# Seizing the Opportunities of a New Economy: Challenges for the European Union

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September 2000

*Abstract:*

*The economic performance of the EU has taken on a new dimension with the notion of a "new economy". While ICT has become a major factor in explaining the prolonged, non-inflationary boom in the United States, the EU is lagging behind in most aspects of ICT. Arguing that the impact of ICT is inter-related with a range of factors, including innovation, human capital and organisational change, this paper concludes that systemic weaknesses limit the ability of the EU to adjust and capitalise on new economic and technological opportunities. The direction of remedial action is considered in the areas of: market segmentation; science-industry linkages; ICT infrastructure and services; labour markets and skills; and financial markets, venture capital and entrepreneurship. Capitalising on the agenda set by the Lisbon summit 2000 will greatly hinge on the extent to which there will be improved conditions both for co-ordination between policy areas and complementarity between measures at the national and Community levels.*

## 1. Introduction[1]

Technical progress and human capital have always been central to economic performance. From the work of Romer (1990) onward, it has also been increasingly recognised that growth is not a given, but is strongly influenced by institutions and policies. At the same time, measuring the sources of growth is notoriously difficult. In econometric growth studies, technical progress has mainly been treated as a residual, lumped together with what was left unexplained once capital and labour input had been assigned their shares. In the 1980s, when information and communications technology (ICT) started to draw attention, Solow stated that its impact seemed observable "everywhere except in the productivity statistics". Economists consider that they have done better when it comes to the contribution of human capital. Psacharoulos (1994) found that a sizeable share of cross-country variation in growth performance over the last decades could be put down to education.

In the 1990s, however, the picture changed. Several studies (Barro and Lee., 1996; Nehru *et al.*, 1995) cast doubt on the impacts of human capital and education on cross-country variation in growth. Instead, recent changes in US growth patterns have been associated with new technologies, especially ICT. These changes include the prolonged boom and high productivity growth, and the virtual absence of inflationary pressure late in the business cycle and at levels of unemployment that are far below what used to be viewed as compatible with price stability. US monetary policy has adjusted to what has been seen as a partly new situation. Meanwhile, studies using new data and methodologies have lent empirical support to the notion that ICT is making a significant contribution to US productivity growth, and not only from the producer side (Jorgenson and Stiroh, 2000; Ohliner and Sichel, 2000). On the other hand, little comparable work has been undertaken on other countries.

These perceptions have fuelled the popular notion of a "new economy", embraced by the United States and a few other countries, while the majority of countries are either seen as running a serious risk of falling behind, and/or as being potentially well-placed for catching-up. These views have taken strong hold in the European Union (EU) as the gap between the US and European growth performances has widened. Among other things, there are concerns that the "new economy" brings in its wake wider income disparities, and makes protecting social cohesion increasingly costly and untenable. There are also worries that the vast size of the US market provides an edge that it would be difficult even for an integrating Europe to match. In Lisbon in March 2000, however, the European Council decided on major efforts over the coming years to turn the "new economy" into an opportunity. The European heads of state agreed on an ambitious agenda that includes upgrading ICT infrastructure, bringing ICT into schools, moving towards a unified European patents system, improving conditions for entrepreneurship and small business, and embarking on extensive "benchmarking" of competitiveness.

Does the "new economy" exist? Phrased in those terms, the question may seem *philosophical* rather than *economic*.[2] Here, the focus is rather on whether there have been recent important changes affecting the fundamental characteristics and determinants of growth, and what these changes entail for individual countries and for policy, particularly in the EU. Partly building on work in progress at the OECD on the factors affecting growth (OECD, 2000a; 2000b; 2000c), this paper examines the challenges confronting the

1. This is a revised version of an earlier discussion paper presented at *Economic Integration in Europe*, the Swedish Network for European Studies in Economics and Business, May 23rd-26th, 2000, Mölle, Sweden. Ulf Jacobsson of the Industrial Institute for Economic and Social Research (IUI), Stockholm, and colleagues at the OECD, provided insightful comments. The content of the paper is entirely the responsibility of the author and does not necessarily reflect the views of the OECD or its Member countries.

2. The answer depends on what one means by "new". Among some of the earliest of the Greek philosophers, this was already a central question. Thales (545 BC.) believed that everything emanates from an essential substance (water) which never changes; it just takes on new shapes. Herakleitos (540-480 BC.), on the other hand, perceived the world as being in a state of constant flux.

EU with respect to the "new economy". In Section 2, the paper first reviews the EU's growth performance, especially compared to the United States and outlines the main phases of the EU's policy agenda for raising competitiveness. Section 3 takes a closer look at the increasing importance of ICT and the EU position in this area. Section 4 examines the associated broader framework for industrial organisation, innovation and human capital. The policy challenges confronting the EU are addressed in Section 5. The last section concludes.

Although important policy changes have been undertaken, not least as part of the European integration process, this paper argues that additional reforms are needed. The direction of remedial measures is examined in the following areas: market segmentation; science-industry linkages; ICT infrastructure and services; labour markets and skills; and financial markets, venture capital and entrepreneurship. It is concluded that systemic weaknesses limit the ability of the EU to adjust and capitalise on new economic and technological opportunities. While the Lisbon summit of March 2000 has provided an opportunity for the EU to respond, there is a need of improved conditions both for co-ordination between policy areas and for synergy between the Community and national levels. Naturally, given the scope of this paper, it does not take into account all the challenges facing the EU, such as the issues associated with eastward expansion. As the underlying OECD growth project has yet to be completed, the observations and conclusions presented should be viewed as preliminary.[3]

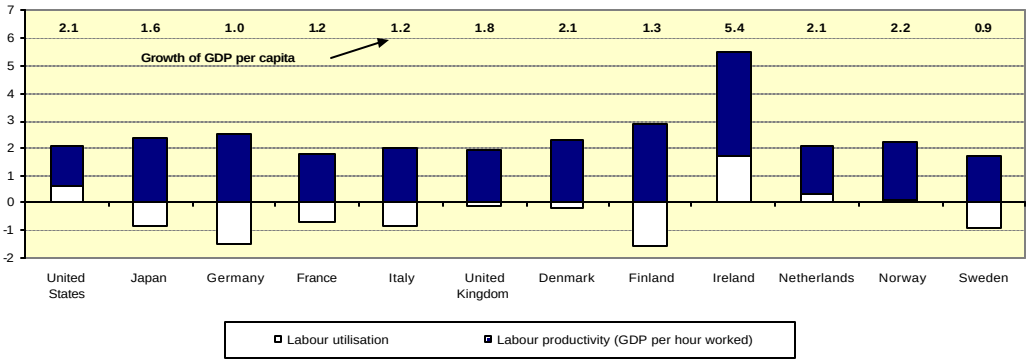
## 2. Sluggish European growth

The countries of the European Union enjoy a high standard of living in many respects, as is observable from various welfare indices, such as life expectancy, health, $CO_2$-emission rates, etc. (World Bank, 2000). In terms of economic growth, however, the region has gone through several decades of dismal performance. Continued sluggishness will clearly have dire consequences for consumption opportunities and should ultimately be expected to have repercussions on many aspects of welfare. Considerable social strains are already visible, not least as weak labour utilisation – and high unemployment – remains one of the key features of the EU's record. In the 1970s, it was increasingly recognised that the European set-up of small, segmented national markets constituted a handicap for economic performance. The compartmentalisation of institutional and regulatory conditions constrained competition and the potential to exploit economies of scale (Cecchini, 1988; Commission of European Communities, 1988), and hampered technical progress and innovation (Geroski, 1988). This notion contributed to the launching of the Single Market in 1992, which aimed to establish complete mobility for goods, services, capital and labour. Similar concerns have contributed to the rationale behind the newly established European Monetary Union (EMU).

An explicit Community-level policy for increased competitiveness was essentially formulated by the 1993 White Paper and further developed with the 1994 Framework for Concerted Action (Commission of European Communities, 1994*a;* Commission of European Communities, 1994*b*). These initiatives introduced a range of measures designed to improve the business environment, including through better conditions for investment in intangible assets, deregulating key infrastructure in areas such as electricity, telecom and ICT more generally, and supporting SMEs at key stages of firm creation and development. It further called for better co-ordination among EU member states in raising industrial competitiveness. Although the process which was thereby set in motion continued during the 1990s, there has nevertheless been a feeling that the EU has not done enough to address the key factors limiting competitiveness.

3. The 1999 Ministerial Council asked the OECD to examine recent disparities in economic growth across Member countries and assess the role of "new factors". An interim report was presented at the Ministerial Council in June 2000; the final report is due for 2001.

**Figure 1. Contributions of labour utilisation and labour productivity to growth of GDP per capita**
Average annual growth rates (%) 1990-98




*Source:* OECD.

Furthermore, EU growth rates continued to lag in the 1990s, not least when compared with the United States. In 1990-98, EU GDP grew by 2% a year, whereas the US recorded 2.6%. The EU figures may appear fairly respectable when judged from productivity growth in absolute terms. However, this was partly because of rising unemployment, as the suppression of low-productivity jobs has led to higher average productivity in the jobs that remain. France and Germany, which generated no net jobs over the decade, actually displayed higher growth than the United States in average productivity per hour worked, although their growth in GDP per capita was significantly lower. By contrast, in the United States, the number of persons employed grew by 1.3% a year over the 1990s, a level matched only by the Netherlands and Ireland in the EU. Figure 1 illustrates these varying performances, showing how labour utilisation and labour productivity contributed to cross-country variations in growth performance between 1990 and 1998.[4] The contribution of labour utilisation varied the most and was clearly negative in several European countries. Whether countries grew fast or not, however, the largest part of growth in per capita income came from higher labour productivity.

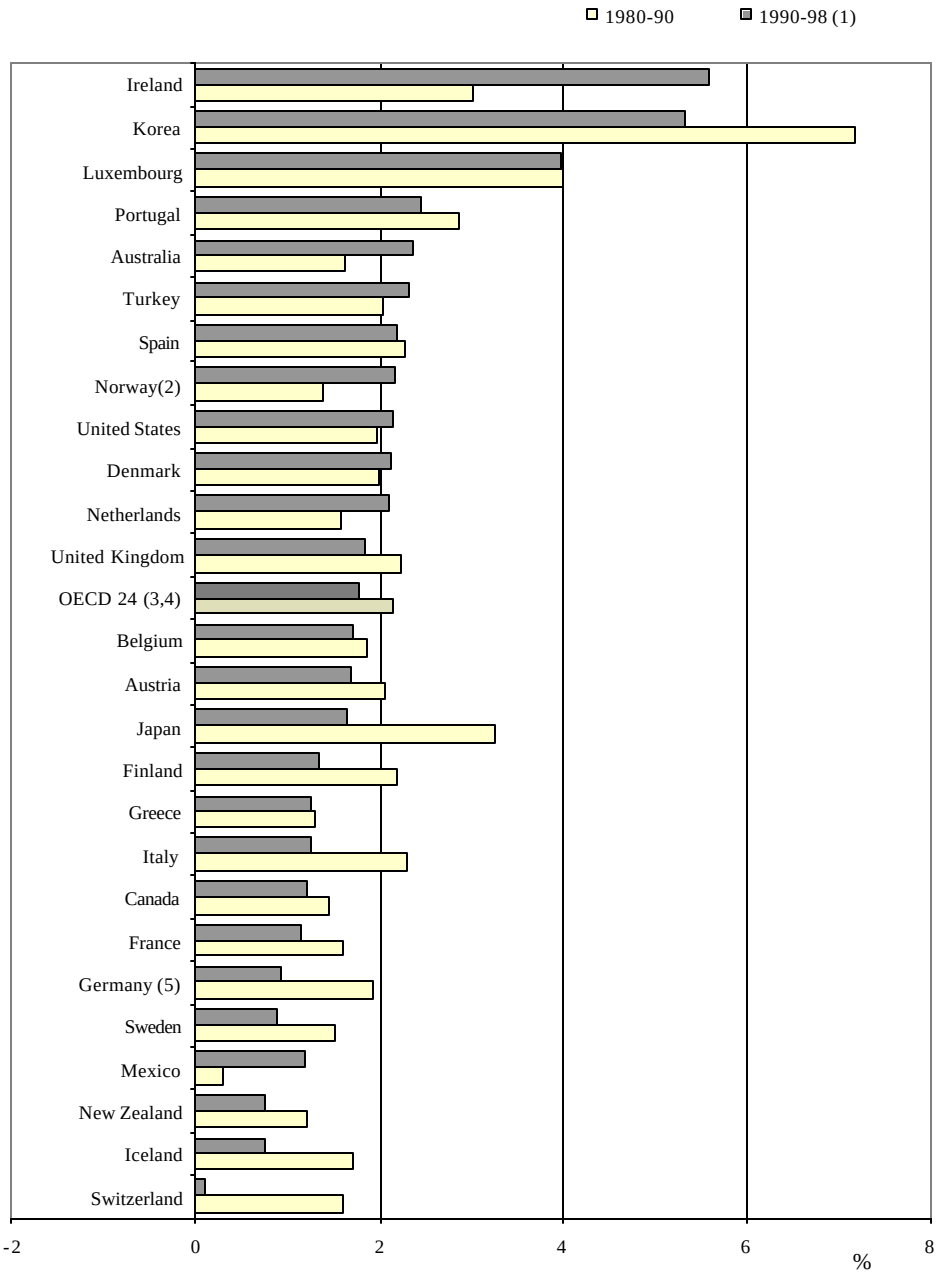
The end of the 1990s has been widely viewed as promising for the EU. Recovery has spread, although it so far lacks momentum in some key countries, notably Germany and Italy. Whereas the EU grew by 2.3% in 1995-98, the US economy accelerated to 3.7% a year. For the first time since 1945, during this period the United States surpassed the EU in productivity growth. The good news for Europe is that this partly reflected a move towards a more "job-intensive" growth process (a reversal of the mechanism at work during the first half of the decade). The bad news is that the gap between the EU and the United States is widening not only in terms of income but, also, in productivity terms.

