostat, 1992; own calculations.

In areas where international markets develop and where they loose their traditional niche markets, small and medium enterprises may have severe problems to stay in business. To enhance their profit situation, large firms are forced to also serve smaller markets. Moreover, modern production technologies provide the necessary flexibility to serve niche markets. Thus competition is intensified in markets, which formerly have been the domain of only a small number of SMEs.

Box 1.4: Types of small and medium enterprises

Types of Small and Medium Enterprises:

1. Market localists
- micro-sized firms, acting in a local or regional context
- orientation towards local consumer tastes and demands
- no subcontracting, no mergers and acquisitions
- poor access to finance capital and consultancies
- high rate of fluctuation, low entry and exit barriers
- often familiy based, low wages
- volatile individually, but stable altogether

2. The Craft Based SMEs
- specialized in diversified and customized products of high quality
- high skilled workers, flat hierarchies, low division of labour
- lacking of close networks of cooperation
- limited access to finance capital, R&D, and distribution channels
- problems with increasing speed of innovation
- threatened by takeovers of big-sized firms

3. SMEs within Regional Networks (Industrial Districts)
- craft based SMEs within networks of suppliers, customers and competitiors
- regionally embedded in support infrastructure
- export orientation
- high degree of product innovation
- lack of marketing and research facilities
- undercapitalized
- their niche markets are threatened by larger competitors

4. High-Tech SMEs (Technological Districts)
- often small firms with technolocically advanced products for special purposes
- highly skilled workforce (often with university degree)
- often spin-offs from larger firms, universities or public research institutions
- high dependence on large organization

5. SMEs in the New Division of Labour
- subcontractors or suppliers of large assembly firms
- first group: system suppliers with cooperative ties
- second group: producing standardized products and used as buffers for costs and risks

Small and medium enterprises are not a uniform class. Rather, there are different types of firms with different types of problems. Many SMEs operate in narrow local or regional

markets in which they are well integrated. They can quickly adapt to changes of demand and are not much affected by structural change and maintain a rather secure position.

Against that, many craft-based SMEs, specialize in highly customized products with high quality and technological sophistication and high export rates face more and more direct competition by large enterprises. Their position is often at risk.

Different types of SMEs share one problem. They have poor access to capital markets, R&D institutions, consultancy and distribution channels. As a result, they often have difficulties to keep pace with innovation and to cope with the internationalization and globalization of their markets.

Experience of SMEs operating in industrial districts underline that these problems can to be solved by interfirm collaboration. Regional networks allow for flexible specialization of the individual firm, while network as a whole reaches a high degree of diversification.

A considerable part of the SME economy is closely linked to large firms as part of their supply structures. These structures are currently changing quite dramatically. Large firms integrate and simplify their supply systems and impose rising demands concerning research and technical development activities on their suppliers which are hard to fulfill.

It is common knowledge that small and medium firms are economically successful because they do things that large firms are not able to do or cannot do efficiently: Serving local markets and market niches, producing highly specialized goods and exploiting marginal labour forces. While this has been true in the past, it is hardly a promising strategy for the future.

The advice must be different. Large enterprises decentralize and develop towards a system of firm-in- the-firm with similar flexibility and capabilities as SMEs. SMEs, on their part, will have to develop those properties which make up for the strength of large enterprises. These are capabilities to accumulate and concentrate large resources, to exploit synergies and to coordinate a variety of different developments. This can be done by means of collaboration and networking. Possible strategies for collaboration are:

1 to find a shelter in large groups and to renunciate of autonomy in order to gain access to the properties and resources of a large enterprise,
2 to collaborate in a "kingdom", that is to work closely with a big-sized firm providing market access and strategic orientation, or
3 to cooperate in a "republic" where several firms collaborate on equal terms and bring in their particular strengths in products, production processes and markets (cf. Sengenberger/Loveman/Piore, 1990).

The need to collaborate is cutting across long-standing traditions of the SME economy. Due to these traditions, SMEs are usually quite hard to convince to collaborate with competitors. Collaboration, and networking thus, will not emerge on its own. Processing approaches to initiate networks between SMEs have been undertaken in Denmark as well as by a number of EC-programs. The success of these programs justifies further public and private endeavours.

Employment, work and welfare: The great challenge

Work and employment are the most serious future challenges to industry and society in Europe. It seems as if we were approaching the end of an epoque, in which wealth was drawn from human work. Payed labour is becoming a scarce good rather than a basic factor of production. A relatively small but highly skilled and motivated workforce produces rising wealth. Those less skilled and less performing disappear in unemployment statistics, informal work, odd jobs or join the clientele of welfare offices.

Industry in Europe is under high pressure to strongly increase its productivity in order to secure its competitveness. European societies however, may pay a high price for successfull improvement of productivity: structural unemployment.

Generally speaking, structural unemployment is caused by a mismatch of quantities and qualities of labour supplied and labour demanded. E.g. the introduction of new manufacturing processes combined with the spreading of new materials will affect employment as well as

the relevance of skills particularly those traditionally associated with metal bending and shaping (Hayward 1992). These processes are mainly due to a time lag between actual change and adjustment.

In the seventies Europe had experienced growth in output going along with growth in employment. In the late eighties and nineties, it has seen growth produced by automation going along with high unemployment rates, high demand for skilled labour, regional isles of growth and a periphery loosing industrial and human substance (Hayward 1992; OECD, 1992).

Structural unemployment is not only a danger to industry. Similar developments are to be expected in the services as well where e.g. modern communication technology and flexible organization are likely to create a strong increase of productivity.

Box 1.5: Productivity Competitiveness and employment: The critical issue

The industrialized societies in Europe are, in a condition where significant productivity increases are necessary to stabilize competitiveness. But competitiveness alone can not be translated into gains in employment. This is why new products and new markets are necessary.

Necessary strategies to increase productivity reduce employment otherwise, if no new economic opportunities are opened up in the long run productivity-induced unemployment will endanger the economic and social conditions which are vital to industry in Europe.

There are two basic strategies for firms to enhnace productivity and competitiveness: by automation and by intelligent production systems intergration technology and human resources. Although the latter shows a number of advantages concerning flexibility inovation, these systems, too, are out for reducing input to get the same output. Under ceteris paribus conditions thus, intelligent production systems will also add to structural unemployment.

Tab. 1.2: Umemployment rates and vacanies in France and Germany

Germany	retall sales volume	industrial production	unemploy-ment rate	vacancy rate indicator	composite leading indi-cator
1985	100	100	7,1	100	104,3
1986	103,3	102,2	6,4	136,4	103,1
1987	107,4	102,5	6,2	149,4	105,3
1988	110,6	106,2	6,2	164,7	111,4
1989	114,2	111,4	5,6	218,9	114,3
1990	123,5	117,2	4,9	261,5	115
1991	131	120,8	4,3	270,9	112,1
France	retall sales volume	industrial production	unemploy-ment rate	vacancy rate indicator	composite leading indi-cator
1985	100	100	10,2	100	101,8
1986	102,4	101,1	10,4	107,2	108,8
1987	104,5	103,1	10,5	117,3	108,2
1988	107,9	107,3	10	134,9	113,1
1989	109,6	111,3	9,4	161,1	112,8
1990	110,1	112,7	8,9	166	107,1
1991	109,7	113,3	9,4	130	107,9

Ironically enough, structural unemployment is often exacerbated by welfare systems. Welfare arrangements in most of Europe support flexible adjustment of the work force to change limiting individual negative social and economic consequences. This mechanism provides

significant incentives to solve economic problems at the expense of employment rather than encouraging alternative economic solutions.

While European social security systems are based on the externalisation of adjustment problems at the expense of welfare budgets, the Japanese system of life-time internalises employment problems resulting from structural change. Large Japanese firms can not simply reduce their workforce to adjust to declining business. Rather, they are forced into processes of diversification thus creating new jobs for their workforce. Besides this is certainly one arguement to explain high capabilities to develop new business in Japanese industry.

Given this situation, current welfare arrangements have to be reexamined with respect to their short and long term impacts on work and employment. More specifically, the strategic problem is to develop alternative designs for the transition from work to welfare, and to develop the European welfare regime towards a stronger support for employment, flexibility and productivity while maintaining a high level of social security.

Important challenges to industry and industrial policy also result from the aging of the labour force. The expectation of experts is that after the year 2000 there will be more older than younger workers.

For firms these demographic trends have important consequences for pay structures, skill levels, recruitment policies, innovation and organisational structures:

* Pay structures and social benefits in most countries follow some kind of seniority rules, raising the cost for "old" labour,
* skill levels and a propensity for innovation is dependent on continuous training which older workers rather tend to look upon as a challenge to their competence,
* higher average age of workforce is associated with higher sickness rates.

On the other hand,the experience of older workers gain in importance as rapid innovation requires experimental application and continuous improvement of new technologies. This may

partly compensate for negative impacts of an aging labour force. This requires adequate training and further education programs, suitable working conditions and also design.

Box 1.6: A strategic problem: Work and welfare

Welfare systems strongly influence the way in which firms respond to decline. Social security systems in Europe often support the reduction of the workforce as a means of adjustment. Against that, the Japanese system of life-long employment forces firms to respond to decline by means of diversification and development of new business.

Another alternative to cope with demographic problems is regulated and selective immigration. Scenarios covering the years up to 2010 have shown for West-Germany that, though in the short run immigration would lead to higher unemployment, in the long run it would lead up to higher growth providing even for the employment of immigrants.

The structure of the European workforce also changes with respect to educational qualification.

Again, water must be poured into the wine: an enhancement of general qualification will work out structurally only, if new production systems are installed requiring higher degrees of qualification, and if new products and new markets are developed absorbing the increased productive potential. Otherwise qualification strategies, the more effecient they are, would augment rationalization effects.

Increasing qualification level of the European workforce may enhance competitiveness of industry, but is at the same time associated with a whole range of problems, such as

* higher labour costs,
* declining availability of skilled blue-collar work,
* lower job chances of the less qualified,
* higher claims to the quality of work places, and
* decreasing social cohesion on the shop floor.

At the same time, industry is increasingly forced to continuous efforts in training and modernization of work to maintain and stabilize global competitiveness. Yet the institutionaland organizational framework for continous training is much less developed than for general and vocational education.

Science and technology: A new innovation regime

Viability of industry and development of a sustainable industrial society in Europe is closely associated with a shift towards technology-intensive and knowledge-based production. This does not simply mean high-technology. Rather, it means a broad trend towards a more intensive application of knowledge and technology both in products and processes. (cf. Kodama, 1991; OECD, 1991b, 1992; Tidd, 1991). This calls for not only partial improvments, but a striagent organization of innovation processes. What is needed , is a new innovation regime.

The shift towards technology-intensive and knowledge-based production leads to a new pattern of innovation. This pattern combines technological break-through in basic research, technology fusion to create new products and continuous improvement of products and processes (Lehner et al., 1993)[5].

Innovation processes dominated by an orientation at technological breakthrough are ratther inefficient,as they do not lead up to a continuous development of products, processes and markets. Against that a more market oriented .... of innovation involves a shift from a science based to a learning based mode of innovation.

Europe has considerable capabilities and potentials for a technology-intensive and knowledge based production, and its technological competence is still high. Industry in Europe still is first in the world in technology-exports, but growth-rates on the market for R&D-intensive

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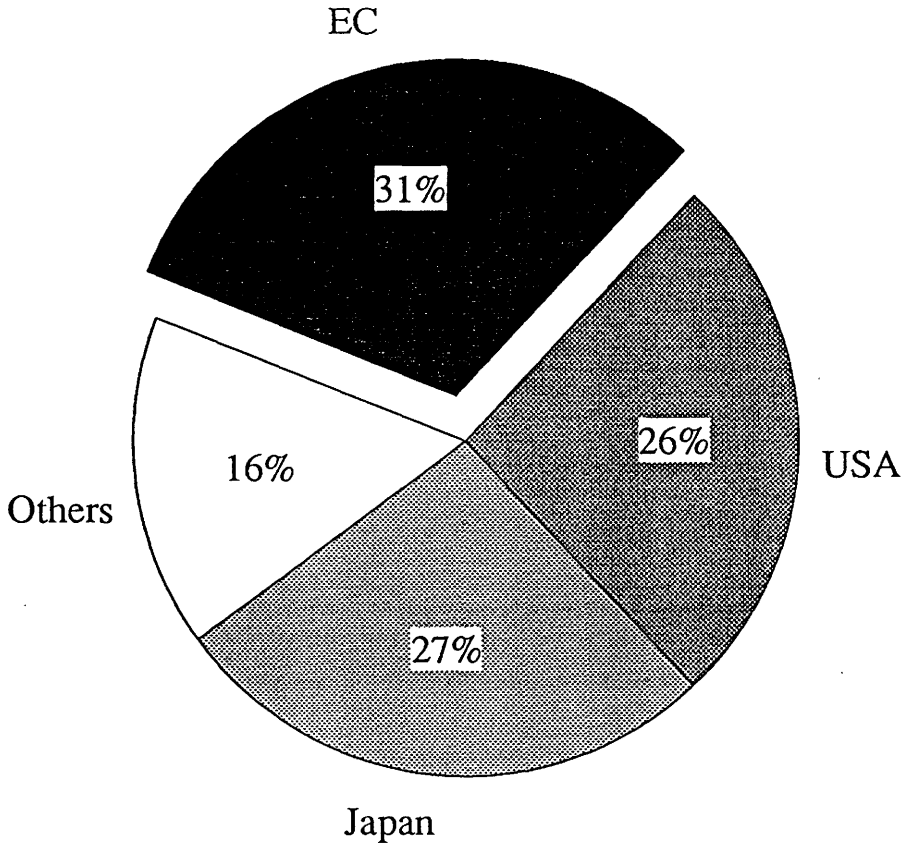
[5] Technology fusion is development of new products based on an integration of different technologies. Illustrative examples of technology fusion are integration of mechanics or optics with electronics in mechatronics and optoelectronics (Kodama, 1991).

products are slowing down(BMFT, 1993). Moreover, industry in Europe has not been capable of developing comparative advantages in technology-intensive industries.

Fig. 1.18: World Trade Share of R&D-intensive Products



Source: NIW, 1993.

European competence in basic research is high. Most European countries put more emphasis on basic research than Japan or even the United States. However, there is a widening gap between basic research and its application and conversion into new products and production strategies. Moreover, the position of European industry in global innovation is often endangered by long innovation times and high innovation costs. (Albach, 1990).

It is well known that Europe has a rather weak position in some key techologies. This is strateggically critical, as "technological interdependencies, a technological food-chain", link the development of different industries to certain key-technologies. (cf. Carlsson, 1989; Fransman, 1990; Kodama, 1991; OECD, 1992; United Nations, 1990).

Tab. 1.3 Innovation Times and Innovation Costs

	Innovation times (Japan serves as an index = 100)		Innovation costs (Japan serves as an index = 100)	
Branch	D	USA	D	USA
Automobiles	112	111	107	103
Office machinery	94	92	134	116
Chemicals	126	119	119	120
Electronics	121	107	117	111
Machinery	113	124	108	114
Metal-working	113	120	99	93
Other	100	96	111	111
All firms	114	113	112	111

D=Germany, USA=United States of America. All figures are average values.

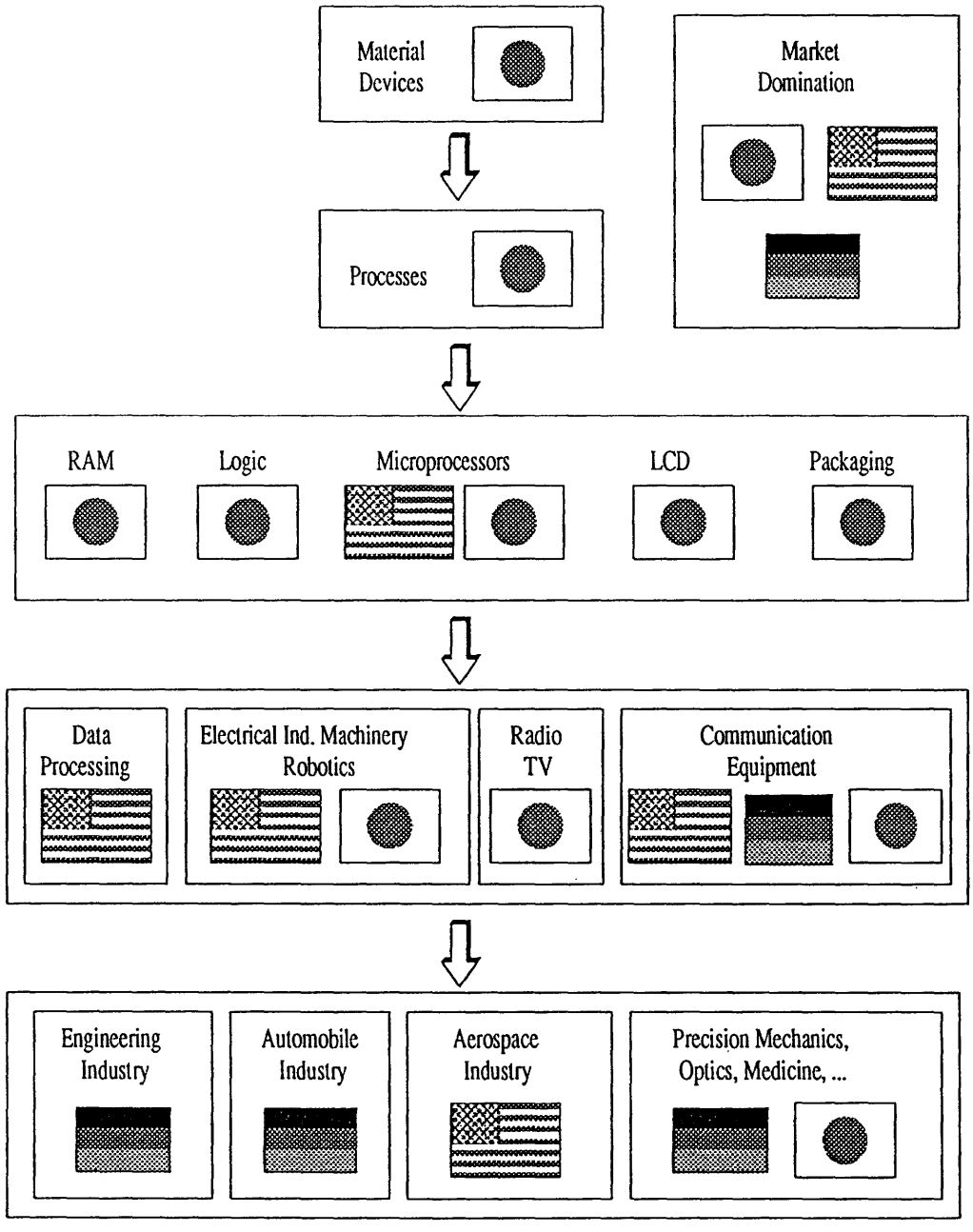
Source: Albach et al., 1990.

The technological food-chain is the simple result of the fact, that development and application of modern technology requires close collaboration between producers and users.

Uneven distribution of wealth in the European Communities has its consequences not only for the infrastructure in science and technology but also for the innovative potential of enterprises. In the South of Europe firms partly are struggling to catch up with a minimum of technological knowledge while the North can afford to head for scientific and technological excellence. Interactive links from North to South still are very poorly developed.

Yet scientific excellence is only one side to the coin; the other side is made up by the social organization of the innovation process (Lehner et al. 1993).

Fig. 1.19: The technological food chain for information technology

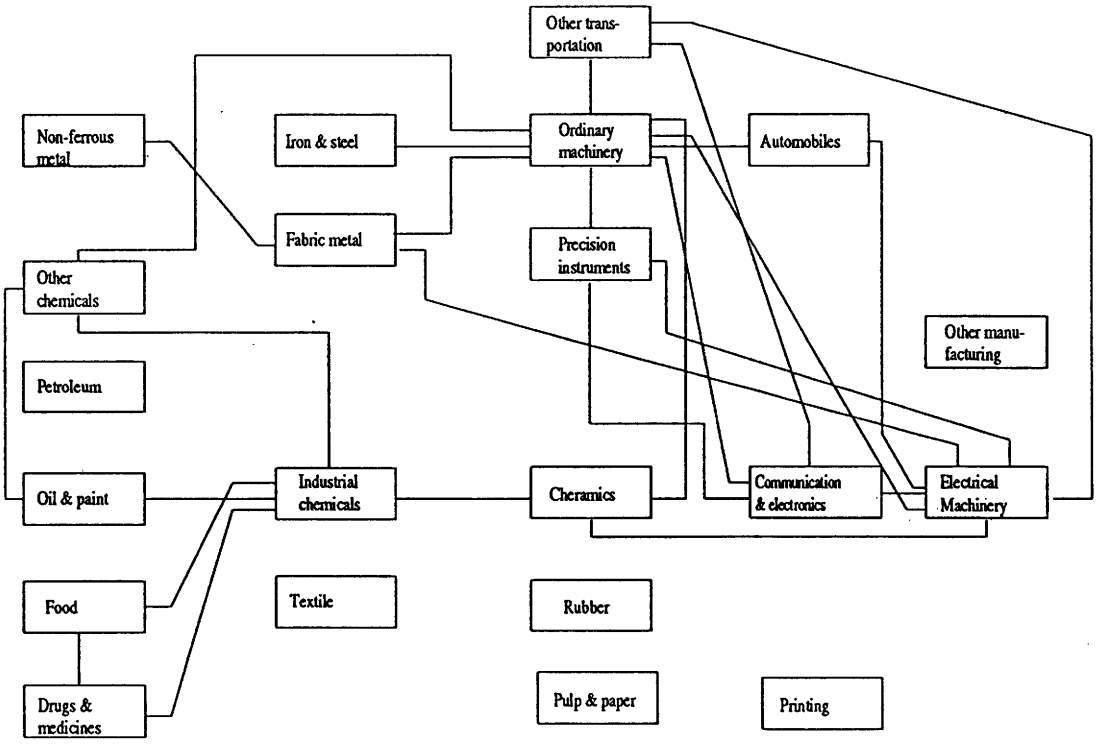


Source: IBM Stuttgart

Japanese success in the innovation race is the product of a different innovation regime. Japanese innovation processes are very closely related to the market and its main thrust are new products and new markets.

For these purposes, research and technological development in Japan is organized in collective projects and networks including a variety of different producers and users of new technology. This opens up not only synergies in technology development but also facilitates facilitates development of new applications of technology and diversification of traditional industries into new fields (Kodama, 1991).

Fig. 1.20: Technological development network for new ceramics



Source: Kodama, 1991.

The difference between Japan and Europe is well illustrated by the case of key-technologies. European programmes on key technologies strongly rely on subsidies for research and application. This strategy, however, fails to produce strong market ties of the newly developed technologies.

More promising strategies should aim at a more favourable environment for development and application of key-technologies. Important elements of such strategies are:

* promotion of strategic alliances, joint ventures and research collaboration to improve international technology transfer and to enhance an open international technology system,
* stimulation of cooperative networks of producers and appliers to facilitate risk-management, to exploit synergies and to establish strong markets ties of technological development,
* development and implementation of a broad socio-technological approach to create markets for new technologies,
* installation of an efficient regulatory regime to promote technological solutions to societal problems, and last not least
* political and technological activities to increase social acceptance of new technology.

Box 1.7: Strategic problems of science and technology in Europe

Development of a powerful innovation regime in Europe is facing a number of strategic problems resulting from change in science and technology:

* The role of university and other public research and its relation to industrial research and development should be reexamined as the traditional division of labour between universities and other public and private research becomes absolete;
* as industrial research is moving more towards basic research, there is the danger that scientific knowledge is privatized and the public stock of knowledge is declining;
* public financing of industrial research can no longer be defined in terms of competitive and precompetitve research, but has to be redefined in terms of strategic research, that is of research exceeding the time horizon of industry;
* traditional sectoral boundaries of research and technical development as well as established patterns of specialization in industry are becoming obsolete and have to be replaced by collaborative networks encompassing different industries and academic disciplines.

Unlike Japan or the United States the European Community has no common tradition of innovation, but rather a variety of different policies and regulatory regimes. Science and technology policies in European Countries are dominated by a concern to optimize national innovation processes in order to keep national economies on a high level.

The development of a powerful innovation regime requires, therefore, the development of an adequate research infrastructure in the less developed regions of European Communities and also the development of European science and technology institutions, such as European centers of excellence or a "European Commission on Productivity".

This should not result in a centralization of science and technology structures and policies. Rather, the idea is to establish a European innovation system with European, national and regional pillars.

New production systems: Changing from within

Discussion about lean production, makes evident that most of the defiencies of performance in European industry are strongly related to organization of production factors. More and more firms in Europe attempt to introduce the major principles of Japanese lean production.

Lean production is well suited to solve a certain range of problems of advanced manufacturing, but neglects others. The strength of lean production is strong simplification and decentralization of production. This includes strict segmentation of production in units with high autonomy and a minimization of interfaces between different organizational units within and outside the firm (cf. Brödner, 1990; FAST, 1984; Lehner, 1992; Warner, Wobbe & Brödner, 1990; Wildemann, 1988).

Yet, segmentation only works if markets are well demarcated and production processes are well defined. If this is not given, and activities within and across firms are interlocked, segmentation creates inefficiencies.

Advanced manufacturing, that is high value-added and technologically sophisticated production, is associated with situations where activities in and across firms are interlocked. Lean production, therefore, has to be complemented the establishment of interfaces betweeen organizational segments and by a flexible management of these interfaces.

Box 1.8: Anthropocentric Production Systems: An Avenue for European Industry

The concept of anthropocentric production system

* is based on advanced scientific knowledge on organization, management and technology in industrial production,
* is grounded on important European experience, tradition and conditions, and
* adapts interesting principles and ideas of advanced manufacturing in Japan.

It aims at a highly flexible, innovative and efficient organization of work and of the broader process of industrial production in a broader sense including R&D, marketing and services.

The concept

Anthropocentric production systems are computer-aided production systems which are strongly based on skilled work and human decision-making.

1 flexible automation supporting human work and decision-making;
2 a decentralized organization of work with flat hierachies and a far reaching delegation of power and reponsibilities, especially to the shop-floor level;
3 a minimized division of labour based on some form of integrated work system design;
4 a continuous, product-oriented upskilling of workers at work;
5 a product-oriented integration of the whole production process including R&D, manufacturing, marketing and servicing.

Flexible automation

Quite frequently, human-centred approaches to manufacturing and production are regarded, by advocates as well as by opponents, as being opposed to the use of advanced manufacturing and data processing technology. Against that, it should be stressed that anthropocentric production systems support the application of leading-edge technology in both products and processes. By this, they also make efficient use of human skills in manufacturing.

Anthropocentric production systems, however, deviate from other concepts of computer-integrated manufacturing with respect to type of technology and the design of computer-aided production systems. For many years, the development and application of computer-aided production technology aimed at full automation. Full automation means a centralised, integrated and complete planning, programming and control of the production process by automated devices. The underlying vision was that of an unmanned factory which was to secure a high precision and efficiency of production as well as low costs. Although this aim has rarely been reached, it played an important role both in reaseach and business strategies.

Meanwhile, it is increasingly recognized that full automation not only involves high costs, but often is the wrong way to a competitive industrial production. Major problems are:

1 Full automation can only be implemented at the expense of flexibility;
2 full automation hinders rather than advances the application of leading edge technology; and
3 full automation may result in high productivity and quality only in certain cases but often restricts productivity and quality.

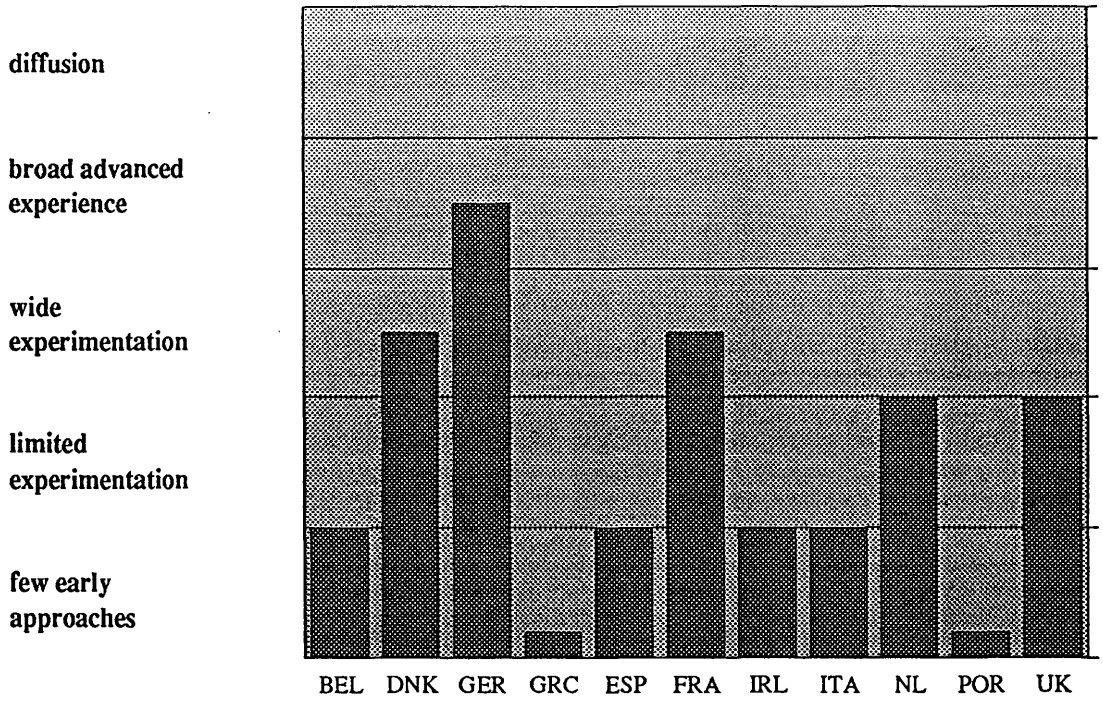
1 if it works at all, mere imitation of Japanese lean production will not make European industry a front runner.

Really advanced manufacturing and modern quality production require beyond lean production.

The task consequently is to develop an organization for fast learning, "intelligent", production systems. Production systems are "intelligent" if

* they make full use of skills, experience and
* knowledge of well trained and motivated personnel on all levels of the organization, and
* combines this with the socio.technological integration of advanced technology.

Fig. 1.21: Anthropocentric production systems in Europe



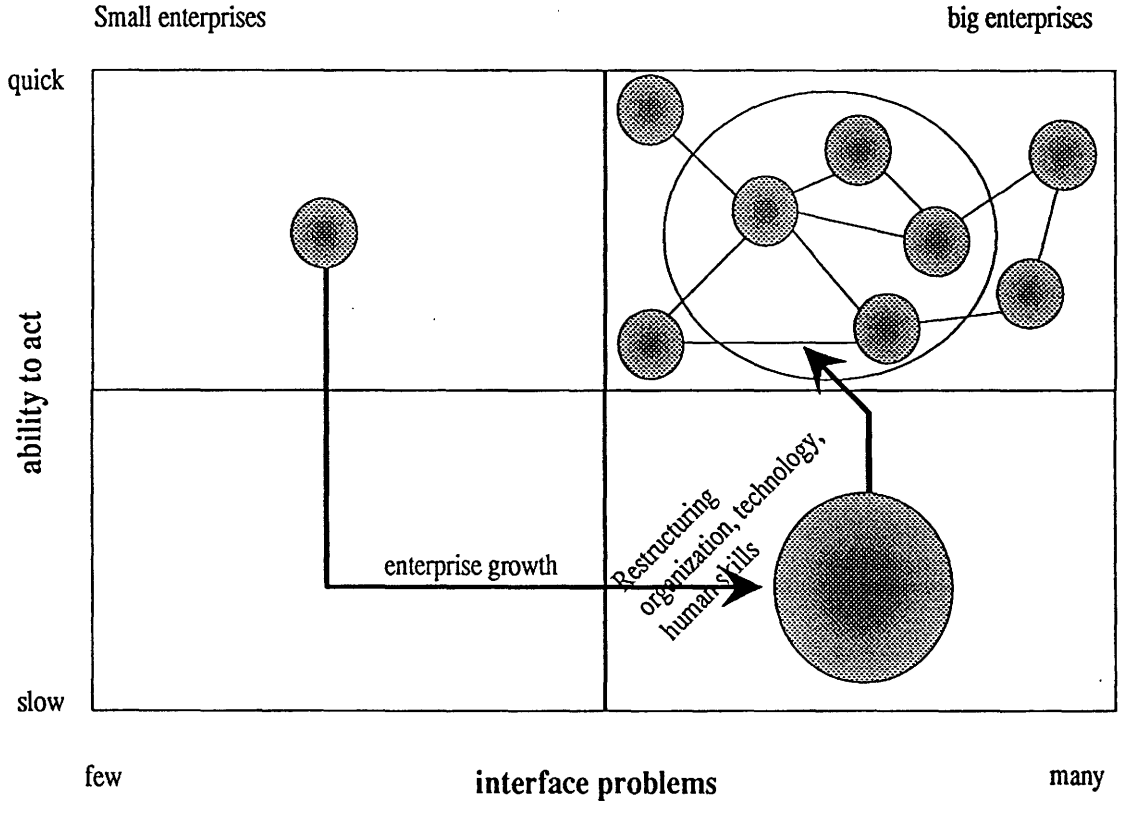
Source: Lehner, 1992.

Most of European industry is still oriented at technocentric concepts of computer integrated manufacturing and quite far away from anthropocentric production systems. In the member states of the European Communities a small number of enterprises has introduced

anthropocentric production systems. In most of the countries, however, experiments are made with anthropocentric production systems. (Lehner, 1992).

This situation points at one of the most critical issues for the future of industry in Europe. Although it is widely acknowledged that competitiveness of industry strongly depends on high performance on the process side, most of industry in Europe still sticks to its traditional organizational structures concerning the allocation of factors (Beer et al., 1990; Lehner, 1992; Tidd, 1991; Warner, Wobbe & Brödner, 1990; World Competitiveness Report, 1992).

Fig. 1.22: Interfaces and flexibility in organizations



Application of the principle of advanced manufacturers are often approached by "firms-in-a-firm" concepts. Organizational units or production segments are treated as a mini-firm which has powers and resources of its own. Relations between different mini-firms are either

governed by internal markets or by the same forms of collaboration as are used in networking between firms[6].

Networking between firms facilitates coordination between firms it helps to exploit potentials, mobilize synergies and to establish collaboration along technological food-chains as an everyday managerial r
routine.

The main problem of networking is not the formal setting of collaboration although this often involves difficult legal and organizational problems. The main problem is to match different structures, cultures and styles and to create an efficient and constructive working milieu for the joint project.

Organising successfull collaboration is anthropocentric management at its best. The "art of managment" is

* to bring the right people together and train them adequately,
* to free them as much as possible form the constraints of hierarchy and formal organization,
* to set up effective incentives for collaboration, and
* to organise intensive exchange of ideas and knowledge between the joint project and the involved firms.

As empirical findings reveal, the development of successfull collaboration is obviously difficult for many firms. Yet where it seems to work is in the so-called "high-tech" industries (biotechnology, new materials, information technology), where cooperation is much more frequent than in mature industries like automotive, aerospace, chemicals, and food processing.

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[6] An instructive example of a "firms-in-a-firm" concept is the plant of Bosch at Cardiff, Wales. Units in charge for the different components of the product are established as mini-firms with strong delegation of powers and responsabilites. Relations between the mini-firms are designed as producer-client relations.

Box 1.9: The virtual corporation

The Virtual Corporation - The Company of the Future will be the Ultimate in Adaptibility

Characteristics of a new corporate model
Today's joint ventures and strategic alliances may be an early glimpse of the business organization of the future: The Virtual Corporation. It's a temporary network of companies that come together quickly to exploit fast-changing opportunities. In a Virtual Corporation, companies can share cost, skills, and access to global markets, with each partner contributing what it's best at. Here are the key attributes of such an organization:

Technology
Informational networks will help far-flung companies and entrepreneurs link up and work together from start to finish. The partnerships will be based on electronic contracts to keep the lawyers away and speed the linkups

Excellence
Because each partner brings its "core competence" to the effort, it may be possible to create a "best-of everything" organization. Every function and process could be world-class-something that no single company could achieve

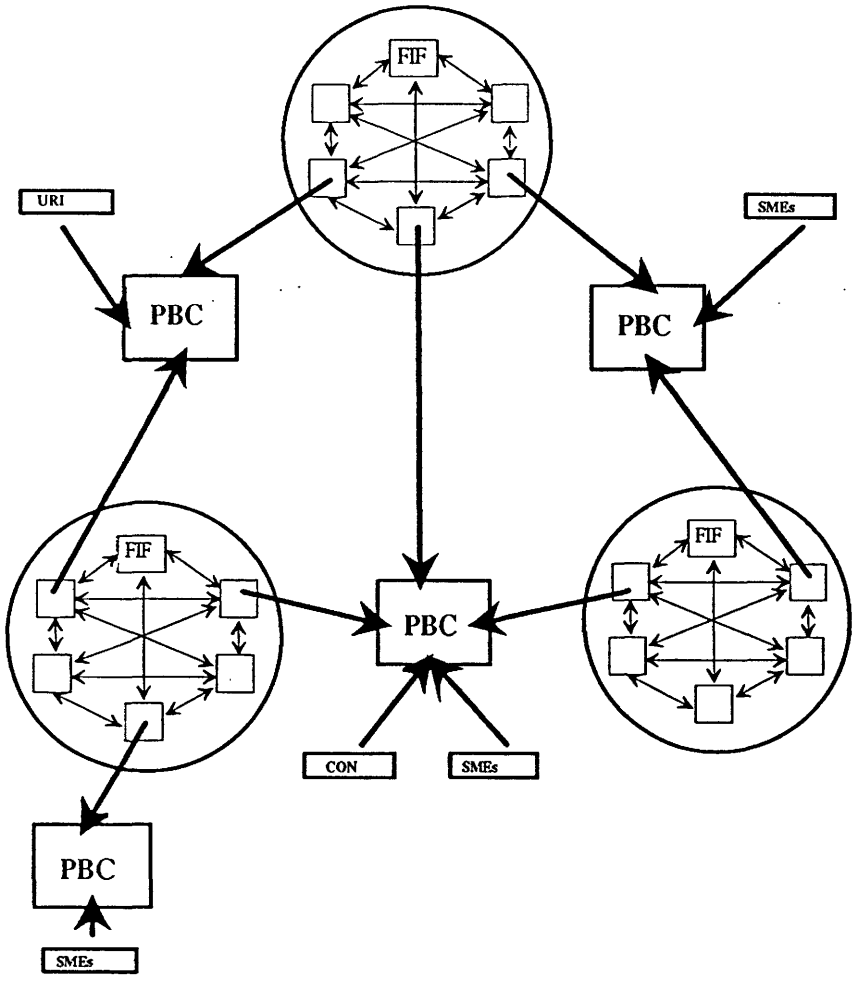
Opportunism
Partnerships will be less permanent, less formal, and more opportunistic. Companies will band together to meet a specific market opportunity and, more often than not, fall apart once the need evaporates

Trust
These relationships make companies far more reliant on each other and require far more trust than ever before. They'll share a sense of "co-destiny", meaning that the fate of each partner is dependent on the other

No Borders
This new corporate model redefines the traditional boundaries of the company. more cooperation among competitors, suppliers, and customers makes it harder to determine where one company ends and another begins.

In Japan, industrial strategies and industrial policy are systematically exploit collaboration as a means to advance competitiveness and performance of firms and whole industries. Against that, in Europe both industry and industrial policy are still reluctant to systematically promote collaboration. Intensive collaboration in strategic fields hardly fits traditional European concepts of competition and enterprise culture.

Fig. 1.23: Virtual corporations in a collaborative economy



Source: Belzer/Hilbert, 1993.

Necessary restructuring of production systems, whether for the sake of enhancing performance or environmental sustainability has to cross traditional boundaries of enterprises and industries. The formal side of organization looses relevance and the informal side of organization gains in importance. The picture of a "virtual factory" replacing traditional firms and their interactions is emerging.

The virtual factory reduces permanent and formalized organizational structures and replaces them by a variety of project-based collaborative links and interdependencies between different organizational units of different firms. Coordination and collaboration is primarily arranged by temporarily assigned and task-oriented teams. Such teams may, for example, consist of people from marketing, R&D, manufacturing and services of different firms and may handle a certain portofolio of orders or tasks.

Strategies and policies for a vital industry

The conditions and perspectives of industry and the industrial society in Europe, which we have discussed here, leave industry and industrial policy with three main tasks:

1 to reorganize production systems to regain competitiveness;
2 to develop new markets to overcome unemployment;
3 to find economic solutions to social and ecological problems.

The two main tasks do not go alone, but are associated with a number of other important tasks concerning innovation, competitiveness and adaptability and welfare.

These tasks have to be aproached simultaneously in order not to solve one problem at the expense of an other - and none is really solved at all.

Moreover, there are synergies to be mobilized. Environmental sustainability may be a motor for the development of new technologies, new products, new markets and new production systems.

All this can not be accomplished along the traditional ways and means of public policy. In particular, it can not be accomplished with isolated activities and programmes which are strongly influenced by particular interests managed by highly segmented bureaucracies.

Under conditions of rapid and multifarious change, and high uncertainty, public policy is seriously mislead if it attempts to prescribe specific solutions to isolated problems. It is also mislead, if it confines itself to the creation of a favourable environment leaving the rest to the market.

The political task is to formulate goals, to seek broad consensus and to establish open and flexible networks to advance the necessary processes.

Policy recommendation
Reorganizing the Communities RTD policy

Community programmes for research and technical development should be shifted from programmes that are orientated at clearly defined solutions and narrowly defined activities to the establishment of networks for problem oreintated and broad application of new technologies.

European programmes for research and technical development should, for example, not aim at developing a certain chip, but rather establish a network of R&D institutions, producers and (potential) users from different sectors to develop and apply new technologies.

Policy recommendation
Networks for socio-technological deversification

In order to develop new markets and new economic opportunities, the Commission of the European Communities should establish networks for socio-technological diversification.

One type of network should be orientated at the development and wide application of key technologies and should be organized along technological chains and potentials for technology fusion. Particularly important technologies are bio-technology, new materials, microstructure technology and communication technology.

Another type of network should focus on economic solutions of environmental problems such as material flows, recycling, emmissions and waste.

The important difference is, that the first form of policy leads at best to a solution of yesterday's problems. Against that the second form may reveal a variety of solutions and applications which can give raise to new products and markets (Kodama, 1991).

Environmental regulation, to give another example, should not translate current technological standards into a rule but rather define dynamic standards on the basis of technology projections.

Broad mobilization of knowledge, experience and support by means of process-orientated networks is particularly important when it comes to development and reorganization of production systems. This involves strong efforts to integrate basic research and applied R&D across different fields, ranging from technology to management and cultural sciences.

Policy recommendation
An initiative for new production systems

Commission of the European Communities should establish a programm for comprehensive development of new production systems which combine high productivity, precision and innovation with high environmental quality.

The programm should be jointly designed and managed by employers, unions, public actors and r&D-institutions, and each single project should also include the same range of participation.

The programm should advance projects which integrate scientific research and practical application.

One possibility to promote advanced forms of production and management is to observe and spread examples of best practice. Another strategy is the establishment of centers of excellence.

A promising example may be the development of the virtual factory. Early activities to analyze, design and experimentally apply possible structures for a virtual factory may provide Europe with a comparative advantage which carries far into the next century.

Policy recommendation
Centers of excellence

The Commission of the European Communities should establish centers of excellence for research which necessitates broad interdisciplinary approaches and integration of scientific knowledge and practical experience.

Centers of excellence should be established for a limited period (probably 10 years) and be organized as joint ventures of public research institutions and private firms. Private firms should be involved by delegating staff and by actively participating in pilot projects.

In order to enhance exploitation of synergy and broad diffusion of results, centers of excellence should develop strong ties and exchange with relevant reseach institutions and encourage mobility of researchers between the centers, firms and research institutions.

Collaborative strategies are particularly important for the viability of the small and medium sized enterprises. SMEs should be further stimulated to form production networks among themselves and with large enterprises to increase their capabilities and capacities in R&D, marketing, sales and services and to cope with the challenges of globalization. Interesting examples for such strategies are the Danish networking programme and the French programme for collaboration of small and large enterprises.

Policy recommendation
Initiating collaborative efforts

The Commission of the European Communities should increase its support of collaboration of SMEs and of SMEs with large enterprises. For that purpose, RTD programmes as well as other programmes offering financial assistance to firms should contain regulations requiring the collaboration of SMEs.

What once had been devised to bring about an industrialized society now turns out to hamper necessary modernization processes.

Welfare systems in Europe are in a considerable disarray. They often impose unnecessary costs on firms and labour and enhance structural adjustment at the expense of labour. At the

same time, they motivate and enable strategies of social dumping. A European social charta is necessary in order to avoid both overloading of labour and social dumping. Moreover, financing of welfare systems must be changed.

Policy recommendation
Reshaping the welfare state

The European social charta has to be decided very urgently in order to secure an adequate social framework for industrial development. Working conditions should not be applicable as a competitive argument.

Part 2:

Markets and Technology:
An Active Approach to Economic Opportunities

The key to the future of industry and the whole economy in Europe is technology-intensive and knowledge-based production. It is the key to competitiveness of industry. It is the key to the solution of environmental problems. And above all, it is the key to employment and wealth.

In the industrialized countries, competition is increasingly dominated by a pervasive orientation at high quality. This is associated with conditions concerning competitiveness that can only be met by technology-intensive and knowledge-based production.

Severe and often increasing environmental problems work in the same direction. Given value systems of the advanced societies, effective improvement of environmental conditions needs development of economic solutions to environmental problems. New technology and improved know-how have to be developed for this purpose.

Beyond this, the advanced industrial societies are increasingly facing a situtation where employment, profitability and wealth can no longer be secured in traditional markets. Development of markets in new directions and creation of new markets are the main challenge to industry in the advanced industrial socities. A fast process of technology-led diversification orientated at economic solutions to social and environmental problems has to be initiated.

Background: The quality economy

In the industrialized countries, the shift towards technology-intensive and knowledge-based production is becoming a dominant feature of industrial change and structural adjustment. With some lag, newly industrializing countries, particularly in Asia, are following up in this development and build up technologically sophisticated industry. (Lehner et al., 1993).

The shift towards technology-intensive and knowledge-based production is expressed in a high and further increasing technological content of many products or in an increasing technological sophistication of the production process. In many industries, high technology

and knowledge content of production develops simoultaneously on the product and the process side. (Kash, 1989; OECD, 1992; de Woot, 1990).

Tab. 2.1: Industry in transition

Yesterday	Tomorrow	Aims/ potential results
Product strategy:		
Long series, undifferentiated products	Short series, specific products	Personalised products
Product, price	Solutions, services	Price premium for qualitiy, reliability,performance
Quality control	Performance audits	Equal priority given to design, production, delivery
Manufacturing strategy:	Speed, response time	Rapid new product introduction
Volume, scale	Flexibility	Multi-use equipment
Throughput	Logistics, flow dynamics, design	Design to reduce handling, movement, transport
CIM, robotics		
Organisational strategy:		
Complexity	Organisation	Avoid diturbance, disfunction, breakdowns
Hierarchy	Autonomy, responsability	Better solution because close to problems
Market entry and direct investment strategy:		
Local, national markets	World markets	Target and differentiate products, services, markets
Sub-contracting	Partnership	Spread risks, share gains
Low labour-cost suppliers	Direct investments in key markets	Directly enter new markets

Source: OECD, Industrial Policy in OECD Countries,Paris, 1991

This development is often explained in terms of a changing international division of labour. More precisely, it is assumed that industry in the highly industrialized countries is declining

and confined to technology-intensive and knowledge-based production. This argument is, however, severely misleading.

The motive force behind the shift towards technology-intensive and knowledge-based production is a pervasive orientation of industry at high quality. This orientation is embracing industrial production more and more. (Lehner, 1992; Ozawa, 1988; Peters & Waterman, 1982; Reich, 1991; Thurow, 1992).

Only a few years ago, a high quality of goods was a particular market approach offering many enterprises a good stand in competition against large mass producers. In some markets, such as mechanical engineering, European companies in particular have often applied this strategy successfully against the powerful American mass production. Meanwhile, high product quality is ceasing to be a special strategy of competition and is becoming simply a precondition of competitiveness in many markets[1].

Quality production is no longer an alternative to mass production, but rather an encompassing feature of most of industrial production. It synthesizes in a variety of different pattern features of both traditional mass production and customized small-batch production. Quality production may operate in different forms ranging from an extremely customized small-batch production to a flexible, diversified mass production[2].

Quality production in the industrialized countries is rooted in the social base of the industrialized countries, particularly in Western Europe. In many of the industrialized societies, particularly in Europe, a long period of relatively high prosperity and other conditions have created differentiated value structures. This has translated into diversified demand, high consumption patterns and capaciuos markets for a wide variety of goods of high quality. As this development continues and includes more and more countries, social and cultural

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[1] We are indebted to Peter Wickens, Director for Personel and Information, Nissan UK, who explained to us the changing role of quality.

[2] This argument rejects a widely shared assumption that mass production is replaced by quality production and flexible specialization as it is forwarded in the well-known book of Piore & Sabel (1984).

diversity may provide new impulses for growth in the global economy (Kotkin, 1993; Featherstone, 1991; Szallies & Wiswede, 1991).

Box 2.1: Quality production

Modern quality production is characterized by the following elements:

* a high quality of goods in response to customers' demand,
* a low degree of standardization and high degree of customization of products,
* a fast adjustment of products to diversified and changing demand,
* a fast adjustment of products to the highest state of science and technology that is economically available at any given time, and
* a strong services component.

In this context we should be aware that the economic impact of cultural and social diversity depends strongly on income and wealth in society. Cultural and social diversity translate the more into diversified demand the higher mass income and purchasing power rise. This points at a strategic problem which we have to keep in mind when we discuss labour-related issues of competitiveness. The problem is that we have little leeway to solve problems of high labour costs by reducing wages or social standards because this could endanger further development of a capacious quality economy.

Box 2.2: A strategic problem: Wages, welfare and markets

In some of the member countries of the European Commission, particularly in Germany, wages constitute currently one of the most seriuos problems of competitiveness of industry.

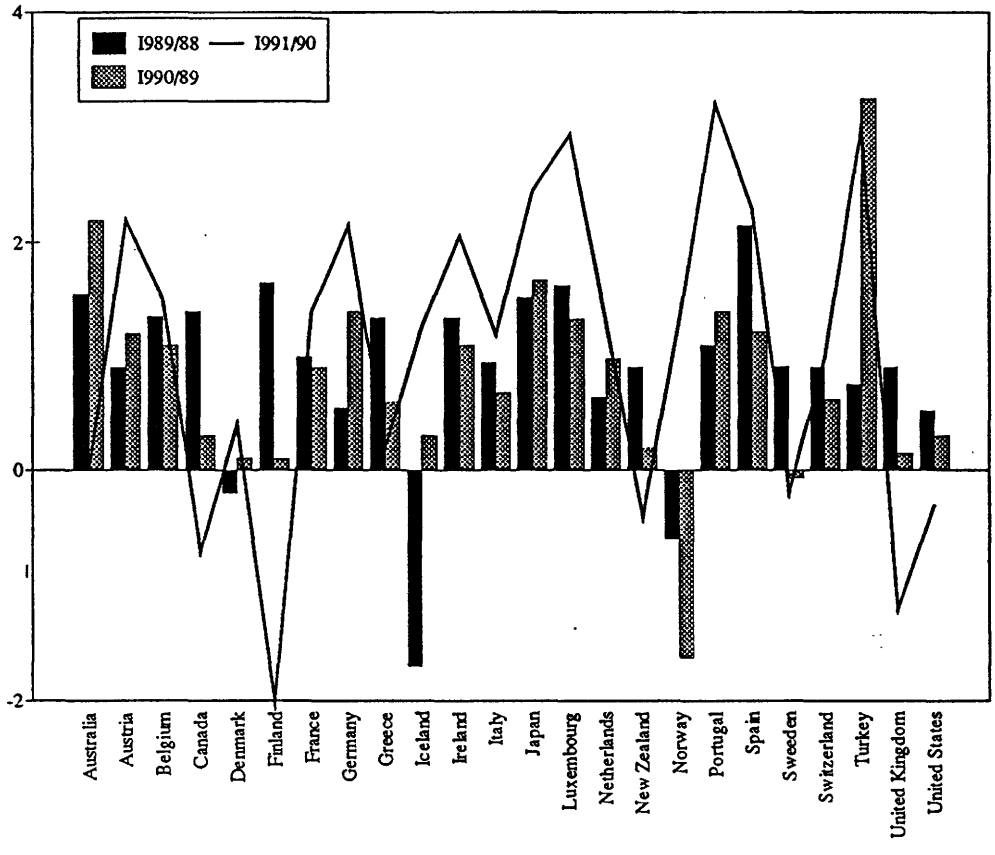
Discussing this problem, we should, however, be aware that high wages are also the source of a high purchasing power and of capacious markets in Europe.

This is particularly important with respect to an issue which is vital for the future of industry in Europe. The issue is development of diversiefied, but capacious marktes. Such markets can only develop in a condition of relatively high mass welfare.

A challenge to industrial performance

Modern quality production constitutes a severe challenge to industrial performance. It is not only representing a wider application of traditional concepts of quality production. Far beyond that, it is strongly developing towards a synthesis of traditional concepts of quality production and of mass production. This results in a complex production pattern which requires far reaching changes in industry. (cf. Beer et al., 1990; Kanter, 1989; OECD, 1991a; Shetty & Buehler, 1987; Warner, Wobbe & Brödner, 1990).

