

III. Factor 10:

Resource Productivity, Competitiveness, and Employment In The Advanced Economies

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Executive summary

Current problems of sustainability, competitiveness and employment in the advanced economies can only be resolved by a radical change towards a knowledge-based and service-oriented economy. This is particularly true for Europe where delayed structural change has resulted in much a lower job generation than we can observe in the United States and Japan. Whilst the USA has achieved higher levels of employment, but at the cost of rising inequality and declining average living standards, the challenge for Europe (and indeed the global economy) is to generate more employment based upon sustainable economic growth which is neither at the expense of welfare nor the environment.

Dematerialization offers a promising strategy for faster and more systematic development of a sustainable, knowledge-based and service-oriented economy. A massive increase in resource productivity advances knowledge generation and reinforces a rapid shift from incremental innovation operating along established product lines in established markets towards radical innovation leading to new products and new markets. A strong orientation towards increasing resource productivity reintroduces a consistent approach to the production of goods and services based upon individual customer utility.

One point, however, is crucial here: dematerialization only works as a strategy to advance structural change towards a knowledge-based economy if it operates in a highly innovative mode. That is why it matters whether dematerialization aims to achieve factor 4 or factor 10. As von Weizsäcker, Lovins and Lovins² show, factor 4 can rather easily be reached by the current state of knowledge and technology and thus has only modest impact on the pace of structural change. Factor 10 in contrast constitutes a strong challenge to the generation of new knowledge and technology and thus operates as a driver of structural change.

1 This report is based on firstly, the work of Tony Charles and Franz Lehner in the project "Future of Industry in Europe" for the Commission of the European Union and research following up this project. Secondly, it takes up research of Willy Bierter, Friedrich Schmidt-Bleek and Franz Lehner in the context of the Factor- 10 Club and the project on "Sustainable Economy" of the Science Center of NorthrhineWestphalia.

2 Weizsäcker, E. U. v./Lovins, E./Lovins, H., 1997: Factor four: doubling wealth - halving resource use, the new report to the Club of Rome, London, Earthscan.

Introduction

The advanced economies face a threefold problem of sustainability. The first is the environmental problem to which we usually refer when we speak of sustainability. The second is a lasting problem of competitiveness which is represented at firm level by weaknesses in innovation and slow structural change; at the level of national economies competitiveness problems are reflected in high and persistent unemployment and/or declining living standards and increasing social inequality. The third and related problem is the maintenance of social cohesion, that is the effective participation of people in the economic process.

Reasonably defined, a sustainable economy is one which is capable of continuously securing and reproducing the basis of its Operation. This includes both the natural System from which the economy draws all the resources which it needs, and a variety of economic and social factors such as knowledge and skills, technology, social values and political regulations which determine the capacity of an economy to generate wealth and living standards in society.

This paper focuses on the economic and social dimensions of sustainability which we summarize under the concepts of competitiveness and cohesion. We first discuss the meaning of competitiveness as an aspect of sustainability and focus upon a dilemma of competitiveness strategies which results from the different meanings of competitiveness with respect to individual firms and to the whole economy. Next, we turn to the issue of social cohesion as a major prerequisite for the social sustainability of market allocation. We examine the implications of increased social inequality and unemployment in terms of social exclusion and the risks to social cohesion and assess the social impact of different strategies and policies of competitiveness. We then focus upon employment as the key problem of competitiveness and social cohesion in most of the advanced economies.

The basic argument of this report is that problems of employment and competitiveness in the advanced economies can only be solved and social cohesion can only be secured with more radical innovation and structural change. The second central thesis is that the factor-10-concept offers both crucial insights and innovative solutions to the problems of employment, competitiveness and cohesion in the advanced economies and also leads to environmental sustainability.

1 The meaning of competitiveness

Competitiveness is a strong and often dominant concern of both firms and governments in the advanced economies. Often, it is assumed that the concerns of firms and governments are identical or represent two sides of the same coin. However there are fundamental differences in the meaning of competitiveness in relation to firms and in relation to whole economies³. Neglect of these fundamental differences leads to public policies which may support the

3 Charles, T./Lehner, F., 1998: Competitiveness and Employment — A Strategic Dilemma of Economic Policy. In: Competition and Change, Vol.3, pp. 207-236.

competitiveness of firms in the short run, but do damage in the long run. Even more importantly, these policies are likely to damage employment, living standards and social cohesion. Last but not least, they frequently severely distort competition.

In a recent competitiveness report, the European Commission⁴ describes a competitiveness pyramid where the standard of living is the top concern and where productivity and employment are the goals on a level below. A competitive economy is described as an efficient economy which creates jobs and raises the standard of living. A similar definition is suggested by the American Competitiveness Policy Council⁵ which defines competitiveness as the capacity of an economy to maintain or increase the living standards of a society in a productive way.

According to the European Commission's Competitiveness Report, the focus of public (and private) activities concerning competitiveness must be to improve the performance of enterprises since "growth and jobs are produced by enterprises operating on a competitive market"⁶. In this view, a competitive economy is one in which the overwhelming majority of firms is competitive. Accordingly, governments are improving the competitiveness of the economy if they help to advance the competitiveness of firms in the economy. This assumption is, however, false. Whilst it is true that a competitive economy comprises competitive enterprises, we cannot assume that any measure which increases the performance or competitiveness of enterprises is also beneficial for the competitiveness of the whole economy.

In relation to individual firms, competitiveness can be defined as the capability of an enterprise to withstand competition and to secure profitability. Firms are competitive, if their products and their prices fit the requirements of the relevant markets, and if they can stay in business profitably under 'free and fair' market conditions. Obviously, competitiveness is or should be a permanent concern of firms and enterprises operating in a market economy. Moreover, for most companies, competitiveness should not be a serious threat, but a problem with which they can cope within their regular operations. Sufficiently well-managed enterprises usually remain competitive over long periods of time, although, under conditions of rapid technological, social and economic change, it may be more difficult to secure or retain competitiveness.

Firm level competitiveness depends not only on internal conditions, but also on conditions which are set or influenced by government and politics. Regulation, infrastructures, taxation, labour legislation and other elements of the political framework of the economy often exert a significant impact on the competitiveness of firms. Thus it seems reasonable if governments attempt to design their activities and infrastructures in order to avoid negative impacts on the

4 European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities.

5 Competitiveness Policy Council, 1992: Building A Competitive America, First Annual Report to the President and Congress, Washington.

6 European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities, p. 8. competitiveness of firms within their jurisdiction. It may even make sense, if governments attempt to design activities and infrastructures and make their territory an attractive location for investment in order to enhance the competitiveness of firms falling within their jurisdiction.

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Currently, many firms pursue strategies of competitiveness which we may label as 'cost-driven'. Cost-driven strategies are those where drastic reduction of production costs is the major means to secure and advance competitiveness. As we would expect, this is particularly the case for firms operating in mature markets. But increasingly, cost-driven strategies also play a role in growing high-technology markets, such as computers and telecommunication where they are applied in attempts to increase market shares and to gain global leadership in the market.

While cost-driven strategies of competitiveness are often necessary or at least reasonable for individual firms, they may create severe problems of employment and wealth for the whole economy. Whether this is the case or not depends on enterprise strategies. If many companies reduce costs predominantly by cutting jobs and/or reducing wages the likely macro-economic effects are massive job losses and stagnating or even declining real incomes. If companies cut costs primarily by re-organizing the production system, restructuring work-time and shift systems, improving design-to-manufacture or increasing customization, they contribute much less to job losses and tend to preserve or advance real incomes despite cutting costs more effectively than the pure (and short term) rationalization strategy of cost reduction.

The problem of the European economies in particular is that in a large part of industry cost-driven strategies are negatively biased towards labour costs and primarily operate by traditional rationalization measures. Even if firms do not simply cut jobs, but introduce elements of lean production or other anthropocentric production systems (which still only a minority of relevant firms are doing in Europe) the sole target is often to reduce labour costs.

In this context, it is interesting that even in Germany where labour costs are comparatively high, labour costs are not the major factor in competitiveness⁷. The study shows that costs of the German electronic industry are about 50% above those of the world leaders. Total factor costs including labour costs account for a cost difference of about 11%, organization deficits make up for another 12%, insufficient design-to-manufacturing is responsible for 17% higher costs and over-engineering for 10%. Obviously, the major cost-related competitive disadvantage of the German electronics industry is not labour costs but innovation. There is insufficient process innovation and product innovation also contains remarkable weaknesses. A number of other studies provide good reasons to assume that the electronics industry in this respect is not an exception, but rather represents a condition which is widespread in German industry. The dominant concern with reducing labour costs by many companies is therefore ineffective in response to the underlying problems of competitiveness.

7 Naschold, F., 1997: Ökonomische Leistungsfähigkeit und institutionelle Innovation: Das deutsche Produktions- und Politikregime im globalen Wettbewerb, WZB-Jahrbuch, Berlin, Ed. Sigma. Who refers to a study of the McKinsey Global Institute.