In the place of this sluggish European growth rate compared to that of the United States, one might have expected something rather different based on the so-called "catch-up" hypothesis. According to this notion, countries at initially lower income levels should be expected to grow faster because they can benefit from learning effects and the transfer of technologies from those ahead (Fagerberg, 1994). Looking across countries, patterns of growth since World War II have been much influenced by the forces pushing towards convergence (OECD, 2000*b*). The performance of individual countries indicates that catching-up also played a role in the growth dynamics of the 1990s. Higher than average growth in per capita GDP in Ireland, Korea, Poland and Portugal is consistent with their relatively low levels of GDP per capita at the beginning of the decade. Meanwhile, low output growth per capita in Switzerland matches the above-

4. Growth in GDP per capita can be broken down into GDP per hour worked and the total number of hours worked in relation to the population. The first component, GDP per hour, is an aggregate indicator of labour productivity, while the second measures labour utilisation.

**Figure 2. Trend growth of GDP per capita in the OECD area over the past two decades**

Total economy, percentage change at annual rate




| | 1980-90 | 1990-98 |
|---|---|---|
| Coefficient of variation OECD total [6] | 0.57 | 0.67 |
| Coefficient of variation EU15 | 0.31 | 0.61 |
| Coefficient of variation OECD24 [4] | 0.32 | 0.61 |

1. 1990-97 for Iceland and Portugal, 1991-98 for Germany.
2. Mainland only.
3. Growth rate for OECD 24 is computed as a weighted average of country growth rates, using country GDP levels expressed in 1993 EKS PPPs as weights.
4. Excluding Czech Republic, Hungary, Mexico and Poland.
5. Western Germany for 1980-90
6. Excluding Czech Republic, Hungary and Poland.

*Source*: OECD (2000*b*).

average initial income level. Between the 1980s and the 1990s, however, the spread of growth rates in GDP increased across the OECD as some of the leading countries surged further ahead, most notably the United States. But even within the EU there was increased variation, with growth picking up in several small, fairly advanced countries, notably Denmark, Ireland, the Netherlands and Norway, while it slowed in France, Germany and Italy. Towards the end of the decade, Finland, Iceland and Sweden also experienced a revival in growth rates.

Another aspect is the unprecedented duration of the US productivity hike. While the expansion continues, and unemployment has stabilised at historically low levels, there have so far been little signs of inflationary pressure. Some observers have pointed to monetary and budgetary policies in explaining this performance, and some see the United States today as a "bubble economy" (Cooper *et al.*, 1999). The United States has developed substantial macroeconomic imbalances in the form of a growing current account deficit, negative savings and the build-up of foreign positions in US securities and equities – which have fuelled "rocketing asset prices". Some argue that the US performance has been artificially enhanced by demand underpinned by unrealistic asset valuations, and that the economy will crash once expectations falter, capital flows are reversed and asset prices tumble. It is true that wealth creation in equity markets, especially in technology sectors, has become a growth engine of significance for the overall economy. Considerations of that kind cannot, however, explain the level and exceptional duration of the US productivity record.

As can be observed from Figure 2, which compares cyclically adjusted growth in GDP per capita in the OECD countries, there is no evidence of any general surge in growth in the 1990s compared to the 1980s.[5] Of the European countries, only Denmark, Ireland, the Netherlands and Norway displayed an upturn. In fact, only a quarter of the OECD countries recorded higher trend growth in the 1990s. Of course, it is possible that growth may have become more difficult to measure, *e.g.* because the service sector has become more prominent and because of rapid quality improvements and shifts towards new products. Ongoing revisions of past growth rates, undertaken by the United States based on new measures of quality improvement in services, point to strongly upgraded estimates in recent years (Fixler and Zieshang, 1999). In the absence of evidence of any general upturn in growth *levels*, however, it is rather the prevalence of shifts in the *patterns* of growth, such as those associated with greater divergence and the duration and less inflationary nature of the US performance, which stand out. Changes have emerged in other respects as well.

Labour productivity growth depends on capital deepening, *i.e.* the services provided by capital to each worker, and on multi-factor productivity (MFP).[6] The faster capital deepening occurs, the faster the growth of output per worker. Capital deepening played a significant role in the 1990s but occurred in a limited number of sectors. Although there are considerable measurement problems, MFP stood out as the most important determinant of labour productivity growth. While estimates vary across countries, with exact numbers dependent on the methodology used, MFP growth was relatively stable in most countries at between 0.5% and 2% per annum irrespective of the measure used. However, in certain countries, there are indications of a noteworthy pick-up towards the end of the decade. These include the United States, again, at an apparently late stage of the cycle. MFP also accelerated significantly in Australia, Denmark, Finland, Ireland and Sweden – by more than 0.5 percentage points in each. This group corresponds to those countries that either improved their overall performance in the decade as a whole (the Netherlands being the only exception) or whose growth rose markedly in the late 1990s from already high productivity levels (Finland and Sweden).

5. For methodological details, see OECD (2000b). Actual GDP growth and the trend growth are broadly consistent. Adjustment for the cycle leads to a small increase in the 1990s, but only for Japan is there more than a marginal revision – from 1.0 to 1.6 % on average – leaving Japan's performance way below that of the previous decades.

6. Multi-factor productivity (MFP) can broadly be defined as the overall efficiency with which labour and capital are employed in the economy, see further OECD (2000b; 2000c).

MFP is determined by various factors, including generally improved ways of producing goods and services. Typically, however, it is spurred by innovation, technical progress and organisational change. In recent years, it is ICT and the accompanying rapid economic change and restructuring, which has attracted attention. This is particularly the case in the United States, where there has been remarkable productivity growth in the ICT-producing sector, but also extensive discussion on changing growth dynamics in other sectors as a result of using ICT. Other countries have sensed a fear of being left behind, which very much applies to Europe. At the path-breaking "Lisbon Summit" of March 2000, EU heads of states agreed to turn the "new economy" into an opportunity for raising economic dynamism, making this a top priority for the European policy agenda over the coming years. The Council set concrete goals for strengthening the regulatory set-up for electronic commerce in order to boost consumer confidence in new services, improving conditions for new technology-based firms through strengthened venture capital markets, achieving a better integration of science and technology policies in the member states, removing barriers to mobility of researchers, establishing a Europe-wide patent system, wiring all schools to the Internet within two years, and increasing social participation and counteracting the creation of a "digital divide". It also set out increased ambitions to monitor and benchmark policy performance.

To sum up, the EU has displayed decades of sluggish growth performance, and the gap with the United States has widened rather than diminished in the 1990s. Evidence of divergence in the growth patterns of OECD countries in general, the exceptional strength and duration of US productivity growth, and the increased significance of multi-factor productivity in those economies which improved their performance the most (especially towards the end of the decade), along with observations of the increased importance of new technology, and particularly ICT, has led to widespread interest in the notion of a "new economy". While past EU policy efforts to improve competitiveness have been insufficient, this agenda has been taken up at the highest policy level as a major opportunity to achieve a more dynamic economy in the EU.

## 3. ICT and the EU

Irrespective of recent changes in growth dynamics, "traditional factors" remain important for economic performance. These include macroeconomic conditions, education and training and the functioning of product and factor markets. In the "new economy" discussion, however, attention has focused on the role of ICT, which now represents by far the most dynamic part of business investment, and not only in the United States. The share of ICT equipment in non-residential investment has been increasing steadily in all G7 countries over the last decade, although it is highest in the United States (Table 1). The share amounted to 20% of non-residential investment in the United States as of 1996, excluding investment in software which is estimated at an additional 10% (6% on average in OECD countries). Among the G7 countries, ICT investment progressed at two-digit levels over the past two decades, accounting for between 10% and 20% of total non-residential investment in the business sector (Schreyer, 2000).

It is nevertheless clear that the United States has a strong lead in ICT, which shows up in different ways. As can be seen from Figure 3, for instance, all European countries lag substantia lly behind in terms of secure servers per million inhabitants. Table 2 points to a compelling US lead over the EU (and Japan) in most other respects as well, although not in the case of mobile users. Figure 4, which illustrates predictions regarding business-to-business electronic commerce across regions and industries, shows that the United States is expected to retain its lead. According to these predictions, the value of such trade in Europe would start catching up as from 2003, while other parts of the world would continue to fall behind. On the sectoral level, high-tech and electronics would continue to dominate, but several other areas are set to evolve into large markets, including notably transportation equipment and transportation and logistics services. In the case of business-to-consumer electronic commerce, the US Census Bureau reports retail e-commerce sales of USD 5.2 billion for the last quarter of 1999 and USD 5.3 billion for the first quarter of 2000. While not directly comparable, Euro monitor estimates that the value of consumer spending at European sites was USD 770 million in 1999, and predicts that this will increase to USD 2 billion for 2000.

**Table 1. The evolution of investment in ICT**

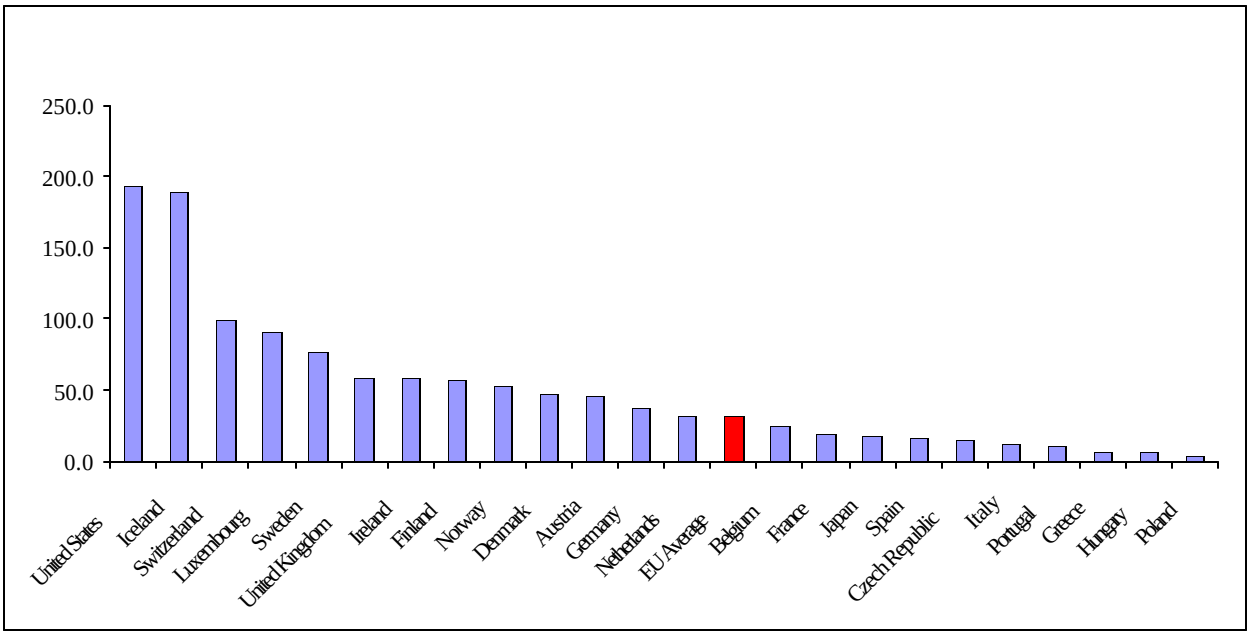
| | Canada | France | Western Germany | Italy | Japan | United Kingdom | United States |
|---|---|---|---|---|---|---|---|
| Share in non-residential GFCF | | | | | | | |
| IT equipment | | | | | | | |
| 1990 | 7.3 | 5.0 | 3.5 | 4.1 | 3.8 | 7.5 | 8.7 |
| 1996 | 10.1 | 6.0 | 6.1 | 4.2 | 4.6 | 11.7 | 13.4 |
| Communication equipment | | | | | | | |
| 1990 | 5.3 | 3.8 | 3.7 | 3.6 | 1.5 | 5.8 | 7.0 |
| 1996 | 6.1 | 4.9 | 4.8 | 5.4 | 3.5 | 6.6 | 6.5 |
| Average annual rate of growth of constant price expenditure on: | | | | | | | |
| IT equipment[1] | | | | | | | |
| 1985-90 | 17.2 | 16.2 | 18.8 | 20.8 | 23.6 | 25.5 | 19.6 |
| 1990-96 | 17.6 | 11.0 | 18.6 | 12.9 | 14.5 | 17.6 | 23.8 |
| Communication equipment[1] | | | | | | | |
| 1985-90 | 20.6 | 19.0 | 18.4 | 25.6 | 34.7 | 20.3 | 16.7 |
| 1990-96 | 4.3 | 2.1 | 3.4 | 9.2 | 15.0 | 2.2 | 5.1 |
| Price deflator[2]: | | | | | | | |
| IT equipment | | | | | | | |
| 1985-90 | -9.4 | -10.2 | -10.3 | -8.1 | -12.0 | -6.7 | -10.4 |
| 1990-96 | -11.1 | -9.2 | -10.7 | -9.1 | -12.5 | -9.1 | -11.5 |
| Communication equipment | | | | | | | |
| 1985-90 | 1.3 | 0.5 | 0.4 | 2.7 | -1.3 | 4.0 | 0.3 |
| 1990-96 | -0.7 | 1.2 | -0.4 | 1.3 | -2.2 | 1.2 | -1.1 |
| Share of ICT in nominal productive capital stock: | | | | | | | |
| 1985 | 4.3 | 2.4 | 2.9 | 1.3 | 1.2 | 3.6 | 6.2 |
| 1996 | 5.0 | 3.2 | 3.0 | 2.1 | 2.3 | 5.2 | 7.4 |

