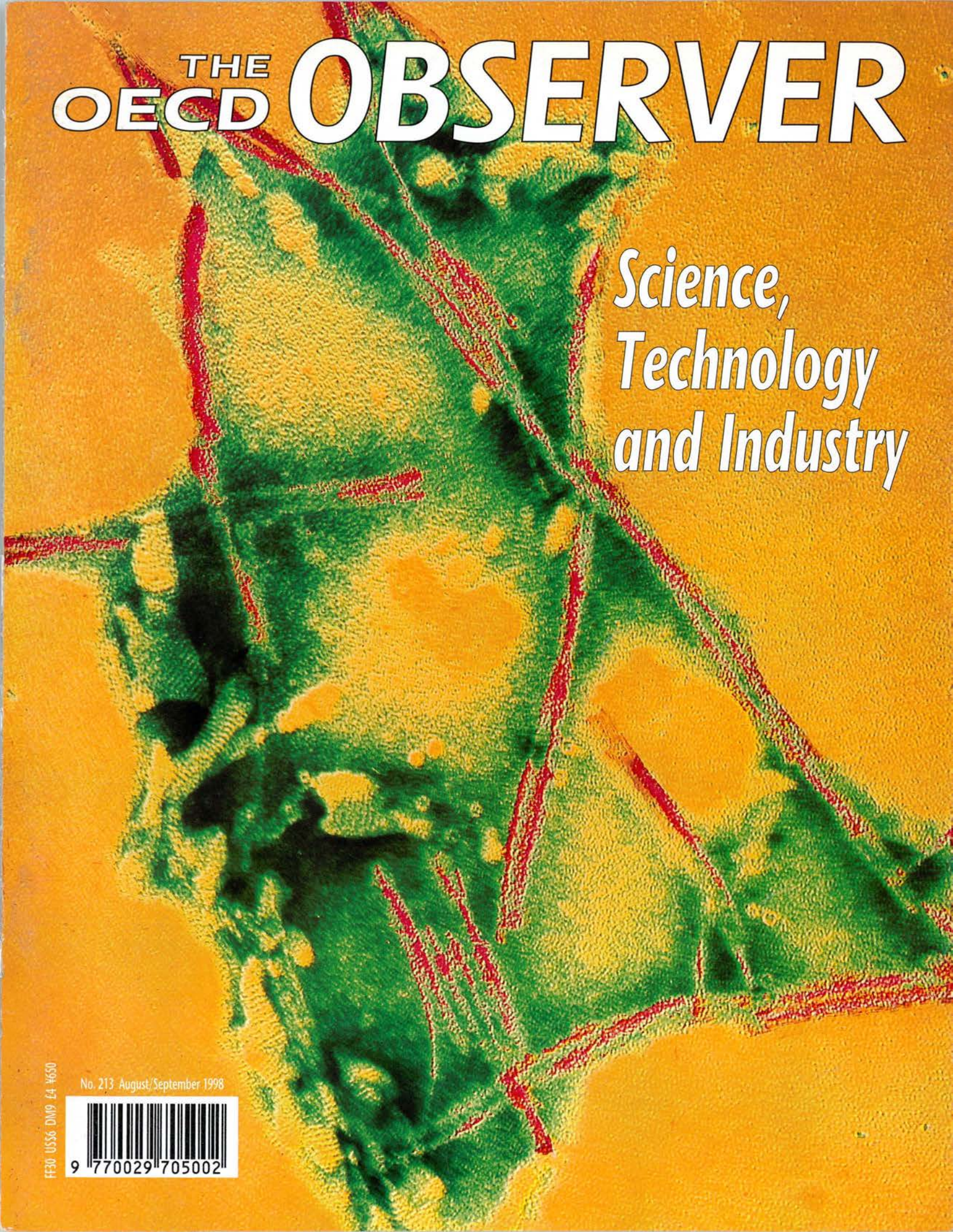
THE OECD OBSERVER



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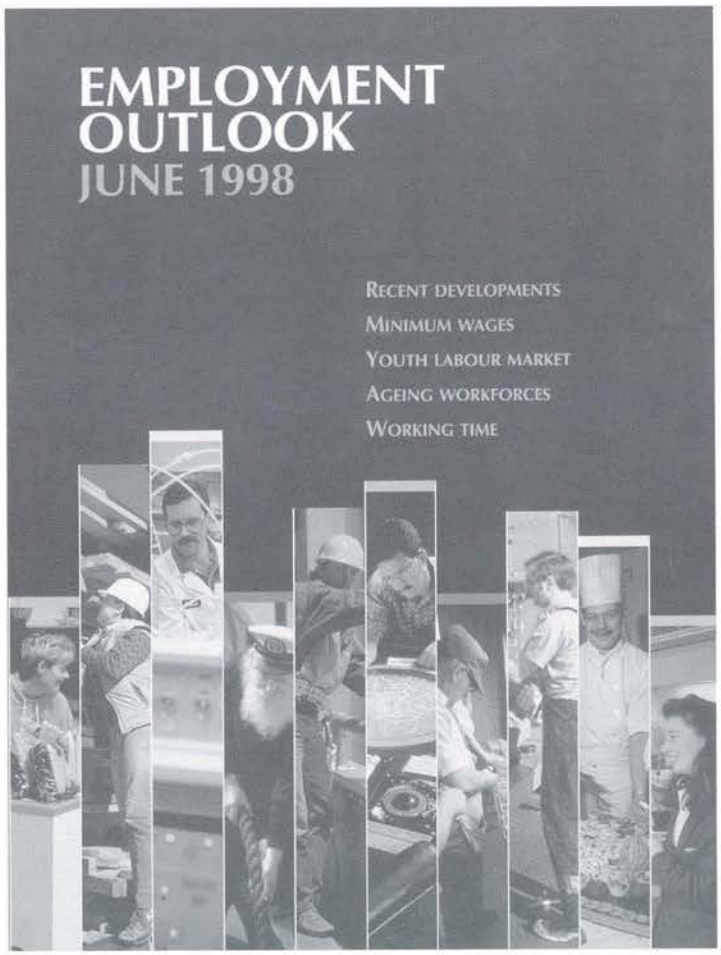
Employment Outlook

Progress in combating unemployment is uneven across countries and the OECD-area unemployment rate will only decline very slowly in 1999 to about 7%, or more than 35 million job-seekers. Therefore, reducing unemployment and expanding job opportunities remain a high priority. New approaches for an employment-centred social policy must be developed to tackle high unemployment and meet equity goals. Beyond the short-term prospects, this issue of the Employment Outlook provides insight into the measures which can help to increase jobs and reduce unemployment in the long run.



Recent developments highlight the problems faced by the jobless in households, as almost 20% of working-age households have no adults in employment. This proportion has increased almost everywhere over the last decade.

Minimum wages help reduce inequalities in wages and incomes but, if set too high, can also cause employment losses, particularly among the young. They are neither 'the' solution to overall family poverty nor the general scourge on jobs that opposite sides proclaim. As part of a coherent package of policies, they can be beneficial in moving towards an employment-centred social policy.

Youth labour-market problems are in the forefront of employment policies, as people's initial foray into the world of work is, for many, a harbinger of their future. While many factors influence the transition from school to work, countries with strong apprenticeship systems tend to do best in successfully integrating youth into employment.

Ageing workforces raise major economic challenges that can be turned into opportunities. 'Active ageing' will become a reality if labour markets, enterprises and workers have the means and incentives to adapt and make the most of older workers' skills while guaranteeing them adequate standards of living.