Fig. 2.1: Changes in final domestic demand in OECD



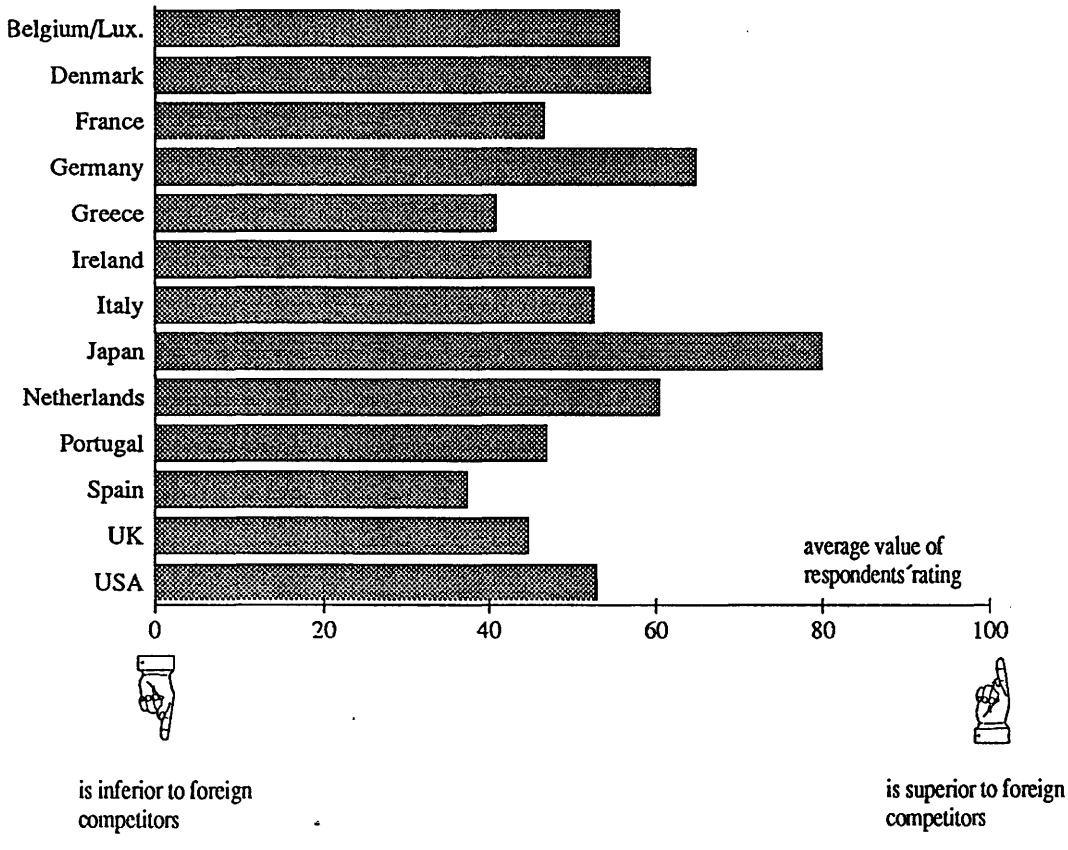
Source: OECD, 1991a.

The pattern combines characteristic features of traditional quality production, in particular strong customization, high product quality and economies of scope, with characteristic features of mass production, in particular strong price competition, high productivity and economies of scale. Moreover, as it is knowledge-based and technology-intensive, modern

quality production is usually associated with fast innovation. Finally, it also includes a strong services component. (Lehner et al., 1993).

This condition production contains considerable inconsistencies and trade-offs. The different features of modern quality production do not fit well together. It is, for example, difficult to assure high quality if innovation is fast, or to reach high productivity in a highly customized production. Competition is shaped by ambiguity. Strategic choices are often complicated. Management has to cope with high uncertainty and ambiguity. (cf. Carlsson, 1989; OECD, 1991c; Pondy, Boland & Thomas, 1988).

Fig. 2.2: Price/Quality-ratio

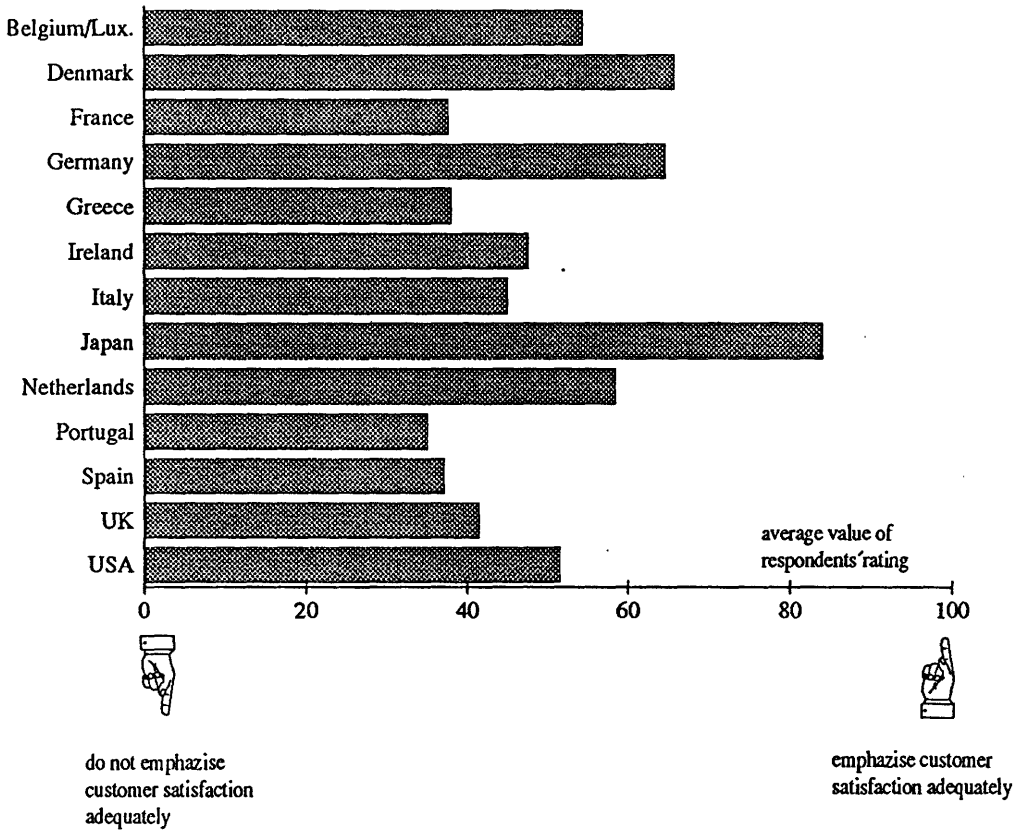


Source: World Competitiveness Report, 1992.

An important aspect of uncertainty and ambuigity are market developments. The social conditions of the advanced societies provide on one side favourable conditions for a quality

economy. At the same time, they produce volatile markets structures with often fast changing demand and strong imbalances between different national or sectoral economies.

Fig. 2.3: Customer orientation

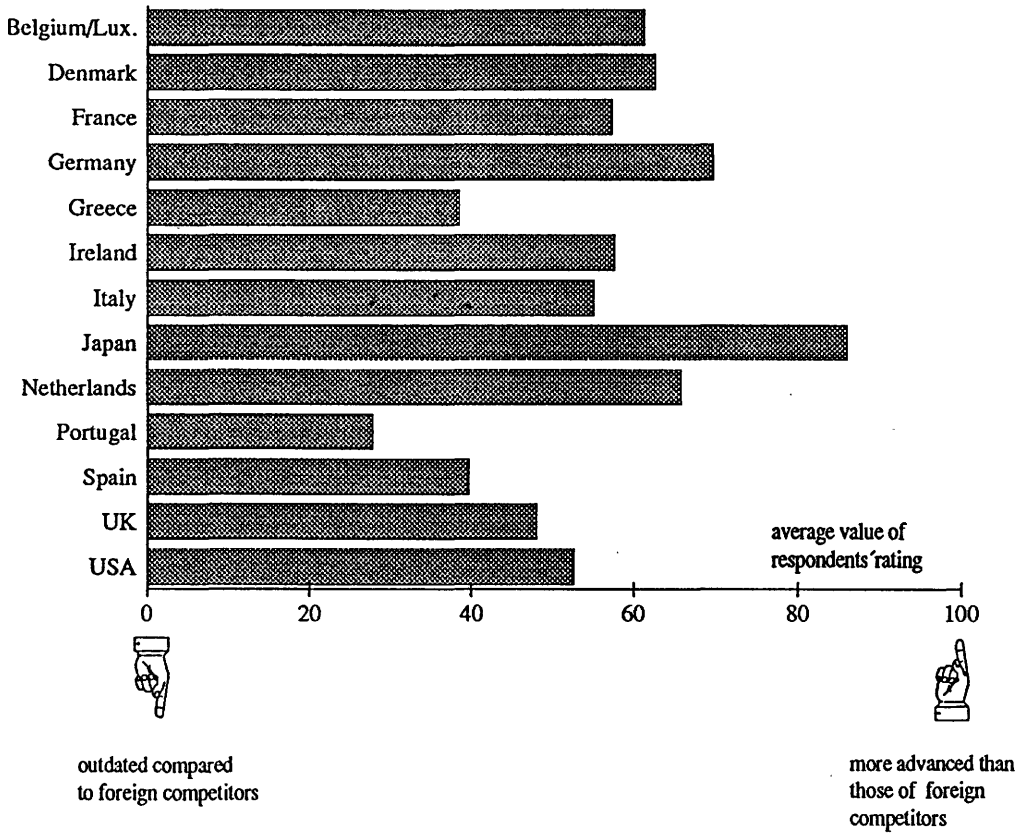


Source: World Competitiveness Report, 1992.

The complex pattern of modern quality production confronts firms and whole industries with difficult requirements. Industry in a number of the member countries of the European Communities has considerable difficulties to meet these requirements. According to the *World Competitiveness Report*, in quite a number of countries and industries:

* price/quality-ratio of domestic products is on the average inferiour to foreign competitors,
* customer orientation is rather weak. And in some countries,
* production technologies are outdated in comparison to foreign competitors.

Fig. 2.4: Production technologies



Source: World Competitiveness Report, 1992.

These findings indicate that industry in Europe often has considerable difficulties to adjust to the new conditions of competition in the developed quality economies. Industry in Europe is shifting its strongholds to quality production, but it is still in search of that excellence which is needed to secure competitiveness in modern quality production.

Competitiveness: What are the issues?

Industry in Europe is currently facing severe problems concerning its competitiveness. This is feeding hot debates on competitiveness. however, these debates are often one-sided and short-sighted. This is likely to enhance strategic choices which

* improve a particular aspect of competitiveness, but create new or increased problems concerning other aspects
* solve problems in short-term, but endanger vitality and viability of industry in the long term, and
* enhance competitiveness of industry in some parts of Europe, but hinder development in other.

Box 2.2: Competitiveness

Competitiveness refers to the permanent capabilities of firms and enterprises to stand competition. Accordingly, problems of competitiveness exist if firms and whole industries are systematically less capable of standing global competition than their competitors are.

Competitiveness is an extremely difficult problem. It depends on a variety of different factors. These factors are linked together in a complex pattern. Relations among different factors often contain interdependencies and inconsistencies. Moreover, there are great variations across the European Communities in patterns of competitiveness[3].

If we look at relative comparative advantage as a main indicator of competitiveness, we find that only few countries have secured comparative advantages throughout the 1980's. Some countries have improved their position but still score negatively. A considerable number of countries in the European Communities has further declined. There are, however, considerable differences across industries.

On the other hand, we should note that enterprises in Europe have developed quite well in terms of profitability. Operational profits in European business are on the average slightly higher than in the United States and Japan.

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[3] The lay amount of large literature on competitiveness points at a variety of different key problems including particularly issues of technology, industrial organization, management capabilities and labour. - Cf. Badarocco, 1991; Kash, 1989; OECD, 1991a, Peters & Waterman, 1982; Tidd, 1991; de Woot, 1990; World Competitiveness Report, 1992.

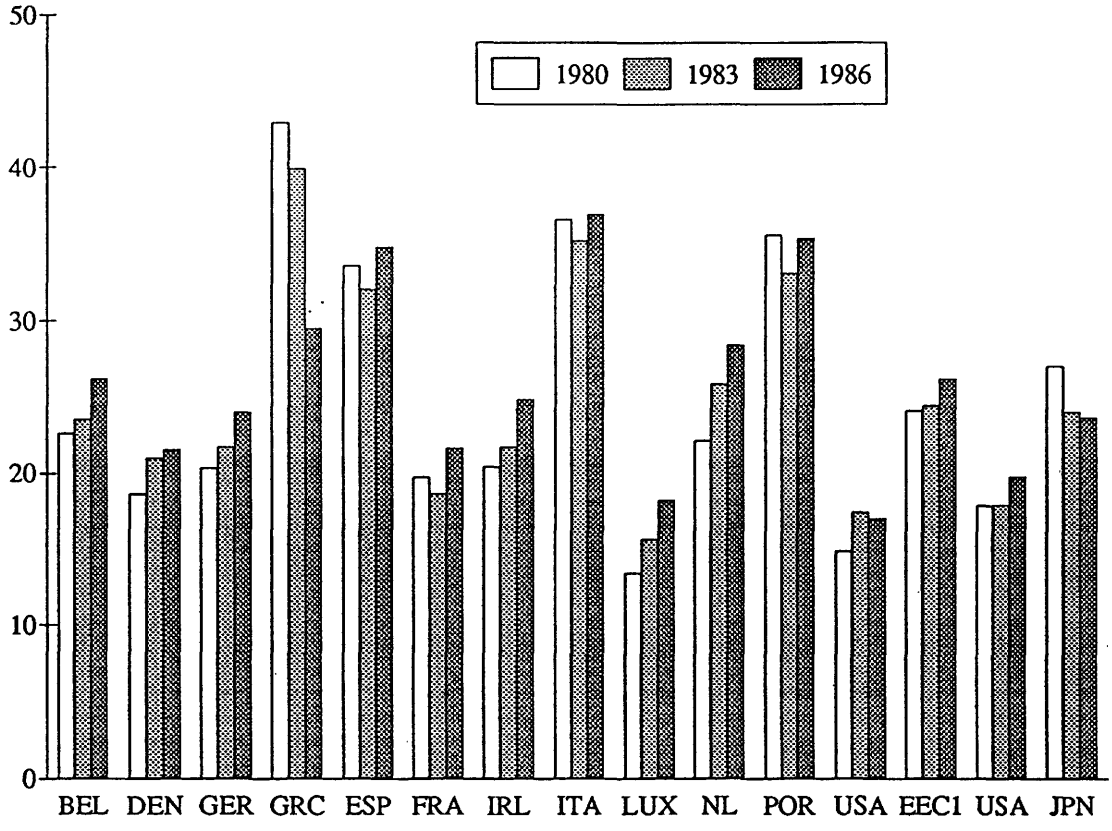
Tab. 2.2: Revealed comparative Advantage (RCA) in manufacturing exports[4]

		High tech.	Medium tech.	Low tech.
Belgium/Lux.	1980	49	102	123
	1990	40	116	124
Denmark	1980	77	58	161
	1990	78	59	171
France	1980	84	99	109
	1990	90	98	112
Germany	1980	95	117	80
	1990	83	121	83
Greece	1980	18	39	210
	1990	18	33	252
Ireland	1980	117	58	143
	1990	181	54	107
Italy	1980	66	91	128
	1990	63	90	140
Netherlands	1980	80	73	143
	1990	80	79	142
Portugal	1980	58	37	194
	1990	47	42	220
Spain	1980	47	86	142
	1990	53	102	132
United Kingdom	1980	127	109	80
	1990	123	97	91
USA	1980	160	106	70
	1990	161	89	74
Japan	1980	130	106	75
	1990	149	113	44

Source: OECD, 1992, Industrial Policy in OECD Countries, Paris

[4] RCA for a particular industry is defined in this case as "the ratio of the share of the country's exports in that industry in its total manufacturing exports to the share of total exports by that industry in OECD manufacturing exports. With exports denoted by X, for a country k, the RCA of an industry i is given by" (OECD 1992:159): $RCA_{ik}=100*([X_{ik}/(\sum_i X_{ik})]/[\sum_k X_{ik}/\sum_{ik} X_{ik}])$

Fig. 2.5: Operational profits in Europe, the United States and Japan



Source: Eurostat, 1988

This does not convey any new message, but reflects a condition which prevails in Europe since many years. Much of industry in Europe has considerable problems concerning competitiveness; yet it still performs quite well. Thus, there seems to be little reason for growing concern on competitiveness of industry in Europe.

However, there are developments which give raise to new concern:

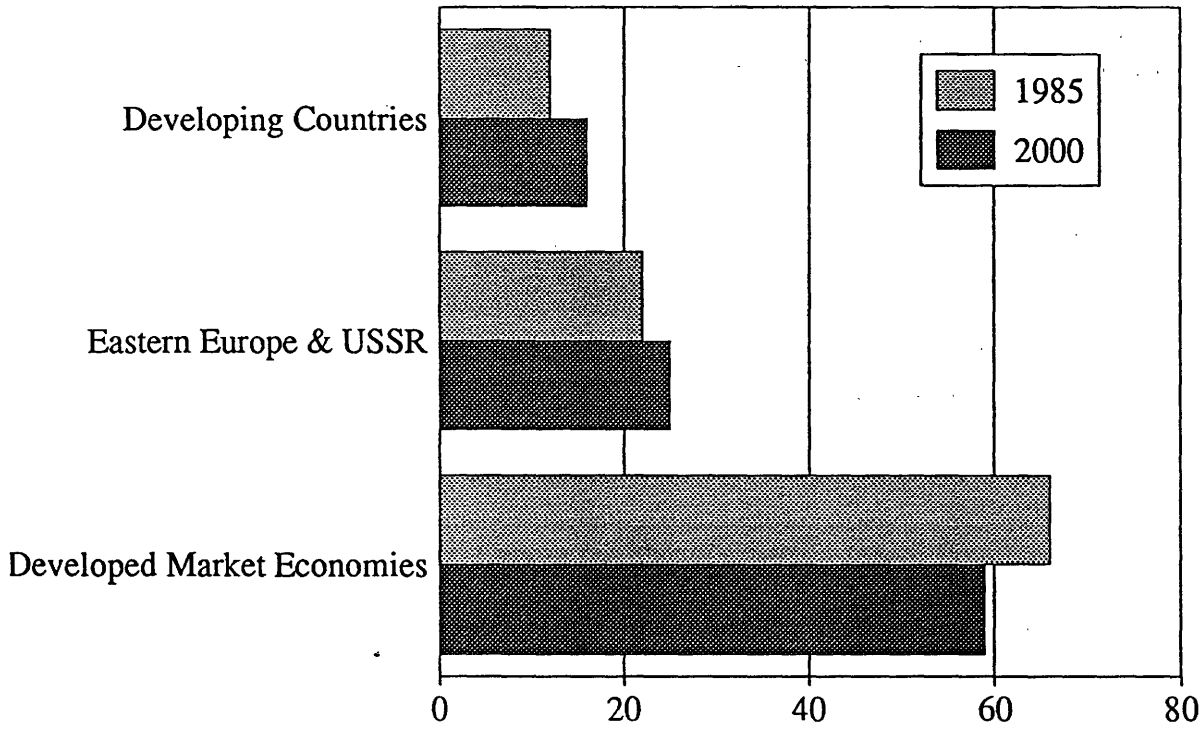
1 the significance of labour costs as a factor of competitiveness is changing,
2 productivity of much industry in Europe is declining in comparison to Japan and the United States,
3 competitiveness is shifting to the soft side, and
4 technological competence is becoming a hot issue.

Labour costs and productivity

In the developed European economies, labour costs are a long-standing and widely shared concern. However, the ground for debate is shifting[5].

In the past, discussion on labour costs has been closely related to industrialization in hitherto little or not industrialized countries. The assumption was that due to high labour costs, industry in the highly industrialized societies is loosing its competitiveness against industry in newly industrializing countries. This argument, however, has not proofed to be true. In spite of fast industrialization on a global scope, the developed market economies still have and are likely to secure an overwhelming share of value-added of manufacturing.

Fig. 2.6: Shares of major country groups in value-added of manufacturing



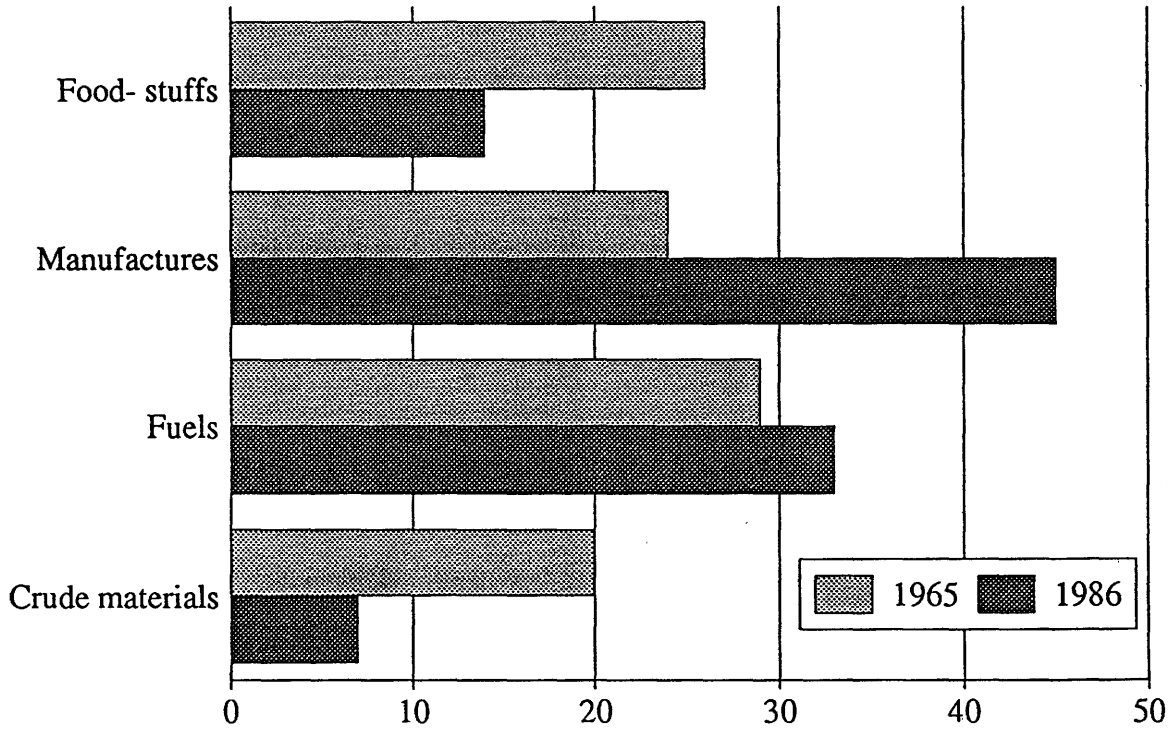
Source: United Nations, 1990.

[5] For a broad empirical analysis of development of labour costs, see CEC, 1989.

Industry in the industrialized countries has lost some ground in labour-intensive productions, but has developed new strongholds in technology-intensive and knowledge-based production. This has secured vitality of industry in the advanced countries (for a more detailled discussion, see Lehner et al., 1993. - See also OECD, 1988a, 1989a, 1991a; Shetty & Buehler, 1987; de Woot, 1991)[6].

In this context, we should note that technological content of exports of newly industrializing countries to the industrialized countries has been growing since the 1970's. This has not increased the significance of labour costs as a factor of competitiveness for the industrialized countries. Rather, the more advanced NIC's have to cope with increasing competition on labour-intensive productions from less advanced countries while their labour costs as well as other costs catch-up to those of the industrialized countries (cf. OECD, 1988b).

Fig. 2.7: Changing composition of NIC's manufacturing exports to OECD



Source: United Nations, 1990.

[6] In this context, we should note that hopes for a service economy with high employment capacities are likely to be in vain. The services are facing strong rationalization as it, hitherto, has been only the case in manufacturing (See OECD, 1991b).

For industry in Western Europe, labour costs may become a much more significant issue in the near future. Low labour costs in Eastern Europe create particular difficulties for Western Europe since at the same time, economic prospects for Eastern Europe are rather gloomy.

Both Japan and North America are, as is Western Europe, surrounded by countries with much lower labour costs. However, economic prospects for Asian and, to a lesser degree, for Latin American countries are much better than those for Eastern Europe. In comparison to Japan and the United States Western, Europe is, hence, facing stronger competition from its cheap labour neighbours and has less prospects of profiting from their development[7].

In current debates, labour costs are increasingly discussed as a factor of competitiveness among the industrialized countries. It is argued that even in technology-intensive and knowledge-based production differences of labour costs are becoming an important and often decisive factor of competition.

No doubt, there is much truth in this argument. Experience of many firms and industries demonstrate this every day. Yet, the case needs to be carefully assessed:

* to some extend, differences in labour costs simply reflect different economic strength and standard of living in industrialized countries;
* in countries with high labour costs, the problem is often erronously conceived as a problem of wages while the real problem is indirect labour costs; and
* most important, the real issue is often not labour costs, but comparatively low productivity and wrong or delayed adjustment.

To the extend to which differences in labour costs reflect different economic strength and standard of living in the concerned countries, they are a necessary factor of economic development. In the less wealthy countries, they enhance rapid catch-up and in the wealthy

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[7] Saying this, we do not wish to support calls for protectionism towards Eastern Europe. Rather, we want to point at the need to support institutional change and rapid development in Eastern Europe (See Jochimsen, 1991).

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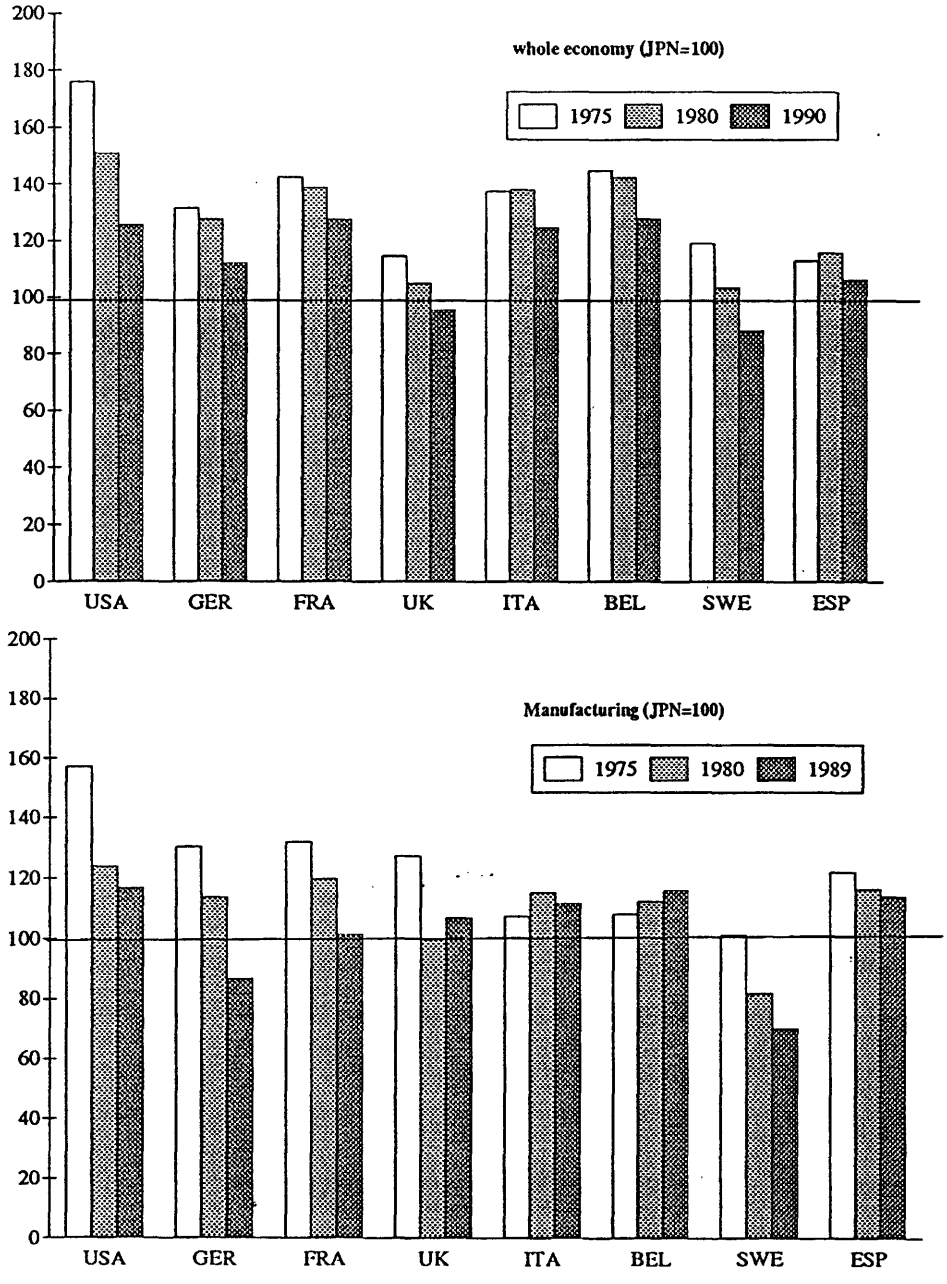
countries they advance innovation. This may be a locational problem for firms, but should not be a case for political intervention[8].

Fig. 2.8: Labour productivity in the whole economy and in manufacturing



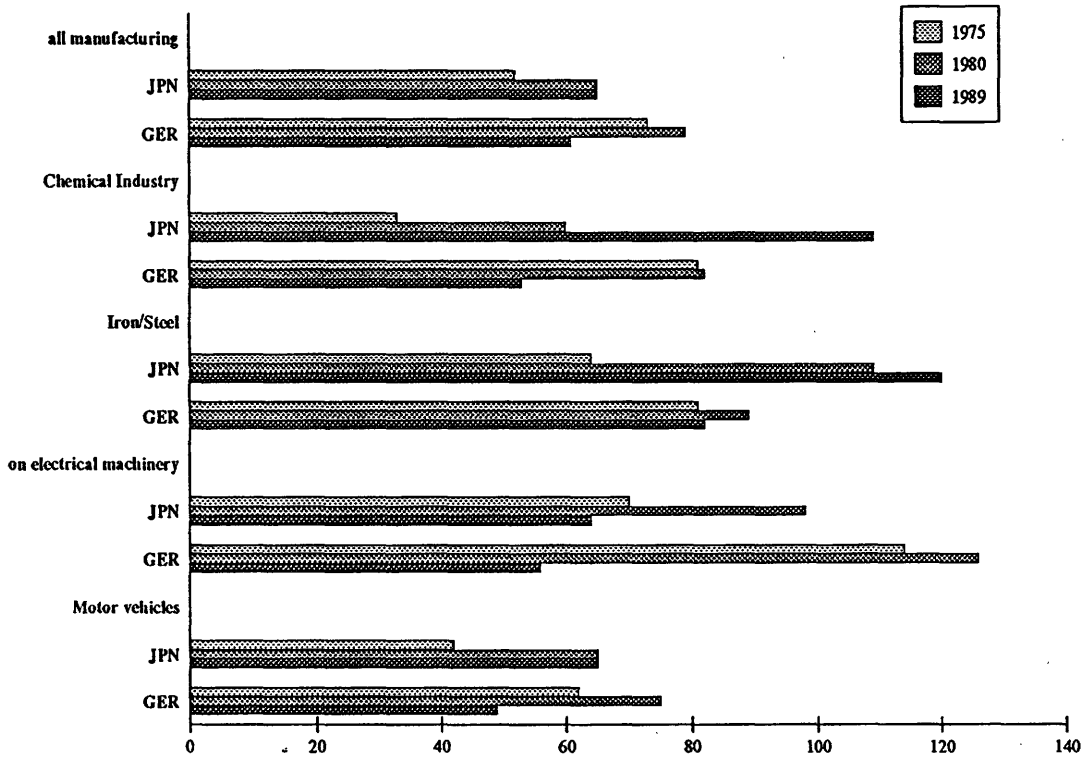
Source: Japan Productivity Center, 1992.

[8] This argument does not justify disparities in social security and social standards which reflect political decisions rather than economic conditions. Rather, such disparities are a concern for public policy because they create distributive conflict, endanger social cohesion and hinder effective market operation.

In countries with high labour costs, cuts in wages do not solve the problem, but weaken domestic market strength. An adequat solution must concern with financing of social security systems. We will discuss this in more details in part 4 of this report.

If we analyze labour costs problems carefully, we often find that the real issue is comparatively low productivity and wrong or delayed adjustment to structural change. The European economies reach, for the most part, a comparatively high labour productivity. This is, however, mostly due to the services whereas in manufacturing the European position is often comparatively low. (Lehner et al., 1993; OECD, 1991a, 1991b)

Fig. 2.9: Development of labour productivity in Germany, the United States and Japan



Source: Japan Productivity Center, 1992.

Data from the Japanese productivity center measuring productivity in purchasing parity power point at a rather negative case for Europe. It demonstrates that in the 1970's and 1980's, productivity in total manufaturing and in core industries has declined in Germany in relation

to the United States. Japanese industry reaches generally better results. Interestingly enough, this aplies particularly to chemical and steel industries where Germany is considered to have a strong position.

Although some of the member states of the European Communities perform in productivity somewhat better than Germany, this case demonstrates that much of industry in Europe has a strong productivity problem rather than a real labour cost problem.

Much of the productivity problem is the result of faults and delays concerning development of organization of industril production. The relevant issue, thus, is modernization of production rather than labour costs.

In European industry, there is a growing debate on "lean production", but in most of industry in Europe restructuring is still proceeding slowly. Many enterprises try to imitate Japanese models. Yet, only few enterprises seem to be sucessful in adapting these models to European conditions and to reaching desired results concerning productivity[9].

Enterprises have even less been capable of developing a genuine European response to the challenge of Japanese lean production. Development of human-centered or anthropocentric production systems illustrate this case. Although it is increasingly acknowledged that these systems mark a promising response not only to Japanese lean production, but to the challenges of advanced manufacturing, real progress is not overwhelming. (Lehner, 1992).

This situation points again at the difficulties of European industry to adjust to the new conditions of competition in the developed quality economies. Particularly, it has difficulties to adjust to the fact that in the modern quality economy competitiveness is shifting to the soft side.

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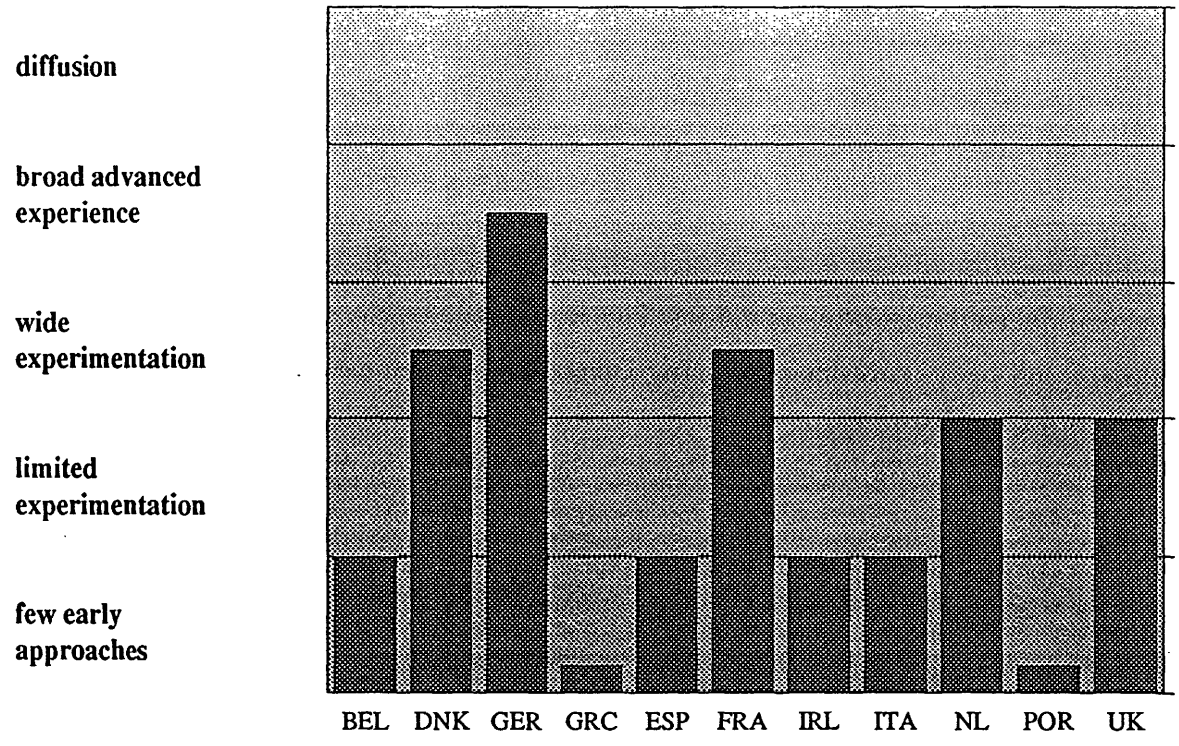
[9] A sucessful example is Nissan UK. The success of Nissan UK, however, is based on the fact that the company did not merely imitate Japanese models, but developed a synthesis of Japanese and European approaches to work organization. - We are indebted to Peter Wickens, personel director of Nissan UK who has provided us with many insights in the "art" of adapting Japanese models to Europe.

Fig. 2.10: Development of anthropocentric production systems in European Communities



Source: Lehner, 1992.

The soft side of competitiveness

The soft side of competitiveness refers to factors like management abilities, workers skills and enterprise culture as well as networking of firms, public-private partnership or social organization of technology development. These factors are becoming increasingly important in advanced manufacturing and reflect the shift of industry towards technology-intensive and knowledge-based production. In the course of this shift, "the human dimension of competitiveness has become a key success factor in a modern economy" (World Competitiveness Report, 1992: 5. - See also Clark & Fujimoto, 1991; Reich, 1991; Thurow, 1992; Warner, Wobbe & Brödner, 1990; World Competitiveness Report, 1992).

A move towards the softer side adds a strong political element to competitiveness. Competitiveness becomes more dependent on the quality of interactions of politics, business and interest organizations. Setting favourable trends and reversing unfavourable trends often needs strong cooperation of political and economic actors in a long-term orientation and restriction of special interest politics. (Carlsson, 1989; Fransman, 1990; Lehner et al., 1993; Wolff, 1986)

The shift towards the softer side is often neglected in current debates on competitiveness which still focuse on isolated conditions. This is particularly true with respect to discussions in Europe and North America concerning Japan. The superior position of Japanese industry in global competition is based

* not only on lower labour costs, but on better organization of production,
* not only on shorter lead time, but on a better innovation regime,
* not only on more high technology, but on better social organization of technology.

In European industry, shift towards the softer side of competitiveness does, for the most part, not create vital problems. In many areas, industry in Europe has considerable strength on the softer side of competitiveness. There are, however, a number of problems which need attention. (Lehner et al., 1993; Thurow, 1992).

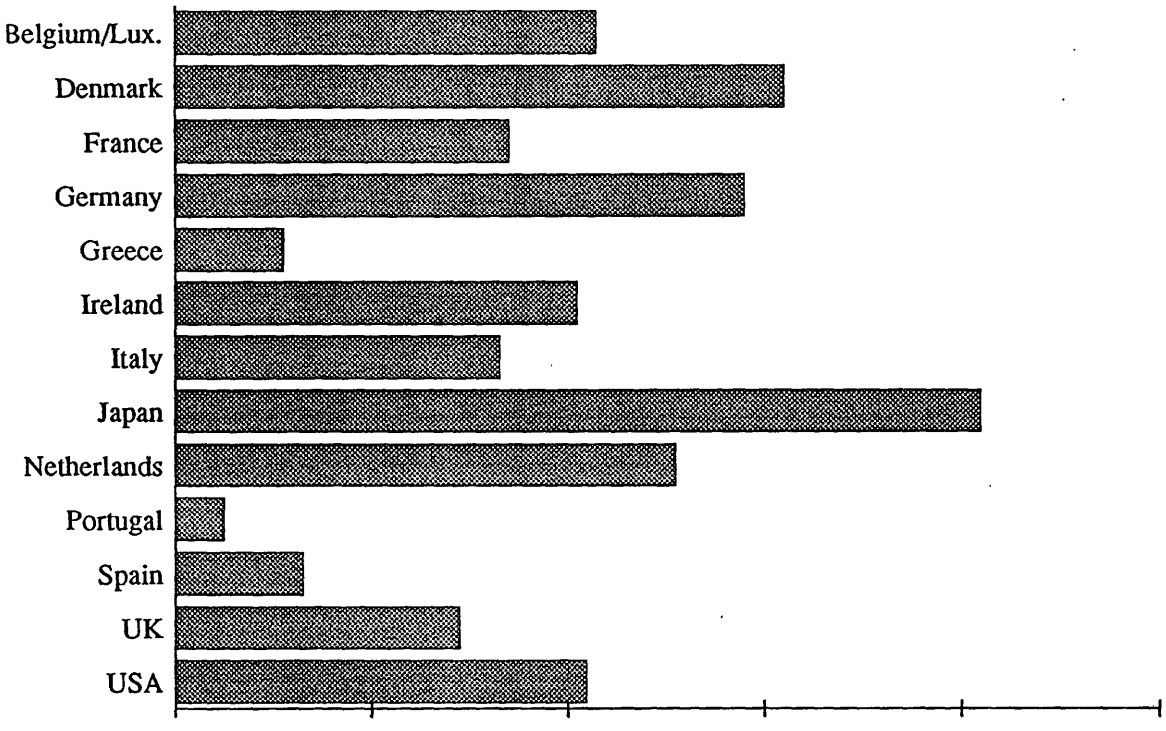
In a number of European countries deficits in management capabilities exist. Enterprises are often not managed in an innovative, profitable and responsible manner. This is particularly the case in France, Norway, the United Kingdom, Spain, Greece and Portugal whereas Germany, Switzerland, Denmark Sweden, Austria and the Netherlands rank comparatively high[10].

As turbulences increase and change becomes faster and far-reaching, this may increasingly apply to countries which still rank comparatively high on these matters. In Germany, for example, it is increasingly acknowledged that current economic difficulties are not only a

[10] We are refering here to data from the World Competitiveness Report which are based on a management survey and certainly can only provide a rather crude picture of the situation. Nevertheless, they illustrate that there is some reason for concern.

sign of a recession. Rather, a considerable part of industry has failed to develop new products and markets and to implement new production systems.

Fig. 2.11: Management

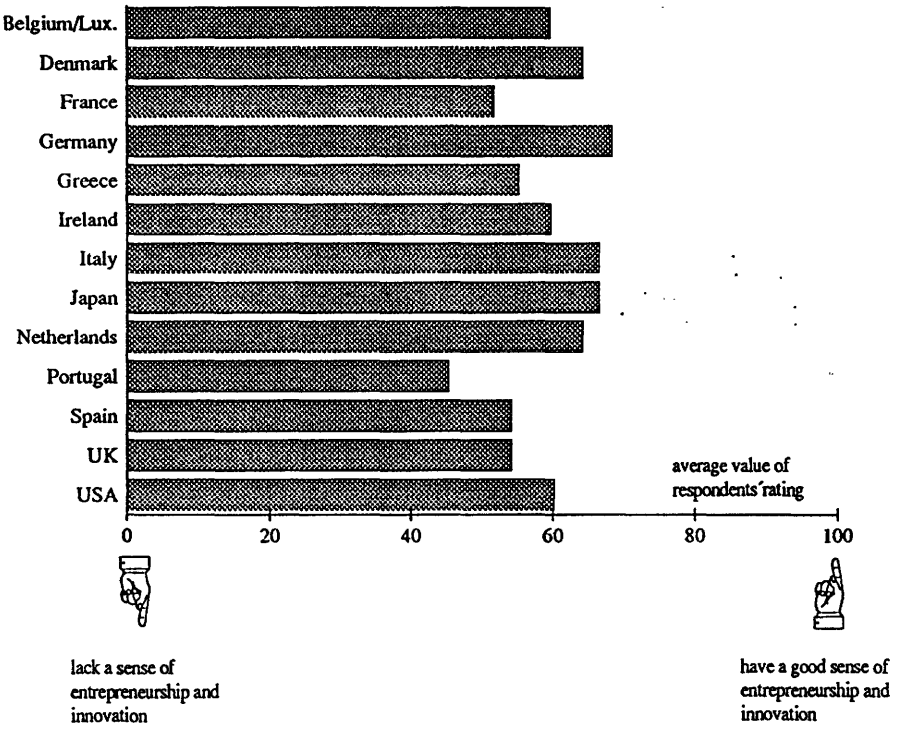


Source: World Competitiveness Report, 1992.

In much of Europe, industry profits from the existence of skilled labour force. However, in a number of countries, severe problems exist in this respect. Spain, Portugal, the United Kingdom, Greece and Italy suffer most from these problems. Even in countries which have a well developed vocational and professional training and education system, such as Switzerland, the Netherlands and Germany, it is often hard to get skilled workers.

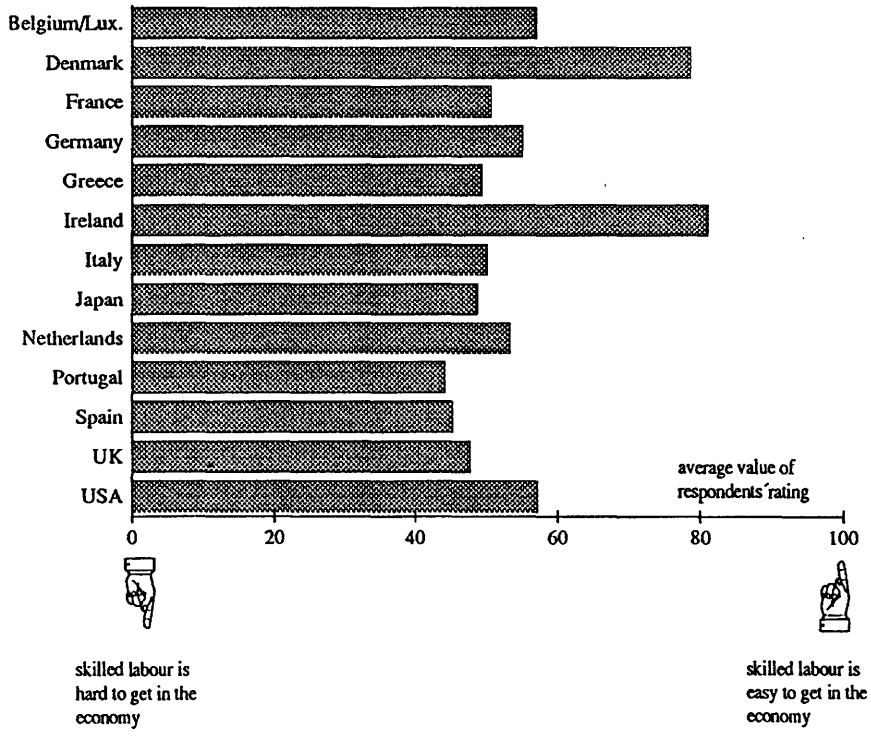
In this context, we should note that disputes on labour costs and related activities as well as massive lay-offs of workers may result in an increasing deficit of skilled workers. In a number of European countries, more and more young people choose jobs and careers outside of manufacturing which are considered to be more secure and more comfortable.

Fig. 2.12: Entrepreneurship and innovation



Source: World Competitiveness Report, 1992.

Fig. 2.13: Availability of skilled labour



Source: World Competitiveness Report, 1992.

In order to secure availability and motivation of skilled labour in the long run, current redundancy practices should be renunciated and adjustment of work to structural change should primarily operate by retraining. This is, as Bosch (1992) an important strategic task for both industry and industrial policy in Europe. As we will further discuss in the fourth part of this report, this does not only imply deviation from long-standing strategies of structural adjustment, but also a fundamental rethinking of the relationsship of work and welfare.

Alltogether, there are considerable weaknesses on the softer side of competitiveness of industry in Europe. These weaknesses together with deficits on the harder side of competitiveness are particularly relevant with respect to a traditional competitive strength of industry in Europe, namely technological competence.

Technological competence: A hot issue

Technological competence is a traditional strength of much of European industry. There are, however, strong warning signs indicating that technological competence of industry in Europe may decline[11].

In an overall measure as it is applied in *The world Competitiveness Report*, some European countries, particularly Germany and Switzerland, still maintain top positions significantly outmatched only by Japan. Most of the European market economies, including Sweden, the Netherlands France, the United Kingdom and Ireland are performing somewhat more modest. Only few countries, notably Greece and Portugal, have a significantly lower performance which is often below that of NIC's.

This overall picture, however, hides some issues which are critical for future developments. Critical issues are both on the hard and the softer side of competitiveness. Europe does not keep pace in major technological developments and has difficulties to build up an adequat

[11] The importance of technological competence for competitiveness is discussed in many studies. - Cf.Kash, 1989; OECD, 1991a, 1991b, 1992; Shetty & Bühler, 1987; de Woot, 1990.

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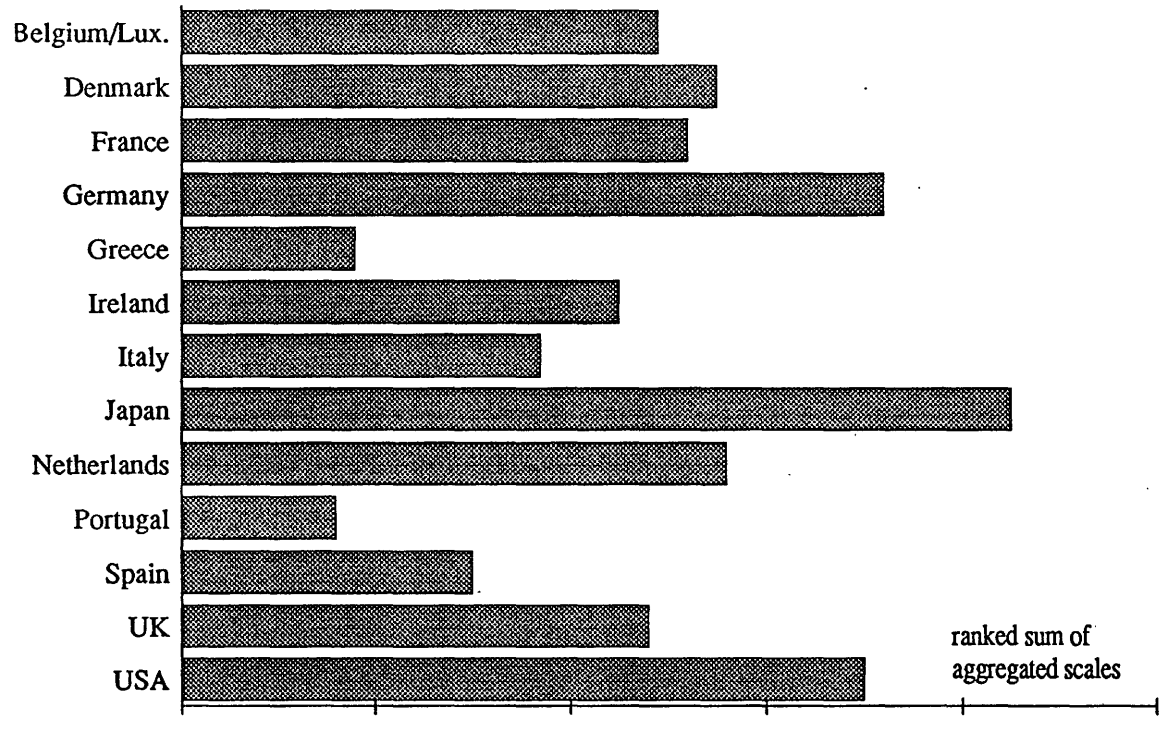
social organization of technological development and innovation. (Cf. Lehner et al.,1993; Roussel et al., 1991; van Tulder & Junne, 1988; de Woot, 1990).

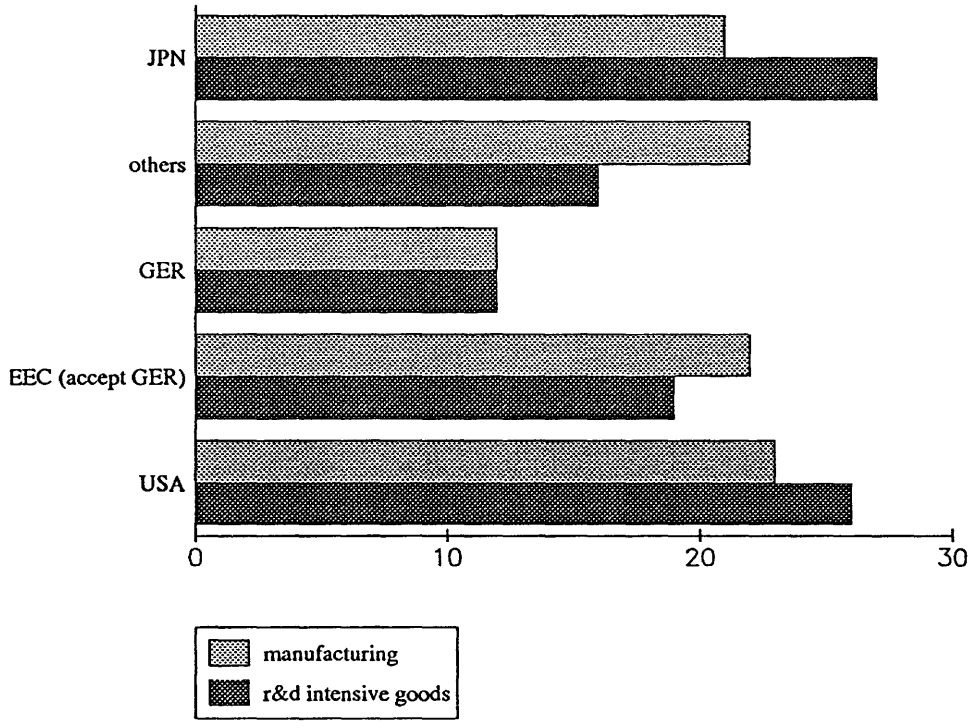
Fig. 2.14: Science and technology



Source: World Competitiveness Report, 1992.