1. Harmonised deflator.
Source: Schreyer (2000).

While Europe lags the United States, the overall situation masks great variation. Those EU countries which are less advanced in these areas, *i.e.* Greece, Italy and Spain, are now undertaking heavy investment in business-to-business electronic commerce, and show signs of catching up. The Nordic countries and the United Kingdom are relatively advanced, *e.g.* in regard to PC penetration, number of Internet hosts per inhabitant or use of the Internet for commerce.[7] The penetration of mobile users, which reaches above two-thirds of the population in the Nordic region, is widely viewed as providing the EU with an edge in the start-up of mobile commerce. Related areas in which the EU may also enjoy an advantage *vis-à-vis* the United States include digital TV and methods for more secure communication, *e.g.* smart cards or the use of mobile telephones for identification. However, the development of the third generation of mobile networks, already under way, will exert a major impact on the preconditions for mobile commerce. Technology, as well as institutions and regulatory conditions, are changing fast, and the scope for genuine competition will be decisive for the ability of producers and service providers to respond.

7. See European Commission (1999) for detailed cross-country comparisons.

**Figure 3. Secure servers in the EU, the United States and Japan**
Per thousand inhabitants, January 2000




*Source*: OECD.

**Table 2. Indicators of e-commerce readiness: Japan, Europe, United States**

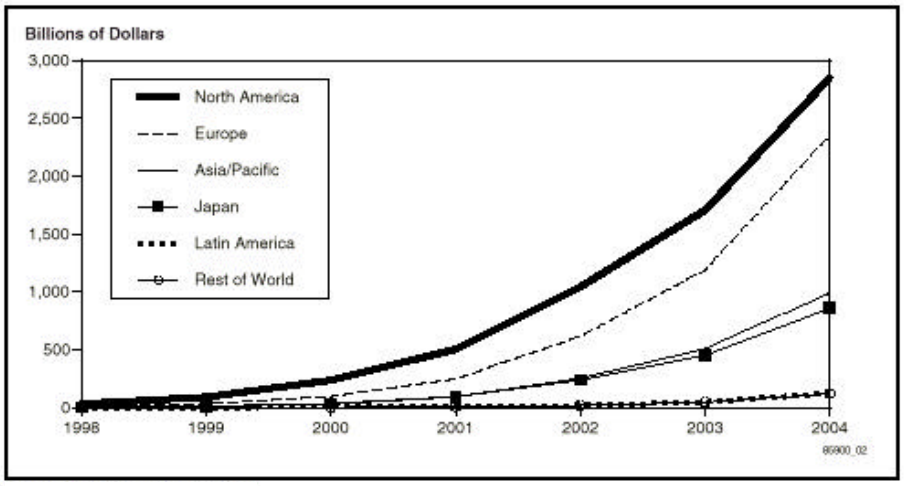
| | Japan | European Union | United States |
|---|---|---|---|
| Internet hosts per 1 000 inhabitants 1999 | 18 | 30 | 118 |
| Secure Web servers per million inhabitants 1999 | 9 | 25 | 123 |
| Installed PC base per 100 inhabitants 1997 | 20 | 21 | 50 |
| PCs per 100 white collar workers 1997 | n.a. | 47 | 82 |
| Employees using e-commerce enabling technologies 1999 (percentage) | 60 | 49 (1) | 65 |
| ICT expenditure/GDP (percentage) 1997 | 7.5 | 5.9 | 7.7 |
| ICT in business sector R&D (percentage) 1997 | 26 | 20 | 22 |
| Cellular mobile subscribers (percentage) 1999 | 45 | 40 | 30 |

(1) Average of France, Germany, Italy, and the United Kingdom.
*Source*: OECD (2000*i*) and OECD Telecommunications database 2000. Host data from the Internet Software Consortium; secure Web servers data from Netcraft.

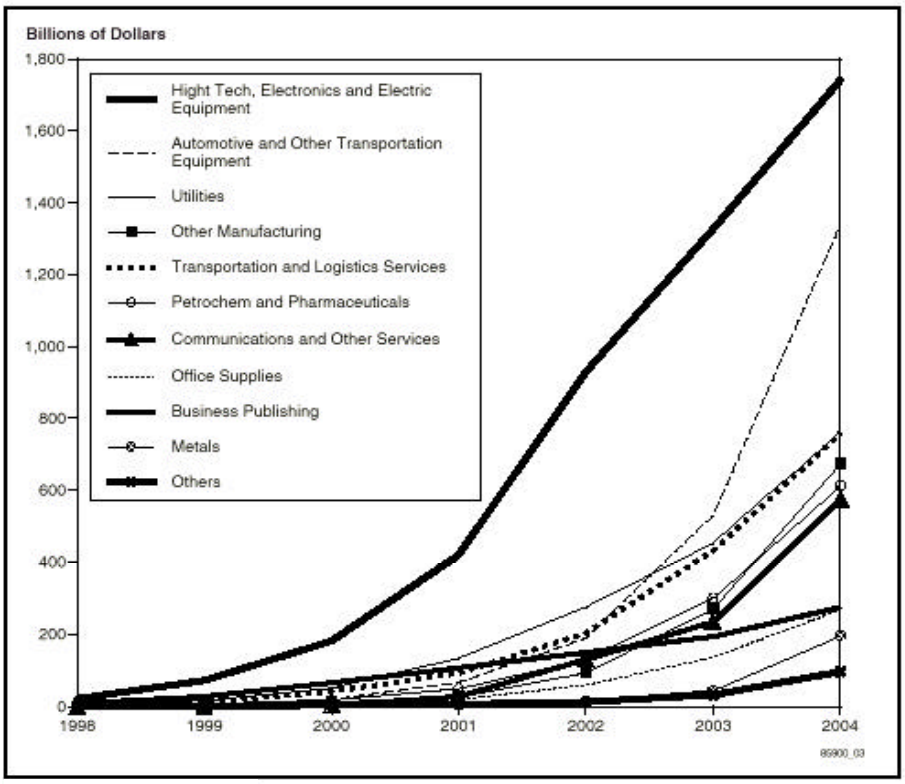
An important factor in how ICT is used is the extent to which firms approach it in a proactive and strategic way. There are indications that European firms are less aware of the need for a formal e-commerce strategy (PFA Research, 1999). This is reflected in the absence of any correlation between use of the Internet and adoption of a formal e-commerce strategy by European firms. In fact, there appears to be a slightly negative correlation between the rate of Internet adoption and firms' perception that e-commerce plays a strategic role in their company. With the exception of the Nordic countries, and on the basis of a restricted sample, firms in European countries such as the Netherlands, Spain and the United Kingdom are perceived as relatively unlikely to view electronic commerce as strategically important (OECD, 2000*f*).

**Figure 4. Predictions of business-to-business electronic commerce 1998-2004**
Billions of USD

a) Across regions




b) Across industries




*Source*: Knight (2000).

According to available estimates for the United States, almost all economic sectors experienced major cost reductions, rationalisation and efficiency gains in the 1990s which were related directly or indirectly to the expansion of business-to business electronic commerce. Certain estimates point to reductions in process costs by as much as 10 and 25%, and in product costs by some 20% (Goldman Sachs, 1999). For Europe,

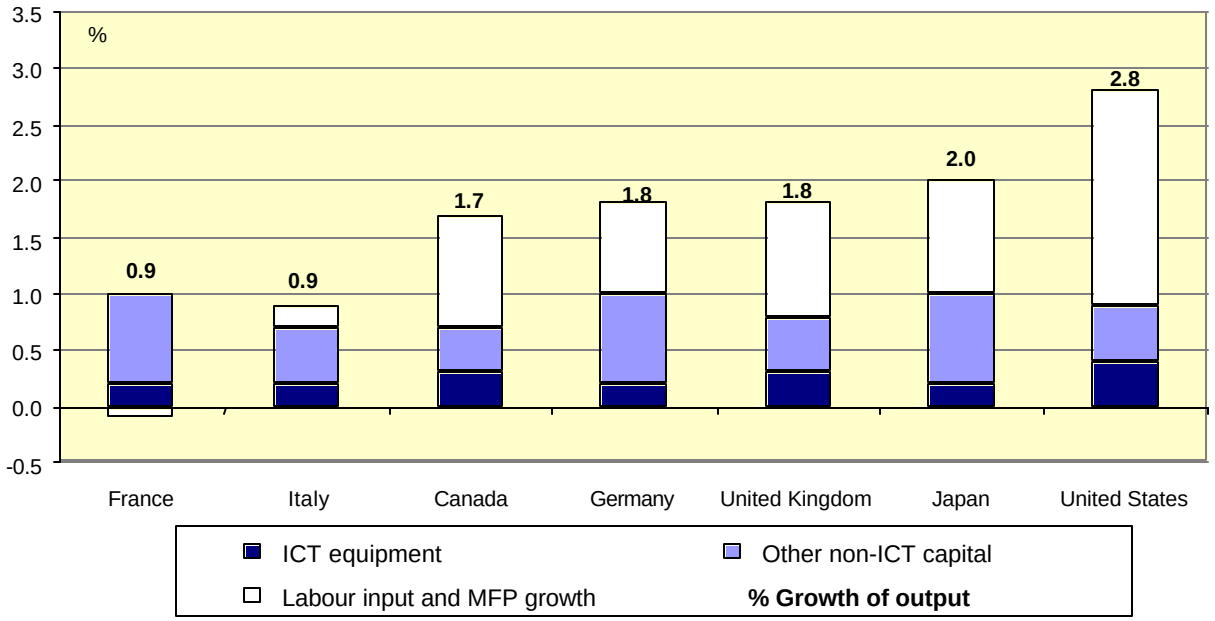
no similar estimates are available. There are, of course, numerous anecdotal observations of dramatic restructuring and increased productivity, in manufacturing as well as in services, which are related to the adoption of ICT and new technologies. In many services, the EU seems to have been catching up with the United States during the late 1990s, but the gap remains significant and the uptake has been associated with the rapid reforms flowing out of the European integration process, privatisation, and regulatory reform (Commission of European Communities, 1998; OECD, 2000*h*). The clearest examples of successful electronic commerce are from the Nordic region. Ranking the best banking Web sites in 1999 (using criteria such as accessibility, navigability, customer service, content, technical performance and visual expression), Interbrand[8] nominated a US bank in pole position, followed by three Nordic banks.

Looking at overall economic performance in the 1990s, the presence of major positive impacts of ICT on productivity is now well recognised as far as the United States is concerned. The Macroeconomic Advisers (1999) concluded that more than half of the contribution of capital deepening to productivity growth in the United States in 1998-99 was due to ICT equipment (0.65% for ICT, out of 1.19% for total capital deepening). Assessing the impact of ICT, especially across countries, is a daunting task, however, which is plagued by measurement problems. Rapid quality improvements and reduced prices limit the ability of traditional productivity measurements to capture the impact of ICT, and there is great variance between OECD countries in the extent to which they apply methods, notably hedonic price indices, which try to control for these changes. A first cross-country examination controlling for differences in measurement methodologies (Schreyer, 2000), concluded that ICT investment exerted a significant and consistently increasing impact on output growth during the 1990s in all G7 countries. In Canada, the United Kingdom and the United States, ICT equipment was responsible for about half of the entire growth contribution of fixed capital on average during 1990-96 (Figure 5). In France, Germany and Japan, the contribution of ICT was somewhat smaller, but still significant. The fast pace of ICT investment has brought about an increase in total investment and extensive substitution for other investment, raising the marginal rate of productivity of all production factors in these countries.