This is no less true for many political strategies of competitiveness which focus predominantly on labour costs whilst neglecting much more important structural problems. This leads to a strategic dilemma where governments often advance firms' competitiveness at the expense of the competitiveness of the whole economy⁸. More precisely, competitiveness of firms is secured at the expense of employment and real income.

4 Competitiveness of firms - what are the real problems?

This strategic dilemma of competitiveness policy is not inherent, but emerges from a misperception of competitiveness problems by many enterprises and companies. This can be well illustrated with the example of the EU. In a nutshell, European debates on competitiveness focus on costs whereas the real problems are much more structural in nature. Empirical evidence shows quite clearly that industry and other businesses in the EU perform quite well in the short run, but face structural deficits which endanger their long-term prospects. Even more clearly, the evidence indicates that while most of industry may still perform reasonably well, the economy as a whole does not.

Competitiveness problems of firms defy simple empirical analysis. Depending on what indicators are used, the picture may be quite different. For example, trade indicators often play an important role in debates on competitiveness and indicate a fairly positive picture for the EU. The EU has a continuous trade surplus in both goods and services. Most of industry in the European Union still performs well, both with respect to export shares and terms of trade. Industry in Europe also performs well with respect to profitability. Pre-tax performance (gross profit over turnover) has been higher in the European Union than in the USA and Japan throughout the last ten years, although the USA has now caught up to and even surpassed pre-tax performance in the EU. We should note, however, that post-tax profitability (net profit over turnover) is lower in the EU than in the USA and has been throughout most of the last ten years; however, performance in relation to Japan has been consistently better. This is obviously a taxation issue, not one of enterprise performance⁹.

A cursory examination of the capabilities of firms in the EU to withstand international competition would not signal cause for concern. However, there are warning signs. In recent years, the share of the EU in OECD exports has declined slightly. In all European countries, exports are nominally still growing, but export growth stems primarily from a global increase in demand rather than from increased market share or export diversification¹⁰. For most of the European countries (including Germany, Sweden and the United Kingdom) export growth from market shares is substantially negative whereas rates for Japan are only slightly negative and for the USA even positive. With respect to export growth from export diversification, again the USA and Japan have positive rates whereas in Europe most countries, in particular

8 Charles, T./Lehner, F., 1998: Competitiveness and Employment — A Strategic Dilemma of Economic Policy. In: Competition and Change, Vol. 3, pp. 207-236.

9 European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities.

10 World Bank, 1998: World Development indicators, Washington.

Austria, Denmark, Ireland, Norway and the United Kingdom have negative rates. Moreover, we also find from World Bank¹¹ data, that for most of the Western European countries, the share of high-technology exports in total manufacturing exports is considerably lower than that of Japan and the United States. Notable exceptions are Ireland, Netherlands and the United Kingdom.

This data indicates severe structural problems - namely, slow structural change, delayed adjustment to global developments and deficits in innovation. As the EU-Commission¹² points out, "export decline is not due to a lack of performance of manufacturing industry itself but to poor initial specialization and adaptation of EU exports to changes in world trade". Industry in Europe has its strongholds in exports (measured by revealed comparative advantage) primarily in medium technology, whereas revealed comparative advantage is low in high technology industries. In contrast, the USA and Japan rank higher in high technology industries and have improved their position in the 1980s and 1990s. This is not only an indication of poor specialization, but also one of slow structural change in Europe. As the OECD¹³ points out, industry in Europe does not respond to global change with sufficiently radical and fast structural change. Development of a knowledge-based economy in Europe lags behind corresponding developments in the USA and Japan.

This is not a problem of technological competence nor one of creativity, although the negative technological balance of payments of the EU-countries seems to point in this direction. Germany and the United Kingdom are among the top exporters of technology and have higher technology exports (as a percentage of industrial R&D) than the USA. Germany, the United Kingdom, France and Italy are considerably higher in technology exports than Japan. At the same time, however, these countries also have much higher technology imports than both the USA and Japan. With the exception of the United Kingdom, technology imports exceed exports whereas in the USA exports exceed imports considerably and in Japan both are about equal.

A less favourable picture appears when we turn to the commercial side of new technology. Industry in most of the EU-countries invents less new and newly developed products than industry in Japan and the USA. Even in Germany, which has a better record in this respect than the other EU-countries, about three quarters of all products on the market have not changed significantly in the last two years. The relevant figure for Japan is much higher even than the German one, whereas the figure for the USA is about the same as Germany. The crucial difference between the USA (and Japan) and Germany and even more the other EU-countries is, however, that in Europe product innovation is concentrated much more in established, stagnating or even declining markets, whereas it is directed more towards new and growing markets in the USA and Japan.

11 World Bank, 1998: World Development indicators, Washington.

12 European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities.

13 OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris.

Similar problems of innovation also exist with respect to productivity. In the past three decades, industry in Europe made strong and successful attempts to catch up with the USA with respect to productivity. As a result, total labour productivity increased from roughly 40% of the level of the USA in 1960 to about 80% in 1990. In the 1990s, industry in Europe is no longer successful in catching-up with the United States. A major reason is, as we have mentioned already, that productivity strategies of many companies in Europe concentrate on labour costs and jobs and operate with traditional devices of rationalization. Only a very small proportion of industry in Europe considers productivity over the whole organization and business process and engages in systematic re-engineering.

The EU-report¹⁴ 011 the Competitiveness of European Industry describes a successful strategy of competitiveness as one which is based on innovation, product differentiation and productivity rather than cost reduction. In contrast, however, much of industry in Europe is structurally conservative. Many enterprises stick to the markets where they have been successful in the past and concentrate more on established core business rather than on developing new business. Export growth is created by growth of demand rather than by increasing market share and export diversification. Driven by global competition, many companies engage in strong attempts to reduce costs but do not pursue organizational or process innovation. This also applies to R&D, where input-output relations are often unfavourable. Also, they do not invest as much in R&D and in new plant and equipment as their heading competitors. Last but not least, while the Europeans are often proud about their education and their skilled labour force, human capital accumulation in many European countries is rather modest in comparison to the USA¹⁵.

These problems create conditions which are likely to reduce firms' competitiveness in the future. They are also the major root of high unemployment and the comparatively modest performance of the EU economies¹⁶.

14 European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities.

15 BMBF, 1997: Zur technologischen Leistungsfähigkeit Deutschlands, Aktualisierung und Erweiterung, Bonn; European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities; Lehner et al., 1993: New markets, new structures and new strategies. The future of industry in Europe. Part 1. Occasional Papers/European Community/Forecasting and assessment in Science and Technology; OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris; World Bank, 1998: World Development indicators, Washington.

16 OECD, 1994: The OECD Jobs Study: Evidence and Explanations; Part 1: Labour Market Trends and Underlying Forces of Change, Paris; OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris.

3 The competitiveness of the advanced economies

Both the Competitiveness Report of the Commission of the EU and the American Competitiveness Policy Council take living standards as the ultimate yardstick of the competitiveness of economies and employment as an essential determinant of living standards. This fits very well with the Factor 10 Concept of Friedrich Schmidt-Bleek, and the associated MIPS-Concept in particular. This concept puts the utility which people receive from material input right into the centre of economic activity (See the later section in this article: Improving Resource Productivity).

If we accept this yardstick, the European economies do not seem to perform very well. Standard of living, measured by gross domestic product per capita, in the EU is still lower than both the USA and Japan. In the 1970s and 1980s, Europe as well as Japan have been catching-up with the USA, but in the 1990s convergence came to a halt. Until the 1980s, living standards in the EU were higher than in Japan, but meanwhile Japan overtook the EU¹⁷.

Such statements, however, should be taken with caution. Although GDP per capita is often used as an indicator for standard of living, it does not really tell us much about the living conditions of people in a society. In the USA, real income has been stagnating or even declining since the 1970s, while GDP per capita has remained on a comparatively high level. Between 1978 and 1995, real hourly earnings in manufacturing declined year-after-year by almost one percent, whereas Japan and many European countries still had an increase of about one or two percent. Real earnings in the whole economy measured by compensation per employee have also stagnated in the last ten and particularly in the last five years, whereas both in Japan and in most Western European countries there has been a considerable increase. In the USA decline of real earnings was concentrated among low skilled work, whereas wages for skilled labour stagnated or even increased. Similarly, in most of the European countries lower wage income groups declined relative to average earnings¹⁸.

If we look at non-monetary indicators of the standard of living, we find again that competitiveness of the European economy may be somewhat better than GDP per capita indicates. On a number of dimensions for standard of living, Europe even performs better than the USA. For example, life expectancy is much lower in the United States than in almost any EU-country, but much higher in Japan than in any European country. Both in the USA and Japan, only about 85% of the population had access to sanitation in 1995, whereas in Western European countries it was between 96 and 100 percent of population. Murders per 1000 habitants are two to eight times higher in the USA than in Japan and any Western country. In most countries of Western Europe, the number of people who share one unit of housing is somewhat lower than in the USA and considerably lower than in Japan. Access to education is, in general, comparable in Western Europe, the United States and Japan, although both the

17 European Commission, 1997: The Competitiveness of European Industry. Luxembourg: Office for Official Publications of the European Communities.