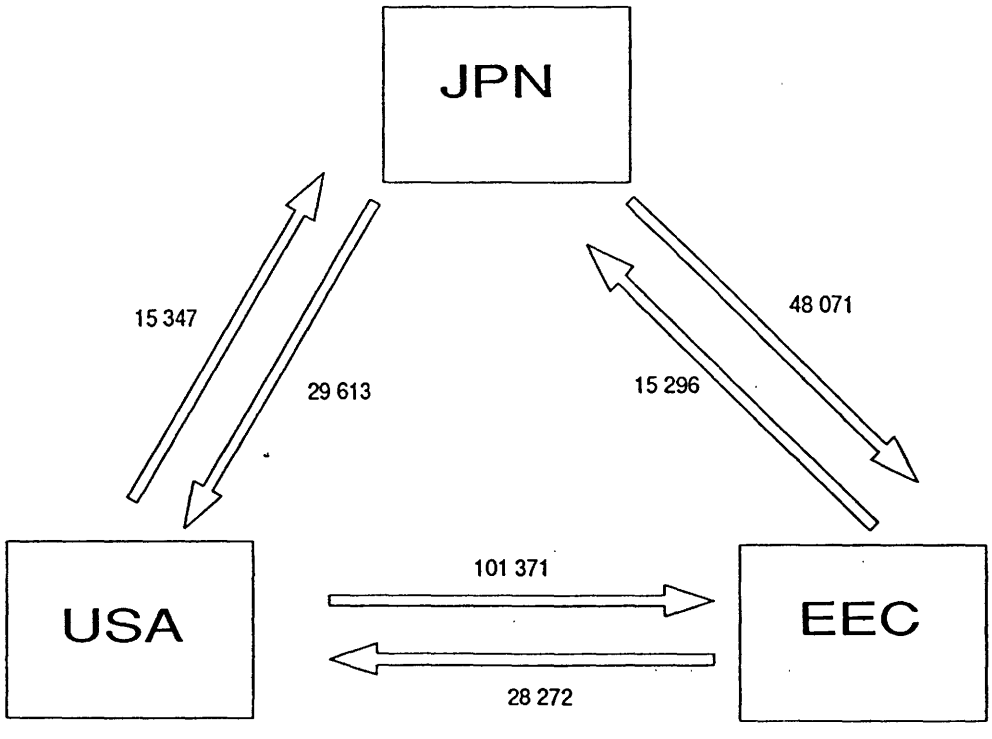
High technological competence of European industry means that most firms are used to appling the best available technology in their products and to quickly adjusting their products to the new and better technological solutions. Based on this, the European Community has reached a share of 31% of the worlds trade on technology-intensive goods. Interestingly enough, this figure is sligthly lower than the European Community's share in trade of manufacturing goods.

Fig. 2.15: Shares of EC in world trade of technology intensive products and total manufacturing



Source: BMFT, 1993.

Fig. 2.16: Patent flows in the Triade



Source: OECD, Science and Technology Indicators, 1991; own calculations.

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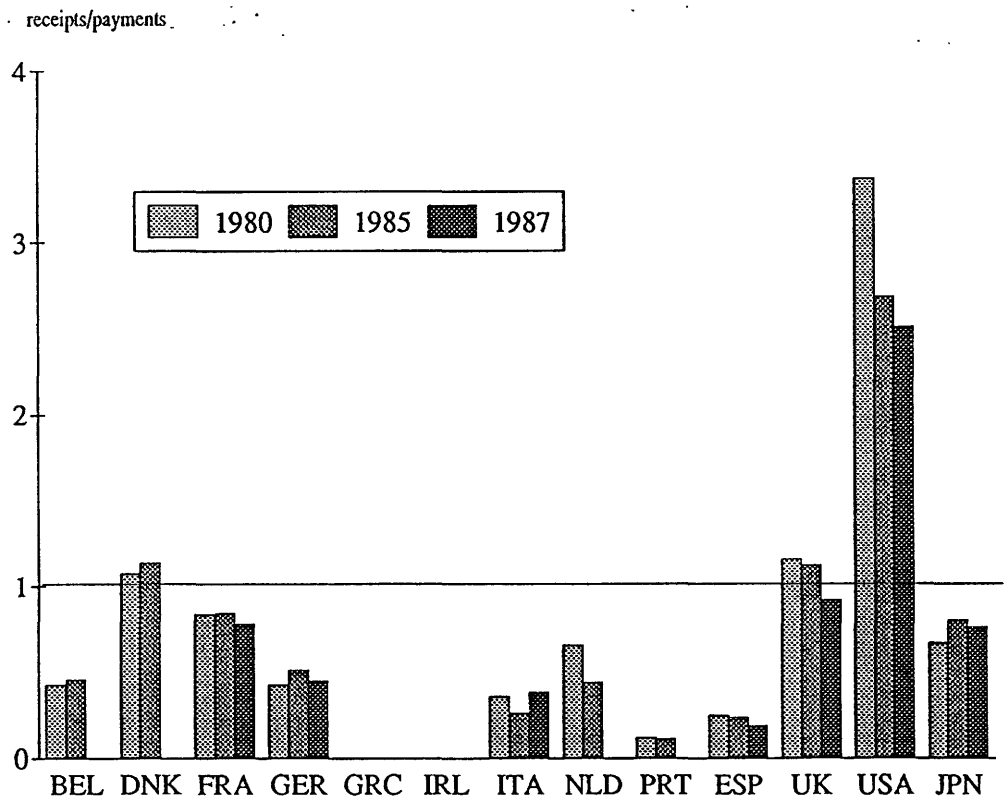
High technological competence does not necessarily mean that European industry is also leading in technical developments. Even less, it does not mean that European industry has a leading position in the most important technologies, particularly in the so-called core technologies.

Fig. 2.17: Technological balance of payment of OECD countries

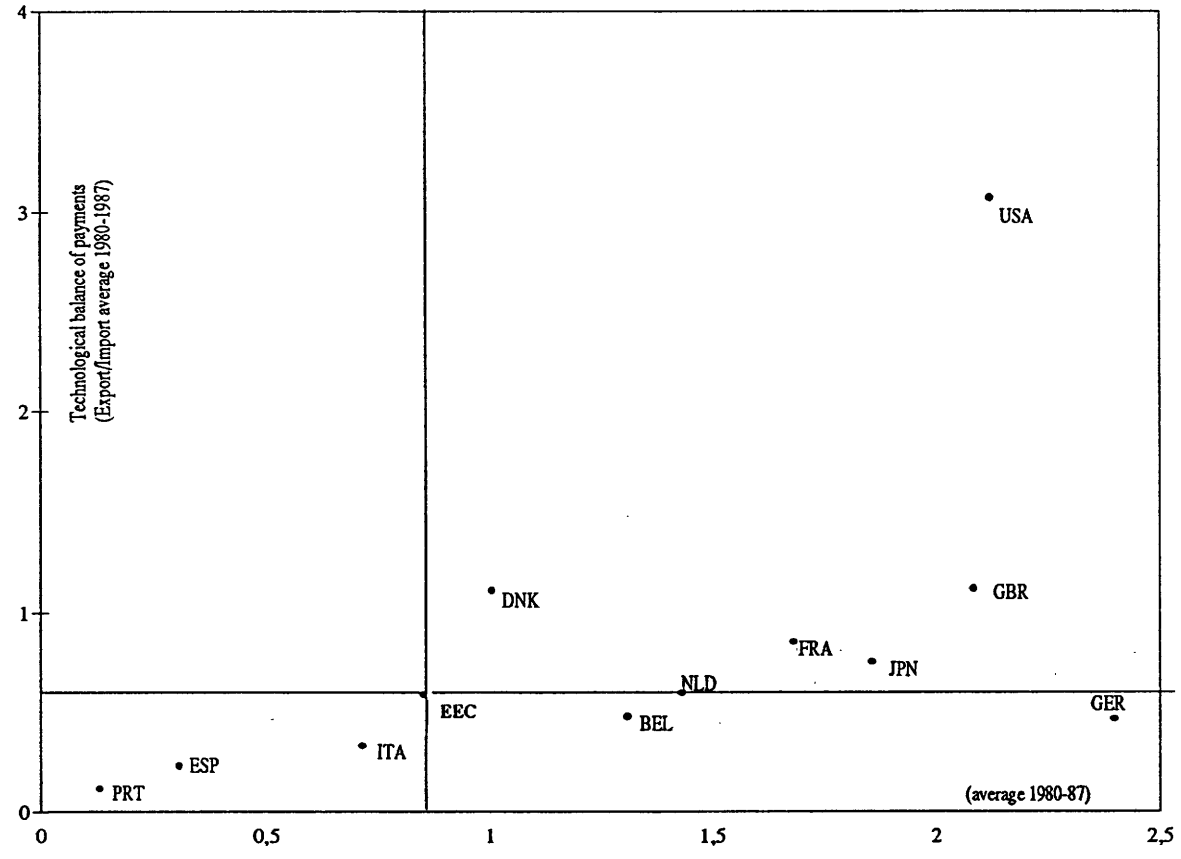


Source: OECD Science and technology indicators, 1991, own calculations.

Available empirical evidence shows quite well that the position of European industry in the development of new technology is not particularly strong. Data on patent flows in the Triade point at a dominance of the United States and Japan in global technological development. For Europe, the situation has declined considerably from 1981 to 1988. Moreover, data on technological balance of payment show negative results for most of the European market economies and Japan whereas the United States have a positiv balance. Finally, an analysis of input-output relations in research and development demonstrates that some of the European countries, particularly Greece, Portugal, Spain, Ireland and Italy, have a low R&D-

input and negative technological balance of trade. However, in these countries, R&D expenditures are growing faster than in the strong economies (Archibugi et al., 1992).

Fig. 2.18: Input-output relations in R&D of OECD countries

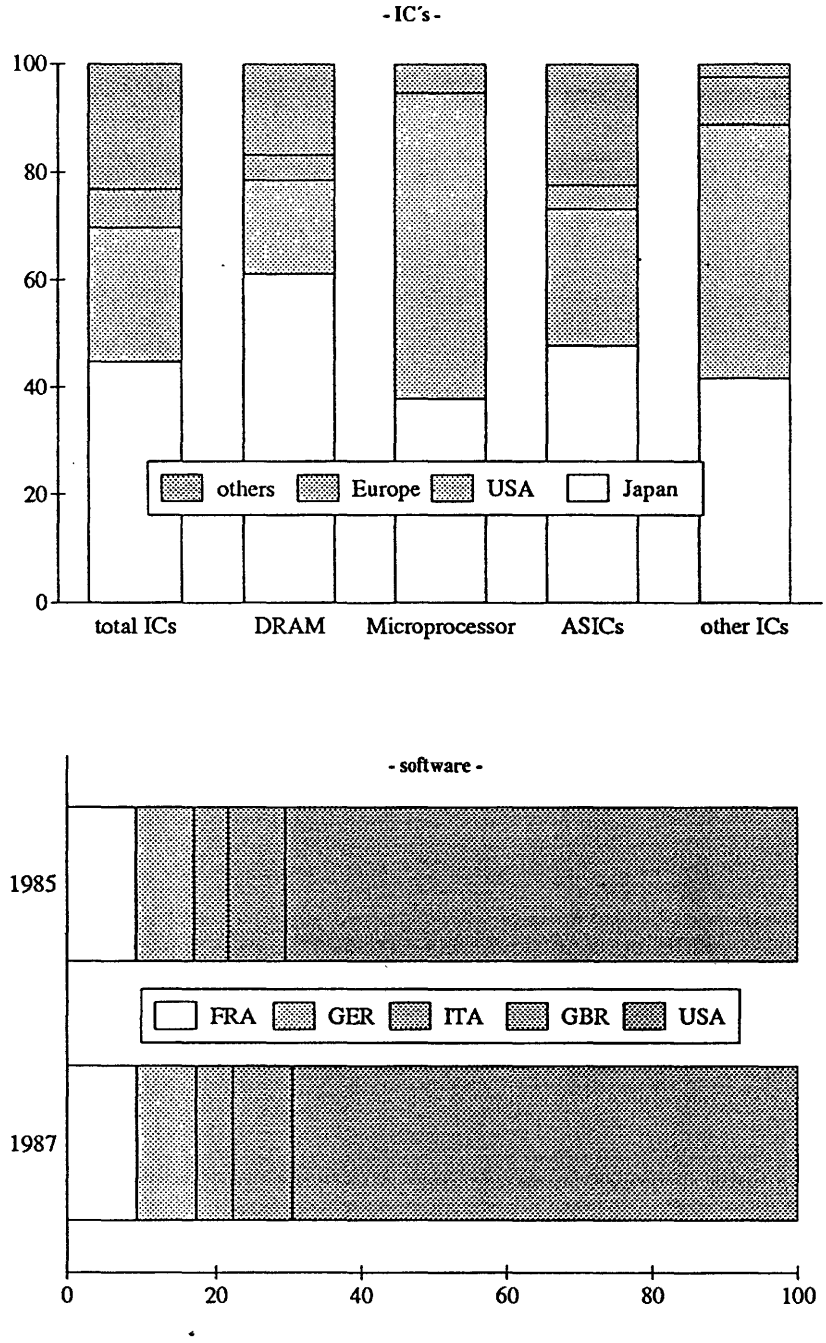


Source: OECD Science and technology indicators, 1991, own calculations.

These data should not be overestimated and are by no means a clear indication that European industry is on the way to becoming technologically backward. Yet, there are at least three problems that may lead to a significant decline of technological competence in European industry, namely

* the weak position of much of industry in Europe concerning core-technologies,
* deficits in systematically building up on technological linkages, and
* a technological "fundamentalism" associated with commercialization problems, long lead-times and an inefficient innovation management.

Fig. 2.19: Shares of Europe, the United States and Japan in IC trade and global software markets

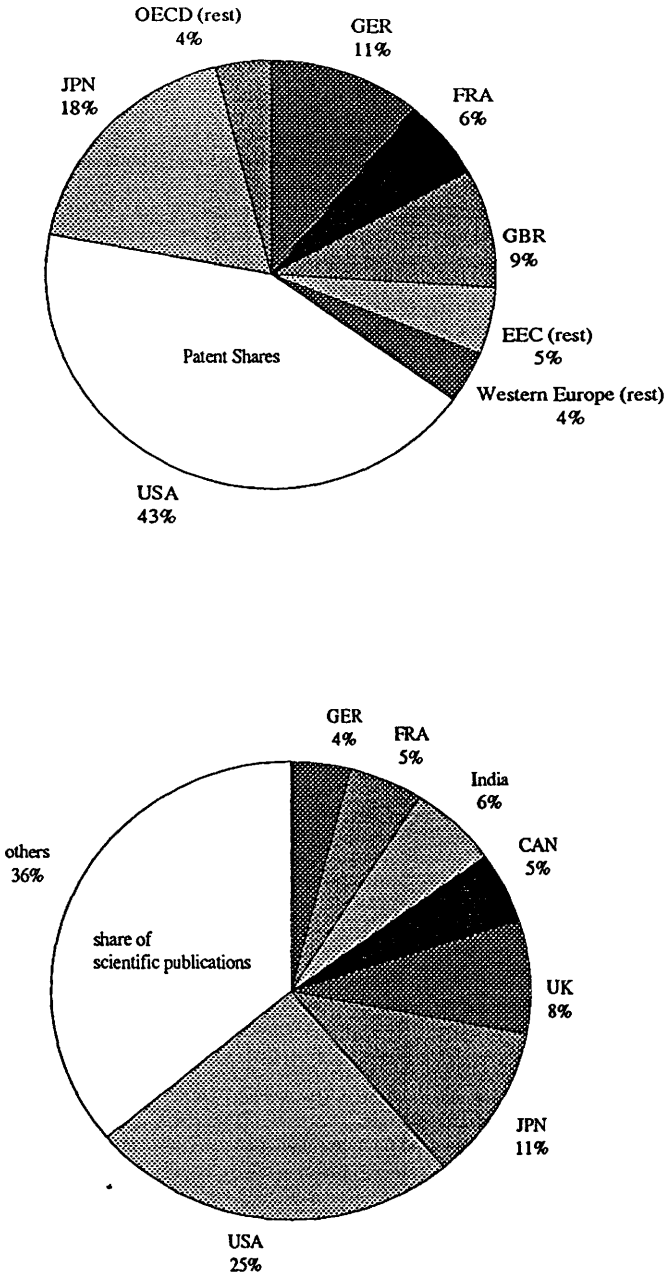


Source: Beldschacher/Klodt, 1992.

It is well known that Europe has a rather weak position in some core-techologies. This is paricularly true for information and communication technologies which are dominated by Japan and the United States. Both in basic and applied technologies, Europe has little say in information and communication. A somewhat better situation exists for software where the

United States dominate, but where Europe could secure a rather good position. (BMFT, 1993; OECD, 1992; van Tulder & Junne, 1988; de Woot, 1990).

Fig. 2.20: Patent activities and scientific publications in biotechnology

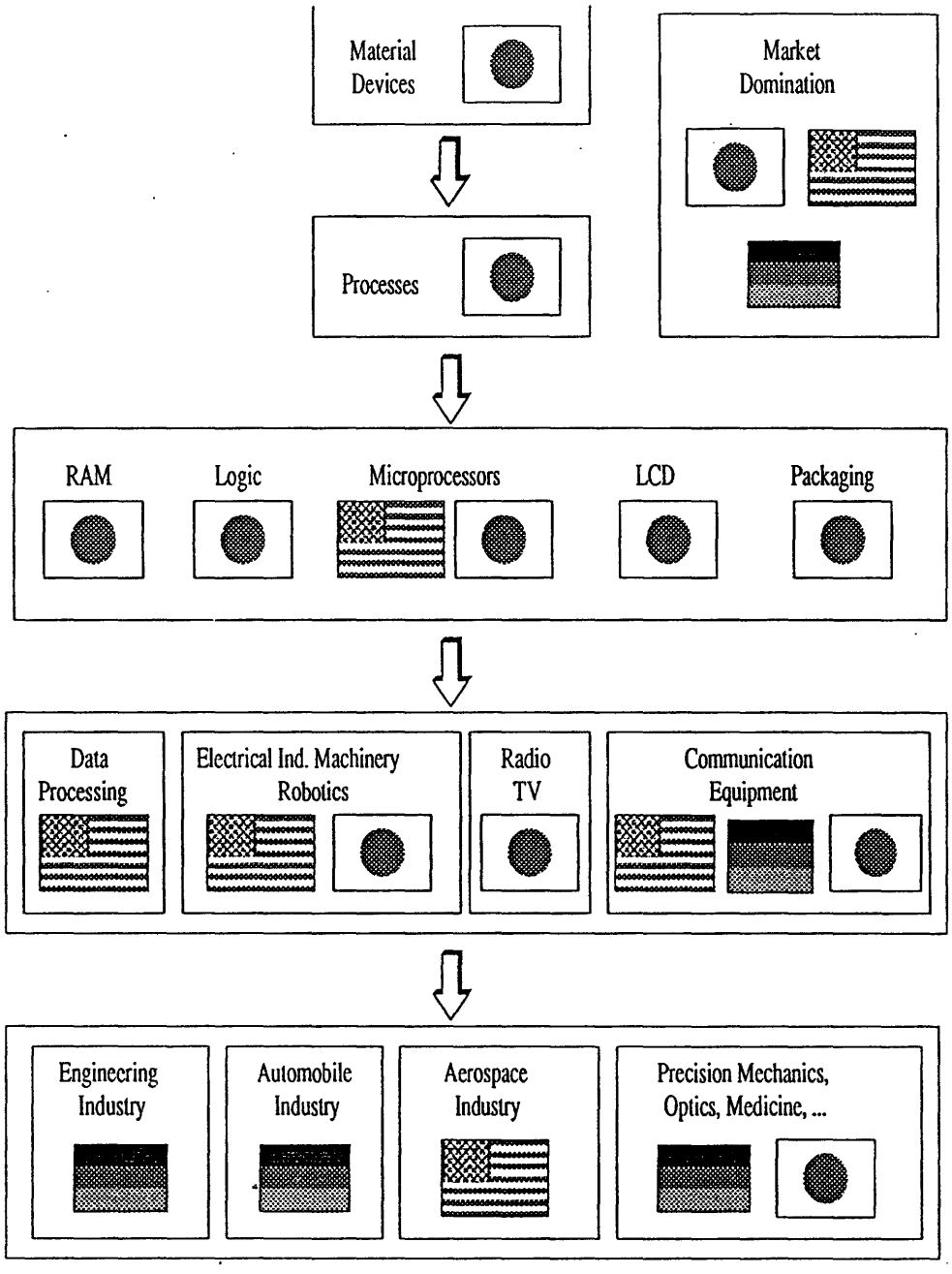


Source: Ifo, 1990.

A similar situation can be observed in biotechnology. Patent activities are again dominated by the United States and Japan whereas in Europe only Germany, France and the United

Kingdom are still significant players. The situation is not better when consider publications as an indicator for research activities[12].

Fig. 2.21: The technological food chain for information technology



Source: IBM Stuttgart.

[12] Data concerning publications are based on the Scienc-Citation-Index which contains some bias towards English language publications.

Deficits in core-technologies may hinder development in industries in which these technologies are applied. Based on technological interdependencies, a technological food-chain links development of different industries to core-technologies. (cf. Carlsson, 1989; Fransman, 1990; Kodama, 1991; OECD, 1992; United Nations, 1990).

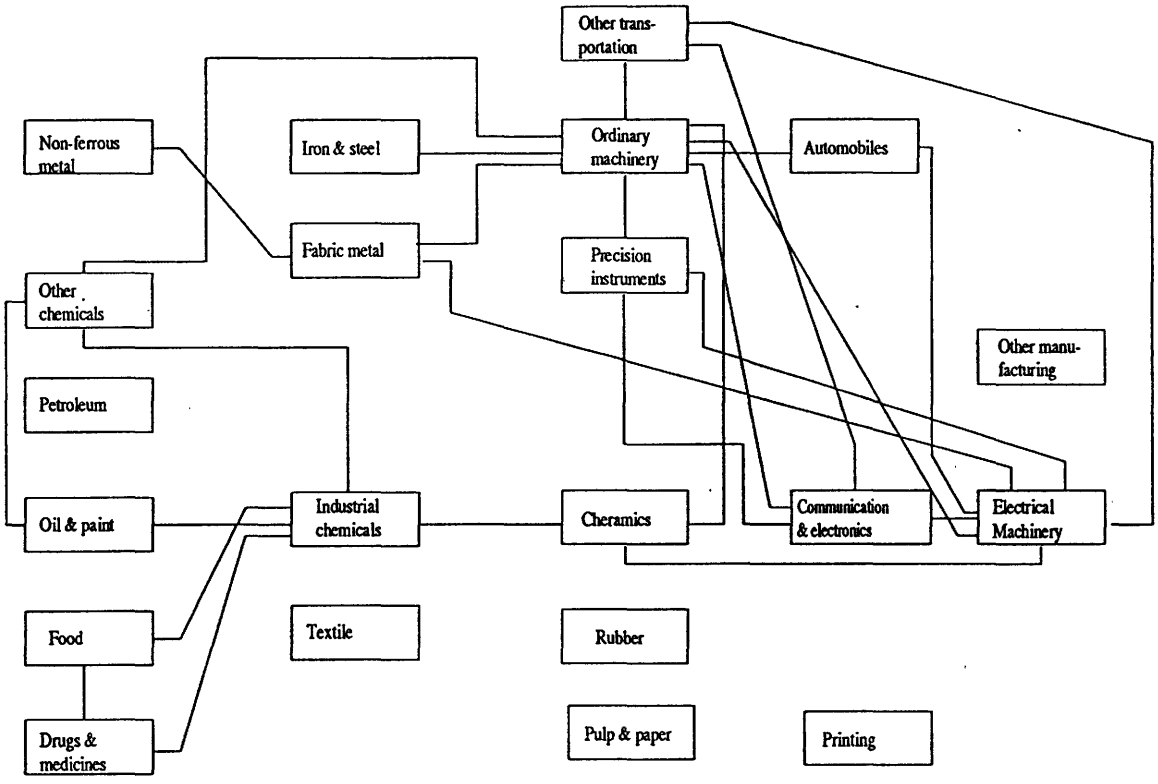
Technological food-chain is not the result of conspiracy or collusion of the kind that Japanese producers of information technology discriminate against foreign users. Rather, it is the simple result of the fact that development and application of modern technology requires close collaboration between producers and users. This is easier and more intensive on short rather than on long distancies and on face-to-face contacts rather than on telecommunication.

Given this case, we should expect that deficits in core-technologies are also likely to result in comparative disadvantages of European locations. They hinder the replacement of traditional industry networks oriented at maturing markets by new networks in innovative and growing markets. They also reduce the capability of industry in Europe to rapidly adjust to changing markets by developing not only new products for established markets but also by developing new markets.

This situation reflects the high importance of the social organization of technological development. Development and application of technologies, core-technologies in particular, is not primarily a scientific and technological problem, but rather an organizational one. It requires a high degree of collaboration and networking among different producers and users. (Badarocco, 1991; Kodama, 1991; Lehner, et al., 1993).

In Japan, collaboration and networking is well established in technologgy development. Development of new ceramics, for example, involves a large number of firms from different industries. The strength of the Japanese innovation regime is that it organizes such networks in collective research. This also facilitates development of new applications of technology and diversification of traditional industries into new fields. (Kodama, 1991).

Fig. 2.22: Technological development network for new ceramics



Source: Kodama, 1991.

In Europe, networking and collaborative research is much less developed. European innovation regimes are often technology-centered and neglect economic and social dimensions of innovation.

A new pattern of innovation

The shift towards technology-intensive and knowledge-based production, which goes along with development of a quality economy, does not simply mean high-technology. Rather, it means a broad trend towards a more intensive application of knowledge and technology both in products and processes. (cf. Kodama, 1991; Lehner et al., 1993; OECD, 1991b, 1992; Tidd, 1991).

High technological sophistication on the product and the process side is likely to induce rapid innovation and a changing pattern of innovation. This is particularly the case in a condition of diversified and volatile markets. More and more, new knowledge and technology is not developed to maturity, but experimentally applied already in a relatively early stage of development[13].

In the view of Fumio Kodama, industrial innovation at least in Japan is undergoing a paradigm change from breakthrough to technology fusion. Technology fusion is development of new products based on an integration of different technologies. Illustrative examples of technology fusion are integration of mechanics or optics with electronics in mechatronics and optoelectronics (Kodama, 1991).

Kodamas assumption of a paradigm shift is to simplicistic. Breakthrough and fusion are not mutually exclusive modes of innovation. Economic incentives, thus, support innovation patterns combining technology fusion and breakthrough. While technology fusion becomes a crucial feature of innovation, scientific innovation and technological breakthrough still remain important. (cf. Lehner et al., 1993; see also Roussel et al.,1991).

Moreover, fast innovation and short innovation cycles enhance premature and experimental application of technology in new products and processes. Continuous improvement of technology, products and processes, therefore, play an increasing role.

Emerging of a pattern of innovation which combines breakthrough, technology fusion and continuous improvement, changes innovation significantly. Innovation processes dominated by an orientation at breaktrough are disruptive, but rather slow and calculable. Processes combining breaktrough, technology fusion and continuous improvement are much more gradual and continuous, but more rapid and less calculable.

The new pattern of innovation involves a shift from a science based to a learning based mode of innovation.

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[13] This pattern of innovation is well explained in Nelson & Winter, 1982.

In a science based innovation mode, scientific inventions have been the major step. Innovation is primarily aiming at technological breakthrough.

In a learning based mode, innovation is a complex task of whole enterprises and production networks. Technological cooperation across production chains or technological linkages is of crucial importance. Innovation is aiming at new or improved products in short intervalls.

Empirical evidence from the executive survey by *The World Competitiveness Report* (1992) indicate that parts of industry in Europe have cosiderable difficulties concerning adaptation to the new role and pattern of innovation:

* R&D in key industries is behind foreign competitors,
* core-technologies, such as information technology, are not exploited strategically,
* total quality control as a tool for continuous improvement is neglected, and
* technological cooperation between companies is lacking.

This situation may carry strong negative effects when it comes to the solution of a fundamental problem of the advanced industrialized societies, namely the development of economic opportunities.

The threat of exhaustion

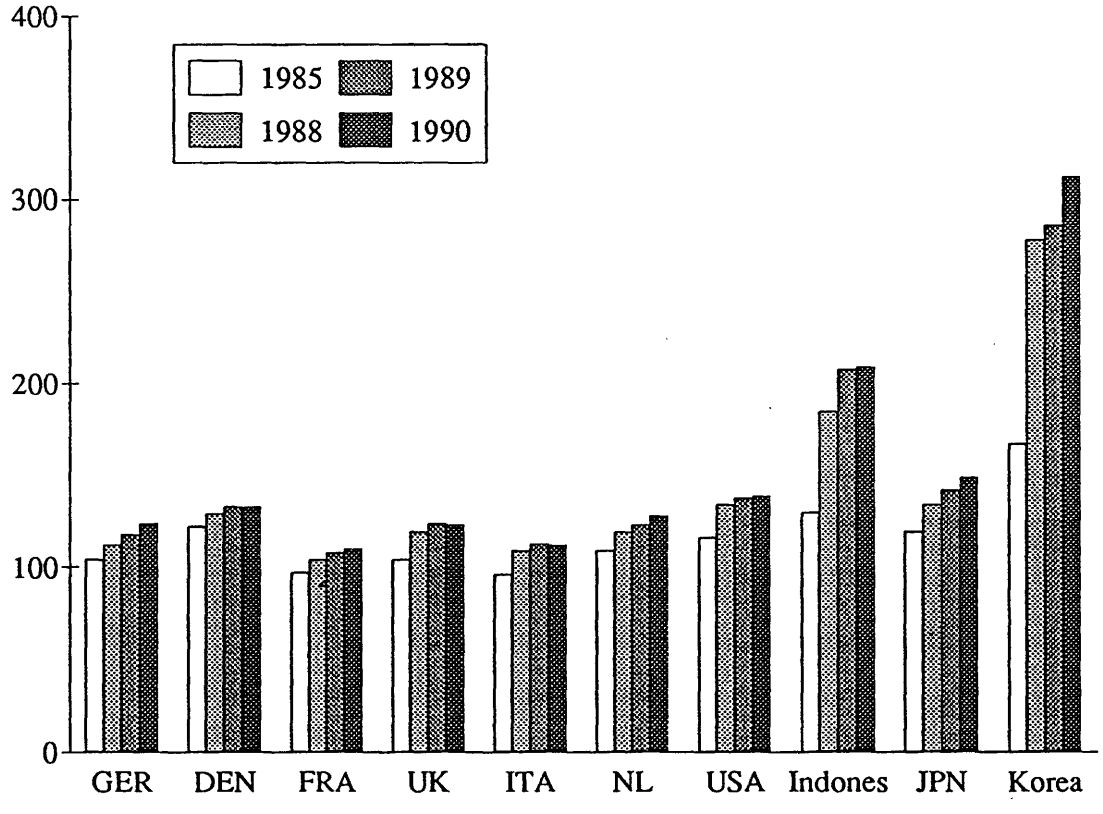
The advanced industrialized societies are experiencing developments which could easily lead to exhaustion of economic opportunities, that is of capabilities to secure returns, employment and growth in industry and services.

In the past, exhaustion of economic opportunities primarily has been associated with mature markets, that is markets with stagnating demand and low technological innovation. Now, the case is more difficult.

While problems of maturity and low innovation still are important in some areas, exhaustion is increasingly arising as a consequence of industrialization in newly industrializing countries and rationalization of industry and services in the industrialized and newly industrializing countries. Strong tendencies of exhaustion are also associated with fast innovation and high design content of products.

Currently, production capacities in industry and services are rapidly growing on a global scale. In newly industrializing countries, new and growing business in industry and services is established at often fast pace. This includes Eastern Europe and the hitherto less industrialized countries in the European Communities. In the industrialized countries and newly industrializing countries massive rationalization also creates growing production capacities in industry and services. (OECD, 1988b, 1991a; United Nations, 1990).

Fig. 2.23: Real growth of industrial production in industrialized and newly industrialized countries



Source: Statistical Office, Federal Republik of Germany, 1992.

Growth of production capacities in industry and services is often not matched by corresponding growth of absorbing capacities of markets. The danger, thus, is that on a global scope production capacities are developed which exceed absorbtion capacities of markets by a wide margin.

This is particularly the case in newly industrializing countries where low wages are a major aspect of competitivness and locational advantage. Accordingly, mass income and domestic markets capacities grow much slower than production capaicities. In Japan, strategies to distribute national wealth in favour of capital formation and at the expense of consumer income have the same effect. (OECD, 1988b).

For the European Community, this creates a difficult situation. Its capacious markets are an important target for imports from newly industrializing countries and Eastern Europe which lack capacious markets. However, in the European Community too, demand is growing slower while production capacities are likely to increase.

In Europe as well as on a global scope, excessive production capacities in relation to absorbtion capacities of markets are likely to lead to more severe competition and a related decline of prices. Economic opportunities will decrease in value accordingly.

Exhaustion is by no means a new phenomenon. Capitalist development is always associated with destruction of economic opportunities. Progress in capitalist economies is, as Schumpeter pointed out many years ago, a process of constructive destruction. As a result of innovation and change, old economic opportunities exhaust and new economic opportunities are created. (Schumpeter, 1942).

Idealistically, the process of constructive destruction creates new economic opportunities as it destroys old ones. This ideal is, however, increasingly beyond reach.

In the last chapter, we have demonstrated that as the strongholds of industry in Europe, the United States, Japan and other countries are shifting to technologically sophisticated quality

production, technology is becoming a crucial factor of competition and competitiveness. The result is fast innovation and high costs for research and technical development.

Fast innovation often channels demand into new markets and results in decline of established markets. An illustrative example is the computer industry where fast improvement of workstations has created squeezing of demand for main frames. This would still fit the model of constructive destruction.

The case, however, is more difficult. In a condition of fast innovation new products are often brought to markets before existing ones have reached profitability. As a result, returns and profitability are declining. Microelectronics and personal computers offer illustrative examples for this situation too. (cf. Kash, 1989).

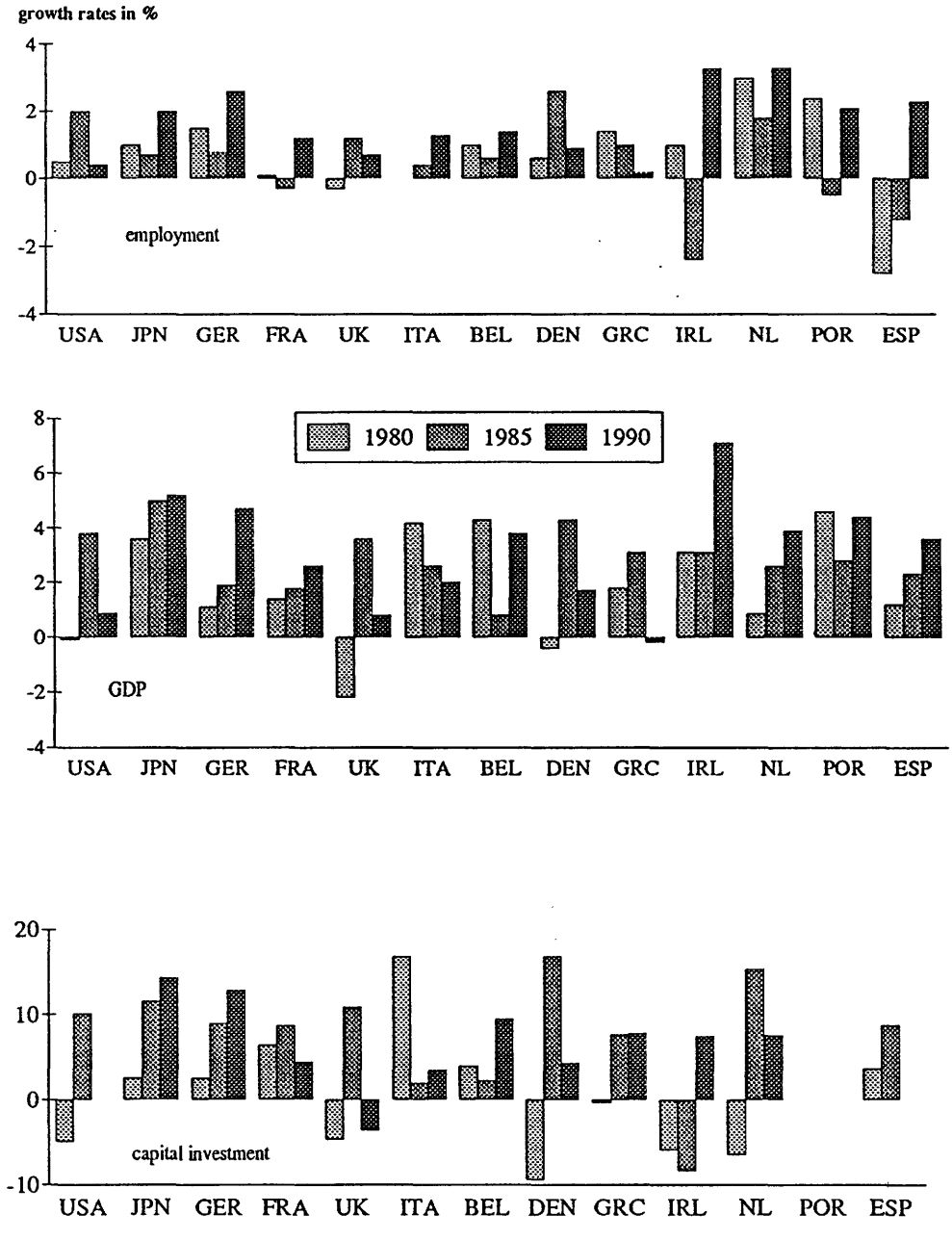
The point, thus, is that with increasing speed of innovation, the process of constructive destruction is likely to become more destructive and less constructive. Rapid innovation, then, is likely to decrease economic opportunities.

Similar effects are also created by an increasing importance of aesthetical or fashion aspects for product quality. This is particularly relevant in a condition of increasing social differentiation where taste and aesthetic principles are becoming more fluid.

Exhaustion is already more than a realistic threat in a number of industries. In plastics, steel and air transportation, for example, global production capacities already exceed global demand. Computers are another prominent example which also demonstrates that exhaustion is not confined to traditional industries or to low-tech industries, but hits modern high-technology industries as well.

The fear is that more and more industries are facing similar developments. Accordingly, losses of economic opportunities in some industries are unlikely to be compensated by corresponding gains in other industries.

Fig. 2.24: Growth of GDP, capital investments and employment in industrialized countries



Source: OECD, Historical Statistics.

In a worst case scenario, we have to assume that this condition will lead in Europe to massive unemployment. Competitiveness and profitability of an increasing number of companies is likely to decline as prices decline. In order to regain profitability and to ad-

vance competitiveness, many companies have to increase productivity, adjust capacities and significantly reduce their workforce.

Since many years already, employment in the industrialized countries is growing much slower than GDP and capital investments. There are considerable variations across countries, but the general trend is that employment tends to decline even when GDP is growing. Excessive capacities and exhaustion of economic opportunities may drammatically speed up decline of employment.

If decline of employment continues, we should expect that in the longer run, competitiveness and profitability of industry and services will decline as well. Long termed unemployment of considerable volume will impose increasing social costs on the economy and result in declining demand. Accordingly, costs of production increase while turnover and returns are likely to decline. Then, exhaustion of economic opportunities in terms of sales value and turnover as well as in terms of employment is becoming a realistic threat.

This scenario is not inevitable, but simply underlines the importance of the problem. Industry in Europe and other industrialized areas is facing a severe threat of exhaustion of economic opportunities.

An active approach to economic opportunities

In view of a severe threat of exhaustion, an active approach to economic opportunities is necessary. A set of strategies ranging from product innovations or changes in design which significantly improve the functional, social or aesthetical value of products to development of new products and new markets have to be implemented. Diversification of industry in Europe in new businesses and markets must be the key issue on the agenda of industrial strategies and industrial policy.

In Europe and the United States, enterprises usually diversify in a particular way. They aquire other firms and use these aquisitions to develop business activities in promising

markets. In some cases, this strategy may create new economic opportunities. Usually, however, it is simply a reshuffling of existing economic opportunities from one enterprise to another and a change in the protofolio of enterprises.

In order to create new economic opportunities, a different type of diversification is needed. Enterprises have to use their potentials, particularly their know-how and technological competence and the skills of their workforce, to develop new products for new markets. Along with this, workforce has to be transferred from declining to new business.

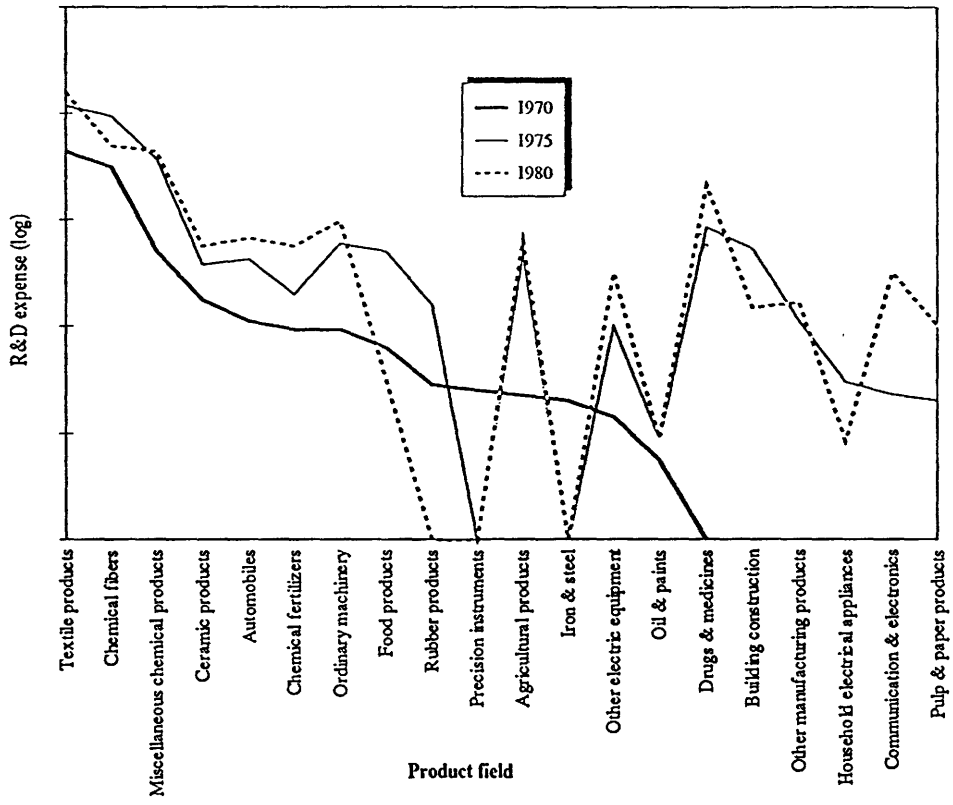
Interesting cases of such a diversification strategy are provided by a number of Japanese firms, for example companies in steel and in chemical industries. Firms like Nippon Steel and Kobe Steel have managed to reduce their traditional business considerably and to secure employment and returns by developing new business.

On the first glance, diversification strategies of Japanese steel companies do not differ significantly from that of European steel companies. New business structures are quite similar. The important point, however, is that the Japanese companies have managed adjustment with their existing workforce and out of their existing potentials whereas European companies have layed off much of their workforce from steel business and managed adjustment primarily by means of mergers and aquisitions.

Japanese companies have developed a type of diversification which is technology-led. It attempts to develop new products on the basis of the technological knowledge and competence of a firm and its personel. This may be confined to new applications of existing technology, but usually includes broadening and development of the technological base. An illustrative example for this case is development of R&D in Japanese textile industry. (Kodama, 1991).

Success of technology-led diversification strongly depends on companies' ability to capitalize on problems, needs and demand which so far has not been satisfied economically or for which better economic solutions may be developed. This may be called the socio-technology apporach to diversification.

Fig. 2.25: R&D profile of diversification in Japanese textile industries



Source: Kodama, 1991.

Box 2.4: Socio-technology approach to diversification

Socio-technology approach to diversification combines two strategies:

* A systematic exploitation and development of companies' technological base and know-how, and
* a systematic orientation social needs and societal problems which are hitherto not satisfied by economic measures.

The aim is to develop a technological solution for such needs and problems which may be translated into a marketable product.

A socio-technology approach to diversification technology-led diversification is a strategy which suits the profound logic of capitalism. The vitality of capitalist economies relies, quite obviously, on their capabilities to translate societal needs and problems into economic demand and to secure capacious markets for the relevant products.

However, it is a difficult, costly and risky type of diversification. Major problems are:

* It requires a combination of a creative marketing with a long-termed R&D which is difficult to organize;
* it faces organizational impediments, such as segmented structures or a lack of collaboration across firms;
* it involves high uncertainty concerning the application of technology and the translation of needs into demand;
* it involves high costs for both marketing and R&D;
* it is time-consuming and often expands far beyond the usual time horizon of firms' activities; and last not least
* it does not fit well into European and American enterprise culture and a related narrow definition of enterprises.

Given these problems, support by public policy may be important.

However, public policy in Europe has a strong tendency to react on the decline of politically relevant firms and industries in terms of protectionism. The concerned firms and industries are kept in business by subsidies or regulated to reduce capacities and to avoid exhaustion. Little or no attempt is made to support utilization of their potentials for development of new products and markets. On the contrary, protectionist policies motivate firms to dismiss with active approaches to economic opportunities. Policies concerning coal mining, steel or ship-building throughout Europe provide numerous examples for this case.

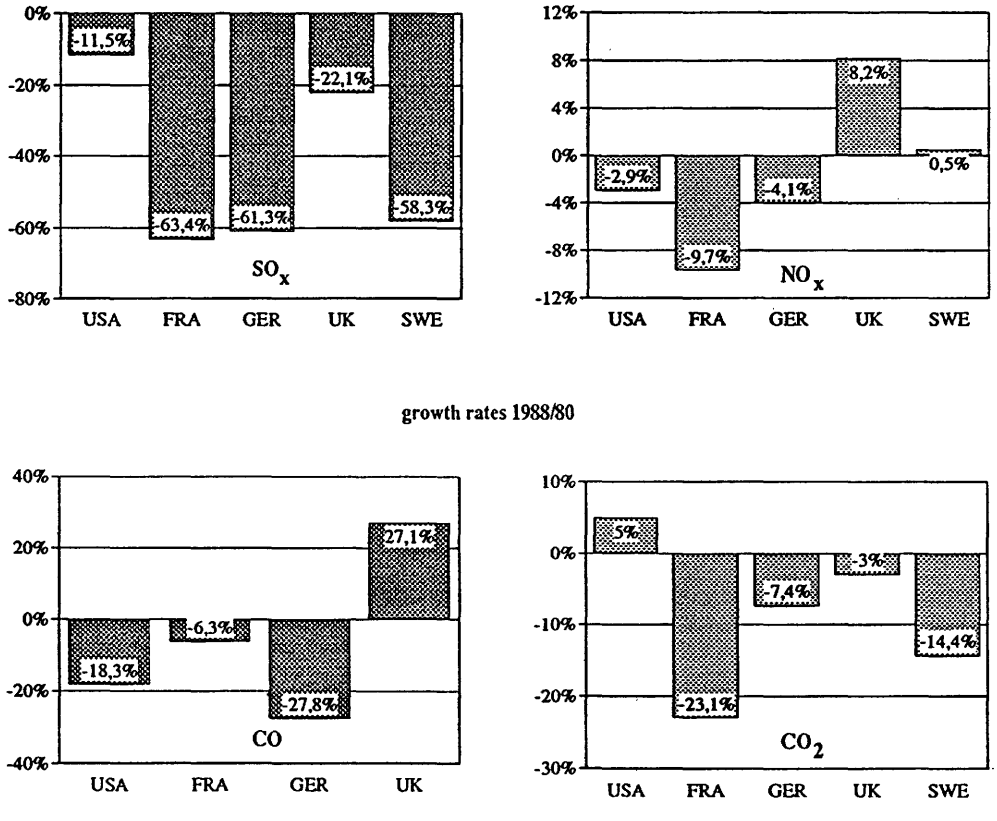
Successful development of new economic resources to fight the threat of exhaustion in Europe, thus, requires not only a strategic change in industry, but also far-reaching changes in industrial policy orientations.

An environmental motor to markets

An interesting case for a socio-technological approach to diversification and development of new economic opportunities is environment. As various studies demonstrate, environmental problems and concern are sharply increasing in the advanced societies as well as on a global scope which requires fast changes of industrial structures and strategies (cf. Brown et al., 1991; Burrows et al., 1991; CEC, 1992a; OECD, 1991d; von Weizsäcker, 1990).

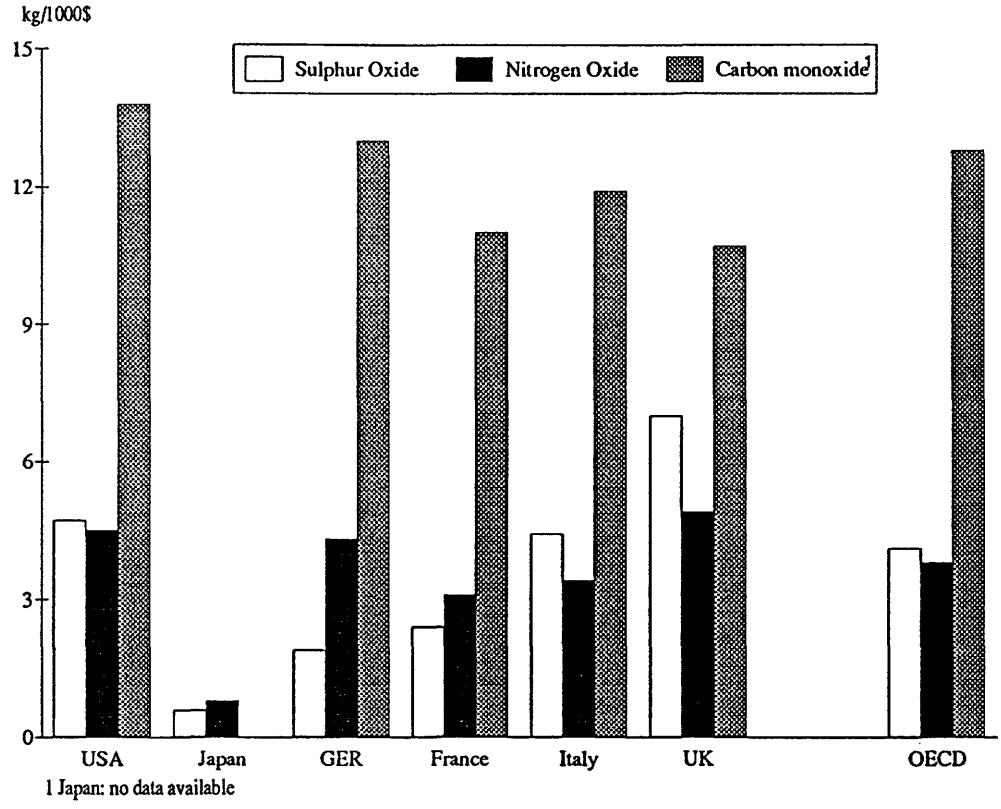
Although emmission of gases has been significantly reduced in the industrialized countries, strategic atmosphere depletion, greenhouse effect and global spread of air pollution remain critical issues.

Fig. 2.26: Development of emmissions of air pollutants



Source: OECD, Environmental Data, 1991; own calculations.