There are still divergent views regarding the impact of ICT on MFP, and particularly on MFP outside the computer industry. Here, measuring impacts on MFP is particularly difficult, especially in services which make up a rapidly growing share of the economy and which are important users of ICT. The application of new methodologies, notably in the United States, which are better suited to picking up embodied technological change, strengthens the impression that ICT played a crucial role in explaining the upturn in MFP, as well as in overall productivity growth, during the second half of the 1990s. Using data up to 1998 and a sectoral decomposition of MFP, Jorgenson and Stiroh (2000) found an accelerated impact on MFP from the computer-producing sector which was sizeable enough to contribute significantly to overall productivity growth. In accordance with Gordon (1999), they did not find evidence of an increase in MFP growth outside the computer-producing industry. However, both Oliner and Sichel (2000) and Whelan (2000), using approaches that, for the first time, allow impacts from the use of both computer hardware and software to be captured, found that recent data do support an uptake in contributions from ICT, emanating from outside the computer industry. These studies, as well as the Council of Economic Advisors (2000), concluded that some two-thirds of the increase in US labour productivity growth in the late 1990s was due to the combined effect in ICT-producing industry and the utilisation of ICT equipment. Although it remains difficult to capture disembodied technology transfers, the present state of the evidence points to significant impacts from ICT in the form of production as well as its utilisation in the US economy. While straightforward comparisons with other countries are not yet possible, Figure 5 suggests that the direct contributions of ICT to productivity growth in several other OECD countries are not that different from those experienced in the United States; it is the combined contribution of growth in labour input and MFP which appears to be higher in the United States.

8. http://www.interbrand.com/IBM.html

**Figure 5. Contribution of ICT to output growth in G7-countries**
Average annual growth rates (%)




*Source*: Schreyer (2000).

Although the effects we observe today are likely to be the result of decades of gradual evolution, it may be too soon for the full effects of ICT to have emerged. Use of the Internet and electronic commerce, for instance, is a phenomenon of the second half of the 1990s and is unlikely to have yet had its full impact on aggregate productivity. There are wide expectations that continued expansion of ICT and electronic commerce will have much more profound effects on production and distribution efficiency than have been seen to date.

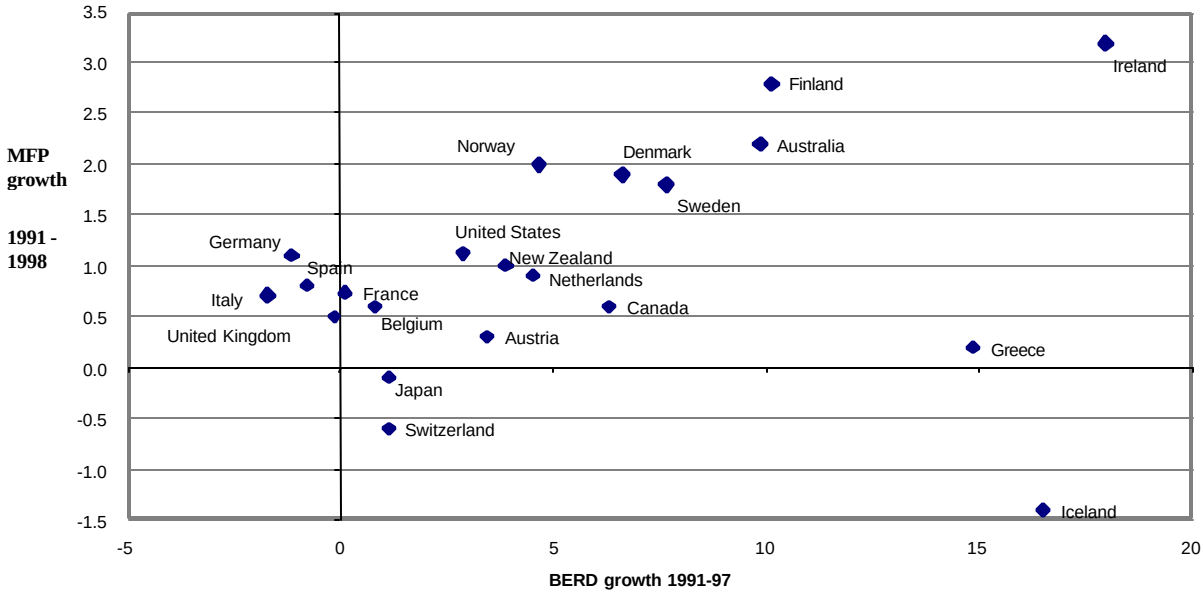
## 4. Inter-related factors

The impacts of ICT resemble in important respects what has been observed in earlier "technological revolutions", such as those of the railways or electricity. Kranzberg (1985) argued that the development of new technology is always evolutionary in the sense that its point of departure is existing technology. A technological "revolution" is characterised by a series of complementary innovations as well as processes of social and institutional adaptation. David (1990) and Freeman and Perez (1990) argued that in the past such revolutions have been characterised by stepwise developments in which productivity growth remained low for many decades – generally half a century or more – before taking off.

This is largely applicable to ICT, as partial impacts have been observed for decades whereas an up-take in overall productivity growth has been identified only in the late 1990s. For various reasons, however, ICT may have started to exert a more rapidly accumulating impact than what has been seen in connection to earlier new technologies. This emanates partly from the unprecedented fall in prices and increases in quality which characterise ICT. Also, because of its nature, the use of ICT is diffused with greater speed, particularly through the Internet, creating a strong potential for network growth with associated externalities. Effects may become visible once certain thresholds of use have been passed. Furthermore, ICT has a potential to rationalise the very nature of economic exchanges, applying to market transactions as well as business organisation. The benefits of ICT will critically depend on how it is put to use by individuals and firms, including how effectively it is integrated with broader strategic objectives and actions. The extent to which this will be the case will depend on a number of conditions and policies.

Innovation and technological change must critically be taken into account. OECD expenditure on research and development (R&D), though only part of total investment in innovation, reached almost USD 500 billion in 1997, or more than 2.2% of OECD-wide GDP, following a surge in the second half of the 1990s.

**Figure 6. MFP growth and BERD growth**



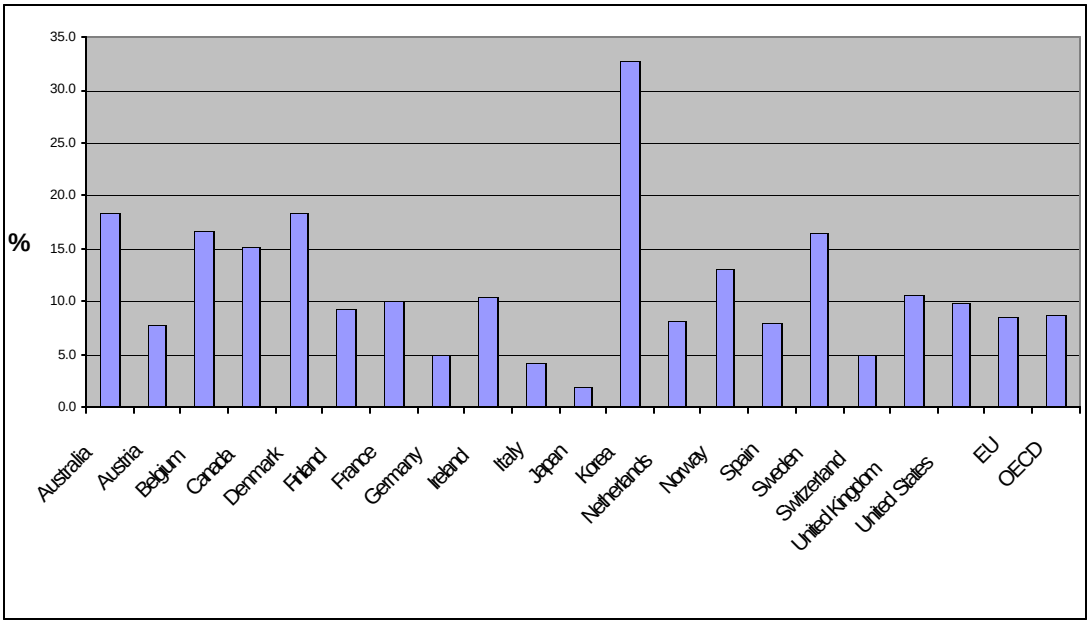

BERD stands for expenditure on R&D in the Business Enterprise Sector

*Source*: OECD (2000*h*).

Although the overall R&D intensity of OECD economies has not yet regained its peak of 1989-90, in absolute terms the global research effort is now larger than ever. The empirical evidence speaks for a positive relationship between R&D and MFP growth (Figure 6).[9] In Europe, only Sweden (3.7%) and Finland (3.2%) have a higher R&D intensity than Japan (3.1%) and the United States (2.8%). On average, the EU again lags far behind (at 1.8%), with Spain (0.8%) and Italy (1.1%) among the larger European economies at particularly low levels.

Meanwhile, the composition and funding of R&D has changed. Defence-related and government-funded R&D has stagnated with the end of the cold war. Instead, civilian and business-funded R&D has increased. Apart from the United States, growth in business-funded R&D has been particularly strong in a number of small OECD economies, including Denmark, Finland, Iceland, Ireland and Sweden. As much defence research is highly specialised with few civilian applications, and as confidentiality may impede diffusion of results, this decline may be favourable to innovation (Guellec and van Pottelsberghe, 2000). On the other hand, some defence-oriented research is extremely long-term and takes on a marked public good nature, making it a potentially valuable complement to more short-term business-oriented R&D. Some major innovations, such as the Internet, testify to outcomes which would have been unlikely in its absence. The mid-1990s saw a trend towards less basic R&D which gave rise to concerns for reduced social benefits and long-term growth (OECD, 1998). Today, there are indications that the science base is becoming increasingly important for innovation. Especially in the United States, the public research sector, and particularly universities, has strongly contributed to an overall surge in patenting, which serves as one indicator of the output of innovation.[10]

**Figure 7. Annual growth rates across countries of patents granted in biotechnology (1992-1999)**




*Source:* OECD, based on USPTO data.

9. The relationship is statistically significant for various measures of R&D – including stocks, intensities and growth rates – and MFP (*cf.* Bassanini *et al.*, 2000).

10. Not all innovations are patented. Some are protected by other forms of intellectual property rights, such as copyright and trademarks, while others are protected by secrecy or first-to-market strategies. Likewise, not all patents are directly linked to innovations, since they may be used as a strategic measure to block, or neutralise, the strategies (or innovations) of competitors.

The ratio of patents granted in the United States to GDP has risen markedly for most OECD countries in recent years. The European Patent Office is experiencing a similar increase, although it started later than in the United States. Although the pick-up is partly explained by changes in legislation (*e.g.* software is now patentable in the United States), it is primarily due to rapid innovation, especially in ICT and biotechnology. Of the overall growth in patents granted by the USPTO between 1992 and 1999, ICT accounted for 31% and biotechnology for 14%. ICT patents rose by almost 20% annually over the 1992-99 period, and biotechnology patents by almost 9% annually (USPTO, 2000). The share of ICT in the patents of different countries is highest in Finland (30%), but the EU average (10%) is considerably below the US level (18%). In terms of absolute numbers, the United States dominates, with 60% of the total in 1999 against 11% for the EU (OECD, 1999*b*). The distribution across countries is very similar in biotechnology. Figure 7 shows relatively low growth rates for most European countries in patents granted by the USPTO in the biotechnology area during 1992-99. The exception is the Nordic countries. In terms of absolute numbers of biotechnology patents, the United States has a 62% share of the OECD total, compared with 24% for the EU.

Patents represent an important component of intellectual property rights, which serve to support innovation as they create a legal framework providing temporary monopoly rents for innovators and first-movers. At the same time, imitation and sequential, complementary innovation are important for the diffusion and further development of new ideas, not least in high-technology industries, and for the application of technologies in the form of software, development of services, etc. (Griliches, 1992; Bessen and Maskin, 2000). This speaks against patent regimes that are too strict or too broad. On the other hand, there are indications that returns from innovation increasingly are captured through other mechanisms. These include traditional trade in technology. While the appropriation of returns through licensing has been viewed as an exception rather than the rule (Teece, 1988), recent studies have pointed to a marked increase in licensing revenues (Dengan, 1998; Kortum and Lerner, 1998).