18 GaB, G./Schmid, A., 1994: Lohn- und Arbeitsmarktentwicklung in den USA, WSI Mitteilungen 5, 290-299; OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris.

USA and Japan are much lower than most European countries with respect to pre-primary education and the USA scores much higher concerning participation in tertiary education. Not surprisingly, energy efficiency is considerably higher in most of the European countries than in the USA. There are also a number of dimensions where the USA performs better than Europe: costs of living are lower than in Europe and there are more telephone mainlines and more TV-sets per 1000 persons, female participation in the labour force is higher than in most of Western Europe. Also, human capital investment is much higher in the USA than in all Western European countries except Switzerland¹⁹.

A particularly important problem of GDP per capita as an indicator for standard of living and competitiveness is that it neglects the distribution of income and wealth in a society and does not really tell us whether or not most people in a society have a secure or adequate income on a long-term basis. Moreover, it is not necessarily closely linked to real living conditions and does not tell us whether or not most people in a society enjoy reasonably agreeable living conditions.

In the USA, despite its high GDP per capita, the income of large parts of the population is lower than that of most people in many EU-countries. Income inequality is significantly higher. As World Bank²⁰ data show, the lowest 20% of the population in the USA share less than 5% of total income, whereas the top 20% have more than 40%. In contrast to that, the lowest 20% of the population in Japan share almost 9%, whereas the top 20% have less than 40%. In the USA income polarisation is increasing and contributes to what Castells²¹ has described as 'Dual America'. In Western Europe, only the United Kingdom and Switzerland have about the same degree of income inequality. In most of the other European countries the values for the lowest 20% are closer to 6% of total income; Sweden, the Netherlands and Belgium even reach about 8% and more. With respect to the top 20% values of most of the EU-countries are around or below 40%.

Lower levels of inequality in much of Europe is largely a result of two factors: higher wage differentials in the USA and the redistribute effects of the social security system in Europe. The impact of social welfare can be illustrated by the data on household disposable income. Relative disposable incomes for households with no wage earner is much higher in Western Europe than the USA: in the latter, such households reach only 39.6% of average incomes, whereas in Western Europe and Japan the corresponding figures are often in excess of 70% and 60% respectively. Interestingly, the figures for Germany (55.9%) and Sweden (58.2%) are rather low in comparison with other European countries, such as the Netherlands (62%) and France (74.8%).

- 19 Statistisches Bundesamt, 1998: Statistisches Jahrbuch für das Ausland 1998, Wiesbaden; BMBF, 1997: Zur technologischen Leistungsfähigkeit Deutschlands, Aktualisierung und Erweiterung, Bonn; World Bank, 1998: World Development indicators, Washington.
- 20 World Bank, 1998: World Development indicators, Washington.
- 21 Castells, M., 1998: End of Millennium. The Information Age: Economy, Society and Culture, Vol. 1, Malden-Oxford, Blackwell, p. 130.

With reference to the above data, we do not imply that the United States standard of living is lower in general than in Europe. Our argument is that it may be grossly misleading if we judge the standard of living and with that competitiveness of whole economies on the basis of GDP per capita. If we look at many other important indicators, many European countries still offer living conditions which are as good or better than those in the USA or Japan. In this sense, one could argue that the European economies have less problems of competitiveness than is usually assumed with the major exception of comparatively weak employment performance. Before we examine employment problems in more detail, we raise the issue of social cohesion in order to assess the implications of different levels of wealth, income and living standards in societies for social sustainability.

4 Cohesion: The social dimension of sustainability

Data on living standards and on the distribution of wealth and income in a society certainly provide a relatively objective picture of social and economic conditions, yet they still hide some of the social meanings of these conditions. Societies differ considerably in this respect. There are a number of societies, such as the USA and Switzerland, where a high inequality of income, wealth and living standards is considered acceptable or even normatively positive. It is considered as an integral element of a society which is strongly based on achievement. Other societies, like Germany or the Scandinavian countries, are much more sensitive to inequality. Equality is an important value in these societies which has in particular shaped politics and its relation to economics over a long period of time and was a key shaping factor in the development of what is called the welfare state. However, in all the advanced capitalist economies, inequalities of income and relative deprivation have been offset by rising general living standards the cake has grown bigger. It is when living standards and general economic security are threatened with, for example, declining real incomes or increasing inequality that social cohesion is called into question.

High income inequality can motivate those in lower income groups to seek additional jobs for the household, as in the USA; it can also provoke racial conflict and ghettoization and criminal activity. In many European Countries high income inequality is likely to provoke redistributive activity via political and industrial action. The European welfare states embodied principles of equality in the 'social contract' although they were by no means promoted only by socialist political parties. All Political Parties recognized the non-zero sum benefits of universal welfare and social insurance, including Bismarck and Churchill.

Currently, it is often argued that the European welfare state is no longer sustainable since it imposes high costs on labour and by this creates a strong challenge to the competitiveness of industry in Europe which is often solved at the expense of employment. The European welfare state, hence, provokes unnecessary unemployment and reduces rather than increases the wealth of most people even of those people on lower incomes. However, we should not overestimate labour costs as a factor of competitiveness for industry in Europe (as we argued above in our discussion of competitiveness). Nevertheless, the welfare state as currently constituted is in a disarray and often hinders rather than advances social and economic development in the advanced economies. The welfare crisis has threatened the quality of provision of services under fiscal constraints. At the same time, welfare state bureaucracy is often experienced as alienation by the beneficiaries. The solution of the problem, however,

cannot simply be to cut benefits from social security and other components of the welfare state. If this would increase inequality and poverty in society, it would not reflect social values in many of the European societies and will therefore not lead to a socially accepted and stable solution.

In this context, we should note that there is an important difference in the evaluation of economic performance between mainstream economists and ordinary people. Economists judge economic performance primarily in terms of market efficiency. Ordinary people, including top managers and politicians, judge economic performance much more in terms of utility which they derive for themselves or for their clients. Economists basically accept any outcome of market allocation if it is efficient and they refuse any government activity which affects the efficient working of the market. Ordinary people, including top managers and politicians, accept the outcome of markets and of government activity if they receive the highest possible utility from their participation in market activities or from government policies.

The fundamental difference between economists and ordinary people is that economists, or at least the theories of classical economics, argue from a given distribution of income and wealth in a society, whereas ordinary people accept a given distribution of income and wealth in a society only to the extent to which it fits their understanding of a reasonably fair distribution and their understanding of the working of society. The distribution of income and wealth in a society raises issues of social justice but also concerns experience quite practically in everyday life and in the work environment, not only as an ideological fact. It determines the way in which people socially interact and in which they may securely live together in a society. This is in essence what we mean by social cohesion.

Social cohesion is an important factor for the sustainability of an economy, that is for its capability of continuously securing and reproducing the basis of its Operation. Even more, it is a fundamental prerequisite of an efficient market economy and thus of a sustainable economy. Outcomes of market allocation which significantly damage social cohesion in a society and the underlying value systems, are likely to provoke some kind of redistributive activity. Such activity does not only include political activity, but also economic strategies to obtain power in the market or a variety of forms of criminal behaviour (including tax evasion and corruption). What all these activities have in common is that they distort the Operation of the market in the short and much more in the long run. They are, therefore, a real threat to the competitiveness and to the sustainability of the economy. This is why markets need countervailing powers incorporated into the institutional arrangements in the economy in order to limit excessive inequalities and abuses of power. Markets alone cannot create social cohesion nor social sustainability. They require state action in the public interest. Whilst 'state intervention' has become increasingly discredited, new forms of state activity are required which both regulate economic exchange and provide the opportunities and support needed to build social solidarity.

It is therefore of crucial importance that we design the institutional framework of market allocation and strategies of competitiveness in a way which secures social cohesion. Above all, the effective participation of people in the economic process must be secured. That is why employment is a key issue for sustainability. Employment is the most important condition for social inclusion and hence it is a key prerequisite for social sustainability.

5 Employment: A Key Issue for Europe

With respect to employment, the EU is clearly performing much less well than both the USA and Japan. This is indicated by higher unemployment rates in the European Union and a much larger share of long-term unemployment which, in many European countries, is almost four times higher than in the USA. Until the 1980s unemployment was much higher in the USA than in many European countries. It is only recently, that the US unemployment rate has improved.

The employment rate is even more significant (employment as percentage of population). Back in the 1960s, the employment rate in the EU was considerably higher than that in the USA, but considerably lower than the Japanese rate. Over the last decades, the employment rate increased significantly both in the USA and Japan, whereas it decreased in the EU. As a result, in the 1990s the employment rate in the EU is far below the rates in the USA and Japan which seem to be converging.

If we look at unemployment and employment, we can observe that unemployment rises partly because there is more labour market participation. This is more accurate in the case of the USA than for most of Europe. Throughout the 1980s and 1990s, France and Italy faced high and still slightly increasing unemployment. In France, employment is rising again after it dropped considerably at the beginning of the 1990s, whereas in Italy the unemployment rate continues to stagnate or even to decline. In the 1990s, Germany and Sweden had a combination of rising unemployment and declining employment, whereas in the Netherlands unemployment has declined since the mid 1980s, whilst employment has slightly declined as well. In the UK, unemployment has declined in the 1990s, and employment rates have improved. In stark contrast to most of Europe, the USA managed to cut unemployment by half and to reach a comparatively high increase in employment.