Fig. 2.27: Man-made emmissions of air pollutants per unit of GDP



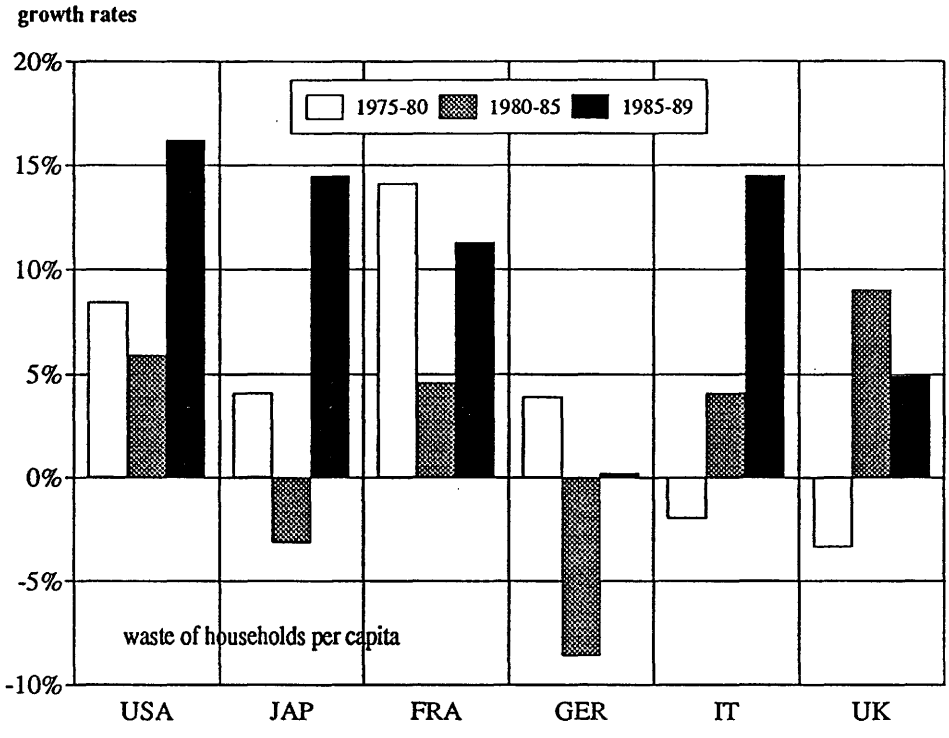
Source: OECD, The State of Environment, 1991.

While emmissions are decreasing in most of the industrialized countries, there is a massive increase of municipal and industrial waste. Similarly, energy consumption has increased significantly.

It is not necessary to discuss these problems in more details here. Suffice it to conclude that environment still is an extremely critical issue for industry.

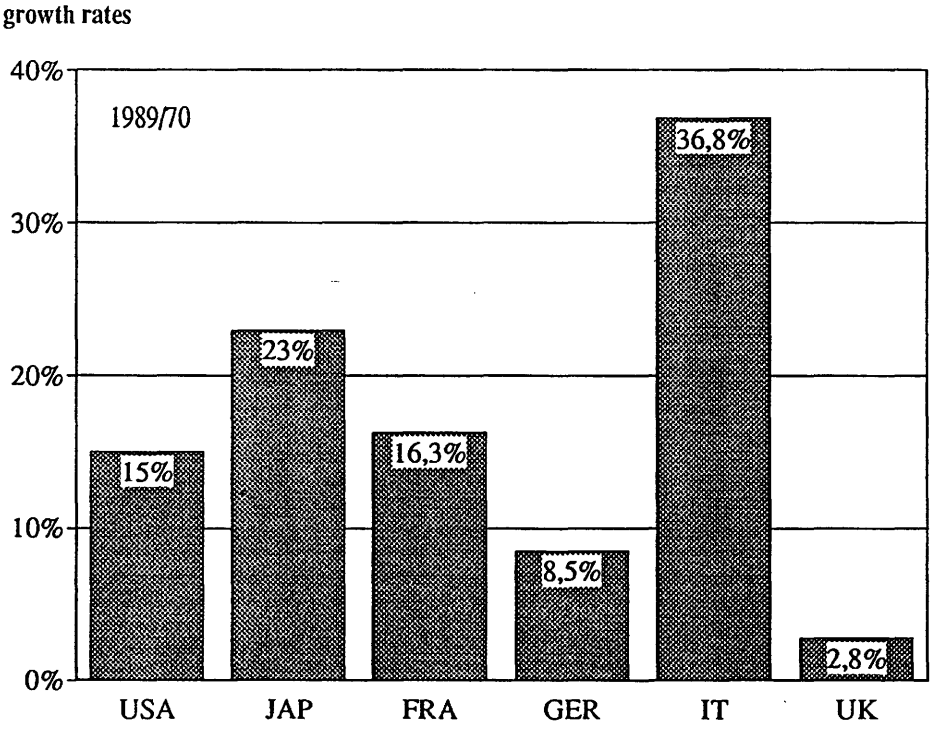
Against that, economic solutions of environmental problems are often missing. Environmental problems still are solved primarily by political rather than economic means. As a result, increasing frictions and contradictions between environmental concern and competitiveness and growth in industry are building up.

Fig. 2.28: Development of waste in industrialized countries



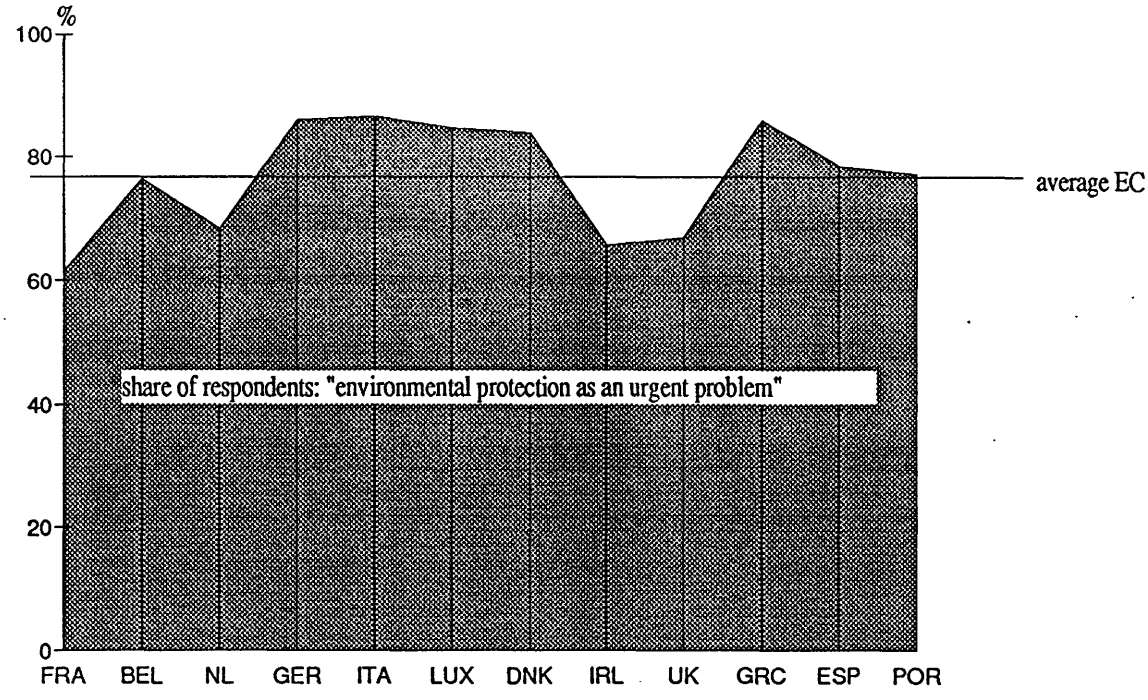
Source: OECD, Environmental Data, 1991.

Fig. 2.29: Energy consumption in industrialized countries



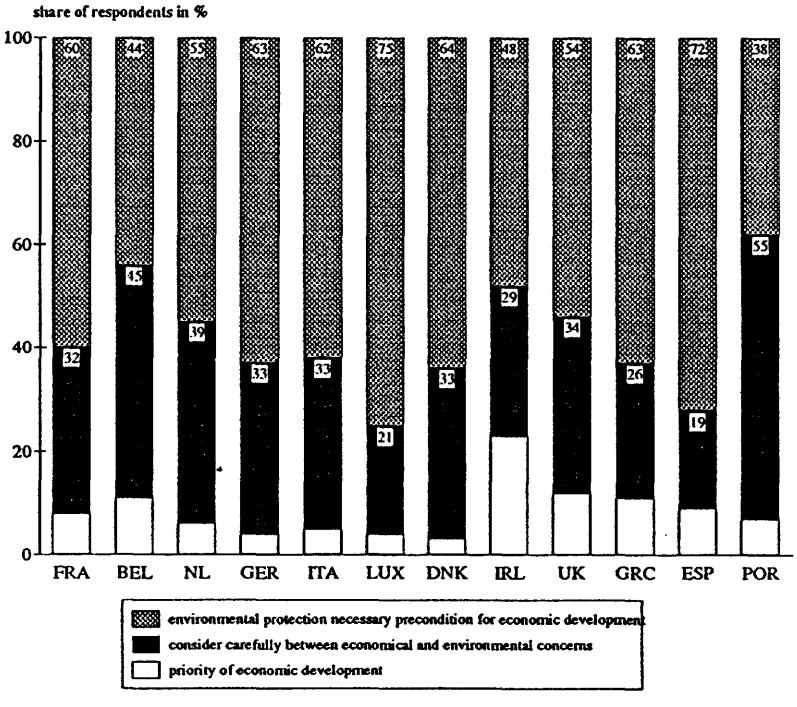
Source: OECD, Environmental Data, 1991; own calculations.

Fig. 2.30: Environmental concern in the European Community



Source: Eurobarometer 29, 1988.

Fig. 2.31: Attitudes towards environment and the economy in the European Community

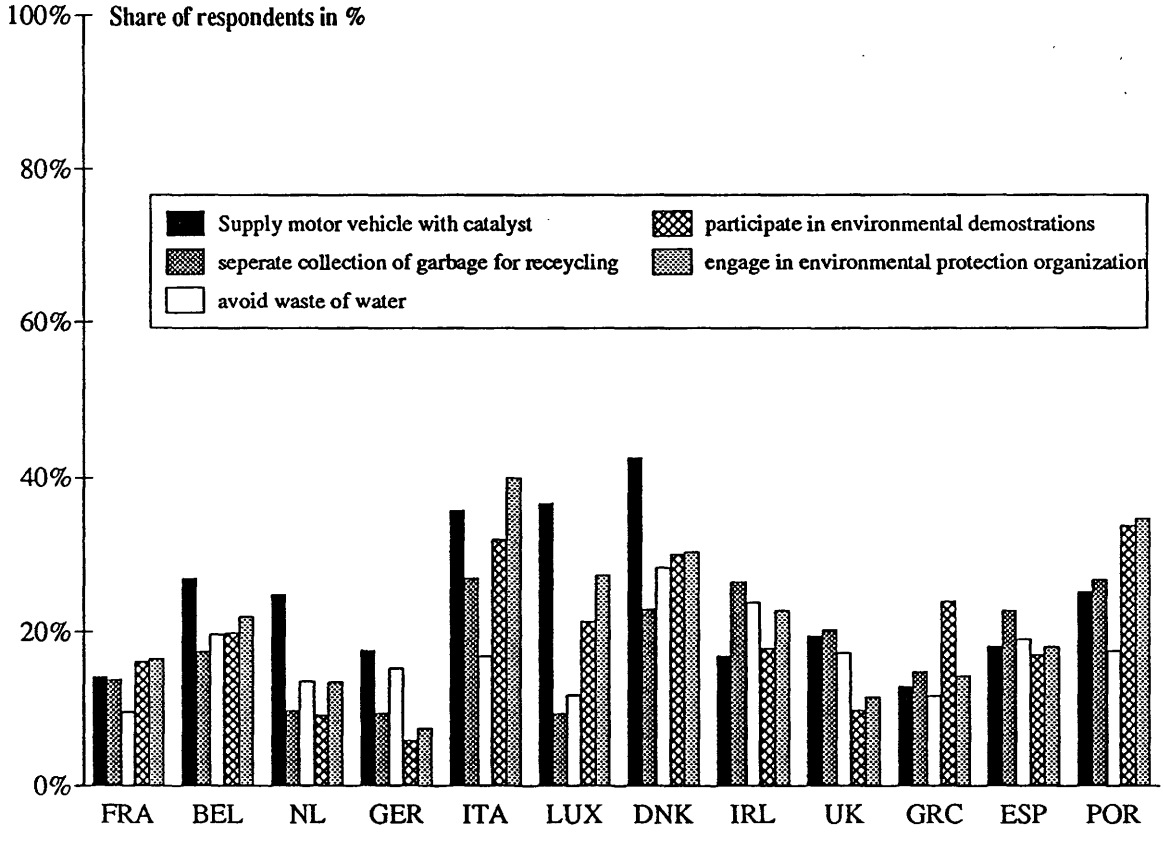


Source: Eurobarometer 29, 1988.

Within the population of the member countries of the European Community, there is a high concern on environmental problems. This holds not only for the rich, but also for the poor countries. In most of the countries a majority of the population also accepts that environmental protection is a necessary precondition for economic development.

These positive attitudes towards environmental issues are, however, not influencing behaviour strongly. Willingness to involve in concrete activities to protect environment is fairly low. The result is a contradictory situation.

Fig. 2.32: Environmental involvement in the European Community

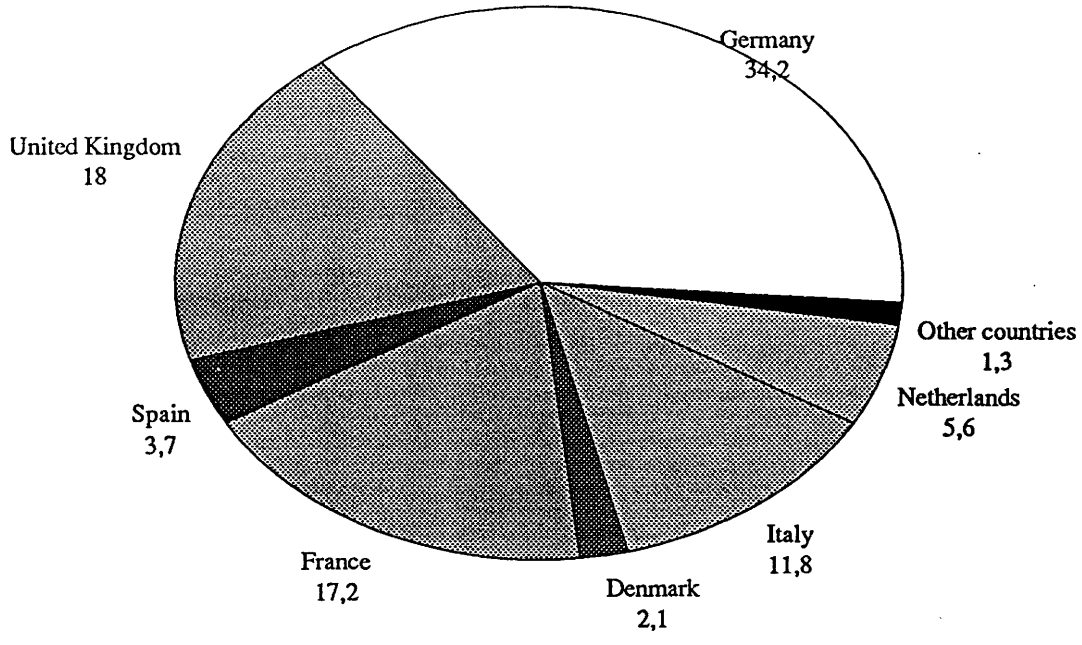


Source: Eurobarometer 29, 1988.

On one side, they support strong and even increasing pressure for political solutions to environmental problems. They also create strong restrictions and problems of acceptance for industry. On the other side, they find it very difficult to solve environmental problems at the

expense of material living conditions. Political solutions to environmental problems face severe restrictions and their effectiveness is unlikely to be of high.

Fig. 2.33: Growth potentials of economic solution of environmental problems



Environmental Expenditures in the EEC Countries in 1988:
Total volume 94 billion DM

Source: Ifo, 1992.

In order to resolve this multiple dilemma, economic solutions to environmental problems have to be rapidly developed. Rather than beeing a restriction to growth and competitiveness, solution of environmental problems is used as motor to increase economic opportunities and to enlarge the scope of market solutions to a wider range of societal problems[14].

As a memorandum of the Commission of the European Community shows, economic solutions to environmental problems bear high growth potentials for many industries. It is,

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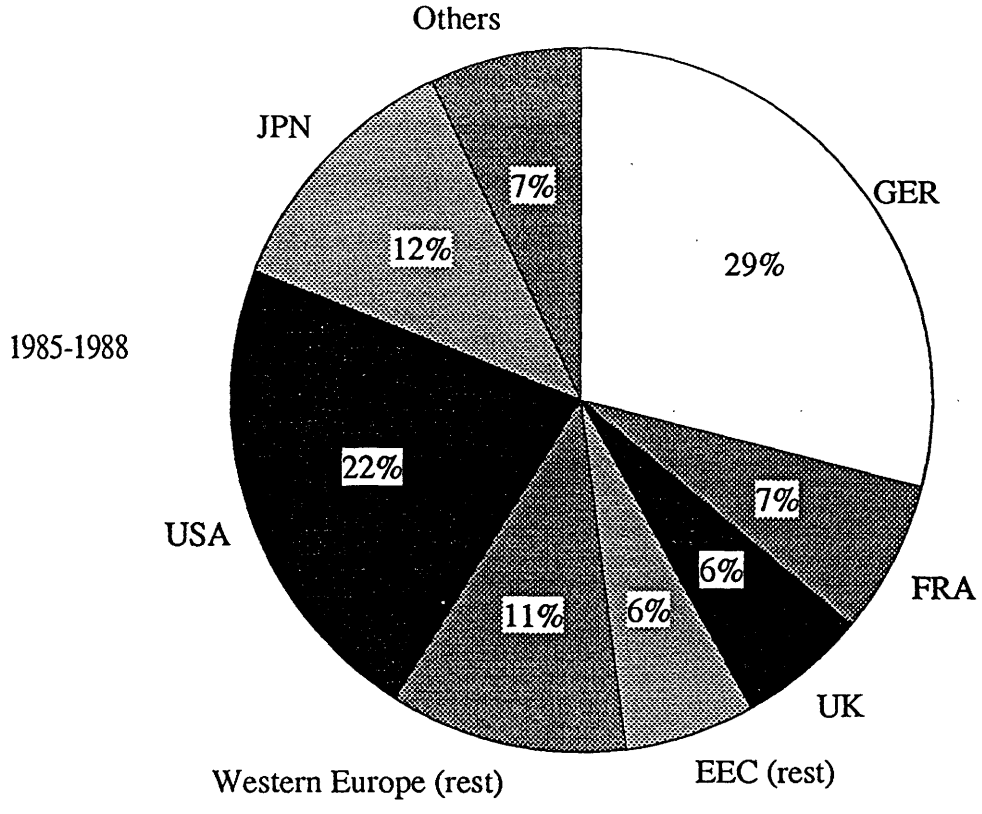
[14] There is a broad discussion on economic instruments for environmental policies. This discussion, however, is strongly concentrating on issues of regulation and often neglects issues of technology and product development. - Cf. CEC, 1992a, 1992b; OECD, 1989b, 1991e; Scherp, 1992; von Weizsäcker, 1990).

therefore, realistically to use solution of environmental problems as a means to develop new economic opportunities and to avoid exhaustion. (CEC, 1992a).

Fig. 2.34: Patents in environmental technology



Source: Ifo 1990.

Industry in Europe, Germany in particularly, is in a good starting position for environment-based growth. It has already heavily invested in relevant R%D and holds a high share of international patents.

A new philosophy of growth

Development of market solutions to environmental problems as a means to create new economic opportunities means a new philosophy of growth is needed. The philosophy is not limited to growth, but rather problem-solving growth.

The philosophy does not only apply to environmental problems, but to social problems as well. Economic solutions to social problems, such as care for the elderly, may enhance economic opportunities and reduce the load on the public welfare system. This is particularly relevant with respect to employment.

The threat of massive unemployment often motivates public policy to think in terms of a so-called second labour market, that is publically financed jobs and training activities. The problem with such strategies is that that they increase welfare spending and directly or indirectly impose higher costs on business and labour. The possible result may well be a vicious cycle where public financed employment destroys jobs in business and increases need for public financed employment.

An alternative to such strategies is public activity which creates larger amounts of jobs in the private sector and stimulates the first labour market. Regulation that puts high environmental standards on public buildings, for example, create strong demand for environmental construction technology and, by this, create new jobs in environmental technology industry.

Strategies of problem-solving growth have to be linked to the global perspective. Currently, a considerable part of the European population and much of the world's population, particularly in the third world, are little or not participating in markets. In terms of population, the scope of markets in the global system is still rather limited. For the most part, global markets are confined to the advanced countries and a small social class in the developing countries.

As is well-known, the economic wealth and the technological knowledge of the world are already heavily concentrated in the "triade", that is in Western Europe, the United States and Japan. These countries also offer comparatively well living conditions. And they exploit most of the worlds resources.

The current concentration of wealth and knowledge, and the high living conditions in the triade can be praised as a great economic success. However, in a longer perspective, this success bears the danger of failure.

High and even increasing disparities in the worlds economic, social and environmental conditions are already resulting in serious problems of migration, criminality, social unrest and environmental destruction. As disparities continue to exist and even increase, these problems will intensify and impose increasing costs on the countries in the triade.

In view of the dangers and risks of such a development, the strategic goal of industrial policy and of industrial activity in the advanced countries must be to enhance a type of global production which guides investments and technological knowledge to the developing countries. Particularly, the aim must be to build up industry which is internationally competitive not only by means of cheap labour, but also in terms of quality and technological performance. This supports development of mass welfare in the developing countries and creates at the same time increasingly capacious markets for the global economy. That is globalization at its best.

Part 3:

Industries and Enterprises:
A Re-examination of Structures and Strategies

The performance of European industry is at stake. European industry certainly has its strength, but also its weaknesses which are truely alarming. Major weaknesses are productivity and development of new products and markets. Its strength is in technological competence and skilled labour. However, both technological competence and skilled labour can not be taken for granted.

This is a general picture which needs qualification. Industry in Europe is by no means homogeneous. Some industries have secured comparatively high performance while performance of others is weak or in danger of decline. The crux of the matter, however, is that we can not simply add up strong and weak industries because there are strong interdependences between industries. As a result, weaknesses in some industries may endanger in the long run performance of industries which currently are still rather strong.

Problems and perspectives of performance often differ considerably between small and large enterprises. Advantages for large enterprises or often disadvantages for small and medium firms. In many cases, large enterprises secure performance in the short run at the expense of small and medium supplier firms. The danger is that small and medium enterprises become the victims of industrial modernization.

In order to attain and secure high performance, smaller and larger enterprises and whole industries have to change structures and strategies. Enterprises have to develop intelligent production systems and to shift from activity-oriented to process-oriented management strategies. Beyond that, collaborative networks of enterprises and whole industries have to be developed in order to account for increasing interdependencies of firms' and industries' performance. A new industrial structure has to be pushed forward.

Performance of European industries: Critical issues

Recent studies on comparative performance of European industries are drawing a rather alarming picture. Decline of technological competence, decreasing productivity, low capabilities in product innovations and loss of market shares seem to be the most serious

challenges and dangers for European industry (cf. Lehner et al., 1993; MIT, 1990, OECD 1991b, 1992; van Tulder & Junne, 1988; de Woot, 1990; World Competitiveness Report, 1992)[1].

European industry often has put too much emphasis on traditional businesses and failed to invest timely in new businesses and new technologies. As a prominent expert, Herbert Henzler, chairman of McKinsey Germany, puts the case, it is not the social burden that has infected Europe's economic health, but the missing ability to shift timely to new value-added business (Henzler, 1992).

Performance of industry in Europe is, certainly, a case for concern. However, in spite of serious problems, the future position of European industry in a global economy is still open. European industries have not only their weaknesses, but their strengths as well. The most important weaknesses are productivity, product innovation and market development. Traditional strengths are technological competence and skilled labour. Technological competence is, however, at risk.

Box 3.1: Key issues of industrial renewal in Europe

* ability to develop new products and new markets,
* ability to secure and enhance productivity,
* ability to fasten time-to-market,
* technological competence and
* abilty to implement adequat organization.

Much of the future of industry in Europe hinges on the capabilities of major industries to shift from traditional structures and established products to modern organization and new products and new markets.

[1] General problems of performance of industry in Europe are discussed in the *FINE-Synthesis Paper No 2*. In this paper, we discuss problems more specifically in relation to particular industries in order to identify major weaknesses.

While many of Europe's industries are successfull in their established, tradional markets, few have impressive abilities to develop new products and markets. European firms are often more reluctant to respond to new market opportunities and rather slow in switching their activities to new value-added business. An illustrative case is development of new materials, particularly of multi-materials where American and Japanese firms act both faster and more systematic than most of their European competitors.

In European industry, product innovation often is strongly oriented at established markets. Firms often act in isolation and efforts in product innovation are limited sector specific resources, activities and developments.

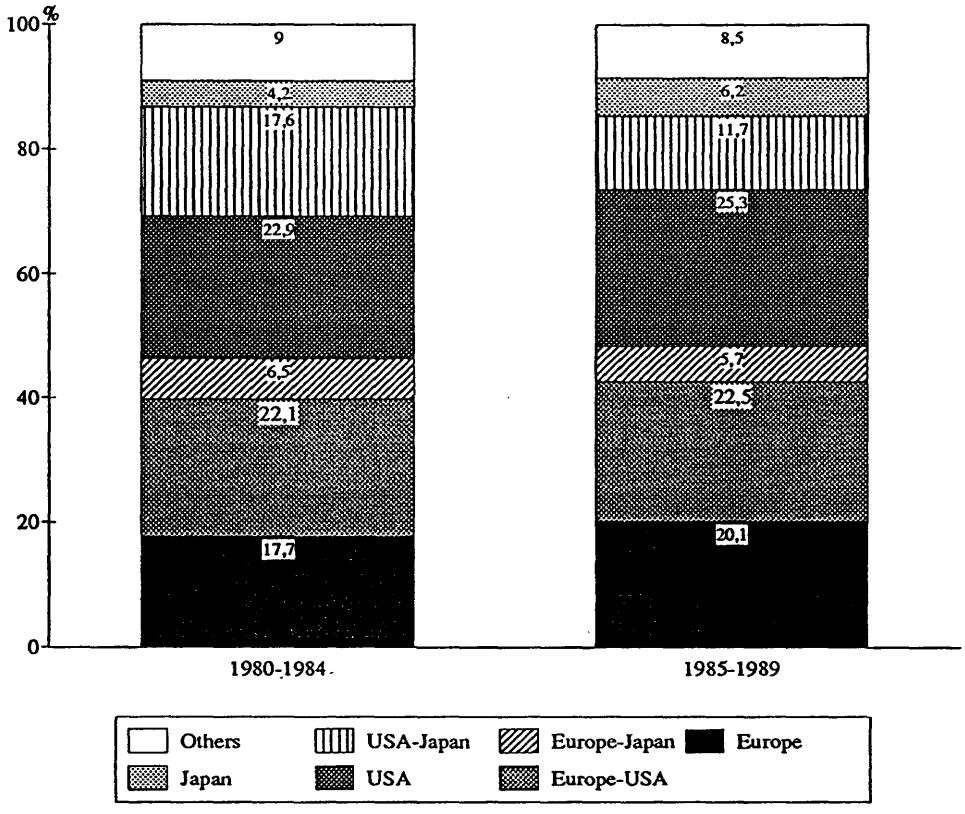
Yet, this focus on firm and sector specific resources is challenged by three developments:

1 innovation of technologically sophisticated products is increasingly dependent on technological advances in supplying industries,
2 fusion of different technologies is an increasingly important momentum of product innovation, and
3 development of new markets requires rapid application and diffusion of new technologies over a variety of sectors.

Capabilities of firms and industries to develop new products, hence, depend increasingly on cross-fertilization, collaboration and synergies across traditional sectoral boundaries. (cf. Kodama, 1991; see also Clark & Fujimoto, 1991; Fransman, 1991; Lehner et al., 1991).

In recent times European industries have become more and more aware of the relevance to systematically develope cross-fertilization strategies in innovation management. However, cross-sectoral cooperation activity is still in its infancy. Against that, in Japan cross-sectoral cooperation is not only enhanced by traditional group structures (keiretsu), but is also systematically organized in terms of collective research projects.

Fig. 3.1. Strategic alliances for R&D in Europe, the United States and Japan



Source: Freeman/Hagedorn 1993.

Problems of industry in Europe to develop new products do not only relate to high technology. There are also considerable difficulties to satisfy less sophisticated demand by downsizing high-tech products to standardized products covering a wide area of application.

As is well known and often discussed, one of the major comparative disadvantages of industry in Europe is productivity. Both in the United States and Japan, value added per manufacturing worker is considerably higher than in Europe. Indeed, differences are often quite spectacular even if we acknowledge longer working times in Japanese manufacturing workers and unfavourable exchange rates[2].

[2] As we have demonstrated in part 2, there are in the European Communities big differences concerning productivity. The average for whole of Europe is influenced by low productivity in countries like Greece or Ireland. Yet, even Germany and other more advanced countries are hardly capable of keeping pace with Japanese developments.

In most industries, product life cycles tend to become shorter and competitiveness increasingly depends on firms' capabilities to launch new products earlier than competitors. There seems to be a new rule that firms which are first-to-market will gain the biggest market share and consequently the highest profits while those with significant delays in product innovation often twill hardly have any considerable returns on their investment.

In electronics, for example, delayed launching of a new product may lead to a loss of nearly half of the total market volume. And variations of development times have much greater impacts on profits than variations of development costs causes. (Sommerlatte 1990).

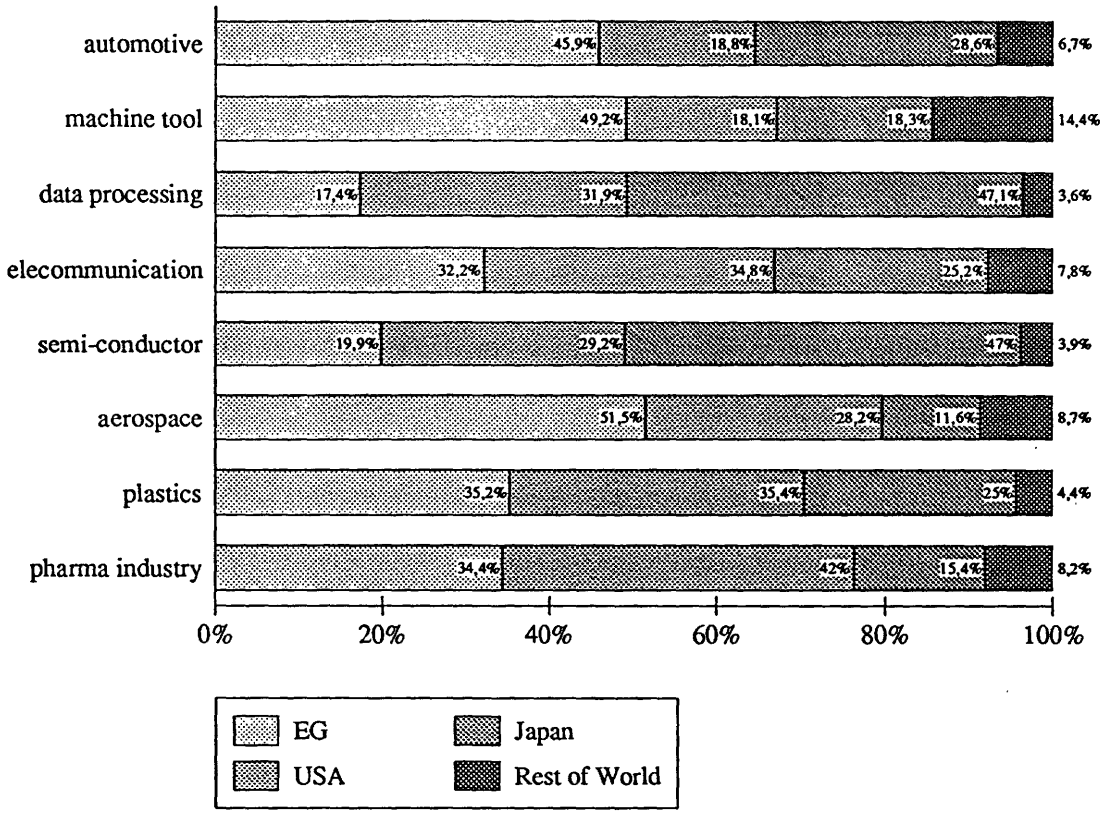
European firms are often rather slow when it comes to development of new products. They have difficulties to keep pace with declining product life cycles and to play their part in the innovation race. As a result, they loose market shares and profit. European industry, thus, is often uncapable of translating high technological competence in market success because new products are launched too late.

A traditional strength of most European industries is technological competence. Indeed, European industry is technologically often at the leading edge. There are, however, early warnings that technological competence of many industries in Europe is in danger to decline.

As patent data show, European industry has problems to catch up with the leaders in two technological areas, which are widely accepted as future technologies: data processing and in semiconductors. Moreover, there are problems in biotechnology and new materials. This data also reveal that the European industry has its peculiar strengths mainly in traditional industries and technologies.

In a future oriented perspective, technological competence, thus, is a key issue of industrial performance in Europe although it is currently not really a case for concern.

Fig. 3.2: Patent shares in major industries



Source: Ifo (quoted in Wirtschaftswoche), 1992; Ifo, 1990

Endangered industries: Gloomy prospects for Europe?

Many industries in Europe are standing at the watershed today. Until the end of the century the switches are worked for staying at the competitive edge of the respective industry or missing connection with the world leaders. Concerned industries have promising potentials to master structural change and new challenges, but non-European competitors face good prospects to pace their European counterparts out. Examples for this situation are mechanical engineering, automotive industry, telecommunications and aerospace industry.

Mechanical engineering is indeed an illustrative example for a position on the watershed. In the last decade, American mechanical engineering has lost ground on the world markets and Japanese mechanical engineering industry has gained heavily. European mechanical

engineering industry remained stable in this period and still profits from its technological potentials and competences. It is still on the leading edge in almost all market segments, but this may change soon[3].

Future competitiveness of mechanical engineering in Europe is seriously endangered by problems of productivity and production strategy. Compared to Japan, mechanical engineering in Europe is in a serious "productivity crisis": Japanese firms are twice or even more as productive as the average European firm. Moreover, Japanese firms usually have more flexible production strategies and cover both markets for special and for standard machines with technologically sophisticated products. They have developed an organization of production which secures high productivity, quality and flexibility.

European mechanical engineering is producing highly sophisticated and innovative products, but time-to-market is too slow to realize full profits. Best practice examples show, that the time for design can be reduced by 30% to 50%.

A major problem is product development. Most of the products of European manufacturers in mechanical engineering are primarily oriented at the demand for highly sophisticated technological solutions of big enterprises. These products are usually too advanced for the needs of small and medium enterprises. As a consequence, European mechanical engineering manufacturers renunciate of a market which is estimated at about 8000 machines in Germany. In the whole European Communities and in Eastern Europe there is certainly a much higher demand for this low-cost and easy-to-use machines.

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[3] The following analysis is based on a study on mechanical engeneering within the FINE-project by Peter Brödner (1993). We also have greatly profited from an interesting study for the Commission of the European Communities on European machine tools industry by WS Atkins (1990) and from a study by Brödner & Schultetus (1992) on machine tools in Japan and Germany.

Tab. 3.1 Productivity in mechanical engineering

	Japan			Average in German Mechanical Engineering in 1989	Germany			
	JA 1	JA 2	JA 3		G 1	G 2	G 3	G 4
Production value/employee	650	795	725	179	239	283	311	199
Value added/employee	336	517	249	95	119	132	149	113
Profit/production value	14%	6%	8%	1,3%	-2 %	2%	5%	2%

Productivity performance indicators of Japanese and German machine tool manufacturers (1990, numbers are thousands Deutsch Mark)
Source: Brödner, 1993.

In a longer perspective, there is another crucial problem. In comparison to Japanese producers, profit rate of European firms is rather low. Obviously, low profits are likely to lead to lower investments in R&D, machinery and related equipment, and marketing and advertising. In the end this impedes innovativen and causes a severe loss of competitiveness and market shares.

A comparison of mechanical engineering in Europe and Japan points at a clear message. European mechanical engineering has to rapidly reorganize in order to attain high productivity and flexibility. And it has to develop market strategies which enhance more flexible response on diversified demand. Otherwise, it will loose ground in competitiveness and enter a downward spiral of longterm decline.

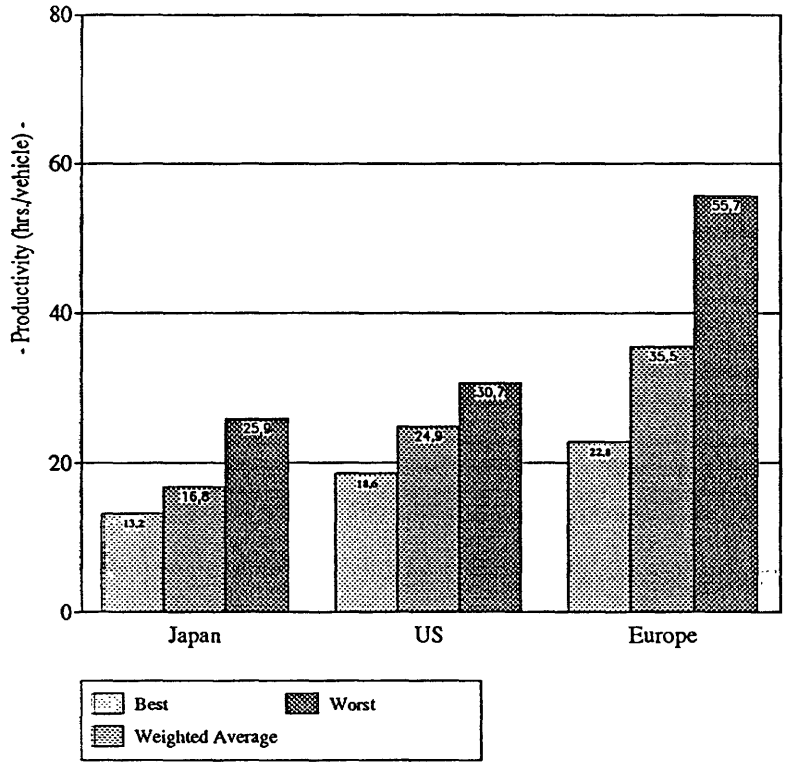
In automotive industry the situation seems to be even more dramatic. European automotive industry is persistently loosing ground against Japanese automotive industry.

European automotive industry has a high technological performance and still secures a leading position. Many new devices like ABS, ASR and turbo charging have been developed in Europe and first attempts to make wider use of vehicle electronics, to implement traffic guidance systems and to transfer ecological requirements to vehicle design have started in Eu-

rope. Technologically, European automotive industry may still be well prepared for the future[4].

However, it has become extremely weak with respect to productivity and consequentially is often not competitive in terms of price-quality-ratios. Moreover, it has a bad performance with respect to development lead-time (time span between starting of development of a new model and market introduction).

Fig. 3.3: Productivity in automotive industry



Source: Womack/Jones/Roos, 1990.

In Japanese automotive companies the time needed for the development of a new car is 46,2 months, while it is 58,6 months in European companies. Even more striking is the difference between Japanese and European manufactureres regarding the time spent between new model

[4] For a more detailled discussion of these problems, see the special study on automotive industry within the FINE-project by Belzer/Dankbaar (1993). - Particular problems of competitiveness exist for automotive component industry which we do not discuss here. They are well analyzed in study by Boston Consulting (1991).

launch and return to normal quality: As it is 1,4 months in Japanese companies, the European ones need 12 months - this is over ten months more. Even American manufacturers perform slightly better (MIT, 1990; Womack et al., 1991)[5].

Box 3.2: A Synthesis of European and Japanese production concepts at Nissan UK

The production concept of Nissan UK combines the following features:

People
* We will develop and expand the contributions of all staff by strongly emphasising training and by the expansion of everyone's capabilities.
* We seek to delegate and involve staff in discussion and decision making particularly in those areas in which each of us can effectively contribute so that all may participate in the efficient running of NMUK.
* We firmly believe in common terms and conditions of employment.

Teamworking
* We recognise that all staff have a valued contribution to make as individuals but in addition believe that this contribution can be most effective within a teamworking environment.
* Our aim is to build a Company with which people can identify and to which we all feel commitment.

Communication
* Within the bounds of commercial confidentiality we will encourage open channels of communication. We would like everyone to know what is happening in our Company, how we are performing and what we plan.
* We want information and views to flow freely upward, downward and across our Company.

Objectives
* We will agree clear and achievable objectives and provide meaningful feedback on performance.

Flexibility
* We will not be restricted by the existing way of doing things. We will continuously seek improvements in all our actions

European automotive industry faces one big immediate challenge, namely to rapidly increase productivity by applying modern concepts of industrial organization and by reorganization of the production chain. The challenge is not simply to copy Japanese lean production. Rather,

[5] Although the empirical evidence reported here is already some years old, ongowing research of the Institute of Work and Technology indicates that the general picture is still valid.

lessons from Japanese lean production have to be combined with European approaches and experiences to develop organizational forms which support European strentgth in technology, design and environmental concern while eliminating weaknesses in productivity. This is particularly important because in a longer perspective, environmental concerns constitute a much more severe challenge to automotive industry in Europe than productivity now[6].

A quite different situation exists in telecommunication industries. The problem is not productivity, but standardization and investments. Telecommunication and related equipment are one of the most promising markets of the future with a sustainable growth potential. In contrast to other market segments of electronics, European firms have a good competitive position in telecommunication: Alcatel, Siemens and Ericsson are ranking in the top ten worldwide, inspite of strong competitors in the United States and in Japan[7].

The future success of telecommunication industry hinges considerably on how far market unification is paralleled by an EC-wide standardization of norms and interfaces. This will lead to better economies of scale and subsequently enhance competitiveness. The prospects for small and medium enterprises in this sector are dismal: Because of the huge investments necessary they can only survive im market niches left by the big firms.

Again a different situation exists in aerospace industry which is one of the outstanding success stories in European industrial development in the second half of this century. Through close interfirm cooperation and with considerable government aid, European aerospace industry has today nearly closed the gap to the world-champion United States. With respect to technological competetence, particularly in relation to civilian aircrafts, Europe has caught up on the United States and is well ahead of Japan. However, United States firms in aerospace industry have an advantage in time-to-market compared to their European counterparts.

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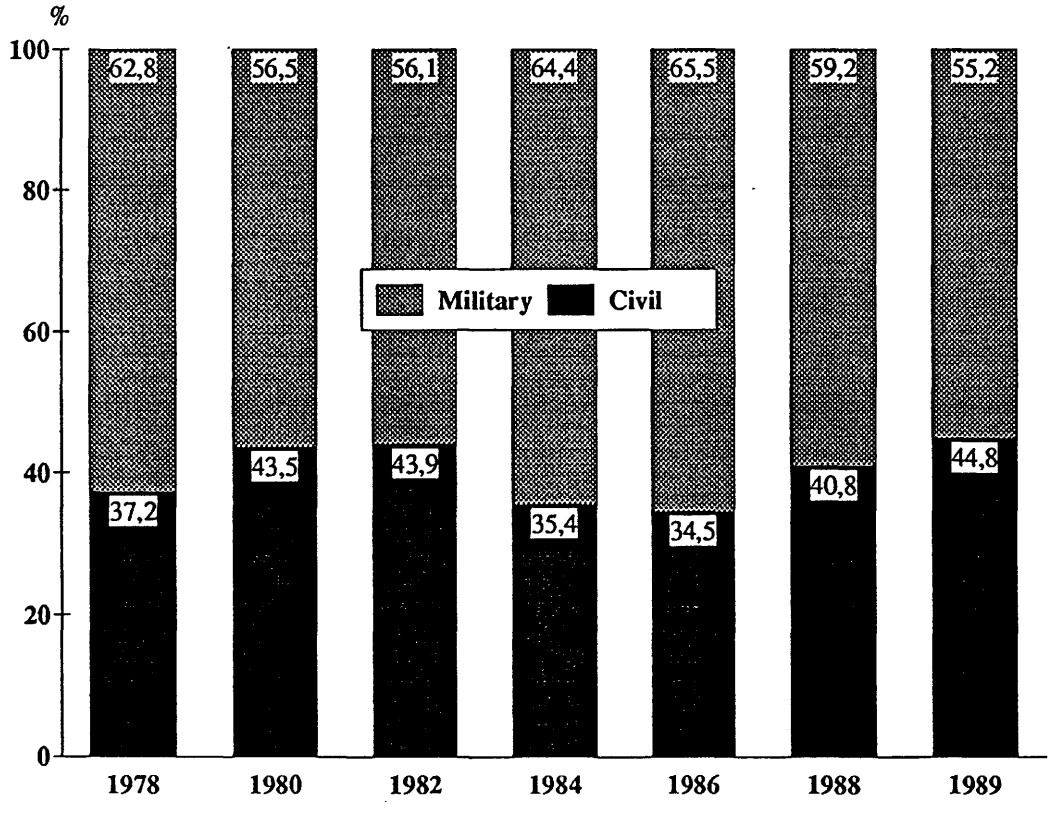
[6] In several discussions with some of the authors, Peter Wickens, director for personal and information of Nissan UK has pointed at the importance of a synthesis of Japanese and European approaches as a major cause of the success of his company.

[7] Again, we refer to a special study within the FINE-project. The study on telecommunications has been performed by Didier Pouillot - Interesting perspectives are also shown in a study of the Commission of the European Communities on advanced communication (CEC, 1992c).

After the end of the cold war and the ensuring reduction in defense expenditures, aerospace industry faces a severe decline in orders for military aircrafts. The importance of the military sector for this industry elucidates the fact that 60% of the industries turnover in 1990 resulted from military equipment. The market for civil aircrafts is expected to grow rather steadily until the end of the century. But the growth in civil aerospace is regarded to be unsufficient to compensate the shortfall in the defense market. Satellites may provide another field of growth, but market volume is too small to balance the decline in demand for military aircrafts[8].

Fig. 3.4: Military and civilian markets in aerospace



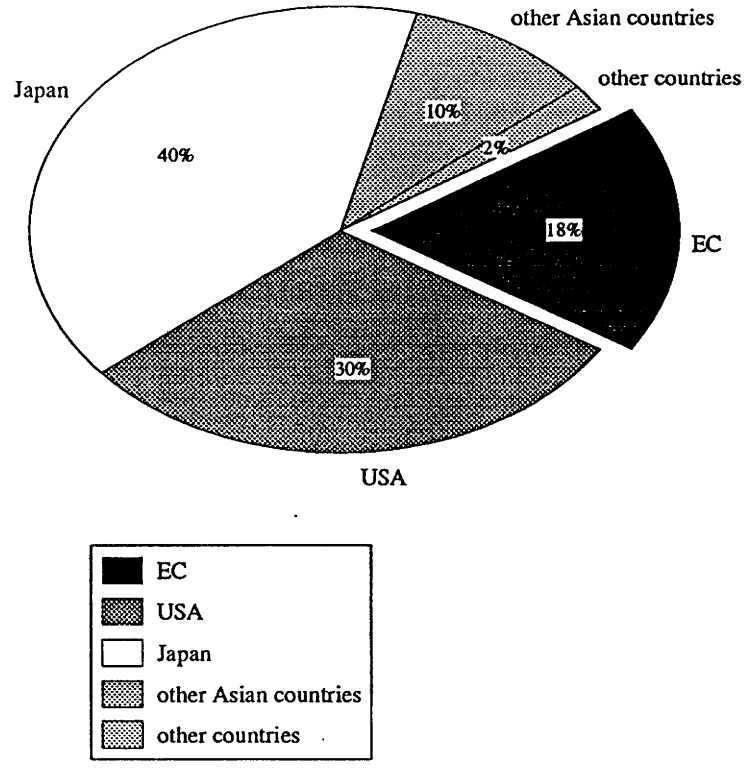
Source: Hayward, 1992.

In a much more difficult situation is electronic industry. Today this industry is standing at the edge of a yawning abyss. Immediate strategic action is necessary to revitalize at least partly

[8] For a more detailled analysis of aerospace industries, see the special study within the FINE-project by Keith Hayward (1993).

its competitive position. Looking at the world market shares, European electronics industry seems to be better off than often predicted. It still provides a quarter of the world market. European electronics industry has in certain market segments a favourable position, e.g. in vehicle electronics.

Fig. 3.5: Shares of European, American and Asian producers in world markets for microelectronics



Source: Panorama der EG-Industrie, 1991-1992

In most markets, however, it is lagging behind and has virtually been decoupled from market development. Products and innovation cycles are determined by Japanese firms, European firms are more and more loosing first-mover advantages. This holds true for consumer electronics as well as for computers and ICs.

Particularly bitter is the backlog in the future industries, e.g. computers and microchips. In the computer market United States and Japanese firms are dominating, DEC has taken over Kienzle and Phillips, Fujitsu did the same with ICL and Nokia. It is expected, that the

Japanese will do the same with their other European OEM-Partners (Bull, Comparex, Olivetti). Though having lost market shares to South-East Asian firms, Japanese producers of microchips still have an outstanding market share while European firms are only of marginal relevance in most segments[9].

The industries discussed so far, are typical for a large part of European industries. They are still in a rather good shape, but there are developments in process which may lead in rather short time to deterioration of competitiveness.

Strong industries: Pillars for the Future?

There are a number of industries which have maintained a good competitive position. Examples are agribusiness, construction, chemical and pharmaceutical industry, and financial services.

Agribusiness (especially food processing) has a good competitive position. Facing the single market, some firms have extended their activities to other EC-countries through acquisitions and interfirm cooperation. A handful of firms are operating on global scale, particulalrly with business in North America. Besides a few European or global players, a huge number of small and medium enterprises are existing - mainly a consequence of different tastes and preferences in the single European regions. European agribusiness is moving to the use of advanced technologies, in particular biotechnology, to improve products and productivity. Distress causes only the starting point of the food chain, agriculture, which contains a huge number of small and inefficient producers[10].

Construction industry is to a large extent protected from international competition, mainly through national or even regional regulations (quality standards, materials used) or non-

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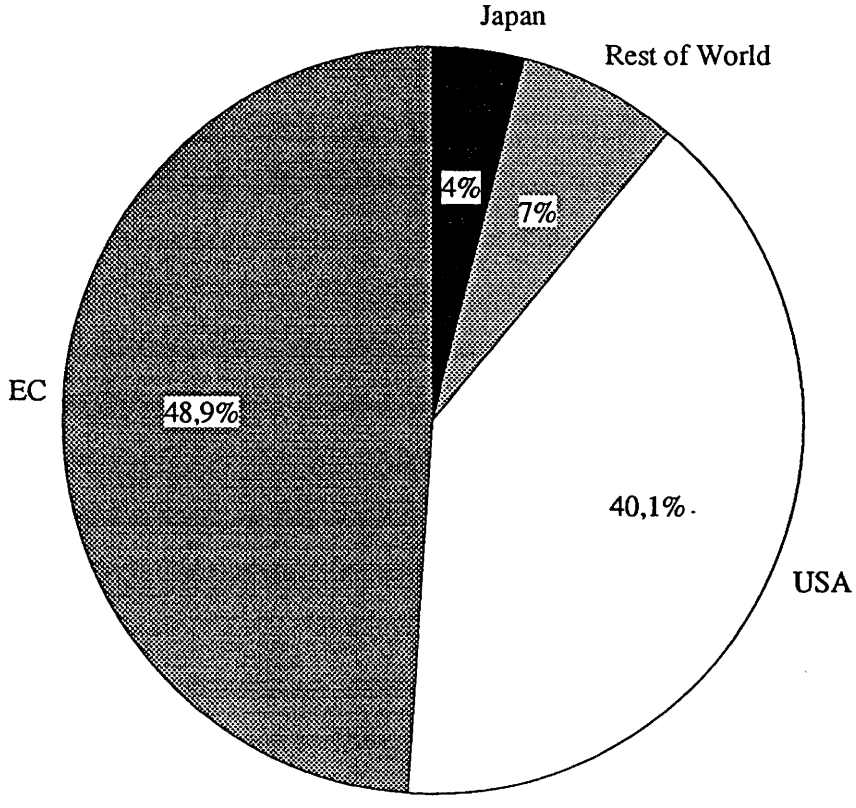
[9] With respect to consumer electronics, see BIS Mackintosh, 1990.

[10] Within the FINE-Project, Professor Wyn Grant of the University of Warwick has written specific study on agribusiness which contains a more detailled analysis (Grant, 1993).

regulative barriers (taste, tradition). Furthermore, the product itself prohibits large scale international competition: it is more immobile and more regional bound than other products. Besides that, European construction industry still profits from it variety of skills and competences and is making first steps to respond to growing ecological needs. Only few firms are engaged in international activities, mainly in countries where know-how about building construction and underground engineering is missing. But this relates primarily to contruction and control tasks, not to the deployment of workers. Here new competitiors are ascending, mainly from Japan or South-Corea[11].

Fig. 3.6: World market shares in chemical industry



Source: Howells/Wood 1991.

Chemical and pharmaceutical industries have a long tradition in Europe and are still the most dynamical industry in the EC. European firms have very early internationalized and maintain

[11] For a more detailled analysis, see the special study on construction industry within the FINE-project written by Brigitte Unger/Frans van Waarden.

a salient position in international competition. This is expressed in considerable market shares in the United States and in Japan. While European firms are loosing ground in traditional bulk chemicals contesting with third-world or Eastern Europe firms, they have strengthened their position in materials, which require high R&D-activities and which fit to customer needs.

With respect to R&D, European chemical industry is roughly on the same level as the United States and Japan. However, the American and Japanese firms often have some comparative advantages in applied research. This is, for example the case, in growth sectors like new engineering polymers or ultra pure ceramics. European pharmaceutical firms have sometimes problems to keep pace with American firms, but are able to respond quickly and efficiently to specific market demands. Problems may arise, if European firms do not enhance their R&D-activities and investments in gene- and biotechnology[12].