Improved markets for technology shift attention to other factors which can serve as a crucial complement, such as tacit knowledge and organisational advantages (Arora *et al.*, 2000). Major changes are, in fact, under way in contractual as well as non-contractual relations between firms. These include a strong increase in R&D co-operatives, which can serve as an effective means of internalising the returns from R&D (d'Aspremont and Jacquemin, 1988). Other prominent examples are mergers and acquisitions (M&A), strategic alliances and other forms of networking among enterprises, both large and small. Rising costs as well as benefits associated with research and new technologies play a major role in the observed expansion of many such arrangements (Andersson and Svensson, 1994; Dunning, 1995; Narula and Hagedoorn, 1999). As M&A enable more rapid entry into new markets, restructuring and technology transfers, there is a potential for efficiency gains along with increased competitive pressures. On the other hand, M&A and other forms of inter-firm collaboration may effectively reduce competition where regulatory and institutional conditions allow for market control by a few actors. Paradoxically, many M&A have turned out not to result in beneficial outcomes for the participating firms. Corporate governance structures which deviate the incentives of management away from the interests of shareholders and the firm, in effect allowing firm behaviour to be steered by managers' self-interest, might explain some unsuccessful ventures. On the other hand, evaluation of the outcomes is complicated by the difficulties of determining what the alternative to an M&A would have been – often, in a rapidly changing environment, it is *not* the status quo (Kang and Johansson, 2000).

Improved access to information and more rapid technical progress are in the process of making it more important for firms to move fast under conditons of highly imperfect and asymmetric information, and to upgrade their capacity to rapidly acquire and make good use of existing knowledge and technology (Grindley and Teece, 1997). As the benefits of external monitoring of technology increase, so do the costs of insularity. However, the ability to absorb external technology is often dependent on own knowledge-creation, since R&D tends to upgrade the skills that are needed for absorbing external technology

(Mowery, 1984; Cohen and Levinthal, 1989). There is evidence that firms tend to be more global in their ability to identify and use external technologies the higher their R&D intensity.

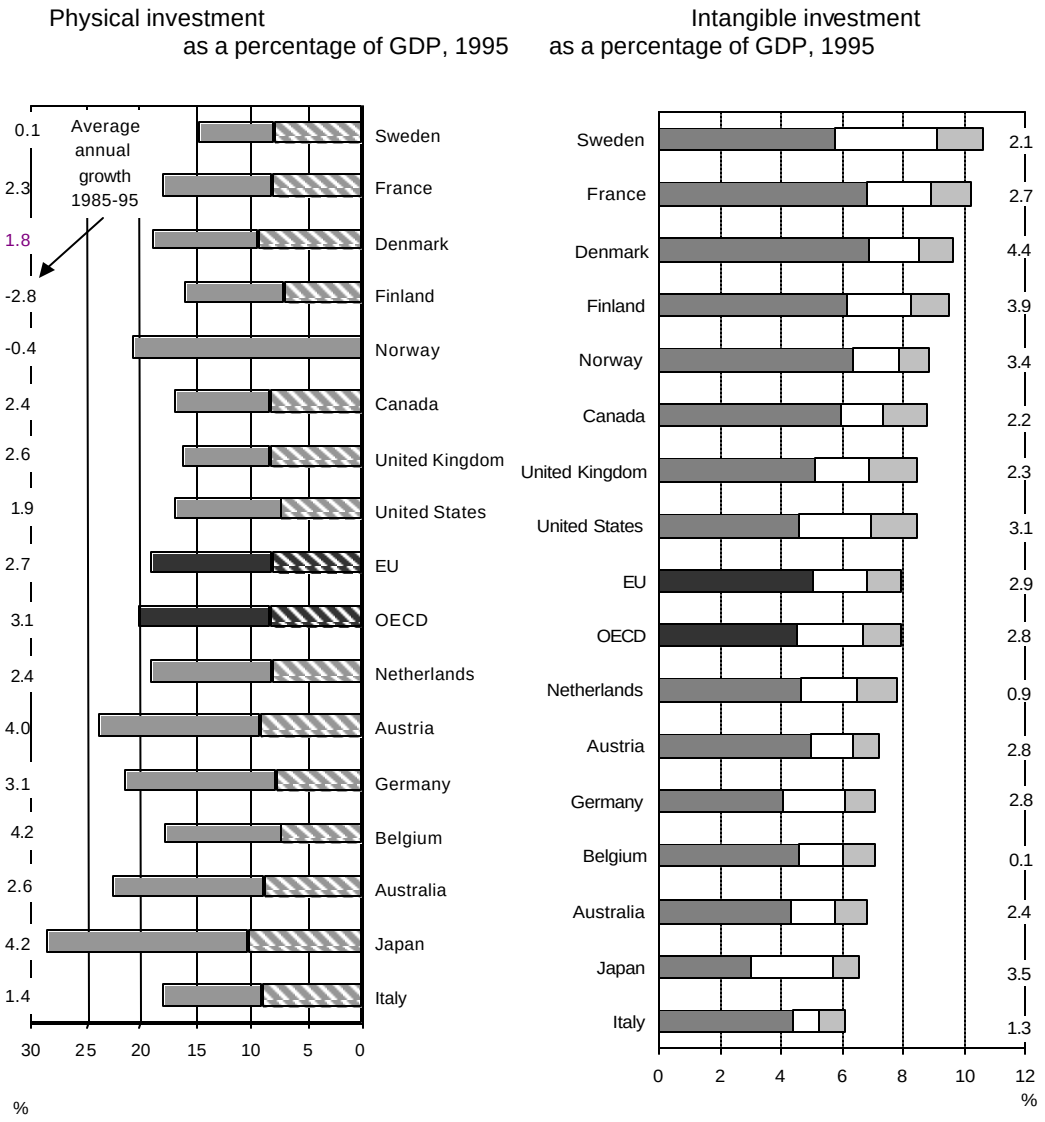
In fact, given the quickening pace of technical progress and information flows, capturing the benefits from ICT and innovation is conditional on organisational structures and adjustments, whether in firms, industries or markets (Henderson and Clarke, 1990; de la Mothe and Paquet, 2000; OECD, 2000*c*). There is a marked trend for firms to focus more effectively on their "core business", interacting (either at arm's length or through various control mechanisms) with other firms – or institutions, such as universities – that are specialising on complementary operations. On the other hand, activities that previously could be carried out effectively within hierarchical structures may become more competitive through market transactions, thus altering the boundaries of firms. Many activities are seen to be moving from the market to the household sector -- home banking is one example -- or vice versa.

Logistics belong to those functional areas which are demonstrating far-reaching organisational change. With enhanced information exchange, companies have much to gain from adopting a structure which can allow them to respond effectively to unanticipated changes in demand. Product life cycles are becoming shorter and there is more scope for product differentiation, calling for greater speed and flexibility and closer integration by businesses of their suppliers in the design and development of products. Many businesses rationalise costly precautionary inventory holdings and the distribution of their products. "Intelligent transport systems" offer opportunities for greater efficiency and quality in transport. Technological advances which integrate GPS, smart cards, electronic data exchange, portable phones and computers allow for more efficient management of freight flows. The Web is used to outsource tasks which were previously carried out internally. There are examples of ICT being applied seamlessly along the business value chain, enabling more sophisticated information links, forecasting capabilities and management systems, and providing timely delivery of products tailored to the specifications of individual customers. In the car industry, the establishment of an Internet platform for moving procurement on line (Ford, GM, Boeing with Oracle – replacing EDI-based systems) aims to strengthen competition and enable more efficient management of the supply chain, reducing inventory, sales execution and distribution costs.

A number of surveys point to recent far-reaching organisational change within firms and workplaces throughout the OECD area. Some have found extensive changes in about a quarter of all enterprises as of the mid-1990s, resulting in flatter hierarchical structures, greater responsibility for individual workers, multiple tasks and stronger incentives for innovation, flexibility and on-the-job training (OECD, 1998; NUTEK, 1999). It appears that such organisational change is serving as an important complement to R&D and investment in ICT and training (Black and Lynch, 2000; Bresnahan *et al.*, 1999; Nyholm, 1998). Firm-level studies have found evidence of complementarity between technological change and human capital accumulation (Brynjolfsson *et al.*, 1998). De la Fuente and Dmenech (2000) argue that the observable impact of human capital on economic growth rises with improved data and, in fact, most probably has increased over time, but that understanding its role requires a better handle on the linkages to technical progress. The relationships between technology, training and employment are likely to be strongly influenced by organisational change (OECD, 1998; Tarabusi, 1998).

A great deal of R&D, innovation, training, organisational change, etc., results in so-called *intangible* rather than tangible assets. This implies that they are more difficult to measure and their returns more difficult for the investor to appropriate. This situation complicates management decisions and strategy formulation, both internally within firms and externally vis-à-vis outside resource providers. Bearing in mind the measurement problems, Figure 8 indicates that a limited set of intangible assets (leaving out marketing, organisational change, etc.) are the subject of considerably larger investment than physical assets as far as the Nordic countries and the United States are concerned. In Japan and a number of continental European countries – Belgium, the Netherlands, Germany and Austria – tangible investment was reported to be higher. There is therefore no doubt that intangible assets, despite the incentive problems that surround them, have become an important component of overall investment.

**Figure 8. Investment in tangible and intangible assets**




*Source*: OECD (1999*b*).

Thus, while most of the "hard" evidence so far points to the ICT-producing sector as the prime source of gains in MFP, the use of ICT more broadly in the economy appears more and more important. This technology "revolution" first showed up as disembodied MFP growth in the ICT-producing sector of the United States, but the scope of its impacts is likely to depend highly on the extent to which it can emerge as technological progress embodied in new ICT equipment used in many sectors. The outcome for a particular country or region will be influenced by the extent to which there are conditions which allow accompanying innovation, the development of new skills and organisational change to complement new technologies.

## 5. Policy Challenges for the EU

The processes discussed above, whether actual or potential, are influenced by a range of policies. In the United States, the willingness of monetary policy during the late 1990s to reconsider traditional perceptions of the economy, including the underlying mechanisms for inflation, and thus to hold off on

higher interest rates, was critical for allowing the "new economy" to "flex its muscles". In Europe, monetary policy and the stance adoped by the European Central Bank (ECB) during the first phase of its regime has been regarded as broadly appropriate, reflecting several factors. These include the general improvement in fiscal balances, the global situation in the aftermath of the so-called "Asian crisis" and the overall context of the European economies. Inflation has so far stayed below 2 per and inflation expectations remained subdued although unemployment has fallen to its lowest level in 7 years, output growth has started to rise and the value of the Euro has declined steadily against the dollar since its inception (Coppel *et al.*, 2000). To what extent monetary policy has been influenced by any perception that the European economies might be moving towards features similar to those seen in the United States, is an open question. Again, monetary as well as fiscal policies, and the evolution of macroeconomic conditions in general, continue to play a significant role in investment decisions as they do in the economy at large.

As has been described in previous sections, there is enormous diversity within the EU with respect to economic performance and the extent to which the "new economy" appears to have arrived. There are, nevertheless, a number of "European issues" which play an important role in influencing the ability of the EU to adjust to and capitalise on new economic and technological opportunities. These include the concern with social impacts and growing income differences, as levels of income and education among households are strong differentiating factors in the uptake of ICT, and wage differences reflecting skills variation are on the increase (OECD, 2000*i*). In the following, I briefly discuss issues in the areas of: market segmentation; science-industry linkages; information and communication; labour markets and skills, and; financial markets, venture capital and entrepreneurship. Conditions and policy action in each of these areas will require serious scrutiny. While the following examination indicates the direction of some requisite remedial policy actions, the agenda outlined should be viewed as indicative and serve as an input to further analysis.

Market segmentation

Although the United States is far from homogeneous and actually displays a range of internal barriers to mobility and restructuring, the EU is a far less integrated economy. On the one hand, institutional diversity can be conducive to favourable reform processes, as it allows for policy experimentation and evaluation. On the other hand, it can also account for inconsistent and contradictory conditions which lead to a segmentation of markets, weak competition and a low ability for regulation to respond to changing conditions. There is no doubt that the EU shows clear-cut features of costly fragmentation. There are many national champions in the enterprise sector, differences in regulations and institutional compartmentalisation in areas as diverse as education, science, transport systems and social security which hamper competition in goods and factor markets, the mobility of labour, industrial restructuring, innovation and the diffusion of technologies. Although antitrust policy is an important instrument for counteracting market power, it is a bleak substitute for an opening up of markets themselves. The Single Market, and the establishment of the EMU, are in the process of breaking down many barriers, which will unleash new competition and creativity, in turn overcoming remaining barriers. So far, however, the empirical evidence points to continued strong price differentials in many markets, including the financial markets (Commission of European Communities, 1996; Commission of European Communities, 1997; Berger *et al.*, 2000). Many of the EU's institutional differences and implicit rules and regulations, seem set to stay. It appears that the downside effects are particularly deleterious in those countries that have been most reluctant to let non-competitive industries decline and to specialise in accordance with their comparative advantages. Stagnant employment conditions are generally found in those countries that have been hesitant to embark on bold structural reform.