The problem therefore, is that the EU has created fewer jobs in the last three decades compared to the USA and Japan. Between 1960 and 1995, the EU had an employment creation rate of 8% only, whereas Japan reached 44% and the USA 84%. Between 1960 and 1994 total employment in manufacturing and Services increased by about 20% in Europe, whereas it doubled in the USA and Japan. Moreover, in the USA, growth is translated more effectively into employment than in Europe - in the USA, one percent of growth of GDP leads almost to one percent increase in employment whereas in Europe it only leads to less than half a percent increase in employment. At the same time, the working population has been growing much less in Europe than in the USA. The EU competitiveness report summarises the low performance of the EU in a simple, but clear way: ...in contrast with the USA where job creation has kept pace with the increased supply of labour, the EU is facing relative employment Stagnation despite less demographic pressure²².

22 European Commission, 1997: *The Competitiveness of European Industry*. Luxembourg: Office for Official Publications of the European Communities, p. 15; Schettkat, R., 1994: *2 Millionen neue Jobs in einem Jahr. Die beschäftigungspolitische Bedeutung des tertiären Sektors in den USA im Vergleich zur Bundesrepublik*“, WSI Mitteilungen 6, 5. 363-370; OECD, 1996: *Technology, Productivity and Job Creation*. Analytical Report, Paris.

According to a widespread assumption, the better employment performance of the USA has primarily to do with the increase in cheap and low-skilled service jobs. However, this assumption is inaccurate. In the 1980s it was the case that many low-wage, low-skilled jobs were created particularly in services. However, in the 1980s and more so in the 1990s, many high-wage, high skilled jobs have also been created. This applies to manufacturing as well as to services where skilled jobs have increased in finance, maintenance and health. This is not just a phenomenon of the USA: in recent years, in six of the G-7 countries employment of skilled labour increased more rapidly than that of low-skilled labour. The main difference between the USA and the European countries is the much higher number of new jobs²³.

More interestingly, we can observe in the USA that in those sectors which are characterised by a high proportion of low-wage, low-skilled jobs, employment increased much less than in those sectors with many high-skilled, high-wage jobs. In the service sectors such as transport and trade, low and even declining wages correlate with slow growth in employment. In contrast, other sectors such as computing combined increasing wages with increasing employment. This demonstrates that the widespread assumption that labour costs are a major determinant of job creation is wrong. It is only true for low-skilled jobs, whereas in high-skilled jobs employment and real income are positively correlated. On the basis of labour market trends in the USA, we therefore cannot draw the conclusion that low wages are a promising instrument to enhance job-creation²⁴.

The positive employment performance of the USA can be assigned to two major factors: Firstly, an increasing flexibility of working conditions which allows work to be organized more efficiently, and higher wage differentials. The result is that more low-skilled, low-wage jobs are retained, whilst high-skilled work which enhances value-added is rewarded disproportionately. Secondly, the pursuit of “radical“ innovation, i.e. innovation which leads to new products for new markets, produced with new processes, and an enforcement of structural change towards services and towards new industries. The second strategy has been particularly effective in the Clinton era, whereas in the Reagan era reduction of labour costs and deregulation of labour markets played a more important role. In contrast to Europe where public policy advances innovation primarily with the aid of technology programmes, innovation policy in the USA has for some time combined technology push and market pull instruments - public purchasing and regulation are used to create lead-markets²⁵.

In view of rising unemployment there is a continuing debate about the future of work. The “prophets of massive unemployment, led by the honourable Club of Rome“, as Manuel

23 Lehner, F./Nordhause-Janzen, J., 1998: Beschäftigung durch Innovation: Strategische Optionen im globalen Strukturwandel. In: F. Lehner, M. Baethge, J. Kühl, F. Stille (Hg.) Beschäftigung durch Innovation. München-Mering:Hayupp, 5. 59-97; OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris.

24 Gaß, G./Schmid, A., 1994: Lohn- und Arbeitsmarktentwicklung in den USA, WSI Mitteilungen 5, 290-299.

25 Lehner, F./Baethge, M./Kühl, J. & Stille, F. (Hg.), 1998: Beschäftigung durch Innovation, München-Mering, Hampp.

Castells²⁶ states, argue that “our societies will have to choose between massive unemployment ... or else a redefinition of work and employment“ and that jobs have to be redistributed²⁷. This debate is certainly not new. In the 1970s and 1980s it was often argued that development of computer-aided production systems would lead to factories without people - with much production, but little work. Recently, Freeman & Soete²⁸ and Aranowitz & DiFazio²⁹ have refurbished this debate again.

The problem with such arguments is that they often neglect the fact that employment in R&D-intensive and high-technology sectors was much better than in non-R&D and low-technology sectors throughout the 1980s and 1990s. They also fail to recognise that, since the late 1970s, productivity in manufacturing has not been driven by computer-aided production, but rather by so-called anthropocentric production systems. Development of these systems certainly contributed much to the humanization of work and accelerated increased labour productivity, but also facilitated a strategy of cost-driven competition³⁰.

Job reduction or downsizing is not an inevitable development. As relevant research shows, high productivity does not necessarily result in job losses, but can also create jobs³¹. The problem of the European economies is that productivity strategies of many companies have centred around traditional instruments of rationalization rather than on the modern instruments of systematic re-engineering. Moreover, many companies have pursued cost driven strategies of competitiveness and neglected development of new products and new markets.

These deficits in process and product innovation and in market developments are, as the OECD³² clearly states, the major root of employment problems in Europe. If innovation and structural change can be accelerated in Europe, there is no danger of a jobless future. Germany, France, the United Kingdom and other European economies have been slow in developing new markets and new economic structures and in transforming their economies towards a knowledge-based and service oriented economy. Even in the USA, which is

- 26 Castells, M., 1996: *The Rise of the Network Society. The Information Age: Economy, Society and Culture*, Vol. 1. Malden-Oxford, Blackwell, 255.
- 27 Giarini, O. & Liedtke, P. M., 1998: *The employment dilemma and the future of work*.
- 28 Freeman, C./Soete, L., 1994: *Work for all or mass Unemployment*, London: Pinter.
- 29 Aranowitz, S./DiFazio, W., 1994: *The Jobless Future; Sci-tech and the Dogma of Work*. Minneapolis: University of Minnesota Press.
- 30 Lehner, F., 1997: *Weltklasseproduktion: Der Wettbewerb der Produktionssysteme*. In: F. Lehner, P. Wickens (Hg.), *Schlüssel zur Weltklasseproduktion*, München: Hampp.
- 31 Stille, F. & Bitzer, J., 1998: *Beschäftigungswirkungen von Innovationen: Analysen zu einem komplizierten Verhältnis*. In: F. Lehner, M. Baethge, J. Kühl & F. Stille (Hg.), *Beschäftigung durch Innovation*, München-Mering, Hampp.
- 32 OECD, 1994: *The OECD Jobs Study: Evidence and Explanations; Part 1: Labour Market Trends and Underlying Forces of Change*, Paris; OECD, 1996: *Technology, Productivity and Job Creation*. Analytical Report, Paris.

considerably ahead of Europe with respect to structural change and where employment performance is better, structural change needs to be accelerated in order to overcome the current condition of declining real income and increasing poverty.

6 Employment and innovation

Public policy often assumed that innovation per se heads to more employment, but this is not the case. The relationship between innovation and employment is a rather complex one³³. If we examine the relationship between innovation and employment at the bevel of individual firms, we generally find a positive correlation. Innovative enterprises create or secure more employment than less innovative ones. This is particularly true with respect to product innovation. Contrary to widely shared assumptions, (see for example, the assumptions in the argument of Giarini and Liedtke³⁴, process innovation and corresponding increases in productivity often enhance employment as well. We also find a positive correlation between innovation and employment at the sectoral level. Sectors with more innovation tend to have per saldo a better performance with respect to employment than sectors with less innovation. From a macro-economic perspective, things are quite different. Evidence at the firm and sectoral level cannot be generalized to the wider economy, because there are important indirect employment effects. For example, innovation which leads to increasing employment in one firm may negatively affect the competitiveness of less innovative firms which suffer much larger job losses.

Lehner and others draw some simple but important conclusions from an analysis of relevant research: Firstly, while more intensive innovation activities of firms in general are usually favourable with respect to employment, governments are ill-advised if they support individual innovation activities of firms in the hope of creating more employment in the economy-at-large³⁵. Secondly, if governments support individual innovation activities of firms in the hope of creating new employment in the wider economy, they are only on safe ground when they support new products and the development of new markets for which no competition has been established. Thirdly, Governments are on much safer ground, if they do not support individual innovation activities of firms, but advance the innovation capacity of the economy and support the development of powerful innovation Systems.