Financial services are a business where hardly any conclusive statements concerning international competitiveness can be made. Modern information technology made its contribution to the internationalization of this business. Banking around the world has become reality. The same holds true for insurance. As a result, many non-EC firms came to Europe. But this does not imply that European financial services lost competitiveness. European firms have spread their activities worldwide too. There is little indication that financial services in Europe have overall outstanding strength or weaknesses compared with their foreign competitors, but there are considerable differences between companies and countries[13].

Considering the situation of different industries, one might be tempted to conclude that all-in-all prospects for a competitive industry in Europe are not all that bad as is often assumed. However, this conclusion would be erreneous. It neglects one decisive fact: With the

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[12] See on this the more detailled study for the FINE-projects by BETA (1992).

[13] A more detailled analysis of financial services has been made within the FINE-project by William D. Coleman (1993).

exception of chemical industry, European industry has its strength in businesses were world markets are not existant or where global competition is limited and rather weak[14].

In these industries productivity growth as well as development of new products is slow. Agribusiness and construction are good examples. They are, for the most part, characterized by craft production with low productivity. Moreover, while changing life styles and ecological requirements lead to a demand for high-value, healthy and nonpolluting products, firms in these industries are very reluctant to satisfy this emerging demand. These industries are, hence not necessarily strong pillars for the future[15].

The problem is even worse because industries are often closely linked to eachother with respect to their performance. Low productivity and innovation in one industry will have more or less severe impacts on other industries. The weaknesses of most of the strong pillars, thus, adds additional risk to those industries which are already in some danger to loose competitiveness.

Small and Medium Enterprises: Victims of Modernization?

Small and medium enterprises are extremely important for the European economies. Speaking in sheer numbers, more than 90% of all enterprises in the European Communities have less than 10 employees while only 0,1 percent of the European firms have more than 500 em-

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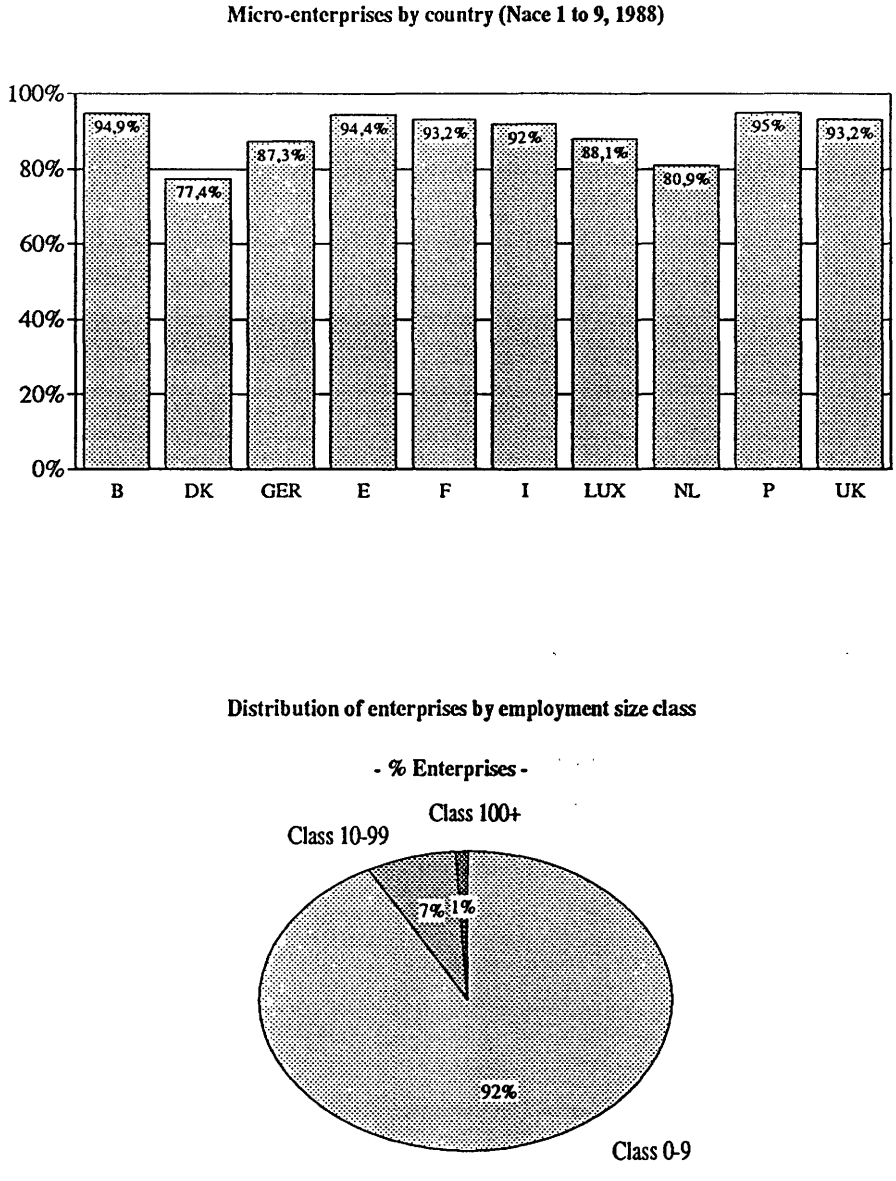
[14] Product idiosyncrasies in the construction industry, in agribusiness and in financial services make their contribution to the fact, that markets haven t developed on international or worldwide scale. E.g., houses or other buildings cannot be moved from one place to another, food and beverages cannot be transported over long distances without the danger to be spoilt. Additionally, consumer tastes and preferences vary from region to region, from country to country, a unique product would not fit to varying consumers demands. Even in financial services, though operating on global scale, many services have to be done on the spot.

[15] To a similar result comes the Japan Productivity Center (1992) in its "International Comparison of Labour Productivity": Comparing productivity in manufacturing in Japan and Germany, one of the major outcomes was that Germany has productivity advantages in traditional industries, while Japan is at the fore in high technology industries.

ployees. The bulk of enterprises have a size below 100 employees and only slightly more than 1% of the firms have more than 100 employees[16].

Fig. 3.7: Size of enterprises in the European Communities by member states

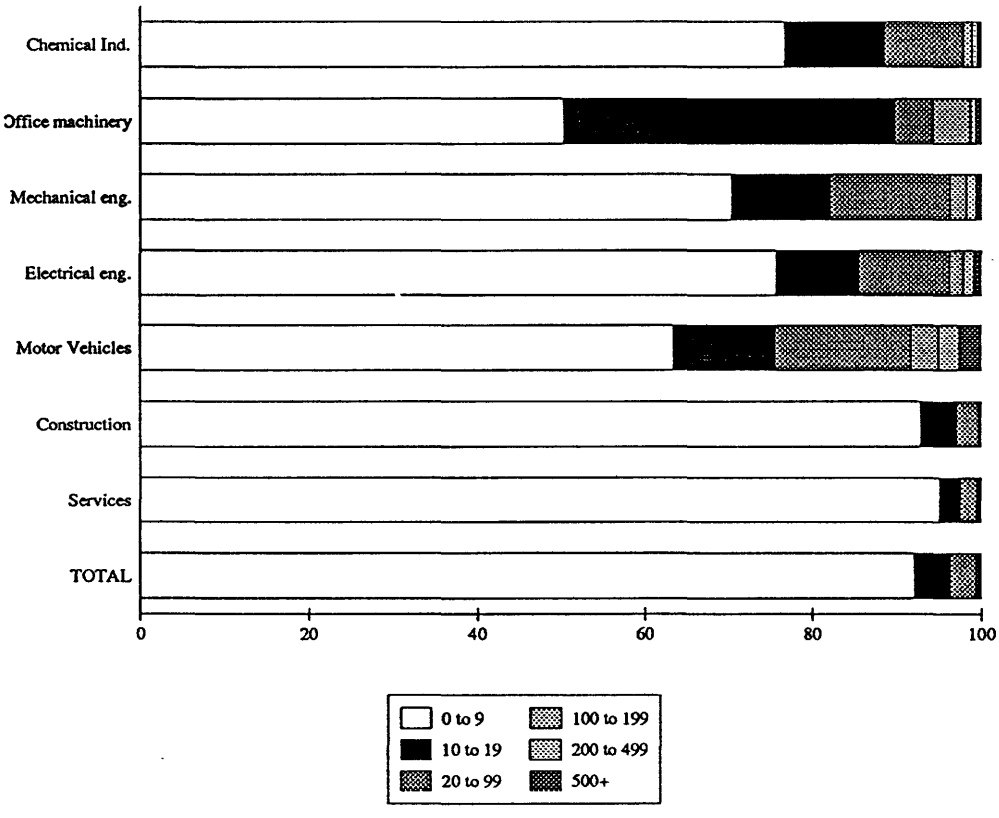


Source: Enterprise Policy/Eurostat 1992; own calculations.

[16] Our discussion of the specific developments and problems of small and medium enterprises is based on a special report for the FINE-project (Hilbert, Kleinschmidt, Rainnie & Sperling, 1993). In a global perspective, problems of small and medium enterprises are discussed in Lehner et al., 1993.

These shares are varying considerably in the member states of the community: While the share of firms with less than 10 employees is more than 90 % in Portugal, Belgium and Spain, it is around 80 % in Denmark and the Netherlands. They are also varying significantly between different industries: In the construction industry small firms are dominating with more than the half of the total workforce. On the other hand, the portion of these firms is rather small in the automotive industry and chemical industry.

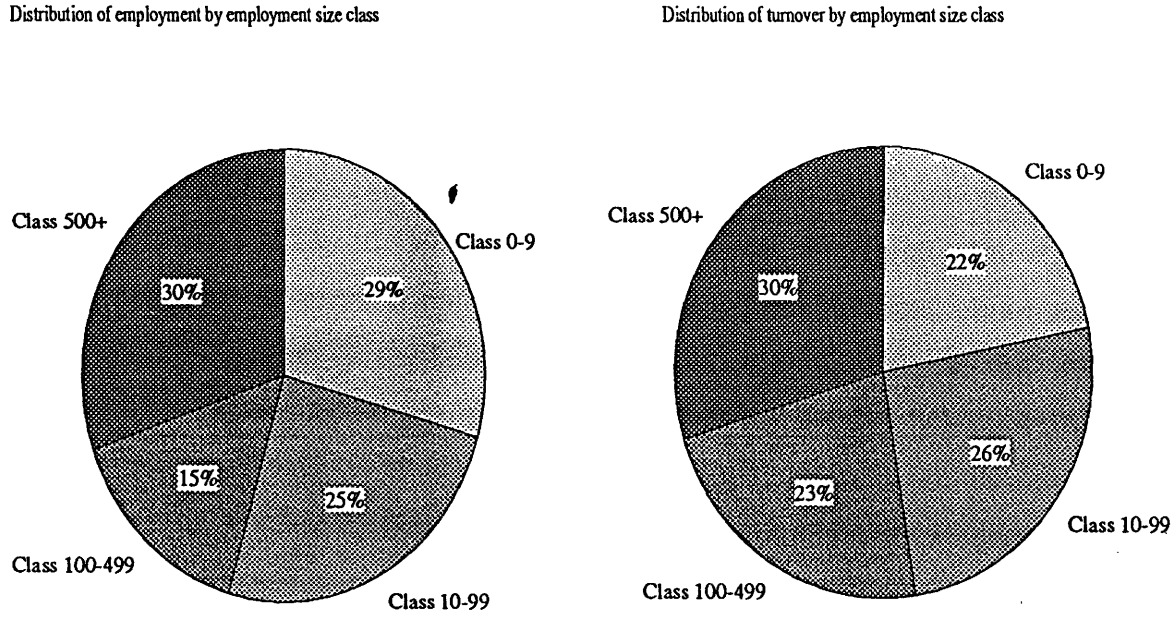
Fig. 3.8: Size of enterprises in different industries in Europe



Source: Enterprise Policy/Eurostat 1992; own calculations.

As is well known, weight of the small and medium economy is bigger in terms of sheer numbers than in terms of employment and turnover. Firms with less than 10 employees make for only 29% of employment and 22% of total turnover. Still, firms with less than 500 employees hold a share of 70% of total employment and the same share of total turnover whereas firms with more than 500 employees account for aboout 30% of total employment and total turnover.

Fig. 3.9: Employment by firm size



Source: Enterprise Policy/Eurostat 1992; own calculations.

Small and medium enterprises, thus, are of great importance for the European economies. They are much more than a marginal economical force.

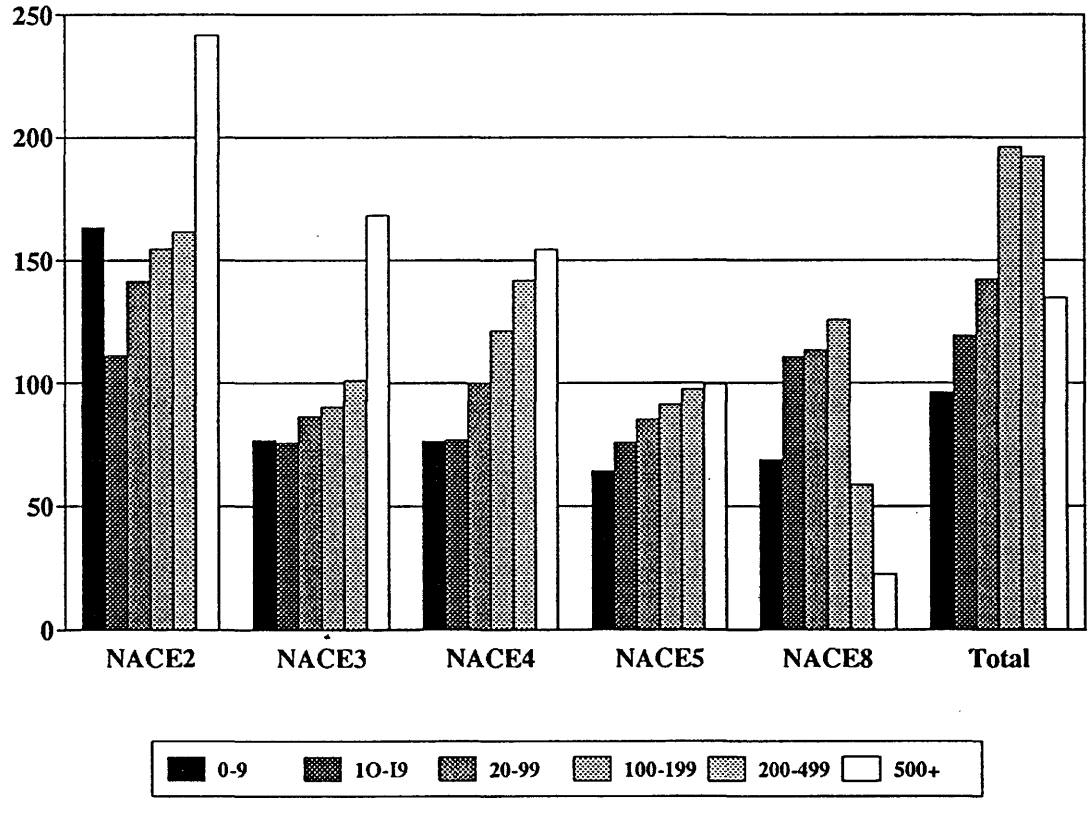
Many small and medium enterprises face an uncomfortable future. In Particular, they face

* increasing competition in their traditional market niches by large enterprises with decentralized and flexible organizational structures;
* increasing financial and organizational burden in keeping pace with rapid innovation and structural change;
* increasing problems and costs of marketing, sales and services in volatile and globalizing markets.

Small and medium enterprises have their specific capabilities and strengths because of their higher flexibility, stronger customer orientation, and informal and non-hierarchical working conditions. But where international markets develop, small and medium enterprises may have severe problems to stay in business. Big firms often have better capabilities in research and developement, in production, and in marketing to cope with the requirements of globalization and structural change.

Many small and medium enterprises have considerable disadvantages in a condition where they loose their traditional niche markets and have to compete with large enterprises, or in a condition where they have to meet high productivity requirements which large enterprises impose on their suppliers. Theses advantages are highlighted by data on tunrover per employee and which show that turnover generally is increasing with firm size.

Fig. 3.10: Turnover per employee by firm size in selected sectors



Source: Enterprise Policy/Eurostat, 1992; own calculations.

This points at a serious danger for many small and medium enterprises: Their productivity seems to be too low to master the challenges of the ongoing structural change. While the quality of their products may remain high, their low productivity will probably cause a severe loss of market shares. Furthermore, low productivity may lead to a decline of profit rates and endanger future investment in new technologies in the long run.

Although such a scenario is quite realistic for quite a number of enterprises, it does not describe a general trend. Even less it describes an inevitable situation.

SMEs: The strong and the weaks

Small and medium enterprises are not a homogenous class, but rather differ strongly in size, technological competence, capabilities, production structures, organization and market activities.

For our purposes, small and medium enterprises may be divided into five categories. Although the categories are partly overlapping, each represents a genuine path of development and a particular configuration of problems. The categories are:

1 the market localists: the bulwark of SMEs,
2 the craft based SMEs: the niche and flexible specialization options,
3 SMEs within regional networks: industrial districts,
4 the high-tech option for SMEs: technological districts, and
5 SMEs in the new division of labour.

Market localists represent the overwhelming majority of SMEs. They are operating on a local and regional context and are strongly integrated in this context. Family ties, neighbourhhood and friendship play an important role in their economic and social behaviour. Orientation towards international developments and globalization is low. Market localists serve markets which are geographically narrowly defined. They are strongly represented in construction, food processing, clothing, furniture, printing, mechanical engineering and in the services.

In this class of SMEs, rate of fluctuation is high because entry barriers as well as exit barriers are low. Individually, the firms are often rather volatile and vulnerable. They have poor access to capital markets, R&D institutions and consultancy. However, as a class of enterprises they are rather stable because they serve narrow markets in which they are well integrated and were they can quickly adapt to changes of demand. Moreover, their markets are, as a rule, of little interest for large enterprises.

Craft-based SMEs also have their origins in local or regional contexts and are often serving these markets. But many of the firms escaped the traditional borders of their regional markets and are strongly involved in export. They have specialized in highly customized products which have high quality standards and require skilled work. Traditional businesses of this type of SME are primarily printing, mechanical and electrical engineering, and consumer goods like furniture.

Organization of production in these firms can be traced back to artisan production and has been adjusted meanwhile to changing requirements concerning technology, organisation, skills and production. The entrepreneurs are standing in the centre of these firms and are often running the firms alone. Organization is usually characterized by flat hierarchies, easy communication, low division of labour and high flexibility of work rules. Product innovation is closely related to customer demands and accomplished in cooperation with them.

In the past, these firms have been successful in gaining a strong market position. For the future, this position is often at risk. Relevant enterprises increasingly face direct competition by large enterprises. They are often lacking access to capital, R&D and distribution channels. They are used to operate alone and are not well suited for a condition in which collaboration is becoming increasingly important. And they are threatened by acquisition strategies of large firms.

The firms operating in industrial districts are also craft based, but differ in one important respect from the usual craft-based SME: They have been successful in avoiding isolation and have early developed a network of close interfirm cooperation within certain regions, particularly in Northern Italy, Juteland, Baden-Württemberg and Cataluna. They are

predominatly working in traditional and labour-intensive industries producing consumer goods like footwear, textile, clothing, ceramics, and furniture, but also in mechanical engineering, particularly in machine tools, packaging machines and electronic musical instruments.

Based on mutual trust embedded in close social interaction, relevant firms have established cooperative networks with multifarious links between suppliers and producers, and between manufacturing and related services. The networks combine specialization and flexibility and, by this, enhance flexible adjustment to changing demand. Moreover, individual firms may specialize on narrow market segments and operate in small market niches, but whole network often reaches a high level of diversification.

As other craft-based SMEs, these firms also suffer from problems of access of capital and R&D. Moreover, they suffer like other SMEs from problems concerning intergenerational transition of ownership.

Industrial districts have developed in traditional industries. But there is a modern high-tech analogue to that, namely technological districts, where SMEs are involved in future industries like information technology, software, biotechnology or new materials. Technological districts have developed in regions with a strong infrastructure for R&D and a related innovative milieu comprising large innovative firms, research institutions and universities.

Whereas networking in industrial districts is focussed on material production, this is not essential in technological districts. Rather, networking is focussed on research and technical development. Less by formal collaboration but intensive, informal exchange is dominating between various research institutions and enterprises. Indeed, it does not represent an organizational structure, but a milieu[17].

This is a point with an extremely important implication: Technological districts cannot be organized by business or public policy, but they emerge. What can be organized are

[17] We are indebted to Professor Richard Gordon of the University of California at Santa Cruz who has explained as the nature of technology districts at the example of Sillicon Valley.

technology parks, but most of this parks never have developed to a technolgical district and an innovative milieu.

In Europe these "milieus" can be found in the Technopole of Grenoble, in Sophia-Antipolis close to Nice, in the English M4 corridor west of London, and in the German "Technology Centres". In spite of much effort, other regions with a similar or even better infrastructure for research and technological development, such as the Ruhr, have not succeeded to develop to a technological district. Often, the reason is a continuing dominance of traditional industrial milieus and their culture.

A considerable part of the SME economy is closely linked to large firms and are part of their supply structure. In conditions of traditional mass production, many SMEs are operating as subordinate suppliers without technological competence and are, thus, functioning as "extended work benches" of big companies.

In the industrial societies, this pattern is vanishing as much of industrial production, including mass production, is shifting to quality production. Large firms are reducing vertical integration. Accordingly, they increasingly contract tasks in production and services which do not belong to their core business or core technologies out to suppliers. By this, a new division of labour is established between large firms and their suppliers.

For many of the concerned small and medium enterprises, particularly for SMEs with rather low technological competence producing standardized parts, this process is associated with certain difficulties. They have to cope with requirements which can not easily made consistent. They get under pressure to reduce prices, but at the same time should enhance quality standards, adopt new production technology and deliver just-in-time. They are used by large firms as buffers to reduce costs and risks and remain strongly dependent on their large clients.

A quite different situation may exist for small and mainly medium-sized firms that are able to manufacture specialized and complex components or moduls with a high technological content. These firms can more easily master requirements of large firms concerning quality and productivity, and they have considerable innovation capacities. Although pressure on these

firms is often strong too, they have a chance of gradually altering their relationsship with their clients from "sub-contracting to co-contracting" (Dubois & Linhart 1992).

Box 3.3: Types of small and medium enterprises

1. Market localists
- micro-sized firms, acting in a local or regional context
- orientation towards local consumer tastes and demands
- no subcontracting, no mergers and acquisitions
- poor access to finance capital and consultancies
- high rate of fluctuation, low entry and exit barriers
- often familiy based, low wages
- volatile individually, but stable altogether

2. The Craft Based SMEs
- specialized in diversified and customized products of high quality
- high skilled workers, flat hierarchies, low division of labour
- lacking of close networks of cooperation
- limited access to finance capital, R&D, and distribution channels
- problems with increasing speed of innovation
- threatened by takeovers of big-sized firms

3. SMEs within Regional Networks (Industrial Districts)
- craft based SMEs within networks of suppliers, customers and competitiors
- regionally embedded in support infrastructure
- export orientation
- high degree of product innovation
- lack of marketing and research facilities
- undercapitalized
- their niche markets are threatened by larger competitors

4. High-Tech SMEs (Technological Districts)
- often small firms with technolocically advanced products for special purposes
- highly skilled workforce (often with university degree)
- often spin-offs from larger firms, universities or public research institutions
- high dependence on large organization

5. SMEs in the New Division of Labour
- subcontractors or suppliers of large assembly firms
- first group: system suppliers with cooperative ties
- second group: producing standardized products and used as buffers for costs and risks

It remains to be seen how many SMEs are capable of acquiring such a position in relation to their large clients. Much depends upon strategies of large firms and the new division of labour which they may establish. Current developments in automotive industry indicate that

there will be few technological sophisticated system suppliers at the top of the supplier pyramid while most other suppliers facing less favourable conditions and even become sub-suppliers.

A warning is due here: While it may advance efficiency in the short-term, such hierarchical supply systems may prove to become a major impediment to an industrial performance in the long run. Hierarchical structures in enterprises have turned out to be unfavourable for productivity, quality and innovation in whole production chaines will do any better. Rapid innovation and development of new markets, in particular, require collaborative rather than hierarchical structures.

Considering the situation of different types of small and medium enterprises, the conclusion is that prospects for this important part of the European economies are quite uncertain. The relationsships between small and medium enterprises on one side and large enterprises on the other are changing significantly. Large firms are decentralizing and the newly established small, powerful, flexible and partly autonomous units often become competitors for SMEs. Moreover, large firms often integrate small and medium suppliers integrated in a hierarchical organization of the production chain.

Strategies and policies for a vital SME economy

Traditional wisdom is that small and medium firms are economically successful because they do things that large firms are not able to do or cannot do efficiently: Serving local markets and market niches, producing highly specialized goods and exploiting marginal labour forces. This is hardly a strategy for the future because this would leave small and medium enterprises with a decreasing share as increasingly flexible large enterprises enter the traditional domain of the SMEs.

The advice must be different. As large enterprises decentralize and develop towards a system of firms-in the-firm with similar flexibility and capabilities as SMEs, the latter have to acquire on their part those capabilities which make up for the strength of large enterprises. Major

strengths of the large enterprises are their capabilities to accumulate and concentrate large ressources, to exploit synergies and to coordinate a variety of different developments.

These capabilities can be acquired by SMEs by means of collaboration and networking. Examples of industrial or technical districts demonstrate that this is a promising approach. More specifically, SMEs may choose one of the following strategies for collaboration:

1 The first strategy is to find a shelter in large groups. In this case, they renunciate wholly or partly from autonomy in order to gain access to the capabilities and resources of a large enterprise.
2 The second strategy is to collaborate in a "kingdom". This means that small and medium firms work closely together closely with one big-sized firm which provides market access and determines strategic issues.
3 The third strategy is to cooperate in a "republic". In this case, firms collaborate on equal foot and bring in their particular strengths in products and the production process. (cf. Sengenberger/Loveman/Piore, 1990).

The need to collaborate is cutting across long-standing traditions and cultures in much of the SME economy. Due to these traditions and cultures, SME are usually quite unwilling to collaborate. Support by industrial policy is, therefore, often necessary or useful to initiate new organizational structures.

There are two particularly interesting examples of such policies. One is the Danish networking programme and the other is a French programme to enhance collaboration of small and medium enterprises with large enterprises. We will discuss these programmes later in some more detail.

Development of collaborative structures implies that SMEs have to give up their traditional definion of autonomy which is anyway becoming obsolete in the world of advanced manufacturing. In this world organizational boundaries loose, as we will further discuss below, much of their relevance and become fluid. SMEs have to acknowledge this case and

cease to operate in isolation. But this is, as we will further discuss below, true for large enterprises as well.

Box 3.4: Two policies for collaboration

The Danish Networking Programme

Features:
networking of SMEs; joint solutions to common problems, mutual complementarity, improvement of subcontracting links; public policy scheme for 480 mill. DK for 1990-92; network brokers, subsidies on transaction costs; encourage firms to engage in new business opportunities, new markets and strengthening of firms' competitive performance.

Developments:
250 firms with about 2000 firms involved; majority of firms aim at an increase of turnover by joint efforts in marketing and distribution of new and old products; 19% of them with substantial cost reduction, 42% with substantial increase in turnover, 75% agreement on improvement of competitive position by networking; 650 full time employees as direct result.

Prospects:
Joint efforts of SMEs has qualified them to compete on international scale. However, this happens in rather specialized fields. SMEs could not qualify as system suppliers to TNEs with global perspectives.

Restructuring Big Firms in France

Features:
Networks of TNEs and SMEs; national or even international orientation; cooperation in productive and non productive functions; endogenous (role of big firms) and exogenous development (Public sunsidies for conversion).

Developments:
"Societes de Conversion" (subsidies for employment and spin-offs by big firms; in 1988 32.000 firm founders had subsidies from their former firm; consultancy for SMEs by big firms, exchange programmes between firms); from subcontracting to partnership networks, cooperative programmes in order to improve value chain in terms of design, organization, production and transport; sharing skills and reducing risks.

Prospects:
Risk of dependence of SMEs; need for longtern agreements, need of diversification od system suppliers vs. strong ties to big firms, networking between SMEs has to be improved.

A learning firm: Anthropocentric production systems

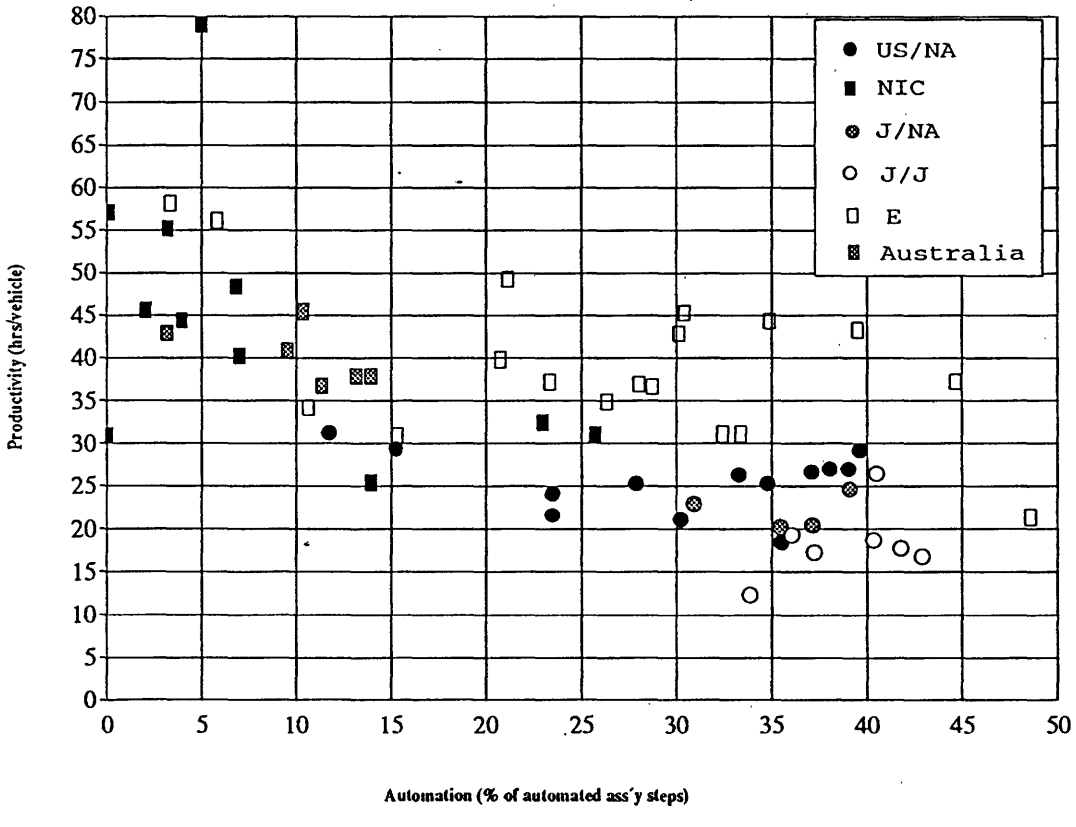
After a long discussion on lean production, it has become clear that most of the deficencies in performance of European industry are strongly related to organization. For many years, a

large part of European industry has been concerned with a "microlectronic revolution" and its potentials for automation, and has missed that the real revolution under way was and is an organizational revolution (cf. Miles & Snow, 1992).

This is certainly not an argument against automation in general. But it is an argument against exaggerated expectations concerning the impact of automation. And it is an argument against automation strategies that merely consider technology and neglect the complicated relationsship between technology and organization.

The well-known study of the Massachussetts Institute of Technology on automotive industry has well demonstrated that correspondence between automation and productivity is rather weak. The world's most automated automobil plant (a German plant) ranks low in productivity, whereas the world's most productive automobile plant (a Japanese plant) ranks low in automation (cf. Womack, Jones & Roos, 1990).

Fig. 3.11: Automation and productivity in automotive industry



Source: Womack/Jones/Roos, 1990.

Meanwhile, this is increasingly acknowledged in European industry and there is a growing discussion on lean production. More and more firms attempt to introduce in Europe the major principles of Japanese lean production. Yet, only a few firms in European industry have already been successful in this attempt. Most of European industry is still struggling with re-organization.

The crux of this situation is two-fold:

1 if it works at all, mere imitation of Japanese lean production leads at the atmost to a second-best position of European industry; and
2 advanced manufacturing and modern quality production require an organization of production which is developed far beyond lean production.

There is much discussion whether Japanese lean production can be transfered to Europe and the United States. The argument against it is that lean production relies on specific Japanese conditions. The argument is not convincing. Empirically, a number of examples demonstrate that a transfer of major principles is possible and even produces expected results. More systematically, Japanese lean production is nothing completely new, but combines principles which are established since long time in European and American industry (Womack, Jones & Roos, 1990)[18].

The point is not whether it is possible, but whether it is reasonable to simply transfer Japanese lean production to European industry. This would be the second best solution. Due to one of its basic principles, namely continuous improvement, lean production is in permanent development and danger is that European industry implements versions that are not at the top

[18] As Peter Wickens, certainly one of the leading European experts on lean production, pointed out in his inaugural professorial lecture at the University of Sunderland in January 1993, lean production amounts basically to an enlightened Taylorism which has incorporated a number of ideas from European craft production.

of development. Moreover, there is knowledge, experience and skills in European industry which can be used to develop lean production beyond Japanese models[19].

Development of production systems beyond lean production is necessary to cope successfully with difficult requirements of advanced manufacturing concerning productivity, quality and flexibility. Much more important, it is to reach high capabilites to develop new products, new markets and sustainable forms of industrial production.

The task is to develop an organization for fast learning, an "intelligent" production system. A production systems is "intelligent" and capable of fast learning, if

* it makes full use on all levels of the organization of skills, experience and knowledge of well trained and motivated personel, and
* combines this with the exploitation of advanced technology.

"Intelligent" production systems are anthropocentric rather than technocentric production systems[20].

Box 3.5: Anthropocentric production systems

Anthropocentric production systems are characterized by the following components:

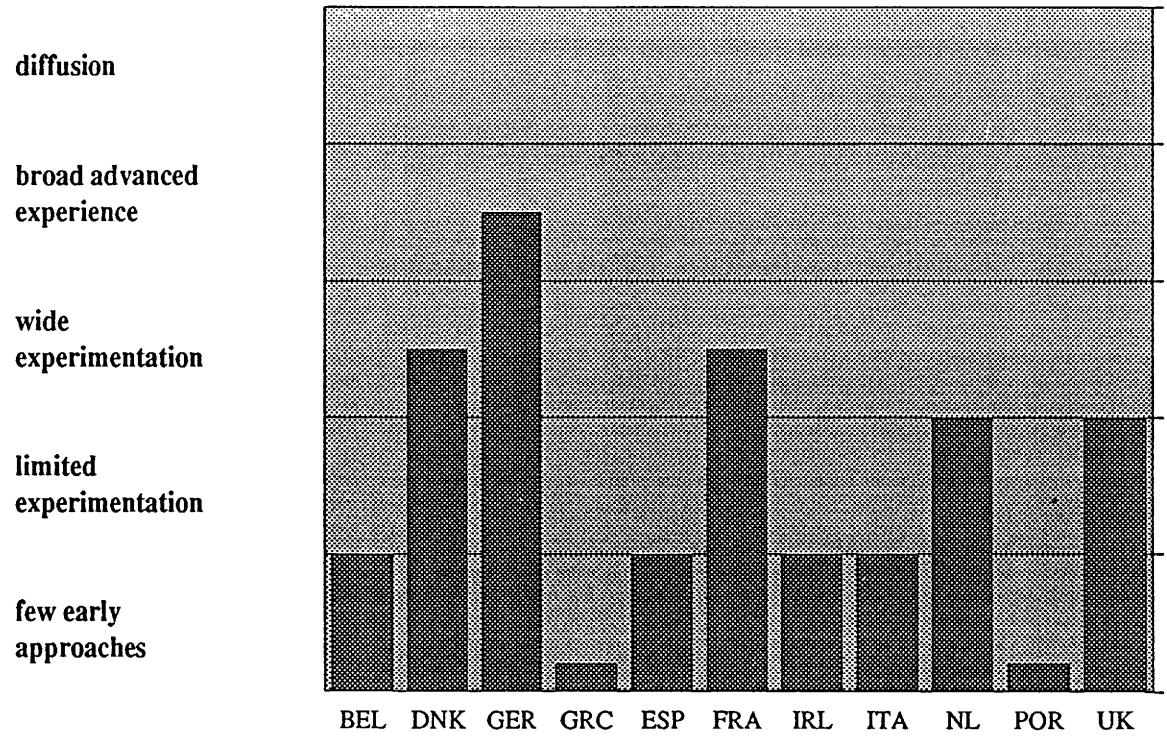
1 flexible automation supporting human work and decision-making;
2 a decentralized organization of work with flat hierarchies and a strong delegation of power and responsabilities, especially to the shop-floor level;
3 a minimised division of labour based on some form of integrated work system design;
4 a continuous, product-oriented upskilling of workers at work;
5 a product-oriented integration of the broader production process, that is of the chain of research and development, work, marketing and services (Lehner, 1992).

[19] Indeed, one of the most successful Japanese transplants in Europe, Nissan UK, has reached its performance exactly in this way. Nissan UK has, for example, strongly delegated decisions on equipment to team-leaders and decentralized budgets accordingly. Moreover, they have introduced continuous education schemes that go far beyond Japanese training and represent European concern for training at its best.

[20] In this report, we do discuss anthropocentric production systems and their advantages as well as problems of implementation of these systems only briefly. For a broader discussion, we refer to another FAST-project in which some of us have been involved (cf. Lehner, 1992).

Most of European industry is still more oriented at technocentric concepts of computer integrated manufacturing and quite far away from anthropocentric production systems. In some of the member states of the European Communities more than a small proportion of industry has already introduced anthropocentric production systems. In most of the countries, there is, however, some experimentation with anthropocentric production systems. (Lehner, 1992).

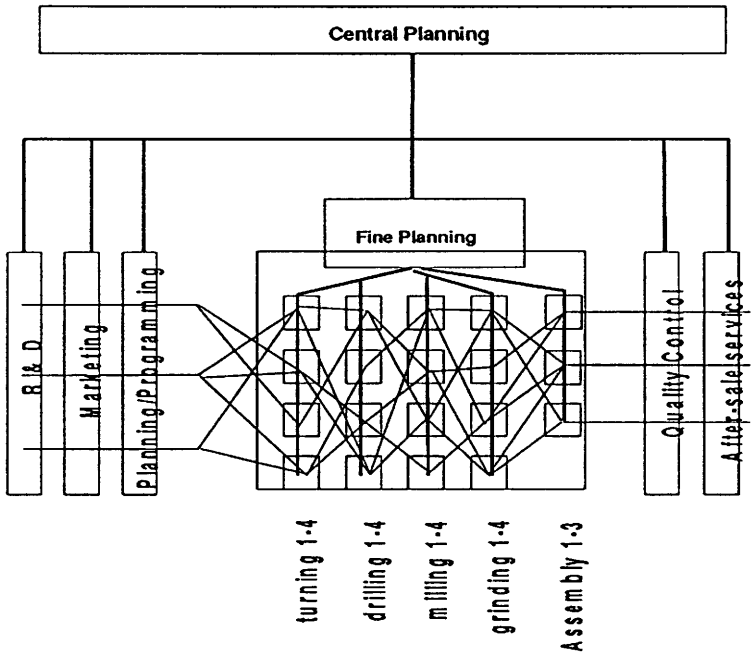
Fig. 3.12: Anthropocentric Production systems in Europe

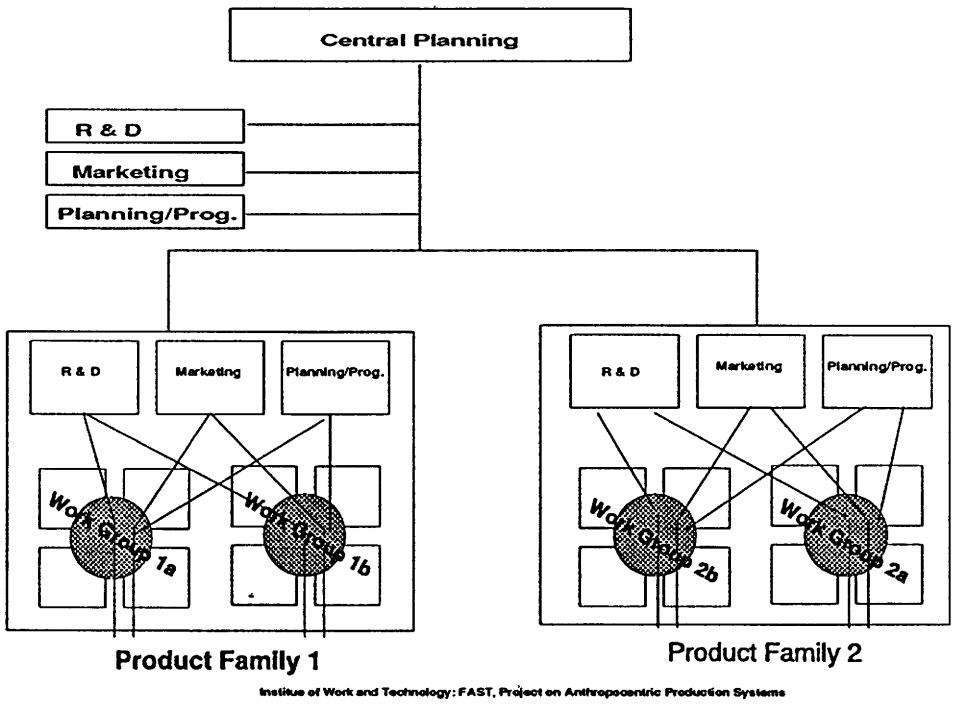


Source: Lehner 1992.

This situation points at one of the most critical issues for the future of industry in Europe. Although it is widely acknowledged that competitiveness of industry strongly depends on high performance on the process side, most of industry in Europe still remains in their traditional organizational structures. There is much discussion on lean production, but rather few firms are establishing lean production, not to speak of more advanced anthropocentric production systems. (Beer et al., 1990; Lehner, 1992; Tidd, 1991; Warner, Wobbe & Brödner, 1990; World Competitiveness Report, 1992).

Fig. 3.13: Traditional and lean organization of production





Source: Lehner, 1992.

Lean production is well suited to solve a certain range of problems of advanced manufacturing, but neglects others. The strength of lean production is strong simplification and decentralization of production. This includes strict segmentation of production in units with high autonomy and a minimization of interfaces between different organizational units within and outside the firm.

Strong segmentation and decentralization is a key condition for high flexibilty, productivity and quality. It also supports continuous improvement of products and processes. (cf. Brödner, 1990; FAST, 1984; Lehner, 1992; Warner, Wobbe & Brödner, 1990; Wildemann, 1988).

There are, however, important limitations to segmentation. Segmentation works well if markets are well demarcated and production processes are well defined, that is if no significant interdependcies and interrelations of market relations, technological developments and production processes exist. If this is not the case, activities within and across firms are interlocked and segmentation does not properly work but rather creates inefficiencies. Rather, well working interfaces between different organizational units or while firms are becoming decisive.

Collaboration: Networking for high performance

Advanced manufacturing, that is high value-added and technologically sophisticated production, is increasingly associated with situations where activities in and across firms are interlocked. Important examples are:

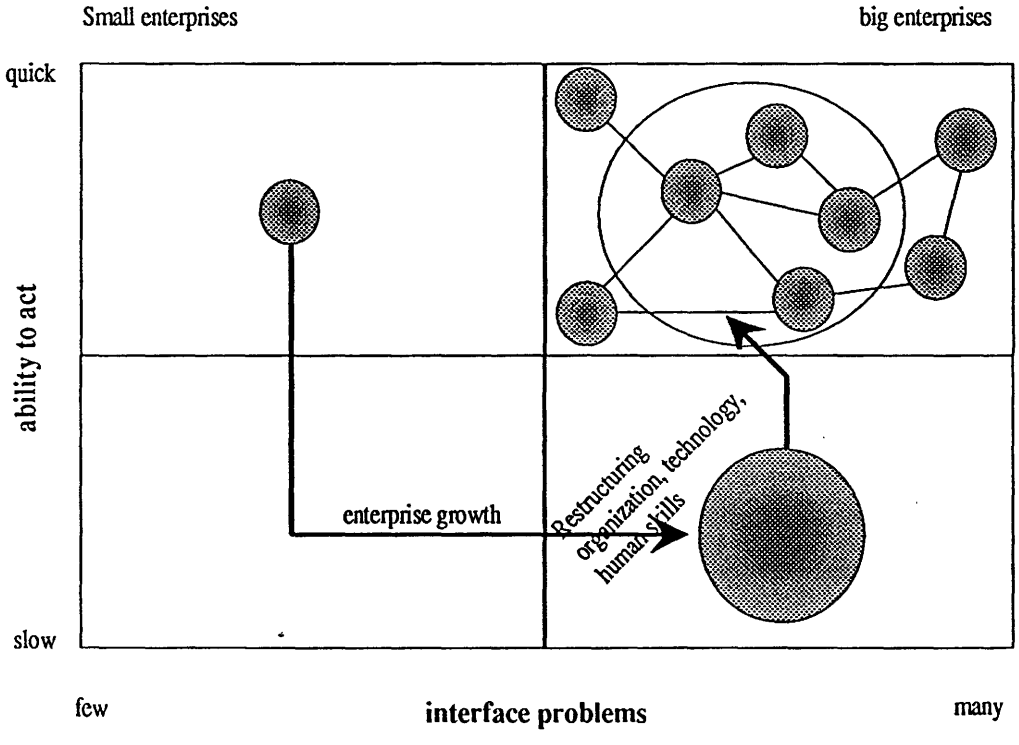
1 As competition is increasingly shaped by rapid innovation and short product cycles, time-to-market becomes a decisive factor of competitiveness. Amongst other things, short time-to-market must be reached by designing products to manufacturing. This links research and technological development closely to manufacturing.
2 Advanced manufacturing is, as we have discussed in the second part of this reprot, by a changing pattern of innovation which combines technological breakthrough and technology

fusion with continuous improvement. Inevitably, this interlockes activities in research and technical development and in manufacturing not only within, but also across firms.

3 More and more, viability of enterprises and whole industries depends on development of new products and new markets and a broad diversification of production. This requires a synergetic use of knowledge, skills and ressources across tradtional boundaries of markets and technologies. Cross-fertilization between different organizational units, enterprises and whole industries is becoming decisive.

4 In advanced manufacturing, organizational boundaries are becoming increasingly fluid and open. Production has to be flexibly organized along the whole production chain. Rapid development and application of leading-edge techology involves collaboration along technological food-chains. Accordingly, interdependencies of activities within and across firms increase.

Fig. 3.14: Interfaces and flexibilities in organizations



In this and similar cases, strict segmentation would create significant impediments for productivity, quality and innovation. Lean production, therefore, has to be complemented by establishment of interfaces between organizational segments and by a flexible management

of these interfaces. This does not mean renunciation of lean production in favour of an increase of formal coordination. That would mean a fall back in traditional forms of large, complex and inflexible organization.

Rather, the task is to develop devices of informal and flexibel coordination which fit to the principles of lean production. The solution is networking rather than formal organization. This is a principle which applies both to coordination within and between firms.

For medium and large firms, application of this principle amounts for the implementation of some "firms-in-a-firm" concepts. Organizational units or production segments are treated as a mini-firm which have powers and resources to serve its task. Relations between different mini-firms are not primarily regulated by formal rules and hierarchy. Rather, they are either governed by internal markets or by the same forms of collaboration as are used in networking between firms[21].

Networking of different firms should be established in order to

* coordinate activites which are interlocked across firms,
* exploit potentials for synergy and cross-fertilization, and to
* institutionalize collaboration along technological food-chaines and in technology-fusion.

Networking, thus, serves as an instrument to bundle resources and capabilities of different enterprises in order to increase performance of all participating firms. Weak and noncommitally cooperation does not sufficiently serve this purpose. Rather, networking has to take the shape of a close, purposive and efficient collaboration in one or more clearly defined projects.

Networking in this intensive form of collaboration is difficult to arrange because the usual means of formal organization are hardly effective. This is well illustrated by failure of many

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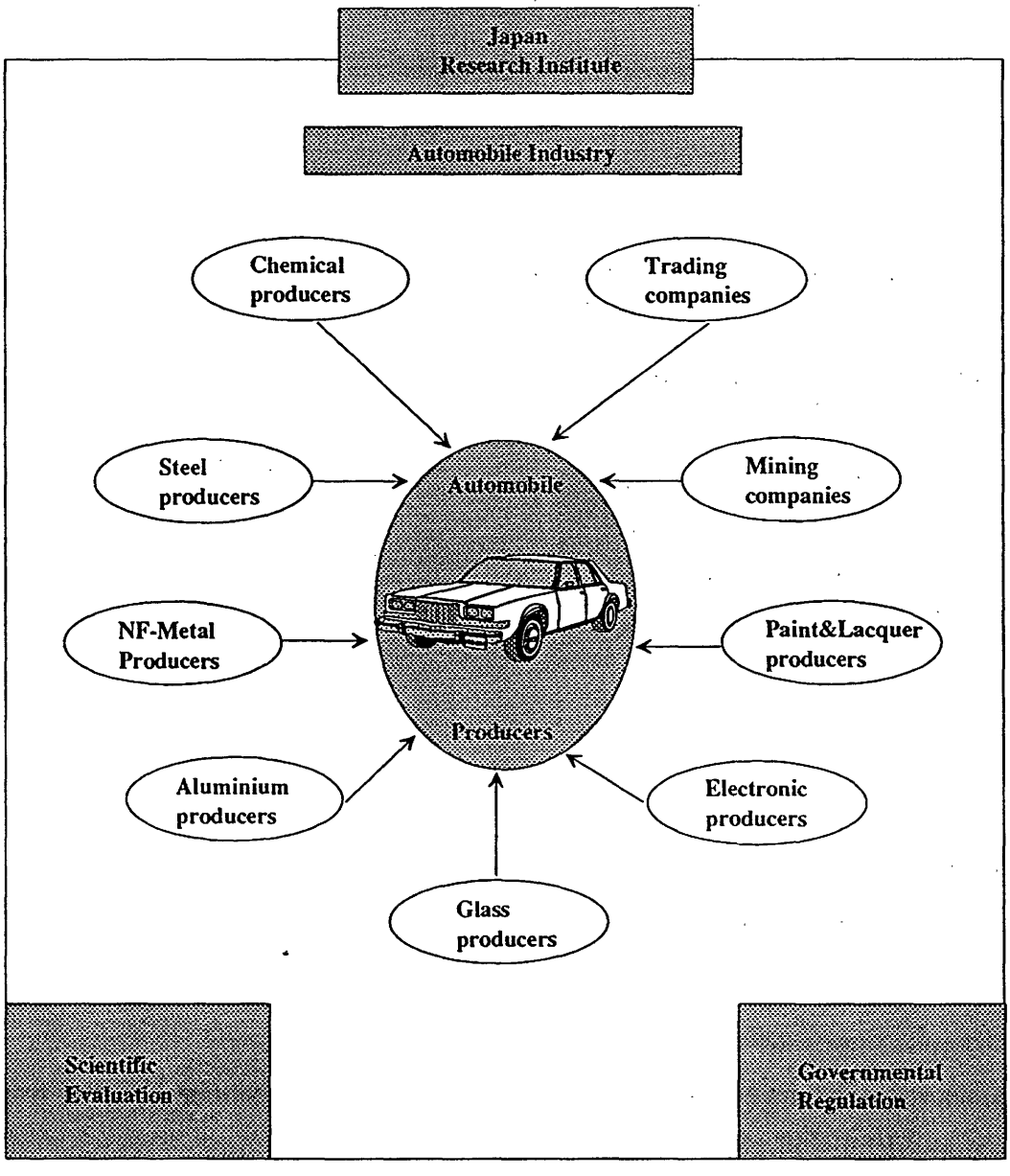
[21] An instructive example of a "firms-in-a-firm" concept is the plant of Bosch at Cardiff, Wales. Units in charge for the different components of the product are established as mini-firms with strong delegation of powers and responsabilites. Relations between the mini-firms are designed as producer-client relations.

attempts of firms to diversify through acquisition. The hope was that in bringing together different firms under one roof of an enterprise this would produce considerable synergies and new economic opportunities. In reality, however, integration of different firms' strategies, organization, culture and social structures often proved to be extremely time-consuming or even failed at all, and the expected results often remained out of reach.