As examined in a number of reports, market segmentation also impedes the capturing of economies to scale. A development in this area is that some new technologies and services related to ICT are associated with a combination of high fixed costs and insignificant variable costs. This tends to favour big firms and – given market segmentation – the largest markets, enabling them to attract and develop mobile knowledge-

creating activities at the expense of the smaller players. Krugman (1991) thus predicted that bigger countries would specialise in this kind of production whereas smaller ones would be left with standardised activities. A possibly related observation concerns the strongly negative relationship between country size and the internationalisation of R&D in multinational enterprises. On the other hand, rather than supporting big firms, ICT and technical progress can have the reverse effect, *i.e*. they can neutralise economies of scale. In fact, observations from a limited number of European countries point to the importance of smaller fast-growing firms for job creation (OECD, 2000*j*). So far, the penetration and use of ICT, including the Internet, has been negatively related to the size of firms. Firms with less than 20 employees continue to lag behind, although there is a certain amount of catching-up. In regard to medium-sized firms, on the other hand, there is recent evidence of rapid catch-up (OECD, 2000*f*).

Faster diffusion of information can clearly facilitate entry into existing markets and may wear down the advantages of incumbent firms more rapidly than was previously the case. Casella (1996) concluded that liberalisation and technological progress, by improving access to foreign markets, reduce the comparative disadvantages of location in small countries, raising their ability to compete in the attraction of activities which benefit from increasing returns to scale. Likewise, the internationalisation of R&D may well be complementary to, rather than a substitute for, R&D at home, suggesting that internationalisation may actually benefit knowledge-based activities in small economies (Akerblom, 1994; Andersson, 1998). Increased mobility of skilled labour can serve to further strengthen such outcomes (Agarwal and Gort, 1999). As regards SMEs, ICT offers new opportunities to create networks, and thus to combine the advantages of small scale at the firm level, *e.g*. as regards flexibility, with the economies of scale provided at the level of a "cluster" or network.

Reviewing the record of the individual European countries, it immediately becomes clear that small country size or, for that matter, a peripheral location, need not be a handicap with respect to the "new economy". A number of small players are among the top performers, including Ireland and Denmark, and more recently Finland, Sweden and Iceland. It is mainly some of the larger countries in continental Europe, notably Germany and Italy, which now seem to present the greatest structural problems. These observations may suggest that limited market size can be compensated for by openness and conditions and institutions that are conducive to competition and restructuring. Thus, while economies of scale – at the country as well as at the firm level – need not be a concern, there can be huge costs of market segmentation. It is essential for the EU, and its Member states, to seriously strutinize and dismantle those aspects which give rise to fragmentation that reduces competition, mobility and knowledge flows, while counteracting the kind of harmonisation which stifles policy adjustment and experimentation.

Science-industry linkages

In this area, outcomes strongly depend on the interplay between institutions and markets. The European science base displays a diversity and richness that help foster multiple skills in national and regional "innovation systems". Ambitious efforts at the community level to generate more productive linkages between science and industry have led to a number of interesting developments over the last decade. Partly through such influences, combined with efforts at the national and local (partly through the Regional Innovation Strategy) levels, a considerable number of municipalities which used to be mired in traditional industries and locked into states of stagnation, have experienced a sudden dynamism in "new growth areas", *e.g.* Munich (biotechnology), Oulu (telecom), Toulouse (aerospace), Ronneby (ICT) and Manchester (technology and art). Despite such successes, the overall picture is less rosy. Many European universities continue to be only weakly related to industry-related interests and demands, and have limited inter-country co-operation. Although EC-support has created many new linkages, the overall impacts appear to remain modest.

There is also the question of patent protection, and intellectual property rights more broadly, in the EU. Not only does this area display a number of inconsistencies across the member countries of the EU, but the reform of patent institutions and their adjustment to changing conditions is generally moving much slower

compared to the United States. This is particularly the case with respect to patent application and award processes, which have been reformed rather extensively in the latter. In addition, the United States has undertaken considerable reforms in the allocation of intellectual property rights in the public research sector, which has strongly contributed to the recorded upswing in university patenting. The EU is certainly on the move, with the new patent law representing a step in the right direction. Many EU countries, including the UK, France and Germany are also in the process of reviewing rules on the ownership of intellectual property rights in the public sector to facilitate further commercialisation of research. It is important that this reform process can move forward with sufficient momentum. The present set-up carries not least costs owing to lack of transparency, which are likely to weigh particularly heavily on smaller technology-based firms.

While improved efficiency, responsiveness and consistency in European patent regulations is thus potentially important, that should not translate into a single-minded drive for stronger patent rights, as that may hamper incentives to incremental innovation. Other related areas which require attention include legislative leniency regarding inter-firm collaboration and other partnerships in regard to R&D and technology co-operation. Here, there are concerns about enhanced market power and reduced competition for innovators if too much scope for co-operation is provided. Again, however, the merits of stronger legislative frameworks are doubtful. For instance, despite traditionally strong antitrust legislation, the US authorities have become largely supportive of strategic technology alliances among firms, and between firms and universities, government labs, etc. (Vonortas, 1999). Such inter-firm linkages appear increasingly crucial for firms' ability to manage the combination of development, absorption and use of new technologies, and in a framework of contestable markets they seem to be complementary with intensified competition and greater efficiency in goods markets.

To embrace the potential benefits of the "new economy", the EU needs to obtain more of a common "research space", in which there are stronger mechanisms for the formation of science-industry linkages irrespective of national boundaries. That requires overcoming standards and traditions which impede the recognition of skills acquired outside a given territory, whether geographical or sectoral, as well as other factors that hamper the mobility of scientists, engineers and researchers. Examples of concrete measures include the recognition of diploma and qualification equivalencies, or reforming conditions for employment of public researchers. It also means putting in place more responsive intellectual property rights regimes as well as making other policies more receptive to the evolving interplay between innovation and technology diffusion (OECD, 1998; OECD, 2000*g*).

ICT infrastructure and services

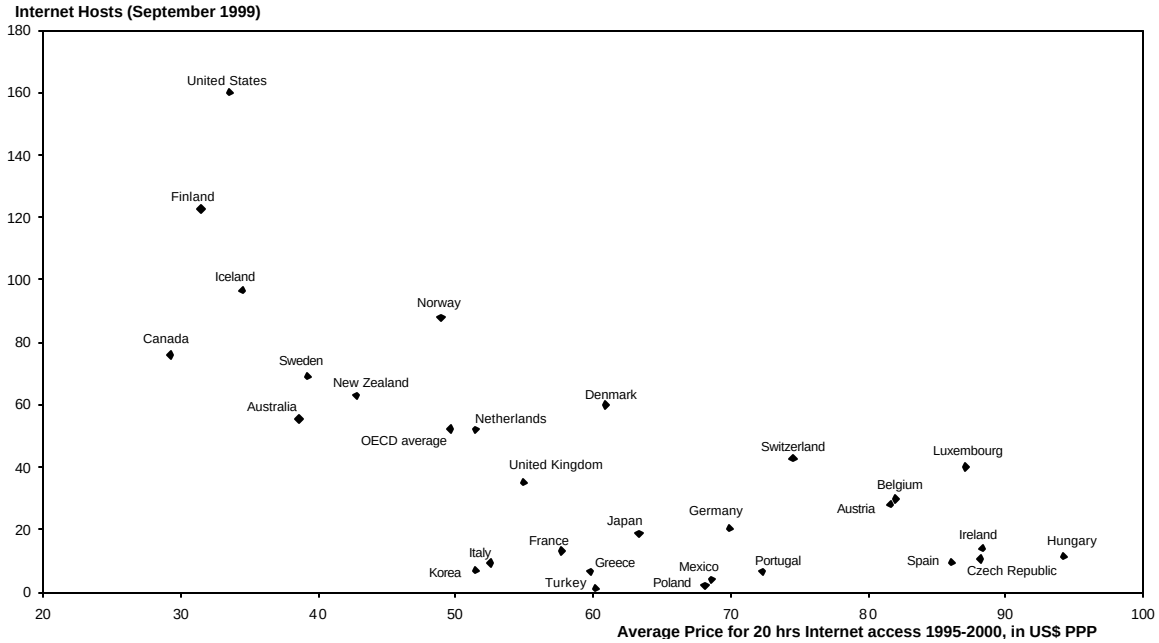
Some of the challenges confronting the EU with respect to ICT have to do with regulatory reform, including the adoption of common standards. This remains a crucial area despite far-reaching privatisation and deregulation over the past decade which have been of great importance for restructuring and innovativeness (Commission of European Communities, 1998 and 1999).[11] Revenues have grown in telecommunications, including for the former monopolies, due to a large extent to market expansion which has compensated for price decreases particularly on domestic long-distance calls and international services. The development of new services, in part related to the Internet, has also made a strong contribution. Meanwhile, there has been an impressive number of new market entrants, with the scope of their success related to the timing of measures to open up the respective national markets to competition (OECD, 1999*c*). However, policy frameworks continue to vary widely in the EU, as do the opportunities for competition, efficiency and market growth. As seen from Figure 9, there is a marked correlation between price levels, in terms of Internet access costs, and the penetration of Internet hosts. Among European

[11] Röller and Waverman (2000) find new evidence on significant impacts of telecommunications infrastructure on overall economic performance, controlling for the problem of two-way causality as development also creates demand for telecom infrastructure. The positive effect is especially strong at high levels of development, which the authors relate to the presence of positive network externalities.

countries, only Finland, Iceland, Norway and Sweden come close to rivalling the United States in these respects. The level of Internet penetration appears particularly disappointing in Italy and France, given their mid-way price levels. This is believed to be related to enduring competition from the Minitel in France and probably also language barriers.

In addition to average costs, the structure of charges matters. The main factor differentiating the cost of Internet access across countries is the existence of local usage charges, widely applied in several European countries, versus the use of unmetered rates for local calls in other countries (*e.g.* North America, Canada, New Zealand and Australia). In recent years, a "rebalancing" of telecommunication charges has lowered 'long-distance' charges and raised the charges for fixed network elements and local calls. While raising fixed charges did not have an impact on countries characterised by unmetered local charges, higher local-call charges significantly increased the cost of Internet access in other countries between 1995 and 1998. Since that time, the negative impact of rebalancing has been mitigated to some extent by the growing separation of the pricing of local telephony and Internet access. However, for the 1995-98 period, higher local-call charges discouraged online use in metered environments. Countries such as Denmark, Finland and Norway have a relatively high penetration of Internet hosts but are below average for indicators of electronic commerce development such as secure servers. In these countries, Internet access prices are low but users have metered telecommunication charges. This makes users stay on line, on average, for less time than in those countries where unmetered access is available even though access rates are high (OECD, 2000*e*). In this sense, those European countries which attain the highest level of Internet use remain characterised by a pricing structure which is likely to retard their ability to turn this into an edge as regards electronic commerce.

**Figure 9. Average Price of 20 Hours of Internet Access and Internet Host Penetration**




Note: Data on hosts for Luxembourg is from mid-1999. Internet access costs include VAT.
*Source*: OECD (www.oecd.org/dsti/sti/it/cm) and Telcordia Technologies (www.netsizer.com).

In the area of mobile telephony, it has been noted that Europe appears to be relatively better placed for the future. This can in part be attributed to the regulatory set-up, as the adoption of a common standard unified the demand side in the EU, whereas four different standards competed in the United States, weakening demand and hence supply. Its single standard has helped Europe to attain the highest diffusion rate in the world and to foster three of the four leading manufacturers in the field – Nokia, Ericsson and Alcatel. On the other hand, this situation does not guarantee a continued advantage. The set-up in Europe is still plagued by rather severe segmentation in terms of national markets, limiting genuine competition on a wider basis. With the next generation of mobile technology under way, the past technological advantages enjoyed by the EU may be gone. Moreover, the reliance on prepaid users in most of the EU raises challenges with respect to applying effective price strategies for 3G mobile services and, unless there is an increase in competition, the required innovation may be slow in coming. The EU has already forfeited the lead in roaming, with costs coming down more quickly in North America than in Europe, and there are signs that US operators have now become more active than European ones in developing new solutions for bringing down the price of Internet access via wireless more rapidly than in Europe. To this should be added the fact that the recent wave of auctioning access to third-generation networks on a national basis within the EU amounts to a substantial tax on future investment in this area, taps the amount of capital available for risky investment by turning it into public rents and raises the already high risks confronted by the industry.

ICT, and the use of electronic commerce, is influenced by a range of other factors as well. These include the quality of infrastructure, where the public sector needs to take an active role in close co-operation with private actors, and to be firmly driven by a client-attitude *vis-à-vis* the user side. Furthermore, consumer confidence and trust are influenced by attitudes but also by policy conditions with respect to privacy, security, authentication, encryption, taxation, measures for dispute settlement, etc. The EU so far remains characterised by less trust, particularly as regards Internet commerce, than is found in the United States. Several European initiatives are in the process of addressing this situation. However, many of these are individual member country activities, with the risk that they may lead to divergent legal situations. Uncertainty and the availability of only complicated and costly antidotes are particularly discouraging for SMEs. The European Parliament has sought to address the situation and the European Commission has a range of measures under way, *e.g.* to secure the availability of business certification services to small businesses at an international level (Commission of European Communities, 1999). The speed with which progress can be made will much depend on the efforts made at the community level, how well they are supported by national strategies as well as the extent to which they can be complemented by global advances, *e.g.* in the OECD.