Trends in working time reflect developments such as the recent reversing of the decline in hours of full-time workers in some countries, a widespread increase in part-time work, but much less increase in other forms of 'flexible working'. Analysis concludes that legislated reduction in working hours alone cannot be counted on to reduce unemployment. Long-term policies building on these grounds should be developed, based on labour market, educational and social policy reforms. An appropriately set minimum wage combined with in-work benefits should help implement an employment-centred social policy. Work is urgently needed on how to design such a package. In the long run, investing in human capital deserves special attention because enhancing workers' productive potential, especially for the least advantaged, is central to increasing their economic well-being and to strengthening the social fabric.

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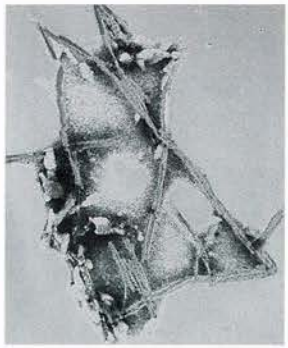

Prions in a 'mad cow' brain. Courtesy of information technology.
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Observer Exclusive

For the Record

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Putting Innovation to Work

Donald J. Johnston, Secretary-General of the OECD

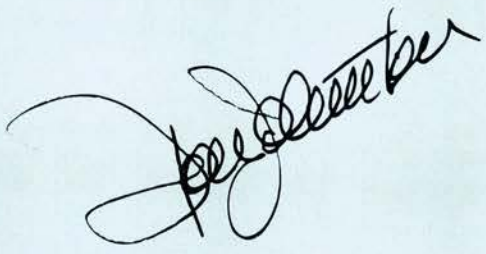
New ideas, new methods and new products are potent engines of economic growth. We are living in a period of unprecedented innovative activity which is generating ever more social and economic benefits at ever greater speeds. The ability of today's firms to produce and deliver high-quality goods and services throughout the world has prised open existing markets and created new ones too. Technology has compressed product life cycles and enhanced the role of the market as a testing ground for new ideas. To borrow Schumpeter's characterisation of the constant remoulding of market economies, 'creative destruction' is proceeding as never before.