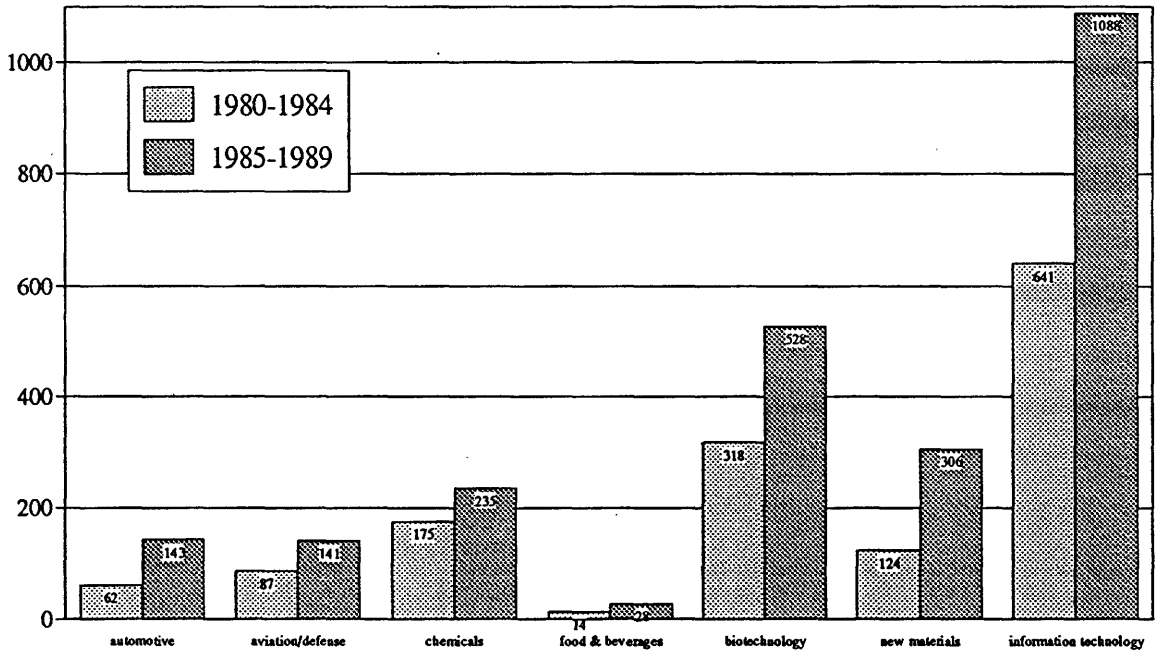
Fig. 3.15: An instructive example of networking: The Japanese consortium on automobil recycling (structure and task)



Source: Japan Research Institute, 1992.

Similar problems occur if independend firms should collaborate intensively in some joint project. Again, the problem is not the formal setting of collaboration although this often involves difficult legal problems. The main problem is to bring different structures, cultures and styles together and to create an efficient and constructive working milieu for the joint project.

Fig. 3.16: Strategic technology alliances



Source: Hagedorn/Schakenraad 1991.

Creating an efficient and constructive working milieu for successfull collaboration is anthropocentric management at its best. The "art of managment" is

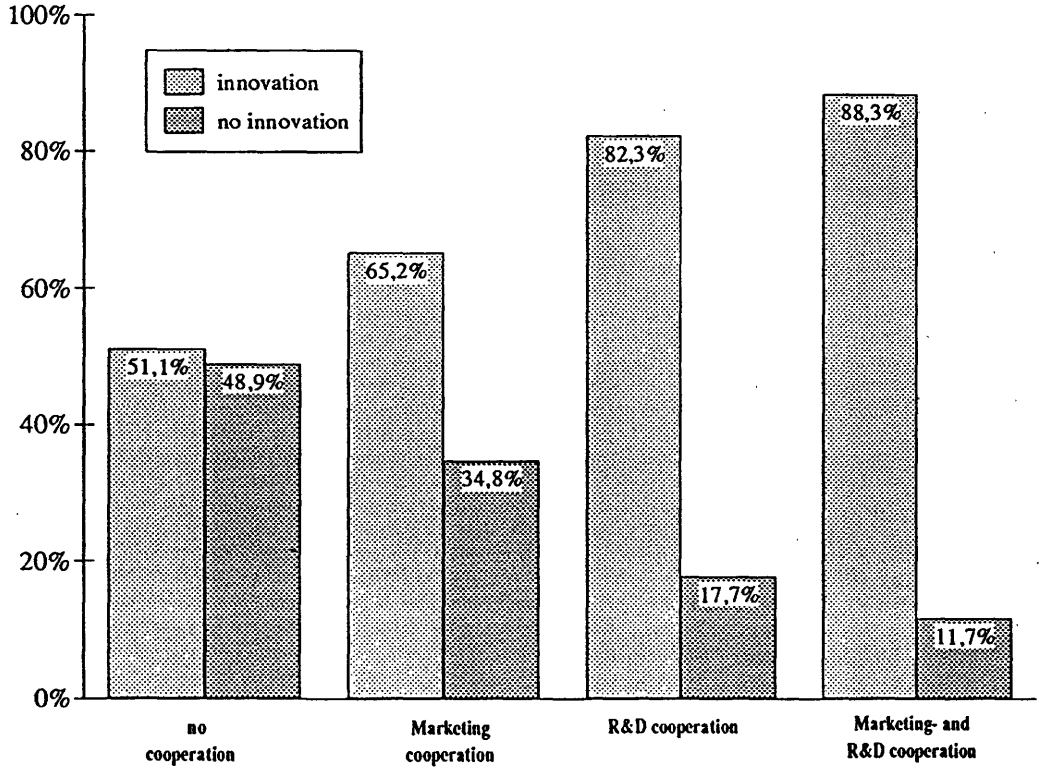
* to bring the right people together and train them adequately,
* free them as much as possible from the constraints of hierarchy and formal organization,
* to set up effective incentives for collaboration, and
* to develop intensive exchange of ideas and knowledge between the joint project and the involved firms.

This "art of management" can hardly be phrased in rules and tought in textbooks.

Development of successful collaboration is, obviously, difficult for many firms. At least, available data demonstrate that intensive collaboration among enterprises is still rather rare. An illustrative case are strategic alliances which are widely discussed since some years, but still rarely established. In recent years, the number of strategic alliances has grown considerably, but still is low in absolute terms.

Interestingly enough, the number of cooperation agreements in so-called "high-tech"industries (biotechnology, new materials, information technology) is much higher than in more mature industries like automative, aerospace, chemicals and food. This demontrates that firms operating in new and expanding industries are more likely to seek new organizational solutions and new ways of solving technological and financial problems than those operationg in established markets which adhere more or less to their traditional relationships.

Fig. 3.17: Cooperation and innovation

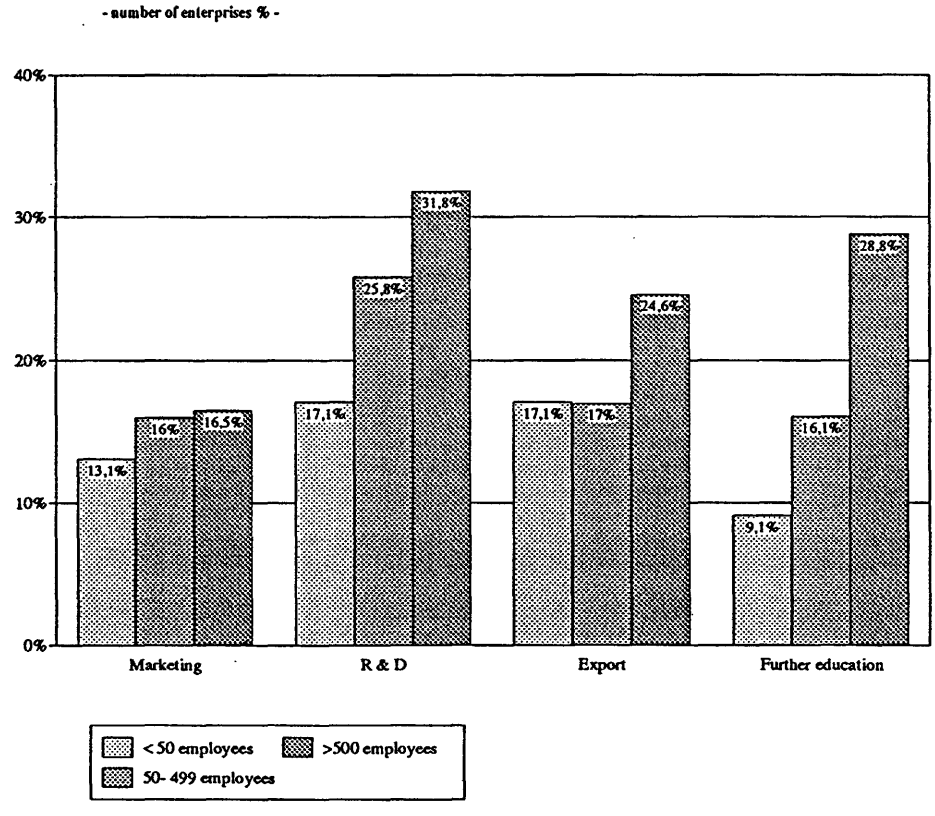


Source: Belzer, 1993.

This is rather paradoxical because collaboration could help firms in mature industries to develop new markets and economic opportunities. A study on manufacturing industry in the German land of Northrhine-Westfalia demonstrates this well. Results of the study which is based on a survey, show that only about half of all firms which have not collaborated have developed new products in the last years whereas more than 80% of the collaborating firms have developed new products (Belzer, 1993).

The study also reveals another interesting phenomenon, namely that smaller firms involve less in collaboration than larger ones. This is particularly true with respect to marketing and research and development where many small and medium firms will not be capable of surviving in isolation. In view of the specific problems which small and medium enterprises face in advanced manufacturing, this is certainly a critical issue not to say an alarming problem.

Fig. 3.18: Collaboration by field and by size of firms



Source: Belzer, 1993.

In European industry, collaboration between firms seems to be much less developed than in Japan. In Japan, industrial strategies and industrial policy are rather systematically exploiting collaboration as a means to advance competitiveness and performance of firms and whole industries. Against that, in Europe both industry and industrial policy are still reluctant to systematically enhance collaboration. Intensive collaboration in strategic fields hardly fits traditional European concepts of competition.

The analysis and explanations in the chapters above have taught a more or less intriguing lesson. European industries need to significantly improve their capabilities to respond to arising problems and new market opportunities more quickly, more innovatively, more efficiently and close to the demands of environmental protection. However, it became obvious that single firms or branches with their traditional strategies are less and less capable to respond to the increasing demand for adaptabiliby. Probably, the challenges of the future can only be met adequately by linking and bundling various resources and potentials from different firms, sectors and actors - from finances via production equipment and know-how to human resources and organisational-knowledge. Or, to put it in other words: The future of industries in Europe is beyond the borderlines of existing enterprises and traditionally defined sectors and branches.

Within the last couple of months it has become more and more familiar to lable such new production clusters "virtual corporations" (Davidow/Malone 1993; De Meyer 1992; Business Week 8/93; Elektronik 9/93). Roughly spoken, this term characterizes a cooperation, a joint-venture, an alliance or something similar which was founded between two or more firms to solve their specific problem or to respond to a promising market opportunity by bundling a part of the resources of the actors involved; mostly, communication in these collaborative systems is supported by making use of advanced information and communication technologies. These new bi- or multilateral arrangements do not only aim at linking the technological strenghts and skills of different participants. Furthermore, virtual corporations to profit additionally from the different market accesses held by the contributing partners. Such a virtual corporation is normally characterized by a very low level of hierarchy and

vertical integration. Instead, all strengths and activities are focussed to realize the vision of quickly responding to a new market opportunity or to solve a common problem[22].

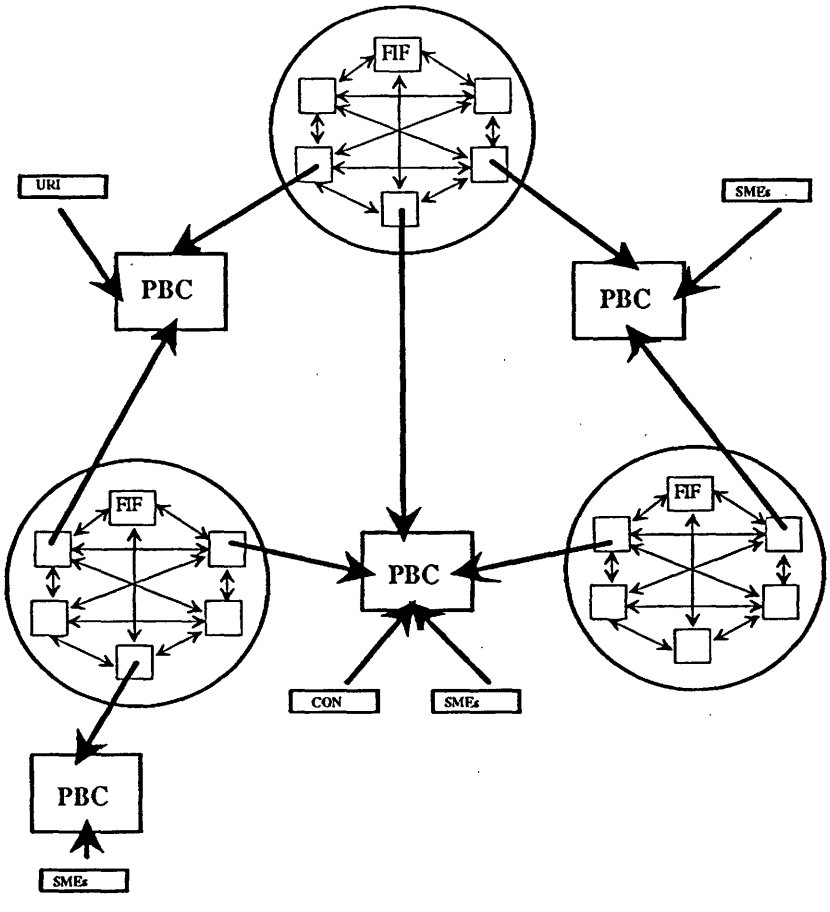
Tab. 3.2: The Virtual Corporation

The Virtual Corporation - The Company of the Future will be the Ultimate in Adaptibility
Characteristics of a new corporate model Today's joint ventures and strategic alliances may be an early glimpse of the business organization of the future: The Virtual Corporation. It's a temporary network of companies that come together quickly to exploit fast-changing opportunities. In a Virtual Corporation, companies can share cost, skills, and access to global markets, with each partner contributing what it's best at. Here are the key attributes of such an organization:
Technology Informational networks will help far-flung companies and entrepreneurs link up and work together from start to finish. The partnerships will be based on electronic contracts to keep the lawyers away and speed the linkups
Excellence Because each partner brings its "core competence" to the effort, it may be possible to create a "best-of everything" organization. Every function and process could be world-class-something that no single company could achieve
Opportunism Partnerships will be less permanent, less formal, and more opportunistic. Companies will band together to meet a specific market opportunity and, more often than not, fall apart once the need evaporates
Trust These relationships make companies far more reliant on each other and require far more trust than ever before. They'll share a sense of "co-destiny", meaning that the fate of each partner is dependent on the other
No Borders This new corporate model redefines the traditional boundaries of the company. more cooperation among competitors, suppliers, and customers makes it harder to determine where one company ends and another begins.

[22] Why virtual? The has its origins in the computer industry - but not, as you might think, in the phrase "virtual reality". Instead, it derives when the term "virtual memory" described a way of making a computer act as if it had more storage capacity than it really possessed. The virtual corporation will seem to be a singly entity with vast capabilities but will really be the result of numerous collaborations assembled only when they're need (Business Week 8/1993).

In telecommunications, the promising growth industry, some alliances and joint ventures are illustrating what a virtual corporation is and how it works (see Elektronik 9/93). See for example the enterprises pooling in and around the EO Inc. which was founded not until 1991 and which is located in Mountain View (USA). AT&T, Matsushita, Marubeni and Olivetti are contributing to this network aiming at developing a so-called pen software which will be able to identity and process hand-written scripts.

Fig. 3.19: Virtual corporations in a collaborative economy



Source: Belzer/Hilbert, 1993.

Up to now, both academic debates and those among managers are focussing on the interfaces between the organisations involved. However, one should avoid to underestimate that the success of *interfirm* collaborations strongly depends on *intraorganisational* features of the firms involved. Anthropocentric production systems which are characterized by both a highly qualified, selfconfident and motivated work-force and by an advanced intra-firm dezentralization (firm-in-firm), will be an excellent intra-firm starting point for contributing to interfirm collaborations.

If virtual corporations are discussed, it is very often implicitly assumed that one talks about project-based alliances and cooperations which only exist for a bounded and narrowly defined timespan. "..., this new evolving corporate model will be fluid and flexible - a group of collaborators that quickly unites to exploit a specific opportunity. Once the opportunity is met, the venture will, more often than not, disband." (Business Week 8/93:37) However, this does not mean that virtual enterprises can be built out of nothing. Different recent studies analysing the birth and development of interfirm collaborations result in a clear message: A successfull operation of such an arrangement is more probable if organizations and persons involved are familiar to each other and if their relationships is characterized by trust. Closeness and trust of the potential collaborators is not a conditio sine quo non, but it makes collaboration much more promising (Belzer 1993; Hilbert et al. 1991; Sabel 1992, Gordon 1992; Grabher 1992).

Idealtypically, a project based cooperation, i.e. a new virtual enterprise, is another knot in an existing broad network of joint-ventures, formal and informal alliances etc. Such a network does not only comprise large, medium and small sized enterprises, but also firms providing business services as well universities and other research institutions. By its very nature, the borders of such a network are blurred and fuzzy. Summing up and putting it into other words: Virtual corporations will be better of if they are based on a collaborative or a network economy (see fig. 3.19).

There is some evidence that regions, nations, sectors and branches differ with respect to their collaborative traditions and practices. The japanese economy, for example, with its famous "keiretsu" is well-known for its ideosyncratic kind of collectivistic spirit. Collaborative traditions are not quite unknown in Europe as well. See for example the European

construction industry which already profitted from collaborative production clusters for a very long period. However, though even Europe has its experiences with interfirm collaboration, European industries have many difficulties to systematically increase and exploit this promising business strategy. Particularly the SME-sector, i.e. those enterprises that are said to profit the most from an increase in interfirm collaborations, is very reluctant to start cooperative arrangements (we already discussed this problem in the previous chapters).

If the thesis proves valid that virtual corporations are a promising business strategy, and if the analysis holds true that European firms and industries are very reserved in starting collaborations, new concepts and means have to be identified to initiate and to develop European virtual corporations (and to motivate European firms to contribute to multi-national, multi-regional collaborations).

Obviously, Europe is missing an adequate strategy to bundle and link existing potentials from various firms and sectors. Perhaps, this gap can be partly filled by further establishment and broad use of a modern information and communication infrastructure. Another promising path could be that business consultants identify the strategic relevance of interfirm collaboration and start to convince their clients to practize this strategy. But precondition to realize this is that the consultants will be able to provide adequate tools to match the interests and purposes of the different partners. However, though these developments and hopes are promising and helpful, European industrial policies as well should not hesitate to develop strategies to better motivate industries to increase their performance and adaptability by founding virtual corporations.

Part 4:

Employment, Work and Welfare: The Great Challenge

Mismatches

It seems as if we were approaching the end of an epoque, in which wealth was drawn from human work. Technological progress has step by step substituted human work. Economic growth does not necessarily also mean growth of the number of work places. A considerable portion of industrial investments aim at reducing human work. A reduced but highly qualified and highly motivated workforce produces rising wealth. Those less qualified and less performing disappear in unemployment statistics, informal work, odd jobs or join the clientele of welfare offices.

This state of affairs raises a number of questions which European society may try to evade but in one way or other will have to answer. Will we approach a kind of society where many are doomed to unemployment and few to overproductivity? Will those who actually work be ready to work more and work more productively to finance a minimum income for all[1]? What about the social esteem of those out of payed work but may be engaged in non-payed work, of which there is so much in our societies? Should we e.g. go on taxing work income instead of the consumption of resources? The list could be continued, and admittedly the following chapter will not cover all these issues. But what should be kept in mind, is that we face a situation in which facts, means and goals are ambiguous and consequently have to be continuously reassessed and redefined - which means that we will have to thoroughly analyze and to learn.

Box 4.1: Mismatches

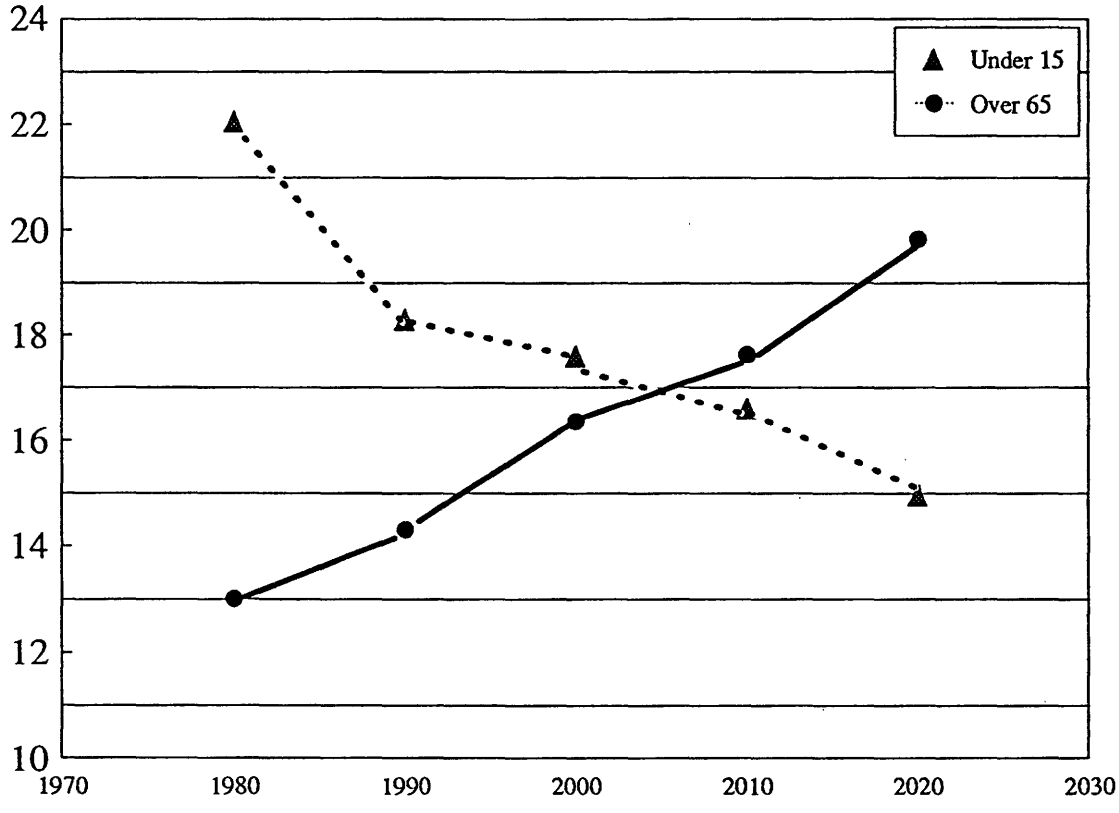
* economic growth - rising unemployment
* unemployment - overproductivity
* quality and quantity of labour offers - quality and quantity of labour demanded
* actual change - industrial adjustment

[1] This situation is highlighted by the Kaldor-criterion, which is met when the profits of the winners outweigh the compensation payments to the loosers, Kaldor (1939: 549-552).

There is much evidence, that work and employment make up a considerable part of the portfolio of challenges facing European societies (Commission of the European Communities 1991a). The dynamics of these challenges are mainly due to a set of mismatches between secular trends, institutional structures and economic rationales.

Throughout Western industrialized countries, shrinking and aging processes of the population can be observed, bringing about a new and irreversible demographic and social structure:

Fig. 4.1: Age groups of total population in EC-12 in percent

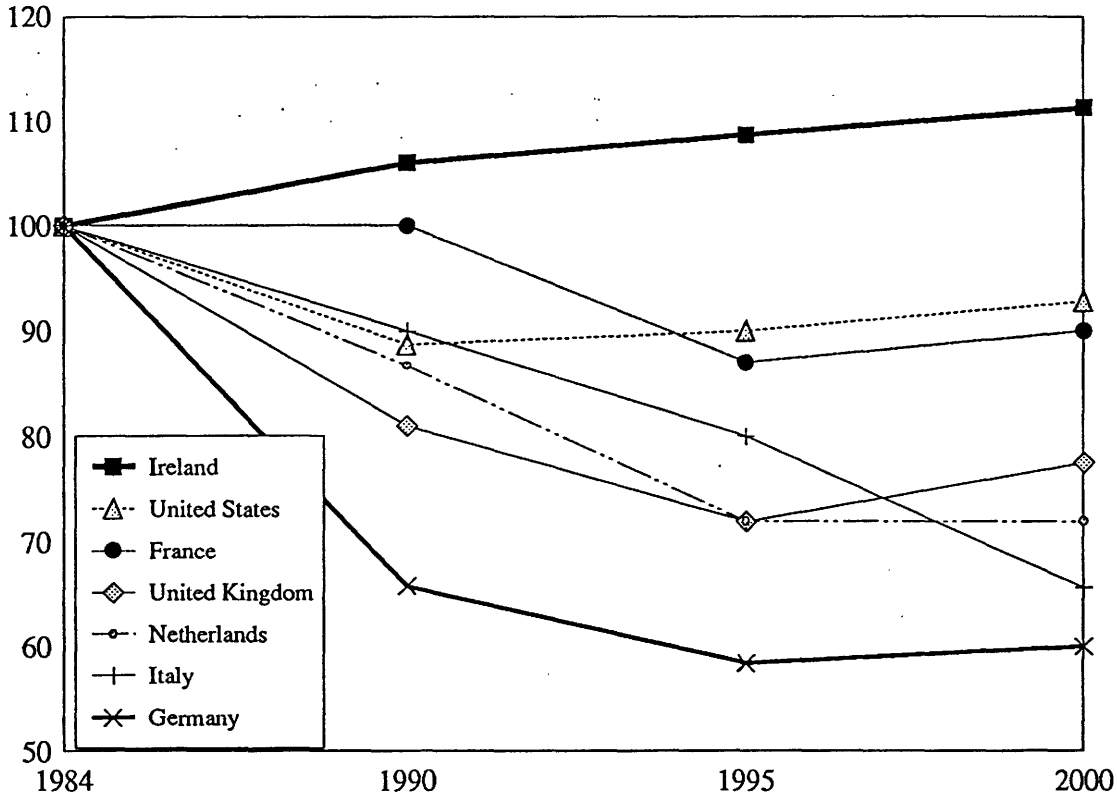


Source: Monod et.al., 1991.

Qualified labour is running short in many industries. By the year 2000 there will be more workers over 50 than under 30 (Naschold 1993). Estimations for Germany point out, that by 2000 there will be a share of 422 people of over 60 per 1000 of the age cohort of 20-59. A peak will be reached by 2035, when there will be 747 over 60 per 1000 of 20-59 years (Deutscher Bundestag 1992; Naschold 1993). Politicians already announce a postponement

of retirement-policies, completely contrary to the present struggle over shortening working time in many countries. Yet at the same time unemployment is marching on.

Fig. 4.2: Share of 15-19 year olds in Europe and the United States



Source: OECD, 1992.

For firms these demographic trends are reflected in the age composition of their workforce with consequences for pay structures, skill levels, recruitment policies, innovation and organisational structures:

* Pay structures and social benefits in most countries follow some kind of seniority rules, raising the cost for "old" labour.
* Skill levels and a propensity for innovation is dependent on lifelong further training, which older workers tend to look upon as a challenge to their competence, while technical innovation threatens both competence and organisational status.

* Shortage of labour and aging end up in organisational sklerosis[2].

These demographic trends receive their erosive powers by the characteristic link of European welfare systems to industrial work. It may be looked upon as an irony of history, that it is the original European project of the welfare state, which makes for much of the structural unemployment problem. Welfare arrangements support the flexible adjustment of labour to change, limiting the negative social and economic consequences for the individual. However, at the same time these arrangements constitute incentives for enterprises to solve economic problems at the expense of unemployment schemes and welfare budgets rather than searching for economic alternatives. The result is considerable financial stress on welfare budgets and the welfare system as a whole, as well as a delay in the necessary structural adjustment of firms and in the search for new economic opportunities and new jobs.

Politically, too, the welfare system provides the instruments to take the strain off politics to formulate and implement employment policies instead of administrating unemployment. This in mind, Naschold (1993) speaks of a "virtuous" and a "vicious" circle of work and welfare.

As has been pointed out in the previous chapters of this report, Europe suffers from a productivity and general competitivity lag vis à vis Japan, and in a number of fields vis à vis the US, too. European industries mostly have defined their backlog in terms of costs, which in most European languages means to cut the cost of labour. But even where firms have taken recourse to advanced models of production, e.g. by an intelligent combination of advanced technology and human skills, the consequent deployment of qualified labour takes its toll on less qualified or less efficient labour - at least as long as there is no growth based on new products and new markets. While the integration of markets favours "strong" regions, peripheral or less developed regions of Europe tend to loose industrial and human substance, thus endangering social cohesion of EC-Europe and the project of a political union (Jochimsen 1992).

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[2] This is also one of the core theses of OECD (1992: 149 ff.).

Tab. 4.1: Expenditure for social security 1962-88 (percent of GDP)

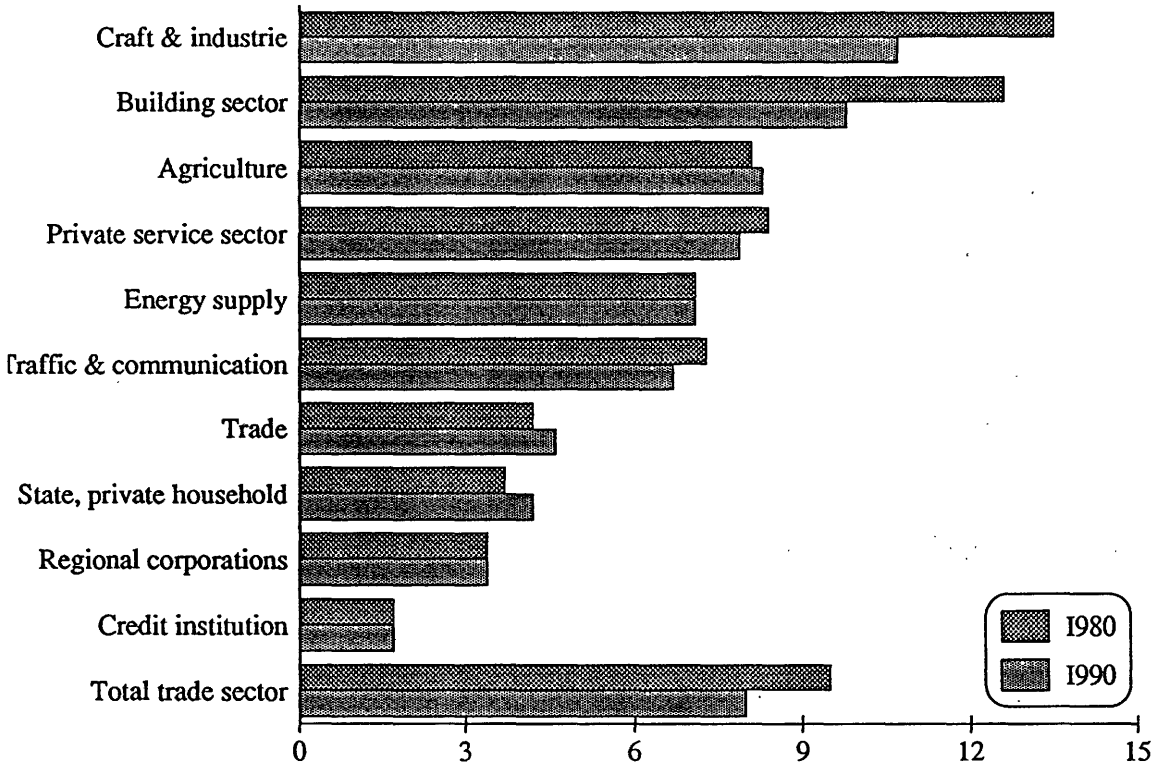
	1962	1966	1970	1975	1980	1986	1987	1988
Belgium	15,5	16,5	18,5	23,0	26,6	29,0	28,7	. .
Denmark	. .	. .	19,6	25,8	28,6	26,8	27,7	28,5
Germany	17,5	18,7	21,4	29,8	28,5	27,9	28,2	28,1
France	16,3	18,2	18,9	22,9	25,9	28,6	28,3	28,3
Greece	. .	. .	. .	. .	. .	. .	. .	. .
U.K.	. .	. .	15,9	19,5	21,4	24,6	23,6	. .
Ireland	. .	. .	13,2	19,4	21,8	24,3	23,6	22,6
Italy	14,3	18,1	18,8	22,6	22,8	22,5	22,9	22,9
Luxembourg	15,7	17,6	16,0	21,5	24,8	25,5	26,4	26,6
Netherlands	13,7	17,2	20,7	28,1	30,4	30,9	31,3	30,7
Portugal	. .	. .	. .	. .	. .	16,4	16,7	17,0
Spain	. .	. .	. .	. .	. .	17,7	17,7	18,1

Source: Gabriel, 1992.

As an alternative to cope with demographic problems, regulated and selective immigration might be considered. Scenario studies covering the years up to 2010 for West-Germany have shown that though in a short run immigration would lead to higher unemployment, in the long run it would lead up to higher growth covering even the employment of immigrants. For West-Germany immigration would increase the GNP by 1% - 1.3%; and employment would rise by 13% - 22%, whereas without immigration it would go down by 6%. Unemployment rates are forecasted with quotas of 9% to 10% - quotas, which because of lacking demand would have to be expected also without immigration. Real income per head would rise within the period forecasted by about a third, again with or without immigration; without

immigration, contribution to social security schemes would necessarily go up (Koll/Ochel/Vogler-Ludwig 1993).

Fig. 4.3: Share of the foreign labour capacity in the total number of employees in the different economical activities (West Germany)



Source: Frankfurter Rundschau, Feb. 2, 1992.

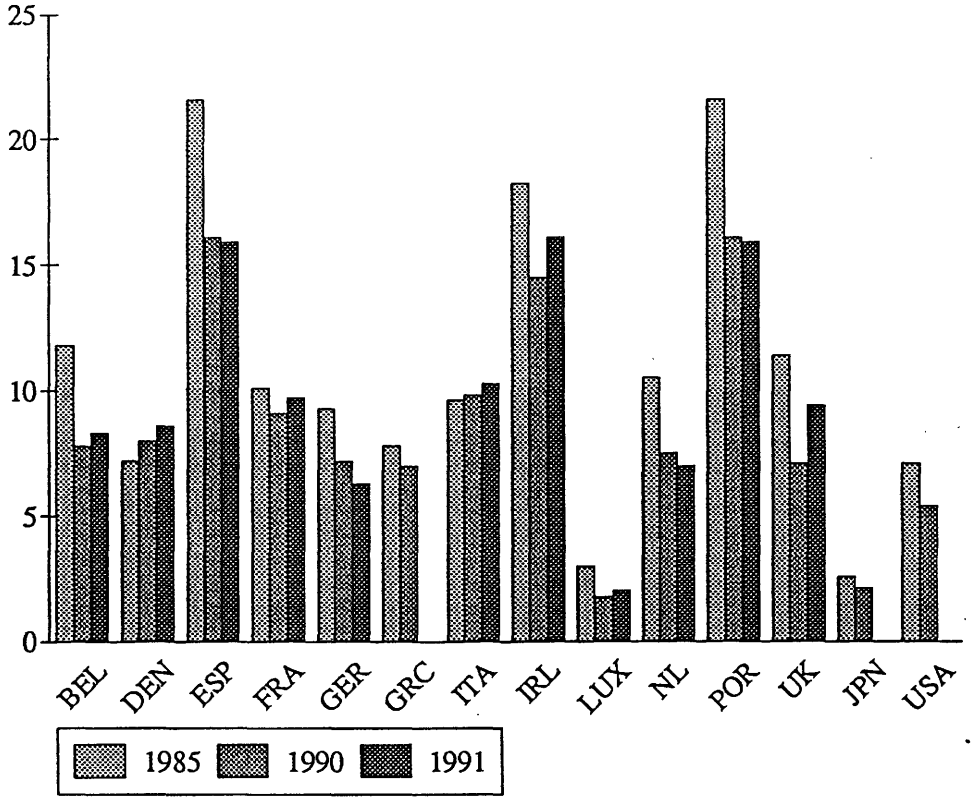
As there is obviously no invisible hand at work reconciliating economic and social imbalances, external effects and contrasting interests, politics is called upon to shape the design and rules of interaction in a Single Market.

Structural unemployment

In the course of a relatively long period of growth, employment in most European countries has gone up, although accompanied by phases of cyclical unemployment and regional shifts. Problems of cyclical unemployment can be tackled by some kind of Keynesian strategies. But

in the last years each phase of cyclical unemployment has added to a growing stock of structural unemployment, which can only be handled in combination with other policies.

Fig. 4.4: Unemployment rates in Europe



Source: Statistisches Jahrbuch für das Ausland, 1992.

Generally speaking, structural unemployment is caused by a mismatch of quantities and qualities of labour supplied and labour demanded. E.g., the introduction of new manufacturing processes combined with the spreading of new materials will affect employment as well as the relevance of skills particularly those traditionally associated with metal bending and shaping (Hayward 1992). These processes are mainly due to a time lag between actual change and adjustment. While the seventies had experienced growth in output going along with growth in employment, the late eighties and nineties have seen growth produced by automation going along with high unemployment rates, high demand for skilled labour, regional isles of growth and a periphery loosing industrial and human substance

(OECD 1992: 150). The situation is well illustrated by a comparision of unemployment rates and vacancies.

Tab. 4.2: Employee activity rate 1950-1987 (economically active population to the entire population in percent

	1950	1955	1960	1965	1970	1975	1980	1985	1986	1987
Belgium	41,6	40,1	39,1	39,0	39,7	40,8	42,2	42,6	42,7	42,9
Denmark	46,3	46,4	44,0	46,3	48,3	49,1	52,0	55,4	56,2	56,7
Germany	46,1	48,2	47,3	45,3	44,2	43,5	44,2	45,6	45,9	46,1
France	. .	43,9	41,5	40,6	42,2	42,4	43,4	43,4	43,3	43,3
Greece	. .	. .	. .	39,9	39,0	38,0	37,7	41,1	40,9	40,7
U.K.	45,2	46,3	45,6	46,1	45,5	46,0	47,6	48,8	48,9	49,0
Ireland	42,2	41,0	37,2	38,7	37,9	36,4	36,7	36,9	36,9	37,0
Italy	..	40,5	43,6	39,3	38,8	38,3	39,8	41,1	41,7	41,9
Luxembourg	. .	42,5	41,9	40,2	40,0	41,7	41,8	42,6	42,5	42,9
Netherlands	37,0	35,8	35,4	35,9	36,8	36,5	38,0	40,1	40,0	40,6
Portugal	36,6	. .	38,4	. .	. .	45,4	46,2	46,9	46,5	46,9
Spain	37,7	. .	38,1	. .	38,6	38,7	36,0	36,2	36,6	37,8

Source: Gabriel, 1992.

The French economy, for example, grew at an annual rate of about 3% anually during the second half of the eighties; yet over the same period employment only grew at a pace of 0.4%. Empirical evidence shows, that enterprises prefer bigger overtime payments to their skeleton crews instead of hiring new personnel.

People outside the employment system still have the chance to find work, but often only in temporary or part-time positions with less pay and fewer benefits (Commission of the

European Communities 1991a; Bernstein/Magnusson 1993). Manifest already in the US, these tendencies can already also be observed on the European labour market.

No doubt, the application of new and modern technologies has contributed to the massive killing of jobs, but, due to the ambiguity of change, they have simultaneously contributed to the creation of new jobs (Schettkat/Wagner 1989). By far stronger than by the introduction of new technologies structural unemployment is accounted for by developments of competitiveness among the triad as well as among the industrialized countries and the newly industrialized countries (NICs). So unemployment is rising as new restructurings of markets and layoffs come on top of earlier ones made in anticipation of the Single Market. E.g. automobile manufacturers will have to cut costs - which in European tradition means cuts in personnel costs - of by and large 50% to close the gap with the Japanese (Belzer/Dankbaar 1993). European steel makers have heavily invested in modern technology and are now among the world's most efficient - yet this has cost Europe hundreds of thousands of jobs.

Unequal distribution of growth and decline among regions and branches, including 'promising' branches, puts severe strains on the national economies as well as on the EC bugets (see also the paragraph on 'Work and Welfare' below). The economic and social impacts and strategic problems of both structural unemployment and unequal distribution of growth can be named:

* a significant decrease of purchasing power and absorbing capacities of European markets;
* a decline of the diversified market structures which have been the stronghold of the European economies so far;
* a loss of industrial competence and competence of human resources;
* a considerable rise of distributive conflict; and
* a decline of social cohesion, regionally, nationally as well as Europe-wide.

Structural unemployment always threatens to start a vicious, self-enforcing circle of less consumption, decreasing market volumes allowing for less output and use of production capacities, which in turn creates more unemployment and destruction of human resources. European markets traditionally operate under the condition of a broad diversity of demand,

which makes for much of their world-wide competitiveness. A significant reduction of purchasing powers of large strata of the population would almost certainly devaluate this asset of European industry. Beyond that, structural unemployment will almost certainly aggravate distributive conflicts and undermine endeavours for social cohesion - preconditions for both the prospects of a political union and global economic competitiveness.

The problems sketched out above already point to policy implications: phenomena of structural unemployment cannot be tackled directly by means of short-term "labour market programmes" of the traditional kind, because the lay-off of labour is only the end of what in reality is a complex and ambiguous process. What is required is rather a strategic, long-term political concept aiming at institutional rearrangements geared to the enhancement of the competitiveness of the labour force. Apart from the issues discussed below, strategic employment policies will have to focus on

- the economies of traditional labour market institutions and processes and their integration into competition policies[3];
- the short- and long-term consequences of different production models for labour market strategies;
- recruitment and personnel strategies of enterprises;
- the development of strategies to enhance the contribution of employment policies to regional development and social cohesion within the Community.

Skills, qualification and training: Bringing about change by learning

In the debate among the economic sciences education and training has been promoted from an exogeneous residual factor to a status of intangible investment[4]. The logic is evident: it is not due to lack of capital investment which inhibits poor countries and regions to catch up with richer ones, but lack of human capital to realize the potential productivity of new

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[3] Basic philosophics of institutional competition are discussed in Siebert/Koop (1993).

[4] For a definition of 'tangible' and 'intangible' investment see OECD (1992:18).

machines and technologies. Comparisions of the competitive strength of Japan and East Asian countries to the US and Europe have made clear that the quality of human capital makes for much of these countries' success (World Bank 1991; Industrial Research and Development Advisory Committee of the Commission of the European Communities - IRDAC - 1990; CEC, 1991b). The message of all these studies is clear: cohesion and competitiveness, the overriding goals of the community in the years "after Maastricht", are to a significant extent dependent on effective education and training policies. The alternative to further training structurally anchored in an individual's working life as well as in a firm's strategy portfolio are rigid rationalization strategies, at the end of which there is remaining only a thin stratum of expert workers managing the production process.

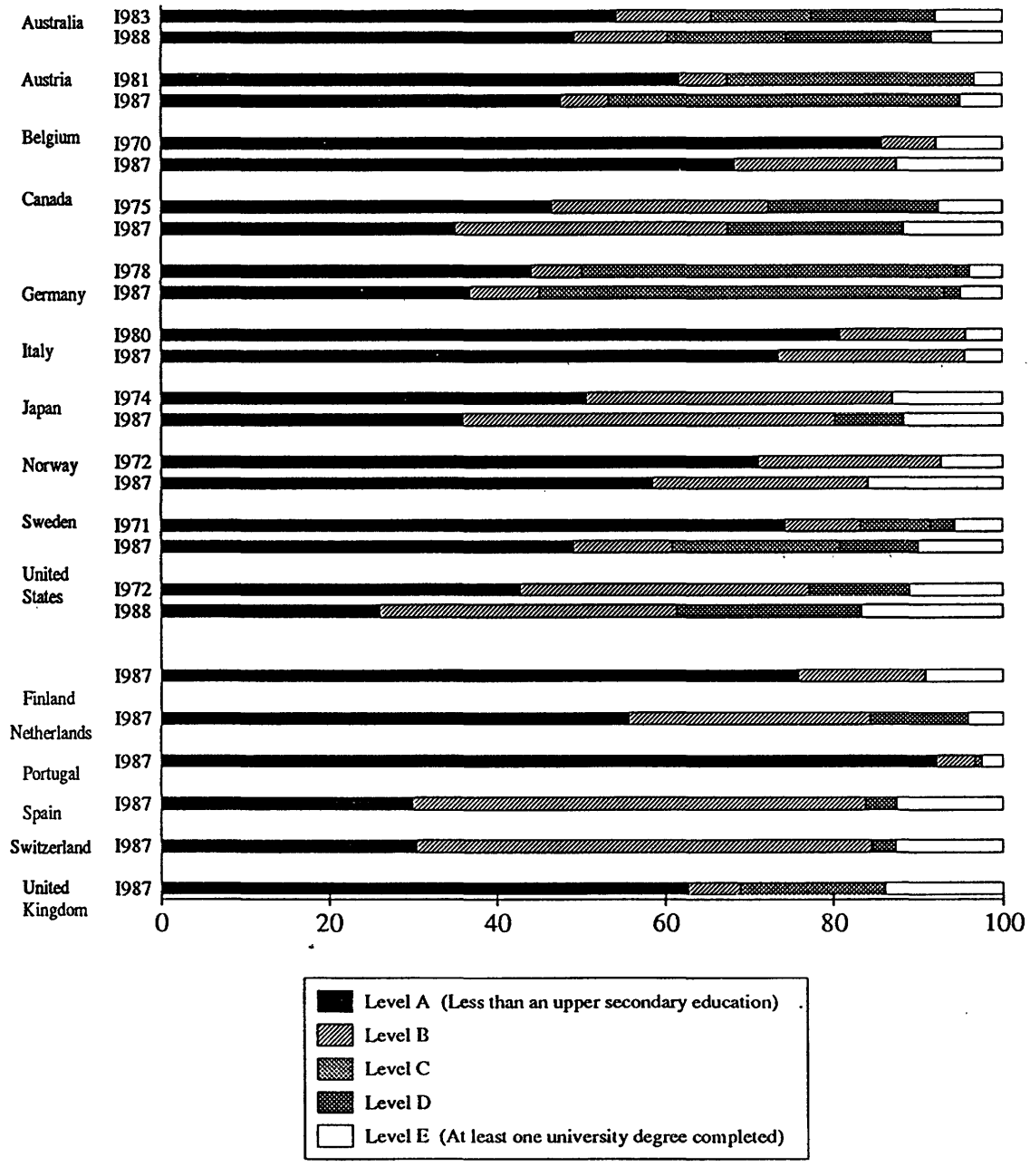
To get hold of the chances of new technologies and the Single Market a favorable institutional environment is needed, a central part of which is the organization of education, qualification and training. Because of demographic developments, EC-countries will have to take into account an overaging of the economically active population with the consequence, that already in ten years time Europe will lack young, qualified and efficient labour. In so far, says Ricardo Diez-Hochleitner, president of the Club of Rome, permanent further training and teaching takes a crucial role. But still firms do not make sufficient use of the creative potential of employees, especially of women, who in his view are the largest unused resource of creativity (Süddeutsche Zeitung, March 4th 1993; Rees 1992). For Herbert Henzler, chairman of the German subsidiary of McKinsey's, qualification and appropriate qualification policies make up the most important single factor of competitiveness and moreover the most important factor within the disposition of national policies (Henzler 1992a).

Along with the changes in the structure of the population and the workforce fundamental changes in the structure of educational qualification can be observed throughout Europe. As more and more youth with higher education enter employment, and further training schemes are extended, a turn-around of the traditional qualification pyramid takes place, leaving only marginal chances to a remaining pile of low qualified and uneducated workers (OECD 1992).

The increasing qualification level of the European workforce makes for much of industries' competitiveness, but at the same time there are associated serious economic and social

problems as e.g. labour costs, the availability of skilled blue-collar work as well as unskilled work, job chances of the less qualified, claims to the quality of work places as well as the quality of working life in general, and finally social cohesion on the shop floor as well as within enterprises as a whole.

Fig. 4.5: Educational attainment of working age population in selected OECD countries



Source: OECD, 1992.

Tab. 4.3: Annual percentage changes in educational attainment levels of working age population

	Level of education				
	A	B	C	D	E
Australia 1983-88	-2,02	0,54	3,16	1,97	3,32
Austria 1981-87	-5,73	1,54	7,32	..	12,30
Belgium 1970-87	-1,28	5,77	..	..	3,07
Canada 1975-87	-2,50	1,89	..	0,55	3,97
Germany 1978-87	-2,16	-3,75	0,90	4,20	2,75
Italy 1980-87	-1,32	-4,91	..	..	3,60
Japan 1974-87	-2,76	1,54	..	..	3,55*
Norway 1972-87	-5,83	6,32	..	..	5,80
Sweden 1971-87	-2,71	1,86	5,31	7,08	..
United States 1972-88	-2,83	0,51	..	2,23	3,34

* Since levels D and E are separated in 1987, but not in 1974, they have been combined under level E for the purpose of this analysis.

Source: OECD, 1992.

Education and training programmes for sure are no instrument to reduce actual unemployment, and hopes for immediate results will be disappointed. Yet in the long run human capital investments will pay off in economic growth, competitiveness, higher wages, innovation and finally in more jobs. US studies of the late 80s have confirmed the conclusion, that company-sponsored training programmes have boosted workers' wages by about 4% to 11%, but productivity gains outweighed higher labour costs (Bernstein/ Magnusson 1993). There are cases where a 10% increase in spending on training schemes produced 3% in productivity over two years, which was twice as large as the pay rise resulting from the upgrading of workers. President Clinton's plans to upgrade US-workers'

skills and training by obligatory training funds are expected to cost enterprises an extra $21 billion per year, which would almost certainly cause them to restrain wages and hiring in the short run. But it would also generate some $63 billion in new economic activities and 2.5 million new jobs over the next three to five years to come. These numbers highlight the underlying calculus of a positive trade-off between upfront costs and long-term gains. The same can be shown for France, where Choffel/Cuneo/Kramarz (1988) have systematically analyzed firm's development during the 70s and 80s. Their studies confirm that active qualification strategies have considerably enhanced performance and strategic efficiency. Robert Reich at his confirmation hearing in the US-Senate: "The overarching goal is not only more jobs for our citizens, but higher-wage jobs." This obviously requires more and better training.

The argument for school and college training runs along the same road. D.W. Jorgenson of Harvard University calculated, that an extra year of high school education adds an average of $96,000 to a male worker's life income and $51,000 to a female's (Jorgenson/Bowker 1989). The lifetime rate of return from an investment in college training averages 10%.

These arguments represent the broadly shared view, that the upfront pains of human-capital investments will bring a healthier economy down the road. The strategic issue headed for is not only training, but the modernization of work to gain global competitiveness. The enhancement of human qualifications brings about change in production systems enhancing competitiveness; advanced production systems put new demands on human qualifications and the development of new skill profiles. "It is not the number of robots and computers, size and technical perfection of work centres or the degree of automation which will decide upon our future success, but our human resources." says Carl H. Hahn, chairman of the supervisory board of Volkswagen AG (Süddeutsche Zeitung March 4th 1993). This philosophy is nurtured by a recent INSEAD-study based on data from 108 big European companies from 15 countries (DeMeyer 1992). Though firms to a large extent had by now absorbed the principles of customer-driven manufacturing, total-quality management and just-in-time-practices, it is argued, this has not significantly enhanced the competitive position of European manufacturing. Therefore, investments in robots are found at the absolute bottom of a list of important future actions to be taken by management. Rather, something extra is

required if a manufacturer is to gain competitive advantage - which according to the study may be found in the "unambiguous commitment to the improvements of human resources." The unmanned factory does not seem to be the current goal of European manufacturers; instead they try to regain competitiveness by upgrading and deploying their workforce. The management problem is to keep the balance between technological innovation, organisational design and the resulting transformation of skill profiles (Baden-Fuller/Stopford 1992).

Weak management performance is a specific characteristic of small and medium sized enterprises (SME)[5]. They often find themselves in a kind of "skill-trap", because the demand-supply-interface doesn't really work: hardly able to predict their short term economic development, they are unable to qualify and quantify their specific skill needs - with the consequence, that trainers or training institutions cannot respond to their demands and expectations, which in turn leads to failure and further neglect of training.

Though the importance of further training is undoubted, this is a field only poorly shaped by political measures and initiatives, although in most European countries there is a considerable amount of politically fostered and publicly funded measures to train and retrain unemployed. Against that preventive measures of further training for the employed are mainly left to the discretion of enterprises. In the consequence most measures are rather enterprise specific and selective, and since most acquired certificates are not generally acknowledged, the mobility of workers is hindered instead of enhanced. Usually, it is rather the well qualified who enjoys the "privilege" of further training than the employed un- or less qualified - a strategy fostering the tendency to build up a highly qualified core workforce and thereby widening the qualification gap on the labour market, i.e. fostering structural unemployment. For Germany a CEDEFOP-study has estimated that only 3% of the unqualified enjoy further training, as against 40% of technical personnel and 65% of management personnel (Höcker 1992). To apply further training as a means of preventive labour market policy as well as an entrepreneurial strategy is advancing only slowly.

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[5] For details see Rainnie/Sperling/Hilbert/Kleinschmidt (1993).

The exception is Denmark, where already in the beginning of the sixties a partly public corporative system of further training for the employed has been established, which in terms of costs and numbers of participants is rating higher than further training of the unemployed. With a share of 0.28% of the GNP (1989) devoted to further training Denmark keeps the unchallenged leading position of the OECD-countries. The importance ascribed to publicly institutionalized further training is reflected by the composition of the overall budget: two thirds are covered by public funds, one third by private money. This relation, and along with that part of the rationale of this strategy, is explained by the structure of Danish industry, which is mainly small and medium sized, with all the advantages and disadvantages of this type of enterprises. The system is financed by a fund fed by contributions of both enterprises and employees, irrespective of the degree of utilization. This way a kind of redistribution of resources takes place between training-intensive and less intensive enterprises and employees. Programmes are operated by a corporative executive committee and intensively frequented. Stress is layed upon training of less qualified leading up to independent qualifications - measures that had to be pushed through against the skilled workers' unions, but meanwhile are acknowledged in collective bargaining agreements.