As we have seen, transport and logistics is evolving into one of the most important areas for use of ICT with associated far-reaching organisational change and restructuring. According to A.T.Kearney (2000), logistics costs represented 7.7 percent of industrial revenue in the EU in 1998, down from 10.1 percent in 1993, and average order lead times had dropped from 18 to 12 days. On the other hand, only 20 percent of companies had distribution centers serving more than one country, which was a tiny increase from 17 percent five years earlier. In the United States, rail and intermodal transport solutions feature much more prominently, there is more effective use of ICT and innovation to improve transport and logistics as a whole, and logistics costs have fallen more rapidly. Although subjected to reforms, privatisation and co-ordination at the Community level, transport remains characterised by a fragmented institutional set-up. The transport systems of the EU are designed and operated primarily at the level of the 15 national states, often with considerable regional or local autonomy. Each country generally has its specific authorities in charge of the different transport modes, *i.e.*, road, rail, maritime and air transport, and with barriers to co-ordination. There is an under-provision of harmonised regulations and common standards, and resources and capabilities at the Community level are fairly insignificant in comparison. Even the flagships of EU co-operation, the large infrastructural projects labelled "Transeuropean Networks", which aim to alleviate key bottlenecks, have generally become bogged down in political struggles and problems with financing.

The result is that certain modes, notably road transport, have been relatively free to respond to the growing needs and exploit natural strengths in flexibility and adaptability, but that insufficient attention is being paid to social effects, such as congestion and environmental externalities. Meanwhile, the development of rail and intermodal transport solutions has suffered. This impedes efficient private distribution and logistics services, and dampens innovativeness and the use of new technologies. Small firms are affected particularly badly, especially when it comes to long-distance and international dealings, since they are in the weakest position to build their own compensating capabilities.

Labour markets and skills

Another area of great importance for reorganisation and restructuring, and one in which regulatory conditions matter greatly, is the labour market. The European countries performed poorly in the 1990s as a whole, ranging from participation rates to unemployment and numbers of hours worked, although improvements were recorded towards the end of the decade. The functioning of labour markets influence, *e.g.* how well the supply and demand of different kinds of labour are matched, how quickly excess demand for labour translates into higher wages and prices, the extent to which workers can circulate between sectors and countries – playing a significant role in knowledge and technology flows, and how well the economy can adjust to changing conditions. Precise outcomes are almost impossible to discern, however, since product market constraints and barriers to start-ups and enterprise expansion interact with labour market conditions in impacting on overall performance (OECD, 2000*d*).

In Europe, Denmark, Finland, Ireland and the Netherlands, belong among those countries that have been rated most successful in improving labour market performance. However, most EU Member countries continue to be characterised by conditions that impede "numerical flexibility" (*i.e.* hiring and firing) and flexibility in working-time arrangements. General data on job mobility, based on average job tenure, suggest that overall mobility is higher in Australia, the United States, the United Kingdom, Canada and the Netherlands, while lower in Italy, Belgium, France, Finland and Japan (OECD, 2000*g*). Over the last decade, there have generally been declining participation rates in the EU workforce for males, as well as for both younger and older workers (OECD, 1999*a*). Meanwhile, demand for skills, and ICT skills in particular, seriously outstrips supply. Wage structures, pension schemes, tax structures, etc., influence the incentives to invest in new skills, applying to both supply and demand. Again, there are important inter-country differences, with notably the United Kingdom - like the United States - undergoing an upgrading of incentives through growing education-related wage differentials (Katz and Autor, 1999). In most of the EU, such trends have been weakened by regulations reflecting social considerations, which have kept wages from widening sharply but hampered the functioning of labour markets and contributed to rising unemployment among the unskilled, as well as those whose skills have become obsolete.

It will be of considerable importance for European policies and performances to what extent ICT will appear as a source of a digital divide or of benefits "for all". Measures which are striving to favour equitable effects must not reduce the incentives and efforts to acquire new skills, or try out new innovative solutions. Productive means are available, such as tax incentives and cost-sharing arrangements for the purpose of encouraging lifelong learning, targeting both firms and workers, as well as public access points targeting especially weak social groups. In addition, the combination of a rapid infrastructural development, lower prices and the development of more consumer-friendly applications broaden the access of households to ICT. This will mean that new means for learning are becoming available, which may result in favourable distribution effects (OECD, 2000*i*).

So far, Europe has been characterised by a strong dominance of higher education in the provision of skills, and in the formulation of policies for skills upgrading. There is an increasing need of effective input from multiple actors and directions, including industry partnerships and other forms of innovation in education and training. Related to this, the educational system as well as the broader labour markets are marked by a lack of openness to exchanges of experience and talent with other societies and cultures. This stands in sharp contrast to the US situation where immigrants are seen as a source of academic strength as well as

entrepreneurial spirit. Apart from being a reflection of broader social attitudes and processes, the situation in the EU is related to regulatory issues, such as the portability of pensions between private and public sectors. Some countries, such as France, are making reforms, e.g., to permit greater industry collaboration with public sector researchers. While there is a long way to go, however, the present setting represents a major drawback in the "new economy", as it hampers the circulation of knowledge and information. For the EU, it adds to the problems inherent in a society of shrinking populations, diminishing the prospects for matching supply and demand for jobs in the economy (OECD, 2000*c*).[12]

Financial markets, venture capital and entrepreneurship

Financial markets represent another important policy domain. In the EU and elsewhere, there has been extensive liberalisation since the mid-1980s. Broadly speaking, financial markets (shares and corporate bonds) have gained in importance at the expense of bank credit, and companies increasingly rely on equity markets for capital. While all countries use a mix of institutional and market-based financing, Germany belongs to those which so far have been characterised by relatively close relations between firms and banks, and concentrated ownership. This type of corporate governance is typically referred to as an "insider system". Conversely, "outsider systems", such as those found in the United Kingdom and the United States, are characterised by dispersed ownership and a stronger role for financial markets, both in providing capital and in determining business strategies. While the prevalence of either system cannot be related to economic performance in any general sense (Tsuru, 2000), they display varying characteristics and have specific advantages (Maher and Andersson, 1999; Carlin and Mayer, 1999).

Concentrated ownership tends to involve more effective monitoring of management by owners and can be helpful in overcoming agency problems. In mature industries, technological change is often incremental, uncertainty is lower than in high-tech industries and learning is often linked to the gradual accumulation of tacit knowledge. Bank-based systems appear relatively effective in supporting long-term investment in such mature industries (Franks and Mayer, 1994; Bebchuk, 1999). Due to incurred sunk costs, banks are often more reluctant to write off loans and sell equity even when they are aware that its value has dropped; this typically makes outsider systems relatively more effective at writing off the value of declining firms. While outsider systems, on the other hand, are relatively weak in supporting long-term relationships, they are more transparent and have more active markets for corporate control.

M&A represent one important instrument in such markets. By substituting new for old managers, and allowing for quicker and more sweeping forms industrial reorganisation, M&A can be important vehicles for creative destruction as well as for the diffusion of radically new technologies as well as for other forms of knowledge. While the prevalence of M&A traditionally has been much lower in Continental Europe compared to the United States, a first major wave occurred in the early 1990s in connection with the formation of the Single Market. A second, much bigger, movement took place in 1999, in connection with the launching of the EMU.[13] With the exception of UK firms, which continued to focus on the US market, other European firms set their sight on other European countries. As a result, with a few exceptions, it is

12. The impacts of such flows on the countries from which these people originate tend to be more mixed. Today, however, some home countries are conscientiously striving to attract these young men and women back, with beneficial outcomes both to those countries and to the United States as new business opportunities arise. This situation has contributed to the exceptional growth of a new Internet-based and highly efficient service industry in countries such as India and China, which are developing closer links with the US economy through these human bonds.

13. In the first three quarters of 1999, EU companies undertook cross-border M&A totalling USD 430 billion, an increase of more than 100% compared to the same period in 1998. During this period, the EU accounted for 70% of the total value of cross-border deals completed in the world. The corresponding figure for US firms was USD 113 billion, which represented a 7% increase over 1998 (KPMG).

only as of the late 1990s that truly European companies, transcending national frontiers within Europe, emerged.[14]

There is no single model for the development of new technologies. For instance, no one type of organisation can be said to be the best, as is the case for products, there is need for room for experimentation in organisational structures (Chesbrough, 2000). Nevertheless, both theory and the available empirical evidence suggest that the vehicles for the penetration of new technologies tend to bear strongly on new firms and/or old firms with new management and organisation (Hobjin and Jovanovic, 1999). The opportunity costs of switching from old to new technologies tend to be higher for incumbents than for entrants (Jovanovic and Nyarko, 1996). Meanwhile, since innovation is often risky and subject to significant monitoring problems, the returns may be difficult to appropriate by investors. Banks may consequently be reluctant to finance innovative activities and firms. This is particularly true in the case of small firms and start-ups which tend to be subject to even higher risk, have no or little collateral and which are confronted with the challenge of building a reputation as well as respecting strict rules of transparency (Nelson and Winter, 1982; Fazzari *et al.*, 1988). Hence, bank-based financial systems are generally more oriented towards the accumulation of physical assets in large, stable firms in well-established industries, and less good at handling the process of re-allocating capital to new firms and activities. Many European economies are still characterised by such systems, which tend to hamper their ability to reap the benefits of ICT and innovation.

The possibility for investors to exit through an IPO (initial public offering) is especially important, as investors engage their funds only if they can recuperate their liquidity afterwards, making secondary financial markets of great importance. The most successful of the secondary markets has no doubt been the US NASDAQ, which was established in 1973. In recent years, various "new markets" have been set up in other countries, including in Europe from 1996. Such markets are designed to facilitate the listing of firms with limited track records due to less demanding rules of access compared to the ordinary stock exchange. Judging by the number of firms quoted and the amount of capital raised, the European secondary markets – EASDAQ, Neuer Markt, Nouveau Marché – have also been successful, although they still lag behind NASDAQ.

The establishment of such markets is only one factor in the development of risky projects, however. Another complementary element particularly important for the early stages of starting a business, is that of venture capital (VC) investment. VC, which primarily aims at the commercial implementation of a major innovative idea or technology, consists of equity or equity-linked investments in young, privately held companies, where the investor is often a financial intermediary. However, it goes much beyond financing as it involves, *e.g.*, careful scrutiny of business plans, monitoring through representation on the board of directors and preferential stock embodying restrictive clauses, for the purpose of overcoming the information and agency problems that arise between financiers, entrepreneurs and innovators in the early stages of business formation. VC investment thus represents a "nurturing" process which is highly dependent on the competence and experience of the venture capitalist.

In the United States, VC investment has played a key role in the funding of innovative firms since the early 1980s, where it expanded rapidly when pension funds were allowed to invest part of their assets in risky ventures. Almost 3 000 US companies financed by venture capital have gone public over the past 25 years. In 1999, 271 venture-backed companies went public in the United States, accounting for half of all IPOs (Thomson Financial Securities Data, 2000). Exploring the experience of 20 US industries over a 30-year period, Kortum and Lerner (1998) found that VC-supported firms accounted for less than 3% of R&D investments but for 15% of patenting in the 1990s. In addition, patents from VC-supported firms are cited