Above all, the conclusion must be that in the advanced economies full employment cannot be reached and secured within established markets and structures, but only if structural change is advanced and accelerated. The type of innovation which is, hence, the key to new employment is one which develops markets in new directions and creates new markets and

33 Lehner, F./Baethge, M./Kühl, J./Stille, F. (Hg.), 1998: Beschäftigung durch Innovation. München-Mering, Hampp.

34 Giarini, O. & Liedtke, P. M., 1998: The employment dilemma and the future of work.

35 Lehner, F./Baethge, M./Kühl, J./Stille, F. (Hg.), 1998: Beschäftigung durch Innovation. MünchenMering, Hampp.

thus enhances a strong leading-edge economy. We call this radical innovation in contrast to incremental innovation, i.e. innovation within established markets and product lines. This conclusion may sound radical, but in effect it is rather trivial since it simply reflects the logic of the advanced economies. The much less trivial question is, in which direction structural change should and can be advanced and accelerated.

Social scientists and economists offer quite a number of different models and scenarios of change of the advanced economies and societies. The most prominent model is currently that of the information age or the information society. Related to this or similar models are concepts like the knowledge society, the communication society or the knowledge-based economy. Another prominent concept is globalization; a related concept is the world society. A long-standing favourite is the service economy or the service society. Ecologically, the most prominent concept is obviously sustainability. Other concepts include post-modernism, post-materialism, post-fordism, the risk society and even more. The predictions and arguments of all these models and scenarios are sometimes conflicting or contradictory, sometimes concurrent or complementary and often not clearly related to each other.

We will not discuss all these different models and scenarios here, but confine ourselves to three models which we consider particularly important for our argument. These are the models of the information age and a knowledge-based economy, the model of the service society or service economy and the model of sustainability according to the Factor- 10 concept³⁶.

7 The Information age and the knowledge-based economy

The concepts of “information age“, “information society“ and “knowledge-based economy“ basically contain arguments to the effect that, in the advanced economies, knowledge and information are becoming the principal factors of production. This is not really a new development since knowledge and information have always played an important role in the production of goods and services. Moreover, the importance of knowledge and information has been growing for many years. As the OECD study on the knowledge-based economy shows, the advanced economies “are more strongly dependent on the production, distribution and use of knowledge than ever before“³⁷. The study also reports estimates according to which more than 50% of GDP in the major economies is now knowledge-based. Knowledge has, as Castells³⁸ points out, become finally “the main source of productivity“. Knowledge is no longer simply a means to advance the efficient use of the production factors, but rather has become the most important production factor.

36 Schmidt-Bleek, F. and coworkers, 1993: A Series of Articles on Factor 10 and MIPS in „Fresenius Environmental Bulletin“, Special Edition 8/93, Birkhaeuser, Basel, Boston, Berlin; Schmidt-Bleek, F. (with Bierter, W.), 1998: „Das MIPS Konzept — Faktor 10“, Droemer Knauer, München.

37 OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris, p. 9.

38 Castells, M., 1996: The Rise of the Network Society. The Information Age: Economy, Society and Culture, Vol. 1. Malden-Oxford, Blackwell, p. 17.

In theories or concepts of the information age or information society, the crucial role of information is strongly related to information technology. It is, as Castells³⁹ argues, the revolution in information technology which has given rise to a fundamental restructuring of the capitalist system from the 1980s onwards. This leads to a new mode of development in the capitalist societies, which Castells calls the “informational mode“. In this mode the production and application of knowledge and the improvement of knowledge generation and information processing are the central feature of production. To quote Castells⁴⁰ again: “the structurally determined performance principle around which technological processes are organized: industrialism is oriented towards economic growth, that is towards maximizing output; informationalism is oriented towards technological development, that is towards the accumulation of knowledge and towards higher levels of complexity in information processing“. Castells formulates in a very strong way what most concepts of the information age or information society argue, namely that information technology leads to an economy which is fundamentally different from the industrial economy. Accordingly, society too is subject to fundamental change.

In contrast to these arguments, the concept of the knowledge-based economy as proposed by the OECD⁴¹ seems to be one of gradual, rather than of revolutionary change. The importance of knowledge has grown over a long time and development of information technology has been a response to this development. Yet, the gradual increase of the importance of knowledge has led to a situation where the economy is changing fundamentally. As investments in knowledge are characterized by increasing (rather than decreasing) returns, the logic of economic behaviour which until now has been shaped by diminishing returns on investment is changing. Knowledge is the key to long-term growth - there is, as the OECD⁴² underlines, “the possibility of sustained increases in investment which can lead to continuous rises in a country’s growth rate“. The generation and application of knowledge moves more and more from an auxiliary function to the core of the production process.

Knowledge and information about facts, scientific principles and laws tend to be abundant, therefore established principles of scarcity must be modified. This is particularly true of knowledge which can be codified and which can be traded like a commodity. This is the type of knowledge which can easily be reduced to information and be transmitted over long distances in a short time and at very low cost. Modern information technology makes this type of knowledge available almost everywhere on the globe at almost any time and makes it accessible for many people and firms. It is, therefore, rather difficult to derive a lasting competitive advantage from this type of knowledge - unless both this knowledge and its

39 Castells, M., 1996: *The Rise of the Network Society. The Information Age: Economy, Society and Culture*, Vol. 1., Malden-Oxford, Blackwell, p. 13.

40 Castells, M., 1996: *The Rise of the Network Society. The Information Age: Economy, Society and Culture*, Vol. 1., Malden-Oxford, Blackwell, p. 17.

41 OECD, 1996: *Technology, Productivity and Job Creation. Analytical Report*, Paris.

42 OECD, 1996: *Technology, Productivity and Job Creation. Analytical Report*, Paris, p. 11.

processing is continuously improved. More and more, we find in industry what Castells⁴³ describes as a virtuous circle where knowledge is used to improve information technology and information technology to improve the generation and application of knowledge, and where the interaction of the two is the main source of productivity.

What is scarce is often not knowledge and especially codified, rule-governed information, but the capacity to use them in meaningful ways. This is the reason why information technology is so important, but it is also the reason why information technology is not the only pillar of the knowledge-based economy. With the capacity to use knowledge and information in meaningful ways, more tacit forms of knowledge, namely know-how, know-why, know-what and know-who gain in importance. These are the forms of knowledge which often cannot or only with considerable difficulties be codified and reduced to information - and which, therefore, often head to a lasting competitive advantage. They require conditions which cannot be easily reproduced. Know-how is based on specific skills and specific experience; know-who is learned in social practice and specific social relationships. Both for know-how and know-who, the social organization of the generation and application of knowledge becomes crucial.

In a knowledge-based economy, the social organization of generation and application of knowledge is also of crucial importance since it is associated with a shift from incremental to radical innovation. Incremental innovation is innovation along existing product lines in established markets and with established processes whereas radical innovation is innovation for new products, new markets and with new processes. The difference is thus one in terms of knowledge and certainty: in the case of incremental innovations, these are based on knowledge of existing situations concerning markets, properties of products and the production process. Radical innovations however, must operate with predictions on markets yet to be developed, products yet to be designed and processes yet to be established. While there may be ample information to make such predictions, they often lead to a range of alternative and conflicting predictions, which can only be tested in the course of the innovation process. In order to cope with such a situation, enterprises and other relevant actors must have a high learning capacity. This in turn needs an adequate organization of the generation and application of knowledge.

The crucial importance of the social organization of the generation and application of knowledge marks the potential weak point of the knowledge-based economy, namely social rigidities. Advancement of the knowledge-based economy requires not only investments in technology and infrastructures, but considerable social innovation. This includes intelligent production systems and learning organizations designed for the efficient generation and application of all kinds of knowledge; management styles in firms and governments which allow for experimentation, failure and learning; efficient government regulations which are adaptable to change; new structures and curricula in education; strong interdisciplinary linkages in science and research; a favourable social environment for innovation, and many other changes in organizations, institutions and behavioural patterns.

43 Castells, M., 1996: *The Rise of the Network Society. The Information Age: Economy, Society and Culture*, Vol. 1., Malden-Oxford, Blackwell, p. 17.

This is where Europe displays particular weaknesses. In industry in Europe traditional rationalization strategies still dominate, whereas few firms so far have engaged in systematic re-engineering. Firms are, as we have discussed, still strongly oriented towards established markets and insufficiently involved in developing new markets. Government structures and regulations, including the public finance system, are rigid and often constitute severe impediments to innovation and change. Firms, public administration, universities and other organisations and institutions are characterized by strong segmentation. Political and economic culture is strongly oriented towards security and certainty and, is thus, less open to experimentation, failure and risk. These and other factors are more often active in Europe than in Japan or the USA. As a result, Europe seems to lag considerably behind the USA and Japan on its way into the information age and in the development of a knowledge-based economy.