The Danish example demonstrates in line with the FINE-regional studies the importance of differentiated regional networks including enterprises, training institutions, federations, unions and public authorities as well as schools and universities, and finally special support for SME's to approach facilities offered. Quite a number of supporting EC-programmes such as COMETT, FORCE, EUROTECNET all go along this road. Yet the studies also make clear, that the social and economic status quo as well as the challenges to meet require activities developed and launched primarily at the regional level. Branch, enterprise and qualification structures, infrastructures and educational traditions are too manifold to be covered by a centrally designed approach. Instead, policies should strengthen the regional institutional and educational infrastructure, especially in the poorer and peripheral regions. Here the provision of an efficient education and training infrastructure may be the kick-off for a sustaining economic development.

Though widely acknowledged to be one crucial issues for structural change and competitiveness, further training programmes are rather diffuse and only poorly

operationalized. To a more or less high degree it is left to industry itself, so that structural effects are rather accidentally than strategically planned. Against that the Danish experience demonstrates firstly, that it is more promising to train less qualified workers while they are on the job than once they are layed off; secondly, state governed or corporatively organized schemes are an efficient corrective to take the edge off the unbalance of market-mediated supply, access and use of further training facilities. This way, it would make politically and economically sense to push cooperative models ranging from vocational training centres to SME-networks to polytechnics and universities and to provide them with the necessary means to successfully take off (Commission of the European Communities 1991; Kommission der Europäischen Gemeinschaften 1992). Although polytechnics and universities are in most countries engaged in technology transfer, they have not been very inventive to gain substantial shares in the further training market, especially in the field of management training for advanced production systems[6].

There is remaining the question of what to qualify in. This question very often postulates an end product that will last for the rest of an individual's working life. But the goal is life-long learning, and each curriculum or training course can only provide another step for further training and education. It has not been the task of the FINE-project to go into any details of education and training schemes proper, yet some general trends should be mentioned which emerge from the FINE-industry as well as from the regional studies. Global competition and volatile demand behaviour require a higher degree of commercial or management thinking on all levels of the firm: employees as well as management have to be aware of cost and quality throughout the organization. "Higher-order"-technologies ask for distinctive skills to analyze, synthesize, solve problems, develop, shape and apply new technologies or systems.

The service industries are in need of customizing their products. Finally, the redesign of work and organisations as a whole require decision-making capacities, responsibility, social skills and adaptability to new situations and conditions. Recently, the European Round Table added "linguistic skills" as a prerequisite for market integration and the mobility of labour

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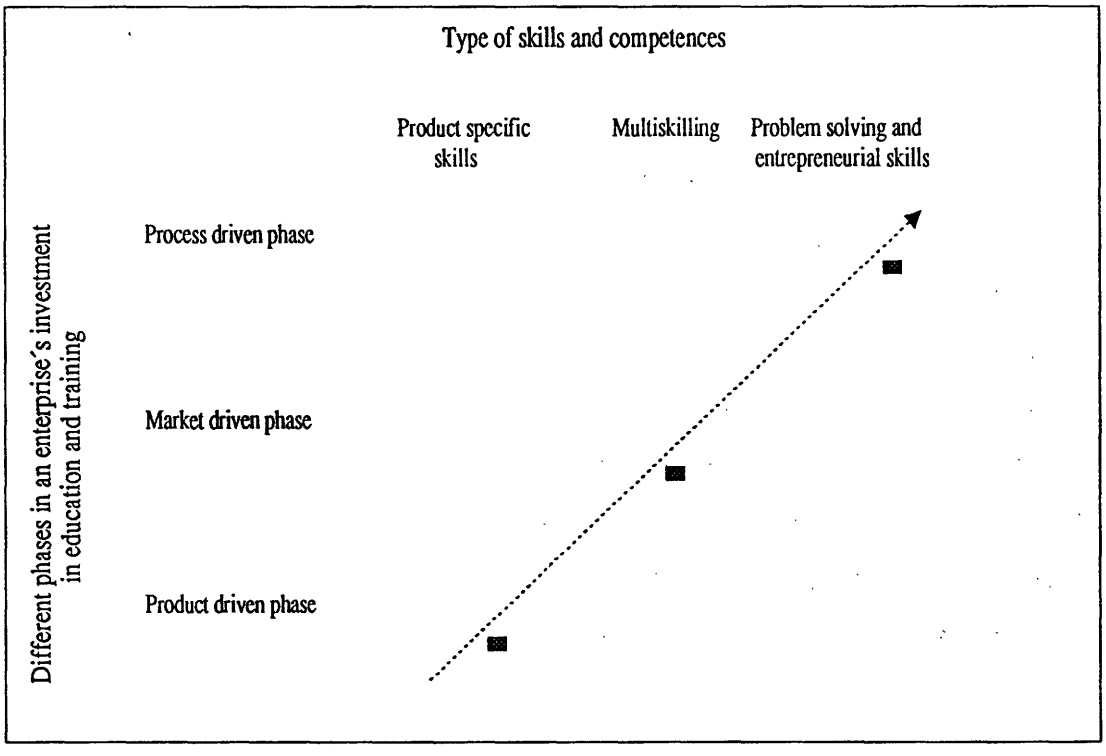
[6] An exclusion to the rule is said to be Warwick University, UK, which has successfully set up a "Warwick Manufacturing Group" conducting joint research with companies. (The Economist, April 17th, 1993).

(Monod/Gyllenhammar/Dekker 1991). It is especially social skills that were found to be of importance in particular to technically and organisationally advanced firms[7].



Source: OECD, 1992.

Box 4.2: Skills

On all levels of the firm's hierarchy the redisign and reorganisation of work require:

* decision-making capacities and responsibility
* social skills
* adaptability to new situations and improvisation capacities
* managerial thinking

[7] A more detailed investigation into skill shortages is given by the Industrial Research and Development Advisory Committee of the Commission of the European Communities - IRDAC - (1990), see also OECD (1989a+b).

Specific stress should be layed upon the advancement of management skills. It is not only market orientation and commercial skills, that are lacking. Deficits are even more distinct in persuasion and communication skills, teamwork, and orientation towards results and performance. Accordingly it is the less qualified executives, who tend to neglect training for themselves as well as for their employees, thus missing to establish a company training culture.

The pressure to deploy human resources more efficiently only in part stems from market and technological developments; considerable strains are exerted by demographic developments. The aging of the workforce and integration of foreign labour will also require particular training strategies, e.g. with respect to previous schooling and vocational training, attitudes, flexibility and experience. Attention will have to be paid to link further training measures to specific career situations in order to develop the willingness to accept the necessity for life-long learning. Instead of a once-and-for-all-passport to a specific career provided by a vocational or professional training certificate people must be convinced that what is needed is rather a portfolio of competences developed and renewed over time and in line with the life cycle of an individual's working life.

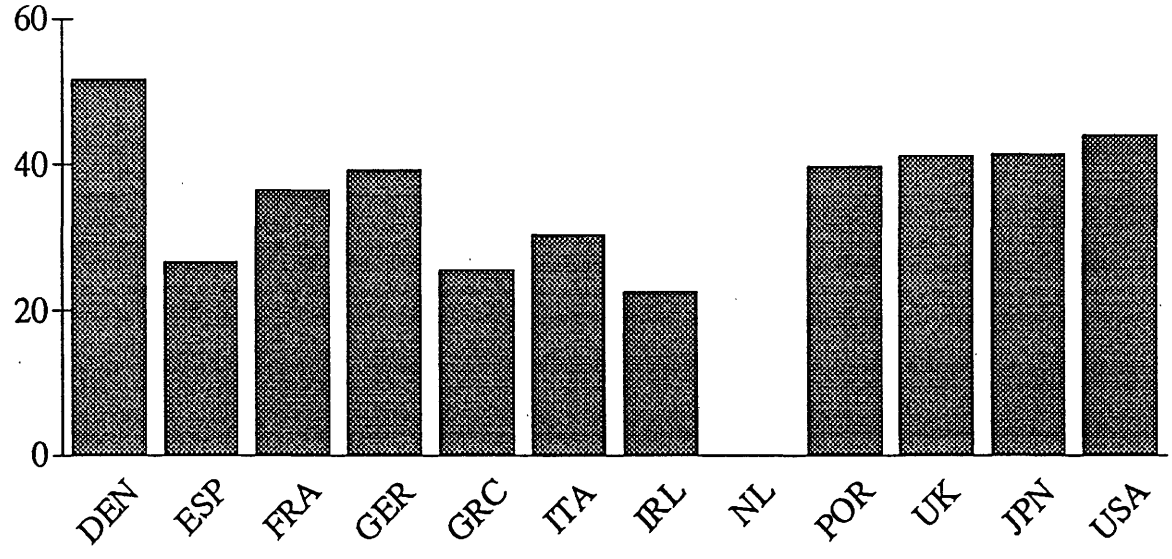
Box 4.3: The important link: Qualification and production systems

An enhancement of general qualification will work out structurally only, if new production systems are installed requiring higher degrees of qualification, and if new products and new markets are developed absorbing the increased productive potential. Otherwise qualification strategies, the more efficient they are, would augment rationalization effects.

The problems arising from the changing age structure of the work force and skill shortages may be encountered by increasing women's labour market participation. In almost all European countries, women's qualification is rising and thus they provide for a major labour market reserve. Especially in regions where industrialisation and the corresponding service branches are only developing they stand for an important development potential. By the end of the 80ies about half of the students in higher education courses in central European

countries were women, yet up to today they only occupy a minority of supervisory or managerial jobs, not to speak of higher executive positions. Open or hidden discrimination and biased recruitment practices still keep this enormous potential closed and unused (Rees 1992).

Fig. 4.7: Female employment



Source: Statistisches Jahrbuch für das Ausland 1992.

In the case of information technology skills Teresa Rees of Cardiff University has shown, that in many of the skills needed in modern jobs, such as communication, team work, languages and diagnostic skills women excel. Yet there are only few careers offered demanding specific women's skills (Rees 1992). She gives the example of secretaries, whose skill potentials are often overlooked as managers' perceptions of the potential of secretaries has not changed in line with secretaries actual skills and training achievements. Her conclusion is, that not only school education, vocational and professional training should be reorganized to meet the specific learning predispositions of women, but that managers should

be trained to understand the implications of new technologies for job design and recruitment policies (Rees 1992: 35 ff.).

As the relevance of qualification and training is undisputed, the main strategic problems are to be found on the operational side. Changes in demand for skilled labour are much more rapid than changes in supply. The diversity of institutional arrangements, infrastructural provisions and economic and social structures require 'individual' approaches instead of a coherent, encompassing concept. As the Danish example quoted above makes clear, matters of qualification and training can be handled successfully on national and even on regional levels. The role of politics and political institutions in this field therefore is primarily to give impulses and to provide platforms, where necessary to press for activities and to coordinate and support advanced and promising model solutions. Why not e.g. offer tax incentives to training intensive enterprises and stimulate discussions to make "competitiveness by training" an issue for industrial relations and collective bargaining agreements. The long-term strategic aim of national and EC-policies should be to convince employees and management alike, that there is no chance to adjust to change, to modernize work organization, to enhance competitiveness, to open up new markets and to secure workplaces except by learning - lifelong.

Work organization and the management of human resources: Promoting change from within

As we are rapidly moving towards a knowledge-intensive economy, new market structures and organizational paradigms are about to change the way economies work, or more precisely: the way competition is carried out. There are enormous growth potentials to be mobilized - on the precondition that politics and industry succeed to match advances in knowledge and technology with the necessary innovations in the workplace[8].

[8] For an elaborated discussion of this issue see: Dertouzos/Lester/Solow (1989) and Eliasson/Ryan (1986).

Successful production strategies have been developed in the context of anthropocentric production systems (APS), that is of advanced production systems which combine computer-based technology with intelligent organization and skilled work (Lehner 1992; Brödner 1992; Monitor-FAST 1992). The visions of the "factory of the future" of the early eighties had been dominated by CIM-strategies; now in the early nineties, the discussion has shifted to "lean production", mainly evoked by the book of Womack/Jones/Roos (1990). This has provoked Brödner to ask: "Should it perhaps have been just another huge marketing campaign of the big data processing suppliers in alliance with interested research institutes and state agencies being horrified by expected losses of competitiveness?" (Brödner 1992). At least the style of discussion suggests the question: "And what is there beyond lean production?"

The strategic problem can be highlighted with a view to mechanical engineering, which as the supplier of necessary means of production is central to most other industries (Brödner 1992). European mechanical engineering shows a marked tendency to further lose market shares to Japan as well as the US. The products of this branch of industry are highly sophisticated, diverse and innovative and they serve a big domestic market. Though enterprises have experienced considerable growth rates and export successes, they have realized only poor profits tightly limiting their financial resources and investment powers. Cyclical fluctuations and management failures in the estimation of markets put aside (Brödner 1992) the industry mainly suffers from a productivity crisis: a highly skilled workforce commanding considerable experience, knowledge and competence has been employed to horizontally and vertically segregated work demanding only part of their virtual competence, thus diminishing the ability of companies to react flexibly and creatively to market changes and to continuously adjust organizational structures. The gap between leading and average companies is widening.

Anthropocentric production systems take up the basic rationale and principles of Japanese lean production systems, but "translate" them into European industrial culture. European management philosophies are implicitly or explicitly still strongly influenced by the tayloristic paradigm, i.e. the worker is the cause of trouble. Consequently programmable automation has been used to (re-)gain independence from (tacit) knowledge and experience of the workforce. But technology turned out not to be the solution, rather it turned out to be part of the problem. In many firms along with the workplaces human skills, ingenuity, knowledge and experience got lost, and as capital investments in NC and CNC technologies didn't pay off, the decline of firms was programmed. Only recently the VDMA, the German

metal engineering association, acknowledged this analysis as one of the reasons for the present situation of the machine-tool industry (Süddeutsche Zeitung March 18th 1993; Süddeutsche Zeitung March 24th 1993).

There is yet another argument for a substantial paradigm shift in production models: in the short run, rigid automation strategies may be a way out of problems of competitiveness and cost structures, but examples have shown that even in medium-term results may turn out disastrous. Automation technologies require significant capital investments, which in turn makes it necessary to achieve high capital productivity. If labour costs cannot be significantly reduced and market shares significantly extended, this may lead to existential problems already in the short run. Against that organizational measures to enhance the productivity of labour is less expensive and less restricted by the uncertainties of markets.

An argument, that should neither be overestimated nor neglected, says that along with rising living standards, rising levels of qualification and changes in the structure and organization of industrialized societies, a general change of values has evolved. For working life, this results in a call for more demanding jobs offering higher degrees of autonomy, chances to take over responsibility and to deploy one's skills. At least to qualified workers, irrespective of blue- or white-collar, these issues are gaining in importance (Brödner 1992). These are conditions, under which manufacturing has to compete on the labour market for qualified labour. The conclusion is, that manufacturing industries will have to make work more attractive, among others by modernizing the production system.

In the introduction to this chapter the aging of the work force has been pointed out as one of the important change factors to be taken into account. Anthropocentric or other variants of advanced production systems explicitly demand for the best possible deployment of skills, practical experience and tacit knowledge. This meets with the secular trend of an aging population and the resulting shortage of qualified labour. In order to productively use the practical experience of older workers and experts, it is necessary to provide appropriate working conditions for them and to provide opportunities for handing down their competence (Brödner 1992). Again the underlying calculus is to exploit the dialectics of competence supplied and competence demanded: the reduction of competence demanded by substituting human labour by technology results in a downward spiral of qualification supplied - qualification badly needed to adjust technology and production to new goals.

Following these arguments, all signposts point towards production structures designed along the criteria of deployment of skilled labour supported by an appropriate level of technology,

provision of holistic working procedures, object-oriented work structures, team-work and high degrees of autonomy and responsibility at the workplace. The steps to be taken along this road are

* to explicitely define the process of reshaping the factory as an intra- as well as inter-organisational process of negotiation rather than a technological necessity; this means that all the workforce irrespective of organizational status and the respective bargaining parties have to be involved and convinced;
* to organize a consensus about objectives and procedures and to see to due consideration of all interests articulated; a neglect of interests might easily lead to failure;
* to make participation the basic principle of decision-making, not only to maintain consensus but to make everybody deploy his competence and experience;
* to ultimately provide a framework, within which more detailed roles, functions and substructures can coherently be developed (Brödner 1992: 40).

The developments, which have been sketched out for the manufacturing industries can also be expected in the service industries, where modern communication technologies and flexible organization are likely to create comparable growth rates of productivity (Coleman 1992: 25). Empirical evidence shows, that in general capital and information technology intensive service sectors show high productivity, but only slow growth in employment (Kendrick 1988). Here again the introduction of technology to cut nothing but costs has the well-known effects on the labour market. In the US, investment in information technology has surged 31% over the last two years, substituting labour by capital. This way, American wholesale trade has lost 53000 jobs over the last year (1992), and 33000 have been laid-off in the insurance industry. In many European countries, telecommunication has enjoyed the status of a public service ranking among the most important employers of the countries. Under the influence of denationalisation and decentralisation, together with technological progress since the mid-eighties a rapid decline in employment is registered. Great Britain, France and Germany are lucid examples (Pouillot 1992). Similar to manufacturing, service firms turn to keeping a lean core of full-time employees and using outside "consultants", many of whom had been specialists and were laid off earlier. But down-staffing is neither a survival strategy nor a substitute for the creation of new fields of economic activity.

An example of handling technological change and opportunities in the services is provided by the German banking business, which under the strains of "technological" lay-offs has developed into a comprehensive "finance business" including insurance services, private pension funds and building societies (Hilbert/Potratz/Widmaier 1992). This has been realized

on the basis of the deployment of employees' skills and experience and new inter-firm cooperation arrangements. Yet by this example it can be shown at the same time, that the enhancement of the quality of work can also result in an increase of the quantity of work, stress and self-exploitation.

This shows the fly in the ointment which should not be ignored. Just like any other kind of process innovation or rearrangement of production facilities, anthropocentric and other advanced production systems carry a considerable potential of rationalization - rationalization in a double meaning: as they make extensive use of people's capacities and as hierarchical rituals are removed, new production systems render work more efficient and meaningful; to the degree additional efficiency is achieved, the economic input-output-calculus come to the fore. This holds even more as pioneering phases out and the anthropocentric logic is generalized. Anthropocentric systems, too, are out for reducing input to get the same output, only they try to reach this goal in a more intelligent way. Under ceteris paribus conditions, i.e. stagnating and exhausted markets, anthropocentric productions systems will certainly add to structural unemployment.

Yet again there is another side to the coin. The "rationalization" of organizational structures and procedures, the challenge to all levels of the workforce to deploy their own ingenuity also carries a potential for innovation and impetus for the development of new economic activities.

This is where economic policy comes in again. Many economic incentives and development programs are basically conservative as they foster the formation of capital and not the development and deployment of work. Innovation policies cover fields which bureaucracies tend to look upon as innovative or promising. But even European low-cost countries are not globally competitive compared to Eastern Europe, the Asian NICs or locations somewhere else in the developing countries. Consequently it is not capital, that has to be rendered competitive, but labour. A comparision of the volumes of the investment budgets of large enterprises and groups and public budgets should long have destroyed any illusion of a political steering of the economy by public money.

The virtual political task rather is to convince and support industry to take the risks to change management philosophies, organizational structures and market strategies. Why not launch a "productivity campaign" systematically developing and demonstrating cases of best practice, forming cooperative networks, developing adequate models of infrastructure, setting up management and engineering training programs and establishing a permanent dialogue to

evaluate progress and to assess chances? Only secondly this would be a matter of funding e.g. of new R&D-programs, and if so, they should be consequently directed towards enhancing the performance of production models and joint industrial innovation projects.

Though the 4th Framework Program (Commission of the European Communities, 1992) already points into this direction, much more stress should be layed on establishing and demonstrating best practice, i.e.: the program should invest even considerable resources in setting up examples of advanced manufacturing in specifically selected branches and regions. The underlying idea is to establish a pull-mechanism just as it has been established by Japanese transplants: firms in the surroundings of these transplants will have to live up to the standards set if they want to keep their workforce and a share in the supply and demand potential; local authorities are challenged to provide appropriate infrastructure, unions and associations will be given a real-life chance to scrutinize hallowed principles and strategies. In so far the program might be better off if it took up a more active and offensive role rather than to submit subsidiary offers. Money does not replace ideas.

Work and welfare: The mutation of an historical project

Whatever single strategy or combination of strategies is chosen to tackle problems of employment, they all will be affected by the relation of work and employment to the welfare system. Given this situation, current welfare provisions will have to be reexamined with respect to their short and long term impacts on work, employment, technology, flexibility and competitiveness.

The main strategic issues are

* to develop alternative designs for the transition from work to welfare, and
* to develop the European welfare regimes towards a stronger support for employment, flexibility and productivity while maintaining a high level of of social security.

In European tradition, the welfare state is the price for a functioning and competitive economy. Although social costs are rather high, they "lay the groundwork for stable, long-term alliances among economic constituencies - workers and managers, suppliers and distributors, private industry and government - as well as a heightened degree of social cohesion." (Henzler 1992b: 61). Most of the various welfare and social security concepts are based on the externalisation of adjustment problems at the expense of welfare budgets based

on taxes and contributions. This strategy obviously has come to an end, as world wide recession has set clear limits to financial possibilities. Governments seek remedy in "Solidarpakt"-strategies, i.e. they seek consensus with unions and associations about cuts into the social system. While in Germany government, unions and associations are still in an infight grimly defending their assets, Italy, the Netherlands, Finland, Spain, Greece, France, Denmark and Belgium have announced or already pushed through severe cuts in social security payments or the postponement of retirement. Sweden has gone farthest cutting pensions, postponing retirement, reducing holidays and payed leave, cutting child and education allowances, introducing waiting periods in case of sickness and reducing employer's contributions to social insurance schemes (Süddeutsche Zeitung March 9th 1993; Süddeutsche Zeitung March 15th 1993).

The opposite to the European state backed security schemes is provided by the Japanese system of life-time employment in return for unambiguous commitment to the firm's goals. Though this is a model of internalisation of employment problems with the fringe effect of enforcing innovation, it has obviously reached limits of economic safe load. Facing a third year of declining profits, a new round of restructuring industry is looming behind the horizon - including the threat of redundancies in manufacturing as well as in the services. White collars will be the group hit hardest by the new development, as they are looked upon as the country's most unproductive. Estimates range between 2% and 3.3% of the workforce endangered by lay-offs. So far shrinkage had largely been offset by a growing service sector - yet this does not happen this time. The response of organised labour suggests that both sides are on a collision course, putting the Japanese system of industrial relations and social security at stake (The Economist January 16th 1993; Financial Times February 6th 1993).

In view of the strategic problems formulated above, this discussion in most countries as well as about the social dimension of the Single Market has been rather onesided, as it has been focussed on the conservation of the internal logic of given systems and mutual accusations of social dumping. What is required in the essence is what is required of management philosophies, too: to take the turn from thinking in terms of costs to thinking in terms of markets. The perspectives of the welfare state are not cuts in social allowances but restructuring and reorganizing the system to foster employment, flexibility and competitiveness. Enterprises should feel the pressure to find economic solutions for their employment problems, e.g. developing new fields of activities and systematically developing the qualification of their work force, employees should feel the pressure to care for lifelong learning and to adjust to new conditions; and finally politics should not be released from the basic task to balance economic performance and social inclusiveness. In all, the basic

philosophy of securing future welfare should be to search for economic incentives to invent various competing, customized forms of social security instead of simple transfer solutions.

Political strategies, therefore, should focus on a change of the externalisation rationale of the various welfare systems. The analysis of earlier reforms as well as a thorough look at latest developments mentioned above make clear, that there are two minimum requirements to be met (Naschold 1993): statutory and intra-plant regulations have to be systematically linked and integrated; measures have to be broad-based on the widest possible range of actors, including the central political level as well as the plant level.

Following the philosophy of a work oriented instead of a transfer oriented system, a number of strategies are conceivable: enterprises might turn to a preventive stabilisation of their workforce's labour capacities by stressing health and safety at work, continuous learning and modernisation of work organisation; that would in turn require unions to agree to the flexibilisation of labour, working-time regimes and changes in working structures. Complementary state strategies would include decidedly active labour market and employment policies, long-term support and incentives for firms' preventive policies, and a flexible prolongation of retirement age and pension schemes. "The challenge of designing an integrative policy in continental Europe is thus to create an internalisation regime which, by its orientation to the work principle, induces sufficient additional productivity growth to provide compensatory payments for the potential 'losers' of the new regime." (Naschold 1993).

Industrial relations: New patterns are necessary

Industrial relations, unions and the system of collective bargaining are important factors in the context of any modernisation strategy. German unification problems already present a well probable outline of the agenda to be expected realizing the Single Market:

* fiercer competition will continue to depress wages even after production picks up;
* services are growing at the expense of manufacturing with the double effect of turning manufacturing into "lean production systems" managing with less but higher qualified personnel less inclined to join a union;
* declining industries and regions will tend to negotiate lower wages and working conditions setting disquieting precedents for breaking up so far hallowed union practices.

The tradition of industry-wide wage agreements, a German idiosyncracy anyway, looks increasingly unrealistic given the actual pressures of competition, regional disparities and differences in firms' structures. Growing service sectors and lean-manufacturing techniques change the structure of firms' workforce. Between 1960 and 1990 the share of services in total employment in Germany has gone up from 40.2% to 56.8%, while the degree of unionisation has dropped from 25% in 1960 to 19.6% in 1990 (The Economist January 3rd 1993). Along with the merging of traditional blue and white collar work and rising qualification levels, a new breed of employees is more difficult to organise; they take their grievances to the plant's Betriebsrat rather than to the union. At Siemens AG, the German high-tech group, less than one-fifth of the workforce has joined the 'appropriate' IG Metall. OPEL systematically exploits this situation in the new Eisenach plant in eastern Germany. The plant is not a member of the employers' association, which allows for negotiations of contracts separate from the rest of the car industry. Aerospace industry is another example (Hayward 1992: 94f.); attributable to comparatively high qualification, higher rates of pay and generally good working conditions throughout the industry and satisfying workplace experience, there is no strong union tradition, not to speak of union militancy.

All this weakens union powers and puts them under pressure to change their internal structures as well as their philosophy of collective bargaining. To court the new breed, they show more flexibility e.g. with respect to working times of programmers and other specialists, take up ecological issues which concern modern white-collar and service workers more than traditional invocation of workers' solidarity. The employees of Lufthansa, the German loss making state air carrier, have shocked the union scene when they gave up demands for pay rise and other concessions. Again, Lufthansa is not a member of any employers' association and has its own wage contract instead. As the economy weakens and foreign competition intensifies, more firms will demand the same flexibility and either opt out or put on pressure to change unions' and associations' structures and philosphies. IBM Germany has just recently announced a legal restructuring of the corporation in order to leave the employers' association as well as the edifice of collective agreements with the IG Metall (Süddeutsche Zeitung March 18th 1993). So in the end the decline of union powers goes along with the decline of employers associations powers.

The decline of union powers is even more significant in Great Britain. The latest survey on industrial relations (European Industrial Relations Review 1993: 229) reveals a marked decline in the extent of trade union representation since the eighties. By 1980 closed shop arrangements, the symbol of British trade union power, had covered almost five million employees; by 1990 it was just about half a million. This was due not only to the political

and legal changes in the course of the conservative government and changes in the structure of the economy; it was also a result of markedly weakening support from employees. Management has turned to use a wider range of channels to communicate with employees and has developed strategies to increase employee involvement. The report concludes, "that the traditional, distinctive 'system' of British industrial relations no longer characterised the economy as a whole."

The strategic task for both unions and employers will be

* to find ways to competitive labour costs;
* to invent bargaining structures to promote greater labour mobility;
* to develop more flexible employment rules;
* to anchor training and retraining to (re-)capture high-skilled, highly paid, high qualitative jobs.

The Swedish LOM-project (management, organisation and participation) (Naschold 1992) is an ambitious experiment to regain international competitiveness on the basis of a general consensus. As against similar programs in other countries it is radically process-oriented and egalitarian, i.e. it aimed at including as many actors as possible from all levels. It started building up basic communicative competence and tried to tie together individual firms with cross-border networks and national innovation structures. LOM was thought to provide the functional equivalent to Japanese consensual innovation structures. The LOM-vision was based on three conceptional modules: as against the 'direct attack'-orientation of most enterprise and national change and innovation programs LOM aimed at an alteration of the change process itself; a communicative infrastructure including all strata of actors was supposed to be a necessary precondition. Secondly, LOM proceeded from the concept of a tight interrelation of language and operative action; consequently an extension of communication competence was thought to induce cooperative action and mobilise synergies resulting thereof. Again the inclusion of all those concerned was seen as a precondition. Thirdly, the idea was to support these processes by central funds and organisational resources. The idea was to establish a "learning organisation" complementary to the conventional, formal organisation.

The basic hypothesis of the program is twofold: the traditional innovation model because of its utilitarian and instrumental approach is appropriate for problems of low complexity in a stable environment. Yet what is needed and what LOM aimed at is the handling of highly complex problems in turbulent environments. Under these conditions a complex

communicative infrastructure including all relevant actors is the necessary condition for rational action and processes of adjustment and change.

The concrete results of the program are apt to suggest a rather sceptical view. Yet the German evaluation team, which included experts from industry and unions, unanimously looks upon the concept as a bold and original idea, theoretically well founded, representing conceptional progress and a model of a specific European road to post-lean concepts of work and industrial organisation.

A final problem should at least be mentioned: The recent case of Hoover, the US multinational which has shifted operations from France to Scotland allegedly because of more flexible pay and other conditions marks the necessity of cross-border cooperation of employee representatives and the establishment of European-level information and consultation mechanisms. Correspondingly there is strong demand for the development and completion of international trade union structures and union - management communication and cooperation structures on European level. There is a number of multinational enterprises which already have established information and consultation arrangements, grown up from a variety of sources and with a broad range of different forms. Many of these activities have been pushed by the Single Market and the perspectives of economic integration. To remain an important player in the game, it should be unions' interest, too, to push much stronger for economic integration by means of powerful European-level representation structures. Though the Single European Act assigns a duty to "develop the dialogue between management and labour at European level" to the Commission, and though there is a considerable budget allocated, the development of appropriate structures should remain mainly with unions and employees' representatives themselves. It is them who will have to suffer the consequences.

Towards new institutional arrangements

Factors pressing for political action in the field of employment and welfare mainly stem from structural unemployment and demographic developments in Europe. While the aging of the population follows a secular trend which can be followed up since the beginning of the century, structural unemployment has its roots in a changing world economy, technological developments and competitive relations between the industrialized countries. Unequal distribution of growth and decline between European regions not only produces a loss of economic welfare, but also threatens the political and social cohesion of the community. This is, in a nutshell, where political action is required.

Solutions can be found along various routes. As has been pointed out in the previous sections, production systems can be modernized, education, qualification and training can be intensified, women can be integrated into the labour market, the relation between employment and welfare can be reviewed and finally the industrial relations system adapted to the changing social structure of enterprises.

This bunch of strategies reflects the multifaceted nature of the relationship between work, welfare and the general subject of competitiveness. Each of these strategies implies investments and costs, each gives rise to externalities restricting the others - but above all each requires a rethinking and critical review of well familiar political rituals. There is no way of attacking issues of work and welfare directly. What has to be changed are structures, processes and understanding of the virtual tasks of industry and politics. Too many key factors of competitiveness are to be found on the micro-economic level, in the capacity of firms and regional or local public authorities to organize change, and it is the interactive and cumulative feedback relationships, which makes the difference.

This may suggest a new division of labour, but this is not the point. There will be no way for industry to change but to follow the economic rationale of scarcity. As change is rapid, there is no time to wait for public initiatives. Their asset at hand and within their resonsibility is their endogenous potential of labour, technology and organization. Qualification and work organization are thus the main strategic issues for individual enterprises as well as for industry as a whole. Each individual enterprise will have to critically review its performance and find out its specific way to alter work organization, personnel policies and strategies of how to compete in the market. Critical analysis and readiness to learn provide the basis for necessary interfirm cooperations and public-private-partnerships, e.g. in setting up training infrastructures od R&D-networks.

To sum up: industrial relations, social security systems, the transition from education to work, work itself and again the transition from work into welfare have to be reorganized to deploy the potentials of an integrated European market and to meet the challenges of a globalized economy. So the virtual political task in the process of change is to organize a new mode of interaction adequate to a changed environment - which with respect to the issues dicussed above is to organize a learning society.

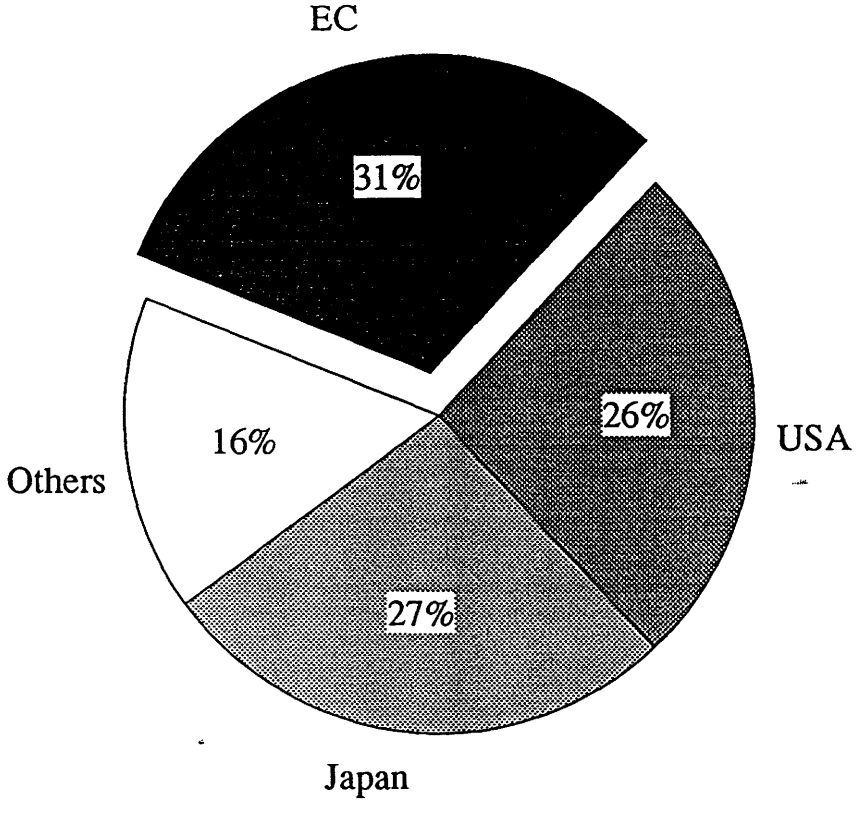
Part 5

Science and Technology: Towards a New European Innovation Regime

The significance of science and technology for European industry

There is no prophecy needed to predict that industrial production in the 21st century will depend even more on the rapid conversion of research and innvoations into new products and production systems. Global competition is bound to increase, not only because in the leading industrial nations innovation times become shorter, but also because more and more countries gain competence in sophisticated industrial production (e.g. NICs, China). The need for European industry to compete in a global environment which is likely to become even more complex and risky within the next twenty years calls for the optimal use of science and technology.

Fig. 5.1: World trade ratio of R&D-intensive products

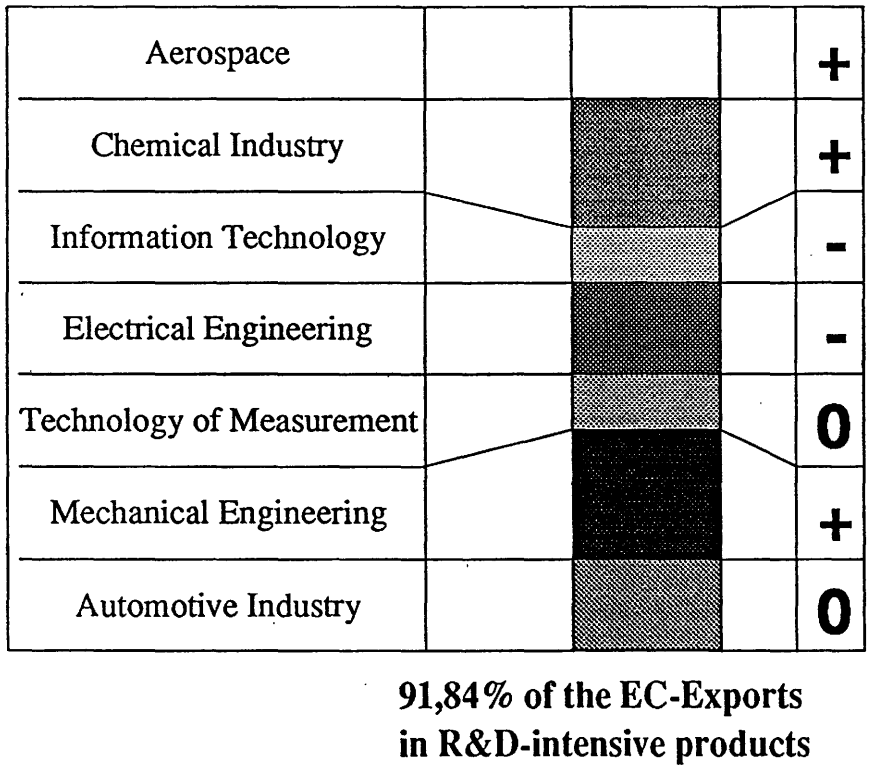


Source: NIW, 1993.

Since the eighties technology-intensive industries have proved to be the most expansive in growth and also in employment. Industry in Europe is still first in the world in technology-

exports, but growth rates in markets for R&D-intensive products[1] are slowing down (Bundesministerium für Forschung und Technologie 1993; cf. Fig. 5.1). This should be reason enough to think about ways for industry in Europe to make the whole process of research and technological innovation, in particular the process of application of research more efficient in order to secure growth and employment. The judgement of experts is polarized: One side sees Europe winning the "technology battle" on the world markets, others see Europe becoming a "technological colony" of Japan or the U.S.[2]

Fig. 5.2: Competitive position of the EC in foreign trade



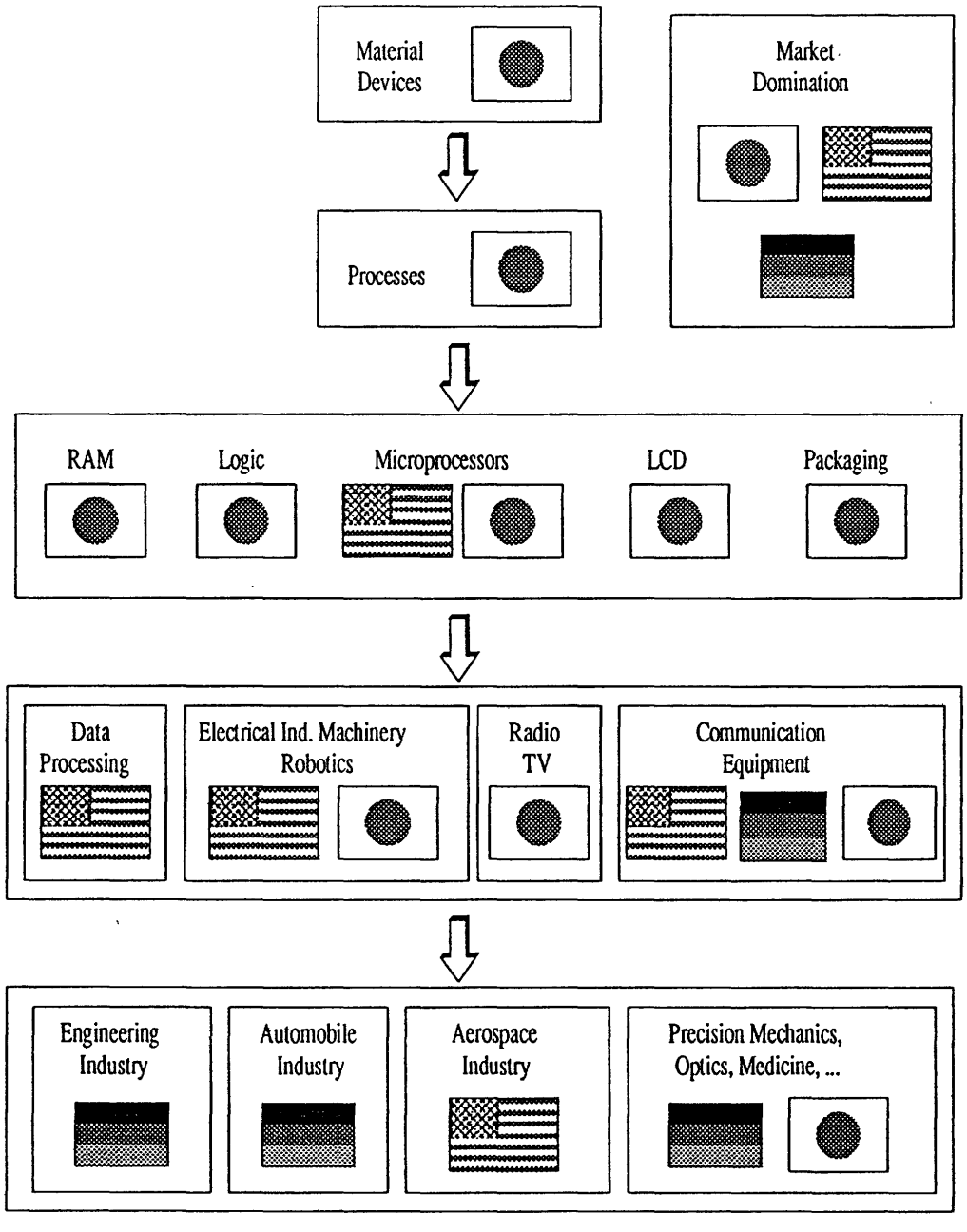
Source: NIW, 1993.

[1] R&D-intensive products here are defined: Top Technology= at least 8.5% of the turover spent on R&D; Higher Technology=between 3.5% and 8.5% of the turnover spent on R&D. (Fraunhofer Institut fuer Systemtechnik und Innovationsforschung - ISI - 1993)

[2] Cf. Burstein (1992), Seitz (1990), Mandel/Farell (1993)

From both points of view, dangers are seen in losses in electronics and information technology where most of the technologies are dominated by Japan. The argument is that the dominance in core-technologies also leads to a dominance in the related "technological food chain".

Fig. 5.3: Technological "Food Chain"

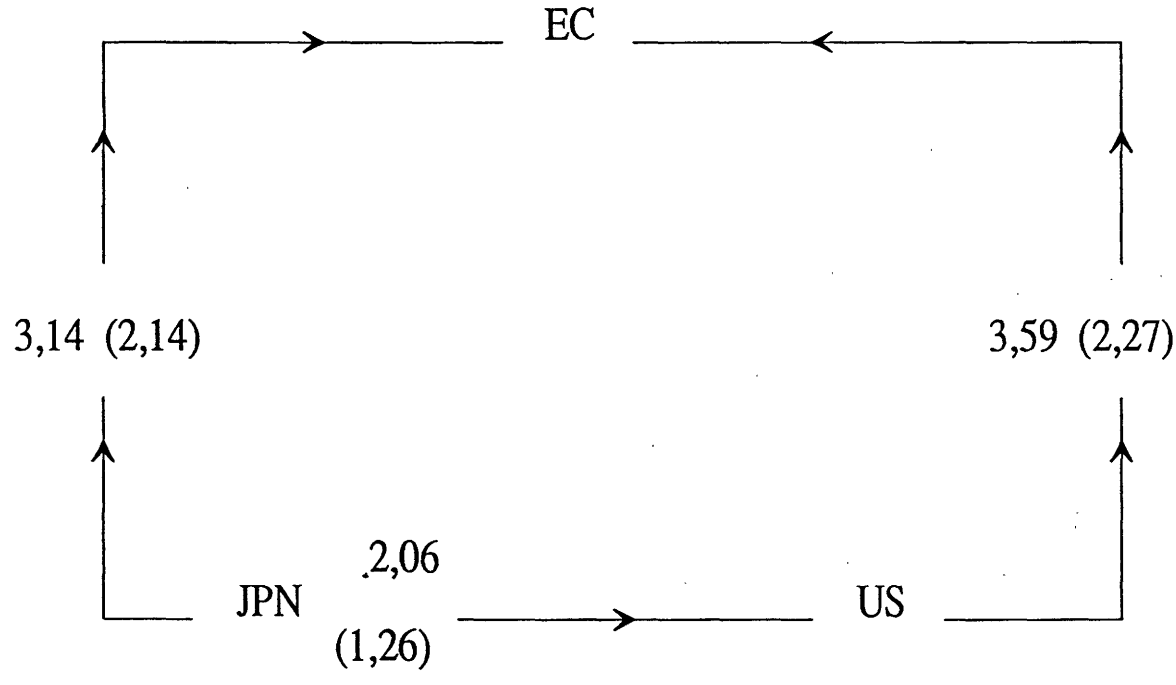


Source: IBM, Stuttgart.

This argument is quite plausible, if we look at consumer electronics or at U.S. mechanical engineering where Japan has taken over most of the market shares. One of the main arguments, however, is that a top position in electronics enables the respective country to use it as a "weapon" to keep other countries away from promising markets. One does not have to go that far, but, in other fields as well, it becomes more and more visible that the pace for innovation is set from outside Europe.

Indicative for this development is, among other things, an international comparison of the number of patents: It does not only show the advantage, but also the rising tendencies for Japan. Fig. 5.4 shows the dominance of US and Japan vis á vis the EC-countries in innovation transfer. From the US and Japan roughly 3.6 respectively three times as many patents have been registered in the EC than vice versa.

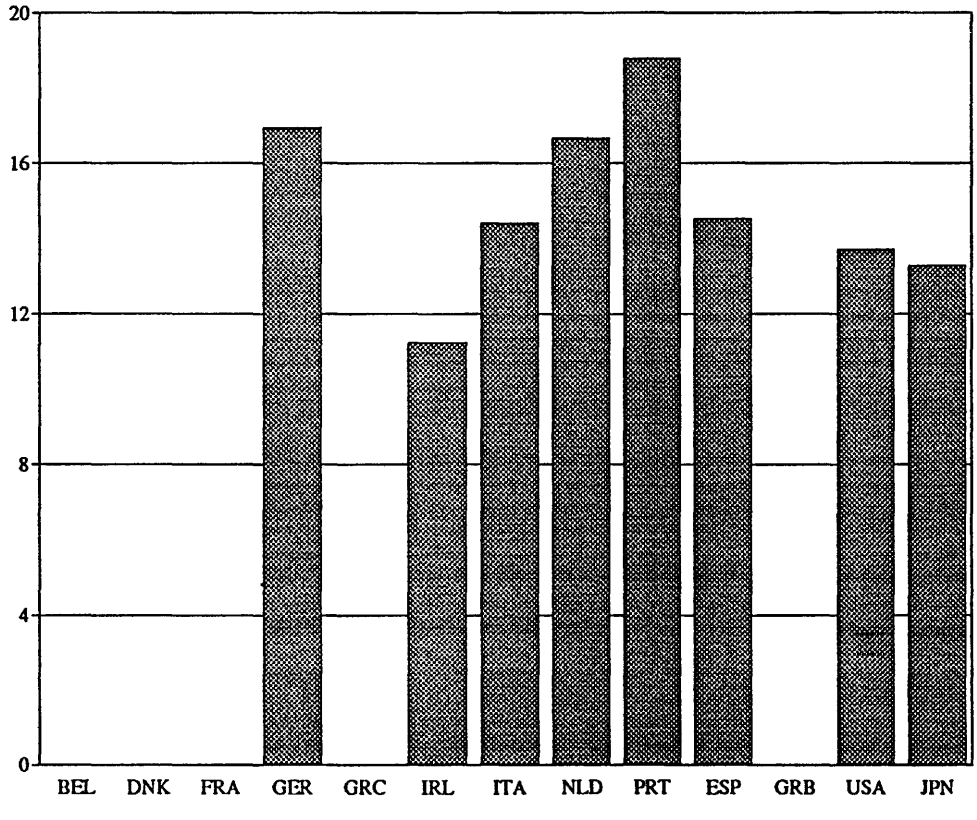
Fig. 5.4: Patent flows within the triade 1988 (1981)



Source: OECD, Basic Science and Technology Indicators, 1991; own calculations.

In a global context, increasing interdependencies and dependencies of science and technology as well as of production make it necessary to think about future innovation strategies. European industry has to adapt to rapid innovation and short product cycles to remain competitive. Rising demands of customers require more product diversification and more complex products, combined with higher quality. This does not mean, that a European innovation regime should exclusively be limited to the Community. To remain competitive, European industry has to be a powerful partner for powerful innovative industries in other parts of the world. In the first place this requires an efficient organization process. Planning of strategies for the direction of innovative production for the future requires networks where industry, research institutions, national and supra-national institutions work together. The Common Market has to be a starting point for concepts that take account of the global interdependencies and answer the challenge especially in terms of cooperation, not only within Europe, but also between Europe and the globe.

Fig. 5.5: Percentages of basic research expenditure/total research expenditures 1987



Source: OECD, Basic Science and Technology Indicators, 1991; own calculations.

Although European competence in scientific and technological research is generally unquestioned, there seems to be a widening gap between basic research and its application and rapid conversion into new products and production strategies. Basic research has, in most European countries, more emphasis than in Japan or US.

However, this does not mean at the same time that Europe's competitiveness is higher as well. Rather the position of European industry on the global markets seems to be endangered by long innovation times and high innovation costs. Albach (1990) shows, that innovation times as well as innovation costs in nearly all branches are lower in Japan and USA than e.g. in Germany (Tab. 5.1).

Tab. 5.1: Innovation Times and Innovation Costs

	Innovation times		Innovation costs	
	(Japan serves as an index = 100)			
Branch	Germany	United States of America	Germany	United States of America
Automobiles	112	111	107	103
Office machinery	94	92	134	116
Chemicals	126	119	119	120
Electronics	121	107	117	111
Machinery	113	124	108	114
Metal-working	113	120	99	93
Other	100	96	111	111
All firms	114	113	112	111

All figures are average values.

Source: Albach et al.,1990.

These data suggest, that inspite of European successful basic research, potentials for innovation are weak. This may be interpreted in such a way that research capacities are not exploited optimally to develop new products and production systems and corresponding markets.

There is little doubt, that in several fields of manufacturing Europe has lost track in leading technologies and, Japan, in particular, is pushing forward in branches, where there has traditionally been a European market leadership (e.g. chemical industry, mechanical engineering). But, while Europe thinks about a faster way to market, there are voices in Japan who warn, that too little is done in basic research and that the strong orientation towards applied research one day might lead to serious deficits in the scientific basis. In terms of markets, however, the Japanese system is more successful. The requirements for the future, thus, as they are formulated by the European Round Table of Industrialists: "The real challenge is to move technology out of the laboratory and in the market place as rapidly as possible" (Monod/Gyllenhammar/Dekker 1991:39) this is only one side of the medal. For future competitiveness in Europe it will be important to find a reasonable combination of both ways: Scientific excellence is needed, but it has to be more than a national thrive for excellence. The whole process from basic research via the development of new technologies to application in products has to be reorganized in a way that societal needs can be quickly transformed into new products and markets. European resources will have to be combined to mobilize the synergies emerging from a multitude of research traditions and specializations to the end of a new innovation regime.

Unlike Japan or the United States the European Community has no common national charcteristics and very different policies and regulatory conditions (Gillibrand in context of the discussion in the Advisory Panel of the Monitor/FAST-Programme). The economic and cultural diversity of Europe is, like in many other respects, opportunity and constraint alike. Science and technology policies in Europe are naturally dominated by a concern to optimize national innovation processes in order to keep national economies on a high level of performance and make the location attractive for foreign investment. Existing disparities and institutional parochialism to some degree reduces capacities and capabilities of a European innovation system. It often hinders the exploitation of synergies as well as of economies of scale and scope. It is not likely nor desirable for the future that the areas of institutional and cultural homogeneity will be broken up. But on the other hand, European diversity could be much more of an opportunity if in the future there were a common thrust to develop a framework for a *European* innovation regime.

This raises questions about the organization of innovation in Europe. Innovation systems, as we now find them in the triade - US, Japan and Europe -, have developed under various cultural influences. Different political and economic "philosophies" have shaped public infrastructure and business climate for the firms. European organization of research and innnovation follows the segmentation of the sciences. The political task here is to break up the barriers between disciplines and institutions. A very general characterization leads to two different types of innovation. Usually the Western type of innovation strategy is inspired by the search for, "break through" innovations. This means that new technologies and products are only developed, when the life cycle of old products is over. Research and markets are treated as more or less seperated spheres. A "step-by-step" innovative development, typical for Japanese firms, means that technologies and products are constantly improved "stepwise" in a continuous process so that a new product is already on the market before the old one is at the end of its cycle. In other words: Europeans rather tend to solve a scientific or technical problem with highest competence first and then start thinking about products, whereas in Japan, the development of a new technology goes along with the development of new products. Accordingly, industrial policy in Europe so far is still to a large degree directed towards high-technology.

Technological excellence and the concentration on a few core technologies, which only account for a rather small and highly competitive sector can not be a value by itself. In mechanical engineering, e.g., experts see large gaps in market needs for "90%-tech", i.e. everything is focused on high-tech markets and only little attention is payed to the relatively large market potentials for conventional products (Brödner 1992). Competition among the triade countries requires top performance in high technology, but short product cylces and the tight competition in these markets diminish the returns. The Japanese model demonstrates that continuous, market oriented (re)search for new products and production processes on all levels is a more promising strategy to secure a sufficient return on investment.