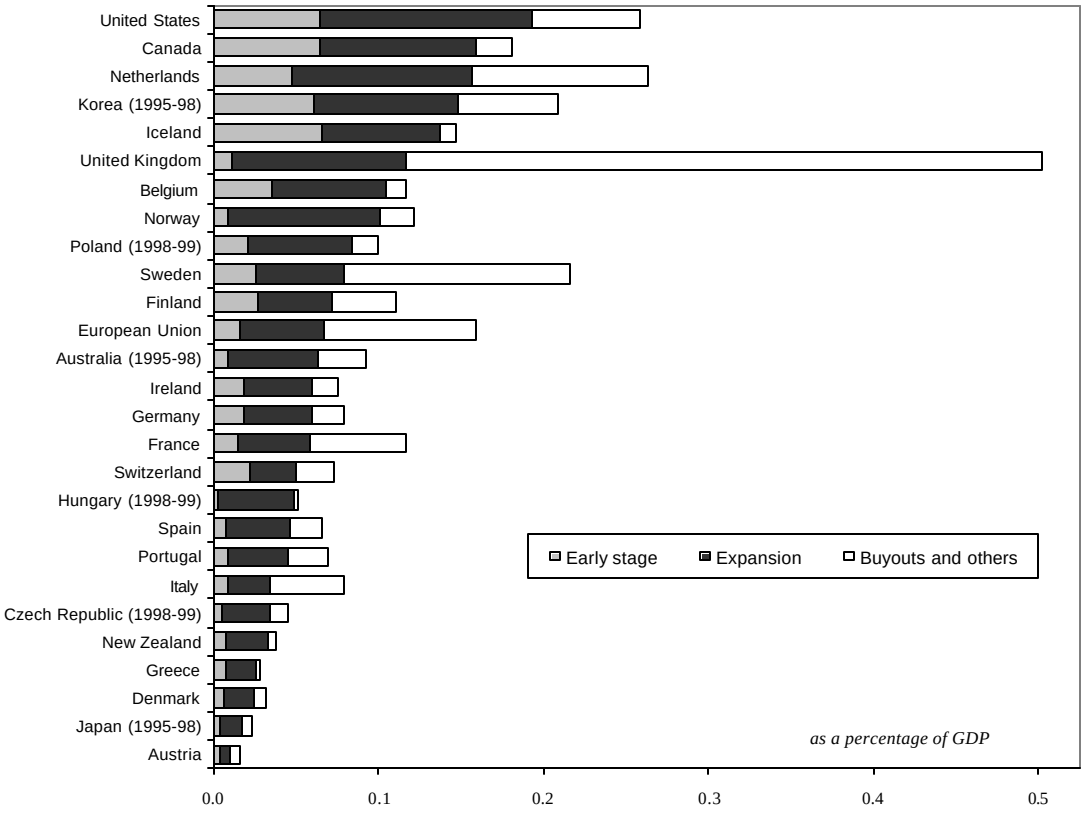
14. These include EADS from Matra-Aérospatiale and DASA, Aventis from Rhône-Poulenc and Hoechst, Framatome/Siemens, and Vodaphone/Mannesmann. The few earlier cases included Royal-Dutch Shell and Asea-Brown Boveri.

more often and are more aggressively protected than other patents, indicating that they have a high technological and economic value (Guellec, 2000). A large and well established VC market may, of course, accumulate venture capitalists with superior experience and enable particularly extensive, multifaceted networks. This may provide smaller, segmented European markets with a serious, and lasting, handicap relative to the United States. However, VC investment is now growing in many other countries, including the EU where the VC industry was small until a few years ago, except for the United Kingdom and the Netherlands. Here, it has surged since 1995, roughly trebling between 1995 and 1998 (an increase similar to that in the United States during these years, but starting from a lower level). Belgium, Finland, France and Germany have experienced particularly high growth. This development has been underpinned by a new awareness in financial institutions of the potential returns, government policies (creation of public VC funds, tax breaks), and the creation of secondary financial markets.

Despite these advances, private corporations contribute much less to VC funds in the EU than in the United States. Pension funds -- the major provider of capital to VC in the United States -- are virtually absent. Instead, banks play a major role in funding VC in Europe, whereas the share of foreign (non-European) capital in VC jumped from about one-tenth in 1995 to one-third in 1998. While differences in measurement and data make international comparisons difficult, Figure 10 broadly illustrates the size and nature of VC across OECD countries during the late 1990s. As can be seen, there is a relatively strong emphasis on early business stages in the United States, where VC is especially important for emerging industries.[15] The surge of VC investment at the end of the 1990s was fuelled mainly by Internet-related investment, which jumped from one-quarter of VC in 1998 to one-half in 1999. The share of health/biotechnology added a further 25%. In the EU, the share of capital directed to early-stage firms, and to high-technology industries, remains much lower. As of 1997, information technology amounted to an estimated 11% and biotechnology 7% of VC in the EU, which actually resembles the distribution of patents pretty well. Figure 11 illustrates the position of individual OECD countries as regards share of high-tech industries in total venture capital investment as well as the share going into early stages and expansion. The European countries tend to be rather far down in both respects, although the Netherlands, Iceland and the United Kingdom have a fairly share of funding in early stages and Ireland and Belgium in high-technology areas. By contrast, the United States and Canada are high up in both respects.

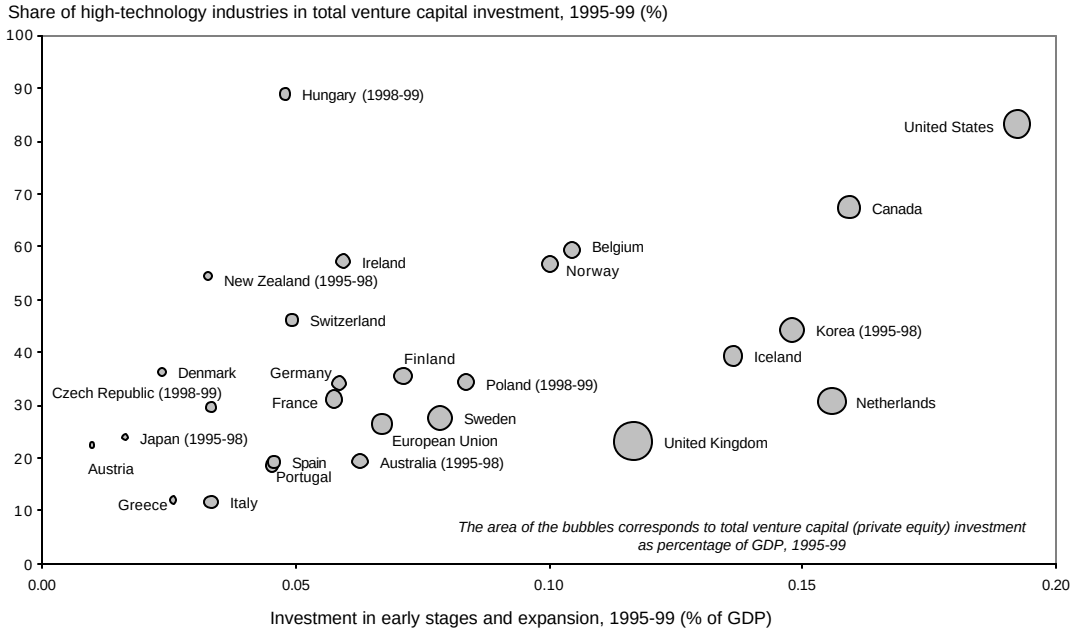
15. The data on VC investment shown in Figure 10 provide only an approximate representation of VC in different countries. The size of buy-outs is weakly comparable across countries, with the US figure under-estimated due to differences in definition. The Japanese figures are particularly uncertain.

**Figure 10. Venture capital investment by stage, as a percentage of GDP, average 1995-99**




*Source:* OECD (1999b) and national sources.

**Figure 11. Share of high-technology industries in total venture capital investment, 1995-99**
Percentage




*Source:* Baygan and Freudenberg (2000).

It is thus not only the amount of money channelled, or the size of a venture capital market, that matters, but its qualities in allocating resources. Its function and its success rate cannot be determined in isolation but will depend on the various conditions which impact on the conditions for networking, knowledge flows, scope for risk-taking and entrepreneurship in the economy. Europeans in general are significantly less likely to start their own business compared to Americans, despite the lesser availability of jobs in Europe. Examinations of the totality of regulatory burdens show that many of the EU countries score considerably worse than the United States, but also than Canada, Australia and New Zealand, when it comes to administrative burdens to start-ups as well as regulatory and administrative opacity. Particularly Italy, France and Belgium come out the worst in the EU, followed by Germany. The United Kingdom, followed by Ireland and Denmark are those EU countries which appear to have the most favourable conditions (OECD, 1999*d*).

Many other factors play a role as well, such as tax regimes and – as always – attitudes. The European picture is not altogether negative. Several countries, notably France and Germany, are in the process of reforming personal as well as commercial tax rates. This will facilitate access to financing as well as the attraction and development of human skills. Many countries are initiating new programs aimed to foster enterpreneurial activities, not only through financial contributions but also through facilitating networking and diffusing information. Another observation is that Europe, like the United States, has local pockets characterised by tremendously high intensity of entrepreneurship, obviously rooted in local skills and traditions which are strong enough to outweigh even what may appear as barren policy conditions. The EU must nevertheless review what factors and policies most critically restrain the potential for risk-taking and entrepreneurship, and rectify these conditions more effectively than it has done in the past. Many of the required decisions need to be taken at the national level, but the Community as a whole suffers as long as the required decisions are not made, and the Community level has an important role to play in disclosing the need for, and facilitating, such measures at the national level.

## 6. Concluding remarks

The troubling economic performance of the EU, especially compared with that of the United States, has obtained a new dimension in the 1990s in connection with the notion of a "new economy". ICT has become a major factor in explaining the prolonged, non-inflationary boom in the United States, but also an important driving force for growth in other OECD countries. In the EU, some of the small relatively advanced states have demonstrated new signs of dynamism. Broadly speaking, the larger continental European countries have been more stagnant, but these as well showed signs of change towards the end of the last decade; growth rates may eventually be rising and unemployment falling beyond what can be explained by traditional cyclical considerations. Nevertheless, the EU continues to lag behind the United States in most aspects of ICT. The impact of ICT, however, is inter-related with a range of other factors, including importantly innovation, investment in human capital and organisational change. While it appears that much of the potential impact of ICT, and the associated technology and knowledge revolution, has yet to come, outcomes will depend on a range of policy conditions and policies.

As goods and factor markets have become more integrated in the European integration process, from the adoption of the Single Market to the establishment of the EMU, and as far-reaching regulatory reforms have taken place in key areas such as telecommunications, the EU has seen extensive restructuring and the rise of new economic activities. There has been a spurt in cross-border M&A, and a much enhanced provision of venture capital. Despite such developments, and the great variability of performance among the individual EU Member countries, this paper has pointed to a remaining systemic challenge for the EU. The EU hardly suffers from any inherent disadvantages due to scale *vis-à-vis* the United States, as witnessed by the performance of some smaller countries, not least with respect to "new economy" factors. Nevertheless, market segmentation continues to plague competition, particularly in services. The EU needs to improve conditions for science-industry interplay and advance on a spectrum of ICT aspects. It has to ensure more competitive and responsive markets – even in those areas where it enjoys relative strengths,

such as mobile telephony. There are also actions to avoid, or actions that should not be taken singly but in combination. Intellectual property rights regimes should be made more consistent and responsive, but not excessively strict. Although effective antitrust policies are important, they cannot compensate for closed markets, and applied to suppress new ways of networking and the formation of alliances in the technology area they might, in fact, counteract rather than favour more competitive goods markets. Measures to strengthen the supply of education and training should be paralleled by those that can free up the demand side. Direct support of SMEs will have limited effect unless coupled with reforms in areas such as the labour market and tax regimes. The progress that has been achieved in financial and venture capital markets needs to be accompanied by increased openness to risk-taking, acceptance of new impetus and skills, and a more favourable entrepreneurial climate.

The challenge is for the European Commission and the individual Member states to progress in a consistent and mutually reinforcing manner. Without the support of its Member countries, the Community level will be stranded, and the EU policy makers cannot act single-handedly, independently of their electorates. Among other things, the EU is confronted with the widely spread notion of a "digital divide" – that the introduction of ICT and accompanying social changes bring a growing and permanent cleft between those who are "in" and those who are "out". This must be addressed in a convincing manner. The policy makers need to ensure – and publicly demonstrate – that ICT bring reduced prices, new services, skills upgrading and higher incomes spread broadly in society. At the same time, they must address the social consequences that arise when some firms, and some jobs, are downgraded or destroyed by rapid technological and organisational change while others prosper and new ones are being borne. However, the EU cannot afford to address these concerns in a way that compromises the incentives to learn, mobility and the scope for creative destruction.

The EU fundamentally needs a stronger capacity for co-ordination to address key, common problems. An impressive recognition of what needs to be done has recently been displayed. With the Lisbon Summit, growth issues were raised to the very top level of the political agenda, and not in an abstract, general context but for the sake of coming to grips with key concrete, structural problems. An agenda has been set to improve both those policies that hamper directly the microeconomic and technological processes at the heart of the "new economy" discussion, as well as to tackle deficiencies in overriding framework conditions. This provides a potential for enhanced horizontal synergy between different, but inter-related, areas of policy making. Equally importantly, the agenda incorporates high ambitions for critical, continuous analysis of what works and what does not work, through transparency and evaluation of results. This carries the potential of enabling a better co-ordination between the Community and the national levels of the EU, without which it will be impossible to implement comprehensive policy responses, rectify institutional fragmentation, build truly common infrastructure, and be fully effective in addressing conditions of inadequate competition. Given the cross-cutting nature of the systemic challenge confronting the EU, the extent to which the momentum of the Lisbon summit can be captured is likely to crucially depend on whether improved co-ordination can be achieved in these respects.

As has been noted, the heterogeneity and variability of the EU is not only a source of problems, but of cultural and institutional richness which gives room to creativity and long-term dynamism. That should not, and cannot, be suppressed. The task is to differentiate what is a healthy state of affairs from what is not, and to translate the former into a policy agenda that is able to gain widespread support and respect. Lisbon was not the end of the process; but it could prove to be a major step along the way. The pressure needs to be kept up, and for that to be possible the EU will have to deliver on a more open and critical scrutiny of where the fundamental problems lie.

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