Some statistics may illustrate the case although these kind of figures are problematic since their measuring basis is not really uniform. As is well known, both the USA and Japan have a higher share of high-technology exports in total manufacturing exports than most of the European countries. This may not be alarming, but some figures behind this situation are: In the USA there are many more scientists and engineers in R&D than in all of the EU-countries and in Switzerland. There are 3873 scientists and engineers per million of people working in the USA in R&D, whereas there are less than 3000 and often even less than 2000 in Europe. Human capital per person in the age group of 25 to 64 years is with \$86,600 (on a purchasing power parity base), much higher in the USA than in most of Europe - where Switzerland reaches \$93,600, Germany \$73,600, Austria \$81,400, Denmark and Sweden around \$68,000, the United Kingdom \$50,500, France \$55,700 and Italy, Belgium, and the Netherlands are below \$50,000. Private and public spending per pupil and student reaches almost \$8000 (in PPP) in the USA, but (with the exception of Austria and Denmark) less than \$6000 in the European members of the OECD⁴⁴.

The degree to which the USA may be already ahead of Europe on its way to the information age and a knowledge-based economy is also indicated by the fact that there are about 330 PCs and 31 internet hosts per 1000 people in the United States, whereas there are only 164 PCs and 7 internet hosts in Germany, 186 PCs and 10 internet hosts in the United Kingdom, 192 PCs and 21 internet hosts in Sweden, 200 PCs and 14 internet hosts in the Netherlands, and so on⁴⁵. The more important fact behind these figures is that the lead markets for most of the modern communication and multimedia markets are located in the USA. Similarly, important lead markets for biotechnology and health goods and services also develop more often in the USA than in Europe, which is supported by much higher spending on health⁴⁶.

Whilst each of the figures outlined here may be questioned, it is hard to deny that Europe lags behind the USA in the development of a knowledge-based economy. However, even in the USA, this development does not proceed fast enough to maintain and increase mass living

44 BMBF, 1997: Zur technologischen Leistungsfähigkeit Deutschlands, Aktualisierung und Erweiterung 1997, Bonn; World Bank, 1998: World Development indicators, Washington.

45 World Bank, 1998: World Development indicators, Washington.

46 OECD, 1996: Technology, Productivity and Job Creation. Analytical Report, Paris; World Bank, 1998: World Development indicators, Washington.

standards. Faster and more systematic development of the knowledge-based economy is, as OECD⁴⁷ argues, a challenge not only for Europe, but also for the USA and Japan.

8 The New Service Economy

The development of a knowledge-based economy is increasingly interconnected with another long-standing development: the development of the service economy. In the view of established economic and sociological literature, global change, industrialization and a changing division of labour in particular, force the advanced economies to transform into service societies in order to maintain their productivity (or to use the modern word: their competitiveness). The prediction is not only that the share of manufacturing in total production and employment is declining while that of services is increasing. Rather, it is argued that services replace manufacturing as an economic basis of society and that social structures and values will change accordingly. The underlying model of change is a linear one: the service society will replace industrial society in the same way in which industrial society replaced agricultural society. This is why we prefer (for want of a better term) to refer to the 'new service economy, to capture the changes we describe below.

The share of the services in GDP and employment services are both rising in the advanced economies. Whereas in most of the advanced economies employment in manufacturing has stagnated or even declined in the last two decades. This is particularly true for the USA where an overwhelming share of the new jobs are service jobs. Contrary to a widely shared assumption, many of the new service jobs are not low-wage, low-skilled, but high-wage and high-skilled jobs. We should note, however, that many of the high-wage, high-skilled service jobs have been created in the field of production services such as software and research and development, and in manufacturing industry itself. In many of the advanced economies, about half of all commercially produced services are production-oriented.

The important role of production services in the creation of new service jobs, particularly of new high-wage, high-skilled service jobs, indicates that the established theory of the service society is misleading, namely that there is a simple transformation from an industrial to a service economy. Rather, what we can observe is that manufacturing and services are amalgamating. The traditional demarcation line between manufacturing and services has become obsolete. In manufacturing, the service content of goods is rising and in many cases outweighs in terms of value-added the material content. As many manufacturing companies outsource service components or organize them in separate companies, this is included in the statistical growth of the service sector. In the service sectors, on the other hand, the technical content is often high, and many services are produced with technologies and products produced by manufacturing industry. Also, organizational forms and processes (lean production for example) developed in manufacturing are increasingly applied in the production of services. Even more important, in many industries the product is no longer a manufacturing good or service, but rather a bundle of material and immaterial goods.

47 OECD, 1994: *The OECD Jobs Study: Evidence and Explanations; Part 1: Labour Market Trends and Underlying Forces of Change*, Paris; OECD, 1996: *Technology, Productivity and Job Creation. Analytical Report*, Paris: OECD.

Both the increasing service content of manufacturing and the increasing technological content of services are to a large degree the result of the development of a knowledge-based economy. The generation and application of knowledge requires new and improved services in research and development, design, education and training, provision of information, and consulting. At the same time this increasingly requires the use of advanced communication technology without which efficient handling of large amounts of information would hardly be possible. As this trend becomes more pronounced in the future, knowledge-oriented services will expand and so will the technical content and complexity of services.

The convergence of manufacturing and services can also be identified if we consider the traditional characteristics which distinguished the delivery of a service from manufacturing. Apart from the distinction between manufactured goods as material and services as immaterial, the major distinction was (and often still is) that services are personalized. They involve the customer directly as a participant in the production process. Nowadays, however, we can readily observe that many services, e.g. insurance's or banking services, are not really personalized, but at best a mass product which is adjusted to customers. We can also find a similar or even higher degree of service content in many segments of manufacturing. Indeed, flexible production systems have greatly advanced the capability of manufacturing industries to customize their products. Beyond that, in a number of industries, new production concepts are developed which attempt to reach full personalization of products, including mass products.

In the advanced economies of the emerging information age, this demand will increase and customization (up to real personalization) is becoming a dominant feature in many industries. In the view of Castells⁴⁸, the information age is characterized by two opposing trends: On the one hand global networks of firms, organisations and institutions gain much power and control economic and political transactions. On the other hand, the distinctive trend of the 1990s, individualism and the strong robe of primary identities (e.g. family, regions) will prevail and will even be enforced as a "dialectical" reaction to the growth of networks. While we share Castells diagnosis of the two distinctive trends, we doubt that these two trends are in strong Opposition. Given the dominance of knowledge accumulation in a knowledge-based economy and the particular relevance of human capital and individual creativity, we would instead expect the emergence of organizational forms in which individuals play a much stronger role and of networks which are strongly decentralized. This could be the type of global networks with strong regional pillars which Gordon⁴⁹ describes as the emerging organization of innovation and production in and around the innovative global firm.

If we analyse this case from the point of view of production concepts, we again come to the conclusion that the two seemingly opposing trends are synthesized. The growth of global

48 Castells, M., 1996: *The Rise of the Network Society. The Information Age: Economy, Society and Culture. Vol. 1*, Malden-Oxford, Blackwell, p. 22ff.

49 Gordon, R., 1996a: *Globalization, New Production Systems and the Spatial Division of Labour*. In: W. Littek, T. Charles (eds), *the New Division of Labour*. Berlin, New York: de Gruyter, p. 16 1-207; Gordon, R., 1996b: *Industrial districts and the globalization of innovation: regions and networks in the new economic space*. In: X. Vence-Deza, 3. 5. Metcalfe (eds.), *Wealth form Diversity: Innovation, Structural Change and Finance for Regional Development in Europe*. London: Kluwer Academic Publishers.

networks is certainly enhancing global mass production, but the strong role of primary identities is advancing cultural diversity and enforces trends towards customization. The solution to this seeming dilemma (at least at the level of the market and consumer choice) may be concepts of “mass customization“. Ideas in that direction or even real trends can be observed in construction, clothing, furniture, machinery and equipment and even in the automobile, chemical and electrical industries. What appears to be a contradiction - mass and customization - indicates emergent trends in the development of production process beyond the limits of both traditional mass production and craft industry.

With strong trends towards customization embedded even in mass production as “mass customization“, a new service economy is emerging which can no longer be described in terms of the traditional demarcation of services and manufacturing. In the new service economy, individual customers‘ utility will be the primary yardstick for the design of products - wether this is a “service“ or a “manufactured good“ in the traditional sense. Moreover, most products will represent a complex combination of “manufactured goods“ and “services“. Producers of machines and equipment, for example, will provide to their customers not only machines and equipment, but also services concerning training, Operation, maintenance, recycling, financing, development and design. They will increasingly offer services by loaning, renting or leasing their products (in the sense of “service delivery machines“) to customers, for instance, offers transportation services with its “Charterway“ system where all kinds of vehicles are available for freight transport. The service of factory and office designers will also include design and assembly of specially designed machine-tools, computers or furniture. With such developments, customers are directly involved in design and in that sense, become integrated into the firm‘ s organization or network.

For Europe, the emergence of this new service economy opens up interesting opportunities to regain its traditional competitive advantage in terms of quality. The development of anthropocentric production Systems has enabled mass producers to increase flexibility as well as the technical and functional quality of their products to such an extent that there is little room for quality production as an alternative to mass production⁵⁰. High technical and functional quality is no longer a special argument of competitiveness strategies, but in many markets simply the entry ticket into the market. However, anthropocentric production systems do not only support flexible mass production, but they could also be the basis for a highly flexible and customized mass production with high service content. This would be an adequate response to the emerging new service economy.