It becomes more and more obvious, that concentration on high technology in Europe does not only slow down the emergence of new markets but also often blurres the view for future developments and requirements that reach beyond economic necessities. The emphasis on economic growth pushes technological feasibility in the foreground. For a sustainable

development[3], this also has to be seen in the context of social and ecological concerns. The challenge to industry and even more to public policy in Europe is not so much to master a particular technological development, but rather to establish a powerful innovation regime which, along with improving competitiveness of industry, also contributes to the solution of problems which threaten social cohesion and environmental stability in Europe. This requires, as Japanese experience demonstrates: "..the maintenance, stabilisation and creative further development of the complex interaction between microeconomic development processes and macropolitical structures (Naschold 1993). This is what the notion of a "new innovation regime" is about. European industrial policy, therefore, is challenged to provide an infrastructure of institutions which, on national or regional basis, enables the relevant actors to bring forth their innovative potential. This is essentially a process of reorganizing the game. At the same time, enterprises are challenged to be open for changes in internal firm organisation as well as for new types of cooperation between firms and other institutions (e.g. universites).

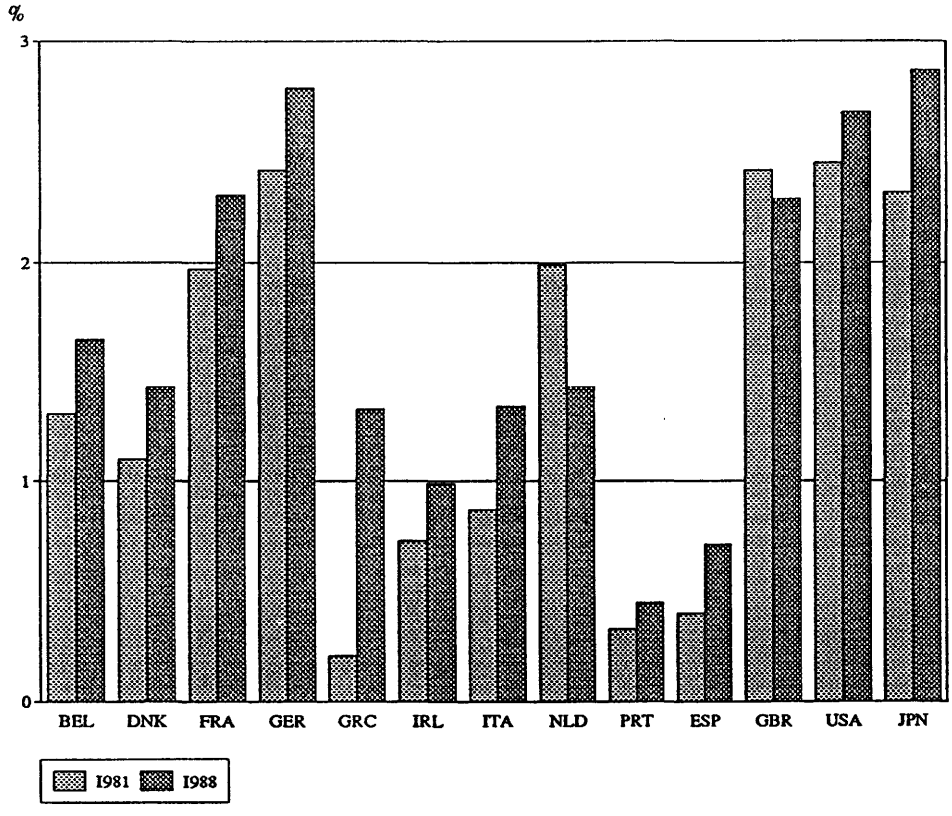
Why we need a European innovation regime: Disparities in Europe

Uneven distribution of wealth in the European Community has its consequences not only for the infrastructure in science and technology, but also for innovative potentials in enterprises. This leads to an uneven distribution of innovative activities and capacities among the EC-countries. A very common indicator of a nation´s development level of science and technology is the amount of money spent on R&D. This figure is composed of all private and public sources that contribute (state, private economy, universities) to the nation´s R&D. Its share of the gross domestic product stands for the emphasis the country puts into new technological development. R&D expenditures in relation to GNP demonstrate that the differences between central and peripheral EC-countries are still quite remarkable. But the

[3] By sustainable development we understand the definition of The Brundtland Report: It defines sustainable development as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs.

data also indicate that in all countries expenditures for R&D gain in significance. This allows the conclusion that innovation is considered more and more important for competitiveness.

Fig. 5.6: R&D expenditures/GNP



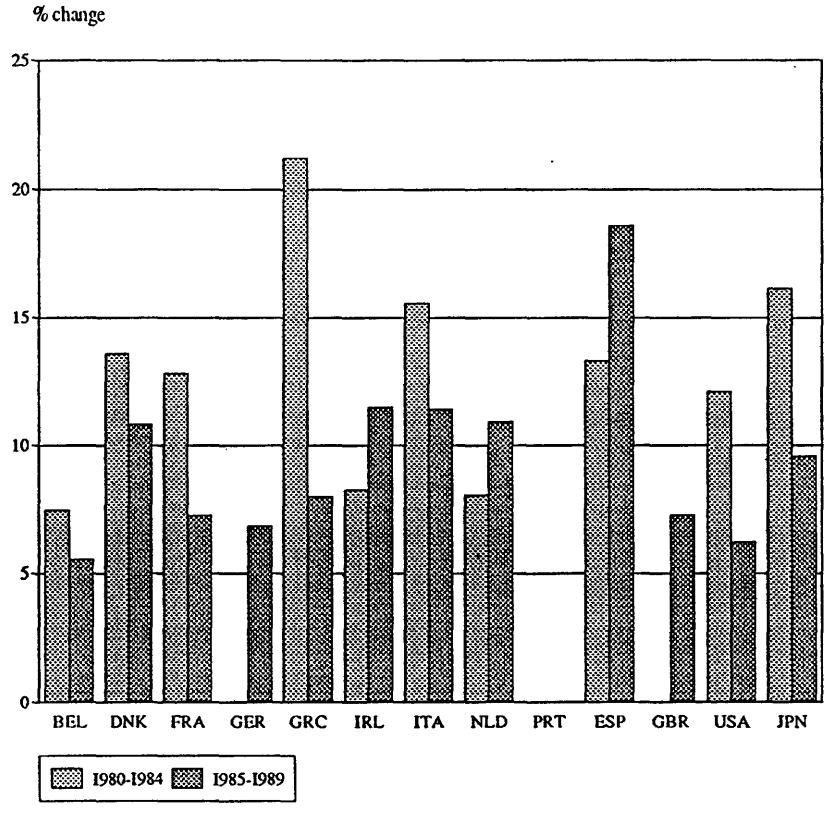
Source: OECD, Basic Science and Technology Indicatros, 1991; own calculations.

Growth-rates over the last few years show, that the values of the leading European nations are only rising very slowly or stagnating. A remarkable increase can be observed in Spain: The average annual growth between 1985 and 1989 was 18.6%. This proves the tendency to intensify R&D but it seems too early to consider this as a "catching up" of Spain, because the overall amount spent on R&D is still quite low.

In the South of Europe firms partly are struggling to catch up with a minimum of technological knowledge while the North aims towards scientific and technological breakthroughs. Interactive links from North to South are still very poorly developed. To break up this vicious circle it undoubtedly is necessary to invest money (cohesion fonds) in poorer

regions in order to provide basic infrastructure to enhance opportunities and attractivity for cooperation between the richer and the poorer countries of Europe. This is the main precondition, under which these regions can become adequate partners.

Fig. 5.7: Average annual change in GERD
(GERD=gross expenditures on research and development)



Source: OECD, Basic Science and Technology Indicators, 1991; own calculations.

Inequalities also have their consequences for social cohesion within the EC. For a wider Europe this problem is even aggravated by the development in Central and Eastern Europe, where ways to new political and economic institutions still have to be found. Van Zon (1992) concludes in a study about Central Europe: "Creating conditions for technological progress in the regions of Central Europe, allowing them to come to an equal footing with the most advanced regions in the world, requires much more than the introduction of a market economy". This also goes for a number of EC-countries.

These regional disparities in Europe call for common strategies which could give national endeavours, like the Spanish, emphasis by making more effective use of synergies in the diffusion of innovative processes. To achieve this, it is necessary to provide the platform, where collaboration can develop. To reduce disparities, one of the conditions certainly will be to put considerable resources into scientific and technological infrastructure. It does not become obvious from data, but rather it is common knowledge, that this alone will not bring about fundamental changes. Inputs in science and technology have to be accompanied by organizational elements like building up communication structures and networks. They have to bring together endogenous potentials (labour, already existing core industries) with knowledge, education and training systems. This is where coordinated action and central funding all over Europe is necessary

Why we need a European innovation regime: Structural deficiencies

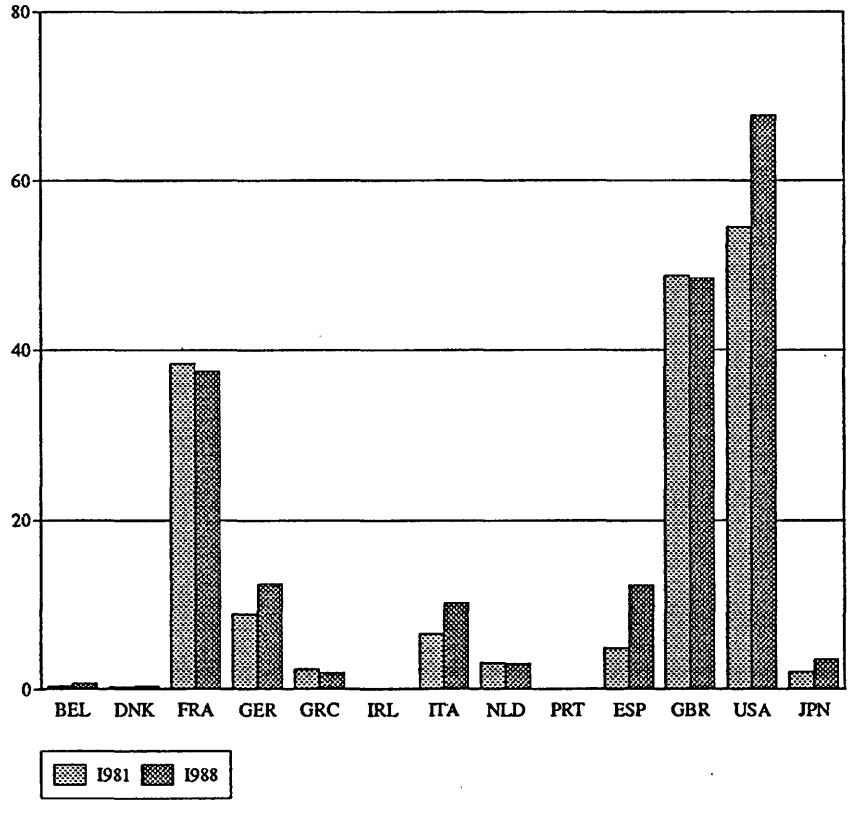
In addition to problems arising from numerical evidence (how much money is being spent on R&D) there are a number of structural obstacles which may further threaten the technological competence of Europe vis á vis the other Triade poles. One of the strategic questions is, what this money is spent on. To answer this we have to look at national policies concerning the distribution of R&D money. Within the EC, particularly France and Great Britain spend a considerable amount on core technologies and for defense-orientated research, which in these countries usually has little spin-offs on the civil sector[4]. In most cases military research concentrates on high-tech: quite naturally aerospace and electronics are among the main fields. They absorb high-tech, but do not contribute to diffusion and development.

Not only on national but also on enterprise level, the concentration on core technologies is visible. Presuming that companies put most emphasis in fields where they expect the most promising markets, the formation of interfirm cooperations and alliances can be an indicator for the importance of particular technologies. In their analysis of interfirm cooperation

[4] In the United States about one million $ p.a. is spent for the "Defence Advanced Research Projects Agency", which fosters civil use of military research (Kleinschmidt 1992). See also: Arthur D. Little International (1987)

agreements Hagedoorn and Schakenraad (1991) show, that over 70% of these alliances are made in information technology, biotechnology and new materials. From this it might be concluded, that in fields, which are considered crucial for future developments, joining of forces already takes place (Hagedoorn/Schakenraad 1991:90). This should be taken as a pattern also for "low-tech" fields and especially for the fusion among different levels of technology.

Fig. 5.8: Military R&D expenditures/Public expenditures

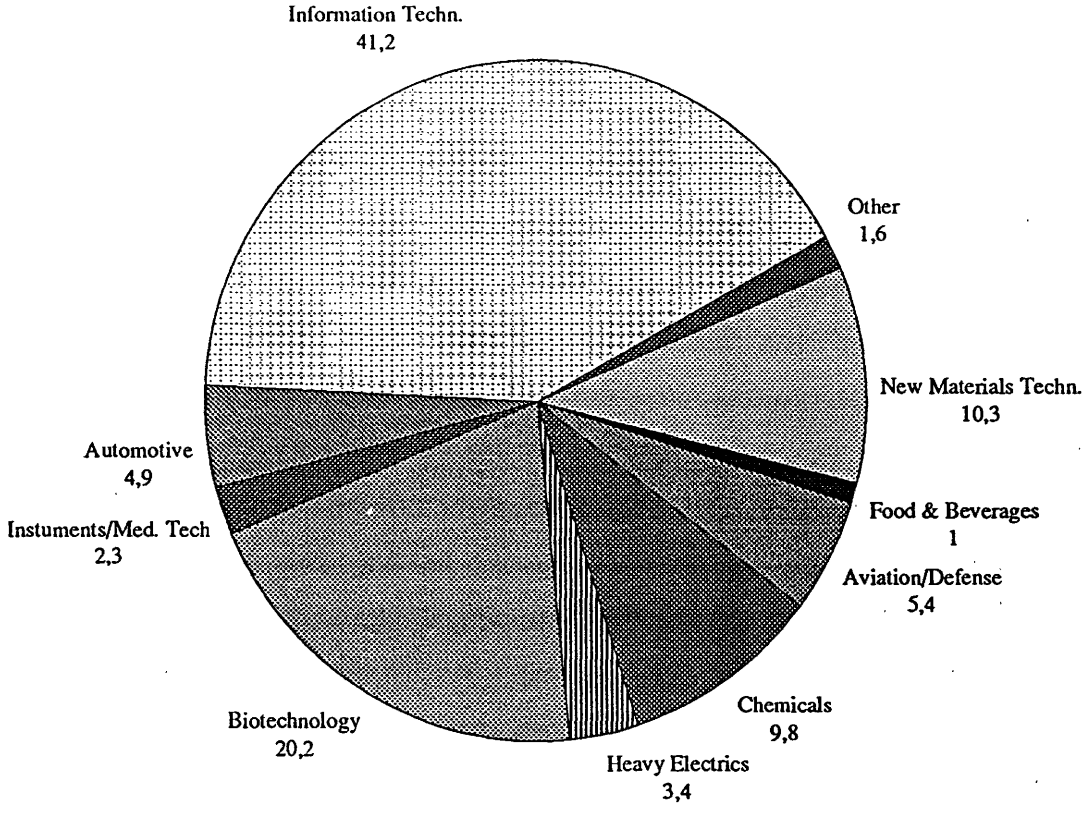


Source: OECD, Basic Science and Technology Indicators, 1991; own calculations.

It remains an open question whether these are the only promising markets. Again the Japanese case demonstrates that strategies including private as well as publicly financed research and - in particular - an efficient management of both leads to market orientated application of different technologies. This also means that the development of new products combines all "levels" of technology and, if necessary, cuts across different scientific disciplines. This also

means new thinking for European enterprises, science and industrial politics because opportunities have to be searched beyond the limits of individual technologies and branches.[5]

Fig. 5.9: Distribution of strategic technology alliances (in %)



Source: MERIT-CATI.

In Europe, generally, attention to neighbouring fields of research and other branches is rather limited. In the long run this will turn out badly for future competitiveness because the development of new market segments may thus be neglected. But it can also obscure the view for the fact, that technology, combined across the borders of traditional fields and branches can contribute to solve e.g. enviromental problems: To think about mobility not only in terms of automobiles, might give innovative incentives for several industries and services. Here, in particular public policy is challenged to provide an adequate setting to make synergies easier (or possible). From the demand side public procurement or regulations (e.g. in the environmental area) can be an adequate steering instrument.

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[5] This argument is elaborated by Fumio Kodama (1991).

The fact, that organizational and structural obstacles are present in all European countries to a higher or lower degree are shown in a number of examples. All over Europe, even in the wealthy countries, resources become more scarce and government programmes for the development of R&D are reduced. This usually means that individual budgets are shortened, without a systematic political decision-making. Usually national research programmes have very little prospective elements and the time that is needed to make fundamental changes in one or the other direction is prolonged by bureaucratic structures.

The research funds of the ***German*** *Umweltbundesamt in Berlin have been reduced by about one third. Innovation researchers complain that this is parsimony in the wrong place: "Money that is put into environmental technology brings much higher returns than money which is put into reducing the backlash in microelectronics." (Wirtschaftswoche 1993)*

- The dominance of cyclical rather than continuous innovation processes is also true for enterprises but sometimes for different reasons. In countries with a low level of R&D infrastructure private R&D activites vary according to the availabililty and the employment of public resources. The example demonstrates, that financial contributions alone do not lead to the systematic pursuit of innovative strategies, but rather to a muddling through, according to available resources. Research is conducted in fields where bureaucrats think should be researched.

In ***Greece****: "In 1988 the number of firms with R&D-activities rose to 185; yet it is interesting that 38 firms which were enganged in R&D activities discontinued these activities in 1988, and 109 new firms were found to have started an R&D activity in that year. ....Thus R&D constitutes a circumstantial activity for a number of private firms and this is related to the fact that in 1989 25% of expenditure in R&D derived from foreign sources (EC-programmes) and the state". Firms engaged in research are concentrated regionally and R&D departments "could hardly be considered well organized research departments capable of engaging in research on new products and other innovations; they are rather trying desperately to keep track of international technological devlopments in their industry" (Petmesidou/ Tsoulouvis1992).*

- Not only the absence of resources, but also the absence of national R&D policies leaves a vacuum to be filled in several countries.

*In **Britain** "public policy for R&D is Fordist in orientation - encouraging the use of high technology to manufacture standard products at low prices." For a long time, the situation was characterized by a "lack of strategic long-term planning for R&D and a lack of institutional integration between research establishments, industry and the state." Only recently technology policy becomes aware of the necessitiy of technology transfer and programmes for a more efficient management of these questions have been started, though endowed with relatively scarce resources. (Charles/Charles/Roulstone 1991; Charles 1992)*

- For a long time in many European countries research has been carried out in an "ivory tower" with no direct connections to application.

*"Generally speaking, **Portugese** expertise and know-how in the field of manufacturing automation is to be found mainly in universities, research laboratories and institutes. There is only a recent tradition (10 years) of cooperation with industry. ...The main problem seems to be found in the division of functions to be executed (such as research-application-marketing-renewal) between the various partners." (Kovács/Moniz/Mateus 1991).*

- There is a tendency to confine innovation processes to technological research and development. As already mentioned, mere technological feasibility does not do the "innovation trick". Introduction of advanced manufacturing systems e.g. requires an equally careful research process about the use of human work.

*"The research policy pursued by the **Spanish** governement therefore shows significant shortcomings with regard to empirical research into socio-economic aspects of which affect the organization of labour." (Homs/Mañà 1991).*

No doubt, R&D-related policy has changed in recent years. The insight that cooperation on all levels is necessary has led to a wide number of national or EC-wide programmes to enhance collaborative strategies. The Fourth Framework Programme includes not only new

fields but also new strategies.The awareness that particular tasks can be carried through much better when synergies are exploited, has increased on the scientific, political as well as on the firm level. In nearly all relevant areas smaller or larger steps have already been taken although there are still a lot of loose ends which have to be tied together in a more stringent way. The above examples reveal particular strategic bottlenecks:

The scarcity of resources requires a more **rational setting of priorities** in the R&D process. The above mentioned cyclical character of innovation processes in most Western countries has to be replaced by a more continuous, more market and more problem orientated innovation policy by companies as well as by public authorities.

The promising steps, that have been made on EC level to promote research, particularly in peripheral countries are only of limited use when R&D is not embedded in some kind of **long-term strategies and cooperative arrangements.** Experience shows that in particular small and medium sized enterprises are not able to catch up with the rapid technological and organizational developments by themselves. This is not only true for peripheral countries in the EC, but just as well for Central and Eastern Europe.

Particularly in countries with little traditional **connections between research institutions and firms** (e.g. Britain, France[6]) such connections should be enforced and further developed. The report to the Commission about European cooperation between universities and industry (Kommission der Europäischen Gemeinschaften 1992) makes clear that the traditional division of labour among universities and industry have changed. The university is not so exclusively responsible for the creation of knowledge any more, since industry has taken over a good deal of research.

Increase of privately financed research, however, only increases private stocks of knowledge. For a European innovation system it is much more desirable to increase the public stock of knowledge and to trigger broad diffusion processes. For this purpose a mangement of science is required, which organizes connections between science and economy, and is flexible

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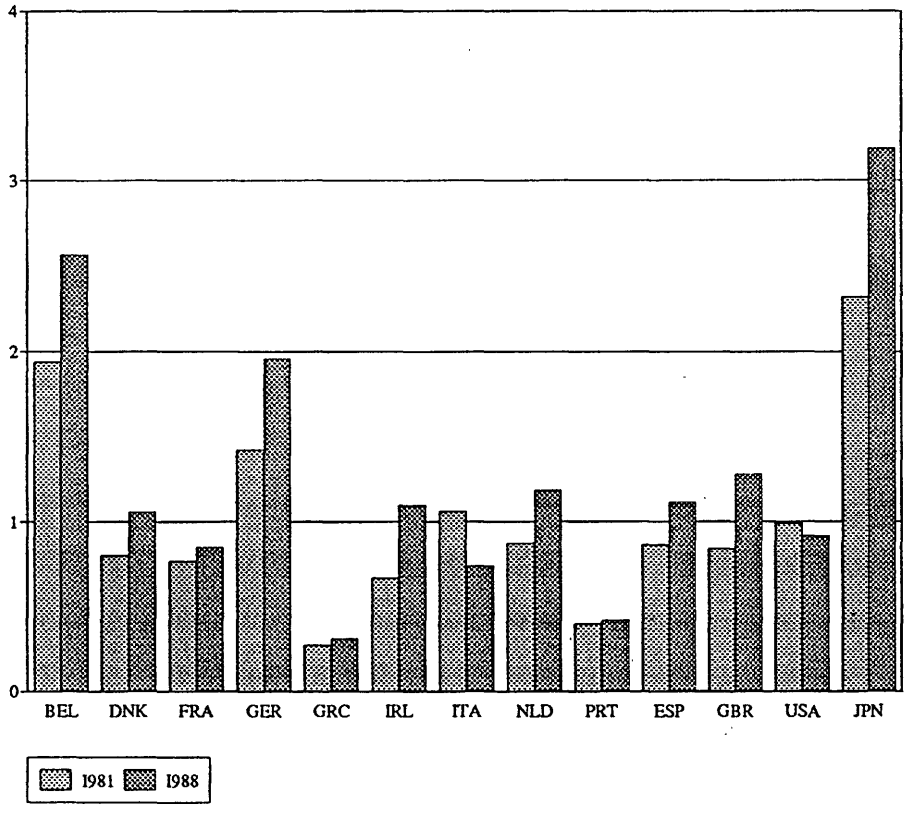
[6] Cf. "Local Systems of Innovation in Europe" (Charbit/Gaffard/Longhi et al. 1991), where the French and the British are contrasted with the German and Italian system.

enough to recognize mutual strengths and weaknesses.To strengthen cooperation between universities and companies not only makes the results more efficient because they gain a more market oriented perspective. If research takes place in a precompetitve area, it also reduces the danger of monopolizing knowledge from private research. The innovative "wealth" of a nation and within the EC can only be increased, if both research institution and economy join forces. This is true for the the development of science and technology as well as for the development of human resources[7]. Of particular significance is the mutual further training e.g. by means of personnel exchanges between universities and firms.

Fig. 5.10: Ratio of government to private R&D



Source: OECD, Basic Science and Technology Indicators, 1991; own calculations.

The neglect of other than technology orientated strategies in the innovation process has a long tradition, not only in Spain.The notion (paradigm) that industrial change only rests upon

[7] EC-programmes like "Comett" put particular emphasis upon common projects for training and education between economy and university.

advances in technology is vanishing only slowly. It has to be replaced by strategies that understand **innovation as problem-induced** and that consequently follow several problem oriented paths. This encompasses not only the significance of labour and its qualification and organizational structures within the enterprises but also social and ecological side-effects[8]. Here as well collaborative patterns are necessary, but: "recognition of the fact, that the problem-solving strategy must go far beyond the narrow horizon of the individual firm is not yet exactly "the norm" in the industry...." (Naschold 1993).

Because of this "narrow horizon" of individual enterprises politics, on national as well as on EC level, politics have to keep an eye on this. Scarce resources, however, have to confine this to areas that are systematically neglected by private initiatives because e.g. in other areas economies of scale can be exploited much better. If losses of technological competence and markets happen, qualified labour and know-how are affected by it.[9]

Why we need a European innovation regime: Geography and logistics of innovation

So far, we have mainly been talking about research and development from a national or supra-national perspective. No doubt, the constitution of the national system of innovation sets a lot of benchmarks for the development of regional or local innovation systems. On the other side, it is common knowledge that actual innovation processes and research take place in firms, universities, and other institutions at the regional level. This argument, which has been confirmed by a number of recent studies (Charbit/Gaffard/Longhi et al. 1991; Hilpert 1992) makes clear that we also have to look at the regional level when we have a European innovative regime in mind. All these studies have in common, that they find certain conditions and/or "climates" for innovation: "The mix between production organizations (small and large firms) and institutions (universities, research laboratories, other public institutions, public policies) build an evolutionary dynamic depending on local history, social

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[8] Research in business administration proves that ecologically oriented mangement and production can have very positive effects on a firm's results (Steger 1988).

[9] A good example for such a development can be found in American machine tool industry (Hirsch-Kreinsen 1992).

as well as economic (Charbitt/Gaffard/Longhi et al. 1991:20). The studies on "Archipelago Europe" similarly identify an innovative structure which is not only by itself a strong center of innovation but is also a "knot" in a national or international system.

Amongst a small number of regions and cities in the Community countries there is a growing concentration of sience and technolgy based industrial development. This constitutes "Islands of Innvoation, i.e. localities where high techno-industrial capability and excellence in science and know-how are concentrated and where firms and research organisations base their development on networks of cooperation. These "Islands of Inovation" are able both to retain small and medium-sized innovation firms and to foster optimal conditions/circumstances and networks that favour development, employment and growth within particular European regions. .....Taken together, with their variety and their mutual interdependence these islands consitute an ARCHIPELAGO EUROPE, which encompasses a range of high technology (Hilpert 1992).

The studies also conclude, that these particular conditions generate innovative networks in very particular locations which are distributed unevenly across Europe and are not necessarily connected to neighbouring and other regions. Empirical evidence makes clear, that these "islands" are mostly located in the fully industrialized wealthy countries in the community and many of them have a strong orientation towards high technology. With regard to the peripheral countries, these "islands" so far have little integrative functions: "These (peripheral) regions are involved in collaborations with Europe´s innovative core only by five to eight percent." (Hilpert 1992:278). The example of the "Four Motors for Europe"[10] (Bacavia/Becher/Clavera et al. 1991) shows, that cross-regional cooperation proves very useful. The authors, however, are reluctant to apply their results to cooperations between more and less favoured regions. The "valorization of diversity" can only rely on a profound knowledge about other regions´ potentials or weaknesses and it is essential that linkages and collaborations are founded on existing potentials. This requires infrastructure in research and education as well as intermediary structures and last not least favourable attitudes of all cooperation partners.

[10] The four motors are: Baden-Württemberg, Catalunya, Lombardia, Rhone-Alpes.

The discussion of these concepts shows that different kinds of nuclei of innovation in Europe exist. In view of a European innovation regime the crucial question is, how these regional potentials can be made fruitful, not only for the well developed wealthy regions but also for the periphery in Europe. The formulation of R&D policies can not do without considerations about the regional and local "geography" of innovation in Europe.

Elements of a new innovation regime

In the beginning of this chapter we have pointed out that scientific and technological competence are among the main factors for different national economic performance. Now that industry in Europe has already lost some of its foreign trade advantages and some of its technological competence, it is worth while to think about a European innovation regime, that enhances future competitiveness of European industry.

As we have seen so far, national policy and regulatory differences, regional disparities and cultural diversity have a number of consequences for the institutional environment of innovation in Europe. This environment so far, is still to a considerable degree governed by the paradigm that national scientific excellence and top quality research in core technologies must be the main (and only) target of a European R&D-policy. European diversitiy, however, can only be stimulating if there is a basic agreement, that national achievements alone are not sufficient to remain competitive in a globalizing economic environment. A fruitful innovative climate within the Community needs an organisation of science and technology which starts with the assumption that the innovation process because of its complexity and fastness needs cooperation and a high degree of flexiblity since new markets have to be developed quickly.

The traditional separation of the European innovation process into different disciplines of science and levels of technology[11] has to be overcome in a way that it is possible to link different fields and levels according to economic, social and ecological development.

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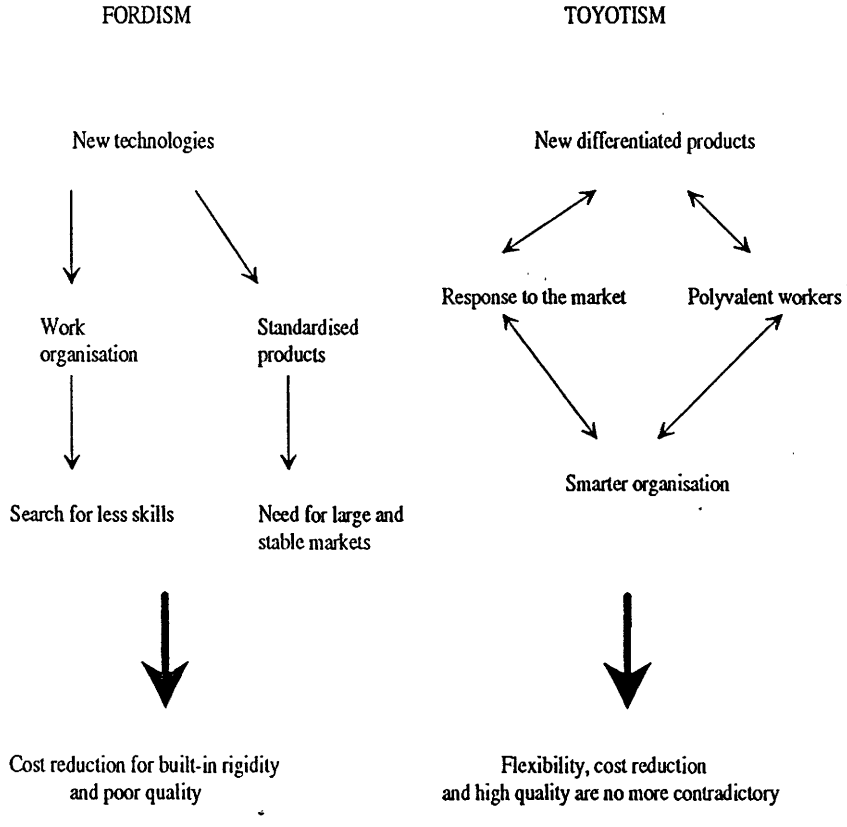
[11] Also refered to as: "pure sciences", "transfer sciences", "productive sector" (OECD 1992)

Quite obviously the Japanese system of innovation has many advantages, which, of course, can not simply be taken over in Europe, but these elements should be carefully checked for their applicability to a European innovation regime.

Japanese success in the innovation race is mainly characterized by an incremental development and "small scale improvements in both products and processes". Naschold quotes experts who have estimated that between 15% and 25% of Japans success can be put down to this factor (Naschold 1993). The figure below shows the different starting points of Western vs. Japanese production organization.

Fig. 5.11: The Fordist and Toyotist models of industrial governance



Source: Boyer, R. (forthcoming)

Japanese "best practice" can teach us a number of lessons: Japanese innovation processes are very closely related to the market, i.e. products are not developed, because there is a technology available. Rather the main thrust are new needs for new products. Technologies are employed to create new or constantly improve products. This requires a respective

organization within the firm, stable cooperative networks between firms or firms and research institutions. In Japan this process is based upon "a harmonious relationship.... between production, organization, strategic orientation and the mobilisation of resource potentials" (Naschold 1993). An incremental development of innovation requires, as the Japanes example shows, close collaboration of all relevant actors, and the abiltiy to communicate.

Another lesson to learn from Japan is the notion of technology fusions. This implies that horizontal connection lines between different technologies (and, consequently branches) lead to promising new developments. Kodama (1991) demonstrates this with two examples: the "mechatronics revolution" and the "optoelectronics revolution"[14]. Both are examples for a very successful development of new products that emerge from the combination of two technologies.

As we have seen the European "web" of innovative potentials is very heterogeneous and therefore requires answers taylored to the European situation. From the results so far we want to show some paths, a European innovation regime could go in order to enhance competitiveness of industry in Europe and, at the same time contribute to social cohesion and ecological necessities.

There is no doubt that technological competence and a strong emphasis on top quality science and technology are indispensable for competitiveness on a global market. Europe's strong orientation towards core technologies and science-based innovation strategies creates a solid stock of knowledge which needs, to be complemented by a problem-orientated strategy that seeks synergies in making the best possible use of this stock.

The availablity of top scientific and technological knowledge can only be the outset for a problem-orientated innovation process. In a number of leading industrial[15] countries recent studies about the future significance of certain technologies have been carried through in order

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[14] The case of optoelectronics is also described in M. Fransmann (1990).

[15] E.g. USA, Japan, some OECD countries (Fraunhofer Institut fuer Systemtechnik und Innovationsforschung - ISI - 1993)

to concentrate on research activities and direct funds to promising fields. For a new European innovation regime, the idea of the further development of a monitoring system within the Community could be a promising starting point. The most important property of such a monitoring system is very high flexibility, so that EC programmes and policies can be redirected immediately, if new needs let expect promising markets. In other words, the monitoring system has to provide a "feedback loop".

The same "flexible-response" system can be employed on the regional level. Its main thrust should go towards flexible long-term strategies, which enable peripheral regions in the long run to catch up, either by development of endogenous potentials or by efficient financial input to build up infrastructure. Only if peripheral regions gain a basis for communcation and cooperation they can be tied up to the "island" system of European innovation.

Under this problem-orientated view, innovation processes have a number of additional aspects:

* The efficient organization of networks on all levels is crucial for the exploitation of synergies. This refers simultaneously to R&D-alliances between firms, the further improvement of relationships between research institutions and firms as well as between public policy and private economy. These networks can be politically launched, promoted and moderated.
* New production technologies require new views on training and education. The significance of a well trained workforce increases. New production systems need equally diligent research on the working conditions and on the technology.
* The application of new technologies and their conversion into new products requires a societal consensus which increasingly gets a critical subject (e.g. biotechnology).
* Ecological consequences of new products and production processes get more and more significance. Change of consumer habits open up chances for new markets. The understanding that it is easier and more sensible to avoid instead of remove pollution contributes to the development of new technologies, but also new mangement principles. Communication structures and corporate identity in firms can change attitudes and start learning processes. These processes can be strengthened by goal-orientated public procurement and EC-wide regulations.

On the European level, thus, it is crucial to develop a problem-oriented new innovative system which not only is able to enhance cohesion within the Community, but at the same time makes industry in Europe a powerful partner for world wide collaboration to enhance competitivenes.

Part 6

Industrial Policy:

Creating a New Framework for Industry in Europe

Driven by fast change on a global scope, industry in Europe has to master a difficult transition. It has to regain and secure competitiveness, to further shift to technology-intensive and knowledge-based production, to attain environmental sustainability and, above all, to develop new markets. A rapid and far reaching restructuring of firms, production chaines, infrastructures, innovation systems and markets is required.

This is not a task for industry and the private sector alone. Rather, strong support by industrial policy is indispensable. New or improved infrastructures are required. The framework for industry needs to be changed. Market forces have to be reoriented at new aims and conditions, and new markets have to be developed. A supportive environment for rapid restructuring, flexible adjustment and high innovation has to be created.

All this points to a wide variety of necessary or supportive activities of industrial policy. The danger is that these activities are performed in isolation or even in competition and are dominated by special interests. Accordingly, industrial policy could easily turn out to be inefficient and misleading. In order to avoid this, differentiated activities have to be developed within a coherent framework.

For this purpose, industrial policy and industry in Europe should join forces in a European project for industrial change. This project compares in importance and scope to the singe market projects. It can be built up from a number of cornerstones which help to increase competitiveness in the short perspective and to develop new markets and attain environmental sustainability in the longer perspective.

A starting point: Labour

A promising starting point for industrial policy is labour. As already discussed in this report, labour costs are an increasingly critical issue. On one hand, high labour costs impede competitiveness of industry in Europe. On the other hand, high wages and social welfare are important pillars for the survival of the European economy.

In this context we should be aware that development of efficient welfare systems in Europe can not be left to national governments alone. The divirsity of welfare systems is most likely to result in exploitation of different social standards for competitiveness of industry. In order to avoid such social dumping, a European social charta is necessary as an adequate social framework for a viable industry in Europe.

Policy recommendation
Reshaping the welfare state

The European social charta has to be decided very urgently in order to secure an adequate social framework for industrial development. Working conditions should not be applicable as a competitive arguement.

Reducing labour costs is only one side of the coin, the other is to make better and more efficient use of labour. Adequate measures for this purpose are a fast increase of productivity by enhancing the development of anthropocentric production systems.

Productivity can hardly be sufficiently increased by technical means alone; rather, far reaching changes in organization, technology and management in firms and even across firms are necessary. Experience demonstrates that current structures often impede or slow down change.

In order to reach rapid increase of productivity inspite of such impediments, joint action of employers, unions and governmental agencies is required. A good example is the Swedish programme for "Management, organization and partizipation" (LOM-programme) (cf. Naschold, 1992).

Joint efforts of employers and unions to increase productivity are only feasible, if these increases are not accompanied by strong job losses. A productivity initiative, therefore, has to be linked to strategies for development of new economic ooportunities and new jobs. This will be discussed later in this part.

Policy recommendation
European initiatives for high productivity

The Commission of the European Communities and governments of the member states of the communities should promote a joint initiative of employers and unions to increase productivity in European industry.

Even successful attempts to reduce labour costs and increase productivity will leave the advanced countries in Europe with the fact that the cost of labour is much higher than that of the surrounding less developed countries, particularly in Eastern Europe and North Africa.

In view of this, the strategy must be to build upon the high skills of the labour force, especially in those EC countries where the average skill level is comparatively low. High skills have to be used for development of intelligent production systems. This in turn may provide industry in Europe with comparative advantages concerning innovation, flexible adjustment and customization, shift to technology-intensive and knowledge-based production. Moreover, it contributes to the increase of productivity.

Policy recommendation
An initiative for intelligent production systems

The commission of the European Communities should further enhance development of anthropocentric production systems and combine this with a systematic effort to design and implement in European industry intelligent production systems with open and flexible boundaries. This should be combined with a systematic effort in vocational and professional training.

While support of skilled work and development of intelligent production systems is crucial for the future of industry in most of Europe, it creates a new problem, namely employment and jobs for those with minor chances to acquire high skills. This may end up in of strong differences concerning job oppurtunities and income between skilled and unskilled workers and related new class-structures. To avoid this, it may be necessary to subsidize low income by means of negative income taxes.

At the crossroads: Technology

As we have demonstrated, technology marks another critical issue for the future of industry in Europe. All-in-all, Europe still has a high standard of science and technology. But application, commercialization and exploitation of new technology is often weak. Moreover, the existing gap to Japan and the United States in some core-technologies, primarily biotechnology and electronics is increasing.

In a short-term perspective, the aim must be to improve the application and short time-to-market in European industry. To a large extent, this is a problem of the organization of firms and production chain, and, hence, not primarily a concern for industrial policy. However, European and national R&D programmes as well as public infrastructures for R&D often contribute to slow application, weak commercialization and long time-to-market.

Most European and national R&D programmes are oriented at so-called precompetitive research and technical development. As innovation speeds up and innovation cycles become shorter, this is increasinly a mere fiction. Attempts to define precompetitive R&D are more and more in vain because we can observe a trend to a covergence of basic research, applied research and product development

R&D policies aiming at high competitiveness of industry have to acknowledge this. So-called precompetitive R&D should be replaced by programmes with a clear orientation at competitiveness. In order to avoid unfair impacts on competition, the programmes must be at any time open for participation of firms. Moreover, arrangements for publication and diffusion of R&D results must be made which serve both the participating firms' for closure and the public interest for a large fund of public knowledge. Such programmes can be organized in terms of centers of excellence.

Centers of excellence are particularly important to attain a broad mobilization of knowledge, experience and support for fundamental restructuring of industry in yet unsufficiently known directions. This involves strong efforts to integrate basic research and applied R&D across different fields, often ranging from technology to management and cultural sciences.

Policy recommendation
Centers of excellence

The Commission of the European Communities should establish centers of excellence for research which necessitate broad interdisplinary approaches and integration of scientific knowledge and practical experience.

Centers of excellence should be established for a limited period (probably 10 years) and be organized as joint ventures of public research institutions and private firms. Private firms should be involved by delegating staff and by actively participating in pilot projects.

Regulations should be made which define intellectual property rights of participants and still secure openess to participation at any time. Competing centers of excellence should be admitted and even enhanced.

A particularly interesting case for centers of excellence is development of the virtual factory. Since a number of years, the combination of modern process technology and organization has gained heavily in importance for competitiveness of industry in Europe. Early activities to analyze, design and experimentally apply possible structures for a virtual factory may provide Europe with a comparative advantage which carries far into the next century.

European as well as national programmes for research and technical development often suffer from some in-built weakness. They focus at specific and narrowly defined goals. They concentrate on technical problems and neglect important economic and social aspects of technology. Last not least, they are biased towards existing markets.

The alternative is to establish in widely defined fields of technology networks of R&D institutions, producers and (potential) users with an open range of goals and activities. The aim is not primarily to reach a particular technological goal, but to develop structures with a high capacity to identify and solve technological problems. Centers of excellence may be used as a core of such networks.

The important difference is, that the first type of programme leads at best to the desired goal, that is a solution which is known in advance, for example a certain chip. The second type aims at a broader development and application of technology, e.g. opto-electronics, and may

reveal a variety of solutions and applications which are not yet known and which give raise to new products and markets. Most importantly, it is not biased towards existing markets, but enhances development of new products and new markets (Kodama, 1991).

Policy recommendation
Reorganizing the Communities RTD policy

The Community programmes for research and technical development should be forcefully shifted to the establishment of networks for fast development and wide application of new technologies in widely defined fields. Goals and activities should be openly defined.

R&D programmes could center around certain technologies, such as opto-electronics. In this case, they should consider the whole technological "food-chain". Programmes could also center around certain problems, such as recycling of automobiles, and they should include all relevant technologies.

In such programmes should not only deal with technical, but also with economic and social aspects of the relevant technologies or problems.

Much of the future of industry in Europe depends upon rapid development and application of key technologies. However, this is often hindered by a low social acceptance of new technology and corresponding legal regulation. In Europe particularly, the social and political environment for new technologies is less favourable than in the United States, Japan and in newly industrializing countries.

In order to reduce these impediments, industry calls for deregulation or for less restrictive regulations. But this is not a solution to the problem. If trust in the security of technological developments and social acceptance of new technology is low, rapid and broad application as well as economic success of new technology can hardly be achieved.

Two corresponding measures are needed. On one hand, a more favourable environment for new technology has to be created. This must include more efficient regulation and administration. On the other hand an efficient security system for development and application of new technology which minimizes risk has to be implemented. This system has to be designed in consensual decision-making process based on broad discussion of industry,

government and the relevant social interests. All sides have to come together in a new techno-culture.

Policy recommendation
Initiating a new techno-culture

In order to improve development and application of new technology, the Commission of the European Communities should initiate a society wide discussion on technology.

The aim of the discussion should be to design efficient regulation and an efficient security system for the development of new technologies, particularly of bio-technology.

The discussion could be organized by intensive hearings of the Commission with industry, unions and the relevant social interests. It could be convened by an independent committee.

The yardstick: Environment

Environment undoubtedly is a major challenge to the development of industry in Europe. Industry in Europe has to strive towards an environmentally sustainable production. At the same time, economic solutions to environmental problems may be the key to new employment and growth. The task is to bring these two aspects together and to create new economic opportunities by developing an environmentally sustainable industry.

Dynamic regulation is a promising solution for this task. Usually, environmental regulation sets standards according to the current state of technology and adjusts these standards from time to time to technological progress. This type of regulation refers to the current state of technology, but does not enhance new technological developments. In order to achieve this goal, regulation should not translate current technological standards into rules, but rather define dynamic standards on the basis of technology projections. More specifically, regulation sets higher and higher standards which have to be reached within a given period of time.

This provides a clear and stable framework because industry knows well in advance what standards have to be reached and thereby may initiate technological developments by creating

a variety of new solutions. This, in turn, may lead to development of a variety of new products.

Policy recommendation
Introducing dynamic regulation on environment

The Commission of the European Communities and national governments should develop a dynamic form of environmental regulation. For a longer period of time, regulation should in advance define rising environmental standards. This should be continuously perpetuated. The basis for the definition of standards should be the projections of technological development.

Another interesting approach to economic solution of environmental problems is public procurement. In the European Community, governments spend a large proportion of the national product and have a high buying power. This can be used to create markets for ecological products. Environmentally advanced forms of construction, for example, can be supported by implementing rules e.g. that all newly constructed community buildings have to meet with certain environmental standards. Similar rules are also possible for a whole range of different products.

Policy recommendation
Environmental targeting of public procurement

The Commission of the European Communities and national governments should support trigger development of capacious markets for environmental products by means of public procurement.

More specifically, European and national regulations should determine that public procurement projects have to meet high environmental standards. These standards should be dynamic in order to induce a technology push.

Environment is obviously a global problem, but regulation is usually national. This involves a significant problem of competitiveness for industry in Europe.

Higher environmental standards for industrial production in Europe may create a comparative advantage in the long run, but certainly constitutes a comparative disadvantage in the short run. Moreover, they cause incentives for industry in Europe to move production which is not competible with European standards to foreign countries and to "export" environmental problems.

Strong efforts to increase environmental sustainability of industrial production in Europe have, therefore, to be combined with the development of an incentive system, a system of tarifs, regulation and subsidies, to protect industry in Europe against competition by environmental dumping. This creates considerable substantial difficulties and also raises difficult questions concerning international trade.

In addition to the strategies described so far, development of economic solutions to environmental problems must be the main concern of the European and national R&D-programmes.

Policy recommendation
A European R&D-programme for an environmental industry

The Commission of the European Communities should initiate a large-scale R&D programme on environmental technology and development of relevant markets. The programme should support networks and centers of excellence focusing at major environmental problems, such as recycling and waste reduction for major industrial products.

A major challenge: Creating new markets

Throughout this report, we have stressed that the future of industry in Europe and its capability to secure employment and growth strongly depends on fast development of new economic opportunities. Environmental policy may be a step in this direction and may be used as a catalyst for development of new technologies, new products, new markets and new production systems.

Policy recommendation
Three measures to support diversification

In order to support diversification of industry to new activities and new markets, The Commission of the European Communities should introduce the following measures:

1 Financial support for declining industry should only be given under the condition that the relevant firms offer a programm for the development of new business and the creation of new jobs for the workers. National subsidies should be subject to the same condition.
2 Public support for development of technology should be linked to the condition that R&D activities are combined with activities for development of new products and new markets.
3 The Commission should create a programme for financial support of development of new markets by means of venture capital and long-term loans. Preferably, such a programme should be performed as a joint venture with the European banking industry and thus, stimulate development of new banking business.

As we have explained in the second part of this report, this is extremely difficult to accomplish and is associated with high risk and uncertainty. It often exceeds the capabilities and the time horizon of enterprises. There are a number of feasible measures by which industrial policy may enhance diversification.

Policy recommendation
Networks for socio-technological diversification

In order to develop new markets and new economic opportunities, The Commission of the European Communities should establish networks for socio-technological diversification.

One type of network should be oriented at development and wide application of core-technologies and should be organized along technological chaines and potentials for technology fusion. Particularly important technologies are bio-technology, new materials, microstructure technology and communication technology.

Another type of networks should focus at economic solutions of environmental and social problems and should include actors from a variety of different fields in knowledge and technology. Particularly they should include experts in technology, organization and regulation. Major targets should be material flows, recycling, emmissions and waste.

Other activities to support diversification of industry could be to reorientate and restructure industry towards a systematic and long-term effort in diversification and development of new markets. For this purpose, new networks should be initiated.

Networks for the development of new products, activities and markets could become a major force for structural change in European industry. Indeed, they could be a key element for new policy structures.

New structures for new policies

Fast restructuring of industry in Europe can not be accomplished in traditional ways of public policy. In particular, it can not be accomplished with isolated activities and programmes which are strongly influenced by special interests and developed and managed by strongly segmented bureaucracies. Rather, initiatives which induce a process of change and mobilize broad support for this have to be found.

Under the condition of multifarious change, vanishing of traditional boundaries, and high uncertainty, public policy is seriously mislead if it attempts to prescribe unique solutions. It is also mislead, if it confines itself to the creation of a favourable environment and leaves all the rest up to the market.

Collaborative strategies are particularly important for policies of the European Commission and governments of the member states for the survival of the SME economy. SMEs should be stimulated to form production networks among themselves and together with large enterprises in order to increase their capabilities and capacities in R&D, marketing, sales and services and to cope with globalization. Examples for such strategies are the Danish networking programme and the French programme for collaboration of small and large enterprises.

Subsidiarity, which is a widely discussed topic in the European Community, is predominantly discussed in terms of some kind of division of labour between levels of government and

public administration. However, it should be understood as a strategic policy orientation which systematically uses proximity of actors to problems and related knowledge and expertise.

Policy recommendation
Initiating collaborative efforts

The Commission of the European Communities should strongly support collaboration among SMEs and SMEs with large enterprises. For this purpose, RTD programmes as well as other programmes offering financial assistance to firms should, if possible, have a rule for inclusion and collaboration of SMEs.

The point, thus, is not so much the division of power among different levels of government. Rather, the important point is to develop a collaborative structure between different levels of government, and between governmental and private actors. Similar to industrial production, public policy has to be shifted to virtual organization rather than be performed in formal structures.

An illustrative case is regional disparities in social and economic living conditions. Experience shows that it is often difficult to persistently reduce disparities. Financial and infrastructural assistance from outside is rarely sufficient. Strategies which aim to build upon endogenous factors, particularly on wage related comparative advantages, are often ineffective and create undesirable side-effects.

The solution, thus, must be a combination of endogeneous and exogenous factors. Such a strategy could, for example, attract investments of large enterprises by heavy subsidies and build around these investments a suitable infrastructure and network of small and medium firms. Obviously, this can not be achieved by European, national or regional governments alone. Rather it requires the collaboration of different levels of government as well as public and private actors.

Policy recommendation
Creation of nuclei for regional economic expansion

The European Commission should initiate collaborative networks as a nuclei for the development of poor regions. The task of the network should be to design and implement a programm which supports investments of large and strong international corporations in lagging regions by heavy subsidies and combines this with measures to build an adequate infrastructure and a network of domestic SMEs around this investment.

Development of collaborative structures is a fundamental prerequisite for a successful management of industrial change in Europe. This applies for the public and the private sector and for the relationsship between these sectors.

Due to change, high ambiguity and uncertainty, it is quite easy to define a wide range of important tasks for industrial policy. The strategic problem, however, is to match tasks with capacities and capabilities. This problem can only be solved if industry and industrial policy join forces in a European project for industrial revitalization which is based on broad support in the European societies.

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Appendix

List of Papers from the Research Networks (to be completed):

Regions Network:

Clematide, Bruno/ Plougmann, Peter: The Danish Industry's Contribution to the Future of Industry in Europe

Dubois, Pierre/ Linhart, Daniele: From Local Networks to a Territory Network

Moniz, Antonio/ Kovács, Ilona/ Cerdeira, Maria: The Spatial Influence of Industrial Development - The Portuguese Case

Nexus Europe Ltd.: A Study of Two Regions in Ireland

Petmesidou, Maria/ Tsououvis, Lefteris: Spatial Clustering & Industry Networks in Northern Greece

Rehfeld, Dieter: Patterns of Economic Restructuring in an Area of Industrial Decline - Industrial Development, Change Factors and Regional Policy in the "Ruhrgebiet".

Telljohann, Volker: The Emilia-Romagna Region

Industries Network:

Brödner, Peter: Mechanical Engeneering

Coleman, William: The Financial Services Sector

Dankbaar, Ben: The Future of the European Automobile Industry

Grant, Wyn: Agribusiness

Hayward, Keith: The Aerospace Industry

Ledoux, Marc Jacques/ Llerena, Patrick: The Chemical Industry

Pouillot, Didier: Telecommunications

Unger, Brigitte/ van Waarden, Frans: A Comparison of the Construction Industry in Europe