There is no doubt that information and communications technology has helped spur the globalisation of markets. Though sparked in OECD countries, it has ignited innovation everywhere. Virtually every sector in every country has been affected by technological innovation, so much so that a global networked economy is taking shape, blurring the old dividing lines between the industrialised world and the transitional and emerging economies. From the growth of silicon-based technologies in the late 1970s came the explosive development of powerful telecommunications infrastructure, which brought once-dispersed markets ever closer together. Now electronic commerce is helping to unshackle cross-border trade in many sectors and is revolutionising traditional services from retailing to banking. Information technology is driving innovation in mature manufacturing industries too. Thanks to improved knowledge systems, controlling stocks is easier than before, with 'just-in-time' manufacturing becoming the norm in the automotive sector. Moreover, many firms now manage their output on a to-order basis.

And there is more to come. We are probably just at the beginning of a new wave of technological change whose effects will be felt everywhere. The life sciences, underpinned by government-led basic research, are delivering benefits to the world's citizens in the form of new medicines and drugs. In surgery, for example, nanotechnologies have opened up new possibilities. In environmental management, work to improve plant varieties and reduce our dependence on ecologically damaging chemical fertilisers is at an advanced stage, while the creation of remarkable technologies derived from living organisms and bio-catalysts is another exciting prospect.

Research and development is becoming a highly competitive business in its own right, which is why governments are increasingly willing to let markets play the leading role in technological development. But as OECD experts argue in this issue of *The OECD Observer*, long-term basic research must be bolstered for innovation to continue thriving.

Every day a fresh breakthrough in science and technology is announced. And thanks to a more accessible global information system, firms everywhere can benefit from it almost at once to produce improved goods and services and generate new markets. It is a virtuous circle, leading to better products, expanded markets and higher standards of living. It encourages new ideas to flourish in a world in search of sustainable growth.



The Economic Impact of Technology

Dirk Pilat

Rapid advances in technology, driven by scientific progress and the search for more efficient business practices, are changing the composition of OECD economies.[1]

There are a number of forces driving the transformation towards a knowledge-based global economy. The growing role of information and communications technologies (ICT), a continuing shift to services and the globalisation of markets and societies are just some of the key ones.

These are long-term trends, which combine with fluctuations in demand and the competitiveness and productivity performance of particular industries to drive structural change and thus the growth and decline of individual sectors. Because countries have different economic structures and comparative advantages, the prospects for any given sector are virtually impossible to judge across the OECD area as a whole. There are nonetheless a number of identifiable processes affecting sectoral prospects, including the increasing role of knowledge-intensive industries, the growth of some service sectors, particularly business, community and social services, and the changing competitiveness of OECD economies.

A major characteristic of the transition to a knowledge-based economy is that output is growing rapidly in those sectors that develop and use ICT intensively and have high skill requirements (Figure 1). Traditional knowledge-based sectors – such as computers, aerospace, pharmaceuticals and communications equipment – only account for a few percentage points of total GDP. By including ICT-related services, such as communications, the share of knowledge-based industries in total business value-added rises a few percentage points. The main contribution to the growth of these industries is made by finance, insurance and business services, which are heavy users of information technologies. This broad definition accounts for almost 35% of business-sector value-added in the OECD as a whole, a share that has grown significantly in recent years.

Growth Sectors

The shift of OECD economies to services underlies these developments. The fastest growing sectors in terms of employment are finance, insurance and real estate, business services, and community, social and personal services (Figure 2). The output and employment shares for electricity, gas and water, construction, and transport and communication services have generally remained stable or have fallen slightly. The share of the distribution sector has also remained stable.

The share of manufacturing in the economy will continue to decline. High-technology manufacturing, such as aerospace, computers, electronics and pharmaceuticals, has been able to maintain its share in the economy. But medium- and low-technology manufacturing, such as chemicals, food products and textiles, has declined markedly over the past decade or so.

The changing composition of the manufacturing sector is also apparent in the trade structure of OECD economies: exports of low-technology industries, such as textiles, have declined in importance, whereas exports of high-technology industries have grown rapidly.

These broad trends are apparent throughout the OECD area. Sectoral developments in individual countries may vary substantially, but

1. ***Science, Technology and Industry Outlook 1998***, *OECD Publications, Paris, 1998.*

Siemens Press Photo

Mastering super-conductivity for super-computers.

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The Economic Impact of Technology

patterns of specialisation are discernible which often reflect well-established characteristics. For example, Germany is traditionally strong in machinery and equipment, Switzerland in pharmaceutical products and Denmark and the Netherlands in food products.