9 Factor-10 and the knowledge-based new Service economy

Having described the opportunities of competitiveness in the advanced economies and their structural implications at length, we can finally come to sustainability and Factor 10. In the introduction to this paper, we have argued that the Factor-10 concept offers a solution to the problems of competitiveness and employment in the advanced economies. It does so because

50 Lehner, F., 1997: Weltklasseproduktion: Der Wettbewerb der Produktionssysteme. In: Lehner, F./Wickens, P. (Hg.), Schlüssel zur Weltklasseproduktion, München: Hampp.

dematerialization of the economy by a Factor of 10 (or more) contains the potential for synergies with the development of a knowledge-based economy and a new service economy.

What is the Factor -10 concept in a nutshell? There is ample evidence that the industrial economy in its present form with its main emphasis on throughput manufacturing is not sustainable. It has developed over the last 150 years and is based on the optimization of the production process in order to reduce unit costs and thus overcome the scarcity of goods of all kinds, from food to shelter to durable goods. Its emphasis on ever more efficient process technologies has led to an enormous increase in labour productivity - on average at least a factor of 20 in 150 years. This was only possible because energy, natural resources and other materials were very cheap in relation to the other production factors. The consequence of this is a very poor performance with respect to resource productivity, i.e. what we get out as utilization value from a product, from a kilogram of material or from a kilowatt-hour of energy (over the whole chain from the extraction of resources to the production of goods until the use of goods) is extremely low. Investigations of the US Academy of National Engineering⁵¹ show: in the USA, 93% of exploited resources are never transformed into saleable goods, 80% of all goods are thrown away after a single use, and 99% of the material content of goods become waste within 6 weeks - a gigantic cost factor for the economy and for nature. All in all, some 90% of the biomass harvested as well as more than 90% of the natural *abiotic* (non-renewable) materials disturbed by machines in their natural settings are wasted on average on the way to making products available to the end-user.

What is urgently needed is a change in course towards a more sustainable economy. In order to achieve sustainability, the economy must operate at a much higher level of resource productivity, i.e. be able to produce at least the same amount of utilization values out of a greatly reduced resource throughput. Only a leap in energy and resource productivity of the order of a factor of 10 in the next fifty years can strengthen the basis for sustainable economic, social and environmental progress⁵². This would allow us to have the present global flow of materials in the next fifty years, including mineral raw materials, freshwater and non-renewable energy sources while still allowing necessary increases of per capita material consumption in the "South". Improving resource productivity is therefore a core concept and prerequisite for sustainability. This means that environment and development be made mutually supportive at the front end of the development cycle, when the goals and policies of society are being set, not at the tail-end after society and the economy have already incurred the damage costs of unsustainable developments.

A ten-fold increase of resource productivity requires and creates new incentives for radical innovation in eco-intelligent technologies, processes, products and services that enhance energy, resource and environmental and economic efficiency over their entire life-cycle.

51 Allenby, B. R./Richards, D. J. (Hg.) 1994: "The Greening of Industrial Ecosystems", National Academy of Engineering, Washington DC.

52 Schmidt-Bleek, F., 1993: "Wieviel Umwelt braucht der Mensch? MIPS - Das Maß für ökologisches Wirtschaften", Basel/Berlin/Boston; Schmidt-Bleek, F. (mit Bierter, W.)1998: "Das MIPS-Konzept. Weniger Naturverbrauch - mehr Lebensqualität durch Faktor 10", München; The International Factor 10 Club's "Carnoules Statement to Business and Government Leaders", Factor 10 Institute, La Rabassière, Carrère les Bravengues, F-83660 Carnoules/Var (France) 1997.

10 Dematerialization, eco-intelligent products and services

Dematerialization is an important concept for more foresighted and precautionary ways to reduce the energy and resource flows which we remove from nature. It is an integral feature of the Factor 10 approach. It includes a new consideration of 'life-cycles' of products and product uses. This means that the necessary changes and improvements are by no means restricted to products, but also include the ways products are manufactured, packaged, transported, sold, used, re-used, re-manufactured, again re-used, cascaded and eventually disposed of. On a larger scale, entirely new products and services must be developed⁵³. Key product characteristics will include not just the life-span but also the intensity of use. While it is popularly assumed that we can only enjoy more services if we buy the corresponding 'service-fulfilling machines' (products), this is not necessarily so. Sharing, renting, leasing and lending are only a few examples of concepts of use that as a whole result in reduced material flows.

From the viewpoint of a sustainable economy, only an extension of the life-span and service-life of products leads to a longer circulation of products in the economic process and thus to a deceleration of material flows and a sustainable ecological effect. A doubled product life-span, for example, halves raw material use in production, halves transportation and its associated environmental damage, and at the same time halves the resulting quantities of waste. A further reduction in the volume of material flows can be achieved with a more intensive and shared use of products. Longevity is, however, only one - albeit essential - criterion. Ecologically sound products must in addition to this be non-toxic in production, use and disposal, i.e. they should include no toxic, and hence difficult to dispose of, materials. In any case, designing radically dematerialized processes, goods and infrastructures - while providing continued or improved end-use satisfaction - is one of the major avenues toward sustainability.

With the strategy of dematerialization, entirely new economic perspectives open up. While it is true that with sales of long-lived products, the turnover of companies in their function as 'producers' is reduced, their turnover in their function as 'sellers of product uses' increases. Resource conservation and acute disposal bottlenecks force us to obtain the greatest amount of service possible out of a product. The longer and more intensively a product is used, the less new production and waste the same service entails.

Strategies for extending product-life reach their limits when a genuine technological alternative - an entirely new invention - emerges and can replace the existing product, fulfilling its purpose in a better, more elegant, more cost-favourable or more environmentally-friendly way. If existing products become obsolete in such a way, extending their service-lives would make little sense. Furthermore, the goal of long-life products is not product immortality, but rather the longest and most intensive use of products possible. Longevity also soon reaches its limits with many groups of products, for example, textiles. From an ecological point of view, then, the rising quality of products and the production process gains significance. This also holds true for many other consumer goods - particularly foodstuffs.

53 Bierter, W./Stahel, W. R./Schmidt-Bleek, F., 1996: "Okö-intelligente Produkte, Dienstleistungen und Arbeit", Wuppertal spezial 2, Wuppertal-Institut für Klima, Umwelt & Energie.

With these, the entire chain of production, from farmers to consumers, must be redesigned with less material and energy intensity, shorter transportation distances and above all a higher product quality.

Changing course towards a more sustainable economy with the objective of ‘increasing wealth with much less resource consumption‘ means to decouple economic success from resource throughout - one way to do this is to change to a “new Service economy“, in which the measure of results refers mainly to stocks of goods and their utilization, instead of flows. Such an economy resembles a service enterprise, optimizing and selling use values and offering a customer-oriented service, and in which manufacturing assumes the role of a qualitatively high-standing subcontractor of the user and the use-system. Evidence from a growing number of advanced companies indicates that trends are moving in this direction.

Rising disposal, material and energy costs not only accelerate the process of the dematerialization of products and processes, they also head to higher transportation costs, making it increasingly less worthwhile to ship everything possible halfway around the globe. As a result, more and more products and materials circulate, are refurbished and re-used regionally⁵⁴. This creates jobs and is not only from an ecological point of view profitable as well as technology-conducive.

In place of global robot factories, decentralized production shops are emerging, or in place of barge steelworks there are mini-mills. Above all, we will see the rise of entirely new decentralized markets for used goods, components and valuable materials. It is true that in the area of direct manufacturing, jobs are lost. But new, more ambitious jobs open up, that are not only more highly-skilled, but also decentralized. This in turn reduces traffic volume, as the refurbishing, repairs and overhaul are done nearby. Furthermore, it requires qualified skilled workers. For producing smaller quantities, in many cases it makes more sense and is also more profitable to use specialized labour. With skilled workers, small quantities can be processed and manufactured more quickly and more flexibly than with fully-automated assembly lines - and this is also generally cheaper. Thus, an increasing need for product and service design, services, repairs and re-manufacturing arises. Increasingly more people are sought for re-manufacturing, or the industrial overhaul of old products. Because re-manufacturing includes far more skilled activities than highly-rationalized new production, a positive market effect emerges: if more is re-manufactured, then less is newly produced. Fiscal reform would support this by massively breaking down (ecologically-damaging) subsidies, by making the consumption of energy, natural resources and other materials more expensive and by reducing the tax burdens on labour through cutting income taxes or wage incidentals. The market thus becomes more service-capable, energy and materially-intensive new production become more expensive, and labour-intensive repairs and re-manufacturing become cheaper and remain in the country or region.

54 Bierter, W., 1998: “Strategien zur Erhöhung der Ressourcenproduktivität - Räumliche Zentralisierung oder Dezentralisierung wirtschaftlicher Tätigkeiten?“, Studie für das WZN-Verbundprojekt “Zukunft der Arbeit“ des Wissenschaftszentrums Nordrhein-Westfalen, Diskussionspapier Nr. 11, Graue Reihe des Instituts Arbeit und Technik, Gelsenkirchen; Bierter, W. (mit Brödner, P.), 1998: “Zukunftsfähiges Wirtschaften und Re-Regionalisierung von Wertschöpfungsprozessen“. In: Gerhard Bosch (Hg.): *Zukunft der Erwerbsarbeit. Strategien für Arbeit und Umwelt*“, Campus Verlag, Frankfurt/New York.

Dematerialization and radical innovations of eco-intelligent products, processes and services strengthen the existing trend of shifting jobs from direct production to “services“. The sustainable shift towards a knowledge-intensive and utilization-oriented service economy means that not only will more people be needed. Also new possibilities for part-time work open up, including opportunities for older and physically-challenged people, who earlier could not participate in the world of work. A wider effect is that many enterprises no longer take certain tasks out of the country, but rather transfer them to their employees and help them to achieve status as self-reliant enterprises. Self-employment could thus come to play a growing role.

11 Improving resource productivity: a new entrepreneurial challenge

Sustainability will be achieved on the market, or it will not be reached at all. Only by making it attractive for both manufacturers and users of goods and services, to consume less materials, energy, and space, will improvements in resource productivity become a reality through the powers of the market. The drive for sustainable development, to integrate the environment into the foundations of our economies, will have significant implications for enterprises. Companies that will succeed in the long term are focusing on meeting tomorrow’s challenges today. Businesses that embrace the concept of sustainability can quickly realise that this is not just a cost of doing business. Environmental leadership heads to more efficient processes, lower cost of compliance with new environmental standards and minimisation of potential liabilities. It will open up strategic new market opportunities that can be sustained in the long-term and create business value and competitive advantage. Multinational companies as well as SME’s, as major providers of goods and services, have a key role to play in this transformation.

The core of business strategies consists in developing innovative technical and marketing strategies which identify and optimize sustainable and economically viable solutions ‘from cradle to the next cradle’, with the aim of providing customer satisfaction over long periods of time, interpreting quality as a long-term optimization of system functioning. The appropriate management tools include essentially the optimization of asset management, resource productivity and risk management, including relevant controlling instruments, and the definition of benchmarks and methods to measure improvements towards sustainability.

A number of proactive companies have already started in the direction of increasing resource productivity.⁵⁵ Their examples show that a new economy is beginning to emerge. They discovered that front-end investment to enhance energy, resource and environmental efficiency, and front-end measures to design eco-intelligent products, processes and services, could be recovered and transformed into new businesses, new markets and new profit centres. They quickly noticed that they could make better products than other manufacturers because they approached the problem differently, namely from the viewpoint of utilization. They

55 Fussler, C., 1996: “Driving Eco-Innovation“, London; Elkington, J., 1997: “Cannibals with Forks. The triple bottom line of 21st century business“, Oxford; Stahel, W. R., 1995: “Handbuch Abfall 1. Allgemeine Kreislauf- und Rückstandswirtschaft. Intelligente Produktionsweisen und Nutzungskonzepte“, 2 Bände, hrsg. von der Landesanstalt für Umweltschutz Baden-Württemberg, Karlsruhe.

invented products that use lighter and more durable materials and require less energy to produce. They also found that they could redesign production processes to require less and more flexible capital plant and to recycle and re-use by-products internally - with benefit to their bottom line. By making the sales of utility (of product-uses) through eco-intelligent products, processes and services the core of their business, these enterprises thus encourage the breakthrough of the principle of system-wide product and material responsibility - a principle belonging indispensably to that of sustainability.

This emerging new economy is the result of a complex combination of factors including new technologies and changes in historic relationships between capital, labour, resources and, especially, energy. 'This trend is reinforced by the demand side moving more and more towards services. In the forthcoming "new service economy", the highest priority for generating prosperity will be in:

- improving the productivity, performance-capacity and quality of service functions, and
- maximizing/optimizing the use of systems as an integral unit of products and services during their total life-span, while considering total costs "from the cradle to the next cradle."

The principle which guides service-oriented strategies of dematerialization is the MIPS-concept of Friedrich Schmidt-Bleek. MIPS means material input per service unit, where service unit refers to individual customer's utility. MIPS is therefore crucial for both the implementation of new fiscal policy measures and enterprise strategies to achieve more resource intensity because it enables the operationalization and measurement of dematerialization. In this view, dematerialization means to decrease for a given amount of utility (service-units) which individuals may derive from a product, the (direct and hidden) material input into this product, or to increase for a given material input the amount of utility which individuals may derive from a product. Economically, this principle puts individual customers' utility right at the centre of product development and design. This may sound trivial. One may argue that in an efficiently working market economy, customers' utility is always at the core of product development and design.

In modern mass production this is, however, only true in the sense that customers' utility serves as a very abstract guideline. There is no systematic orientation at individual customers' utility. Even in market segments dominated by small-batch production, customization is confined to the offer of a limited number of product variants. Beyond that, product development in mass production and in small-batch-production is, as many cases of over-engineering underline, often one-sidedly determined by scientists and engineers and their technological views and interests. A systematic orientation towards customer's individual utility involves a much higher degree of customization than we observe currently in most of industry.

The main benefits for pro-active entrepreneurs include a higher long-term competitiveness through reduced costs, as well as higher product quality and customer loyalty, in addition to a 'greener' image; the main risk is the increased uncertainty due to the introduction of the factor 'time' into the economic calculation. The latter can, however, be substantially reduced by appropriate design strategies, such as modular System design for inter-operability and compatibility between product families, component standardization for ease of re-use, re-manu-

facturing and re-cycling, and the incorporation of loss and abuse prevention into products. Radical innovations require a long-term view because novel eco-intelligent technical, organizational and social solutions can take years from initial idea to full commercialisation. This demands full commitment at the highest levels of a company adopting sustainability principles as a fundamental test of all developments and as a key operating principle in business planning and decision-making on investments, processes, products, services, and marketing strategies.

We can therefore see that the factor-10 concept of dematerialization, the concepts of a knowledge-based economy and a new Service economy have much in common. These conceptual similarities indicate that there are possibilities of synergies between factor 10, the development of a knowledge-based economy and a new Service economy, but these possibilities should not be taken for granted. Rather, we should ask under what conditions can these synergies be established?

As we have discussed above, a knowledge-based economy does not perform according to traditional growth principles, but according to the accumulation of knowledge. Growth does not primarily result from increasing volumes of production, but from value-added created by investments in knowledge. Most dematerialization strategies depend on an increased share of the value-added created by knowledge in relation to the share of value-added from material and their immediate processing. Knowledge-intensity, however, depends on particular strategies of dematerialization.

The crucial point which we want to underline here is that dematerialization will only enhance growth, if it is based on innovation and thus requires new investments in knowledge. If this is not the case, dematerialization may not enhance (and perhaps may even hinder) growth in a knowledge-based economy. As Weizsäcker, Lovins and Lovins⁵⁶ show, it is often easily possible to dematerialize by a factor of 4 with current knowledge and technology. To the extent to which this is true, dematerialization by a factor of four does not drive knowledge-based growth as it requires no innovation and new investment in knowledge. Only if we go far beyond factor 4, which requires radical innovation and considerable new investment in knowledge, can we expect to drive sustainable economic development in the direction of a knowledge-economy and knowledge-based growth. This is an important economic reason in favour of seeking to achieve Factor 10 or more.

56 Weizsäcker, E. U. v./Lovins, E./Lovins, H., 1997: Factor four: doubling wealth - halving resource use, the new report to the Club of Rome, London, Earthscan.

12 Conclusion: Problem-solving growth in a Customized Economy

With respect to innovation strategies, the factor-10 concept offers an important and promising strategy for the advancement of the knowledge-based economy and the new service economy, and by that, to sustained growth and full employment in the advanced economies. Driving development of the knowledge-based economy and the new Service economy in the advanced economies reduces global resource use and also leaves reasonable opportunities of industrialization and socio-economic development for developing economies and newly industrializing countries - and thus points the way towards a reasonable trajectory of globalization.

This is what we have called “problem-solving growth“ in a study for the Commission of the European Union on the “Future of Industry in Europe“⁵⁷. In this study, we define problem-solving growth as growth which derives its dynamics from two sources, namely:

- development of innovative solutions to social and environmental problems, and
- the valorization of diversified needs, and of social and cultural diversity.

With this concept, we do not wish to offer a new theoretically based concept of growth, but simply point to the alternatives to many current ideas and strategies of competitiveness which often advance enterprise competitiveness at the expense of mass income, welfare and environmental quality. We also want to indicate with this concept, that the environmental limits to growth which the Club of Rome postulated and which still strongly shape our understanding of the relationship between the environment on one side, growth and employment on the other, may be overcome with strategies of dematerialization, if dematerialization in turn is based on innovation.

57 Lehner et al., 1993: New markets, new structures and new strategies. The future of industry in Europe. Fast 1. Occasional Papers/European Community/Forecasting and assessment in Science and Technology.