Some sectors are nonetheless likely to experience strong expansion, though with differences from country to country. The world market for information-technology (IT) grew twice as fast as GDP between 1987 and 1995; growth was particularly marked in software and computer services. And given the prospect of new advances, the IT sector will remain a very dynamic part of the global economy.[2]

The health-care market is one area that will enjoy rapid expansion. The ageing of the OECD population, combined with improved health awareness, is driving up demand, just as advances in biotechnology and other health-related technologies are opening up a range of new treatments. Health care may also move gradually from hospitals to the home, partly as a result of financial constraints, thus stimulating demand for simple and user-friendly health products and services, some of which may be provided through the Internet.[3]

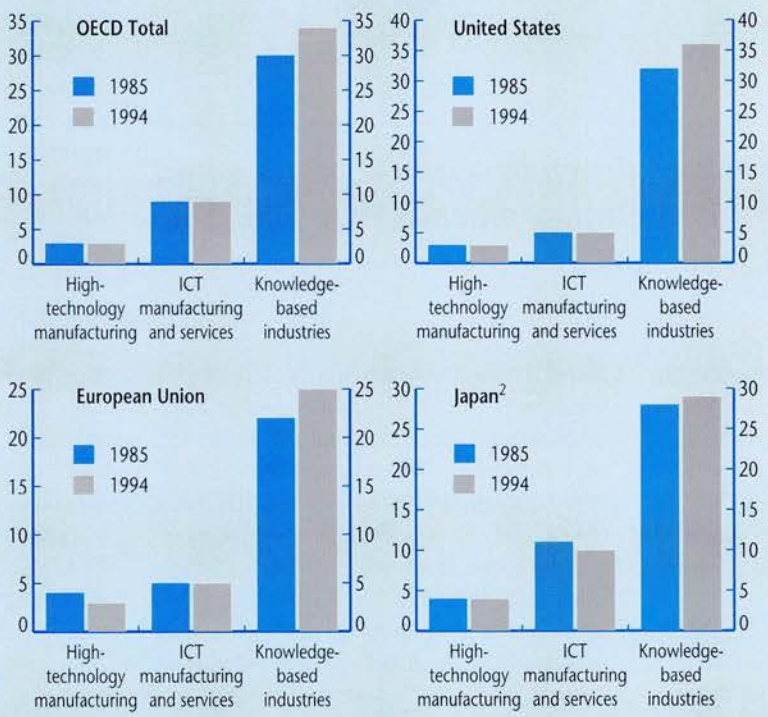
Environmental goods and services are another market where growth is expected to accelerate. Although it is still relatively small, it links several economic sectors, including agriculture, manufacturing, energy, construction, transport and services. Environmental awareness is growing in many OECD countries. There is the rising demand for a better quality of life, while efforts to tackle environmental problems, such as global warming, will continue to stimulate demand for environmental goods and services, not least in the energy market.

Specialised business services are likely to enjoy good growth, as they are already doing in the United States, where services such as accounting, auditing and data processing grew by 10% annually over 1994–96. As competition in manufacturing and services continues to increase, firms are looking for ways to reduce costs and improve efficiency. One strategy is the contracting-out (or out-sourcing) of certain services, such as computer support, cleaning and advertising, a development that will cause the share of manufacturing in the economy to decline. In fact, the commercial success of manufacturing products increasingly depends on associated services; and services are now among the main users of advanced technologies.

A number of other developments will affect industrial performance in OECD economies over the coming years. Continuing globalisation, the growth of foreign direct investment and deregulation are all likely to intensify competitive pressures in many parts of the economy and more directly affect sectors such as energy, transport,[4] communication and distribution, which have remained relatively sheltered until now. The adjustment that will be inevitable could lead to transition problems, particularly in rigid economies.

Industry is also likely to change in other ways. Ongoing technological progress in many areas, including information and advanced manufacturing technologies, will enable further improvements in quality, driven by changes in consumer demand. Firms will have to become more flexible but, to do so, they will have to undergo considerable organisational change. Recent developments suggest the re-emergence of small firms in industries such as textiles and steel; they can respond more quickly to change than large ones, while new technology has limited the role of economies of scale in these industries.[5] It can therefore be expected that, as firms try to innovate, they will

Figure 1
The Emergence of Knowledge-based Industries[1]
value-added
% share in total business sector



1. Information and communication technology (ICT) manufacturing: office and computing equipment; radio, TV and communication equipment; ICT services. Knowledge-based industries include ICT manufacturing and services as well as finance, insurance and business services.
2. Transport and storage activities are included in ICT services.
Source: OECD

2. ***Information Technology Outlook 1997***, *OECD Publications, Paris, 1997.*

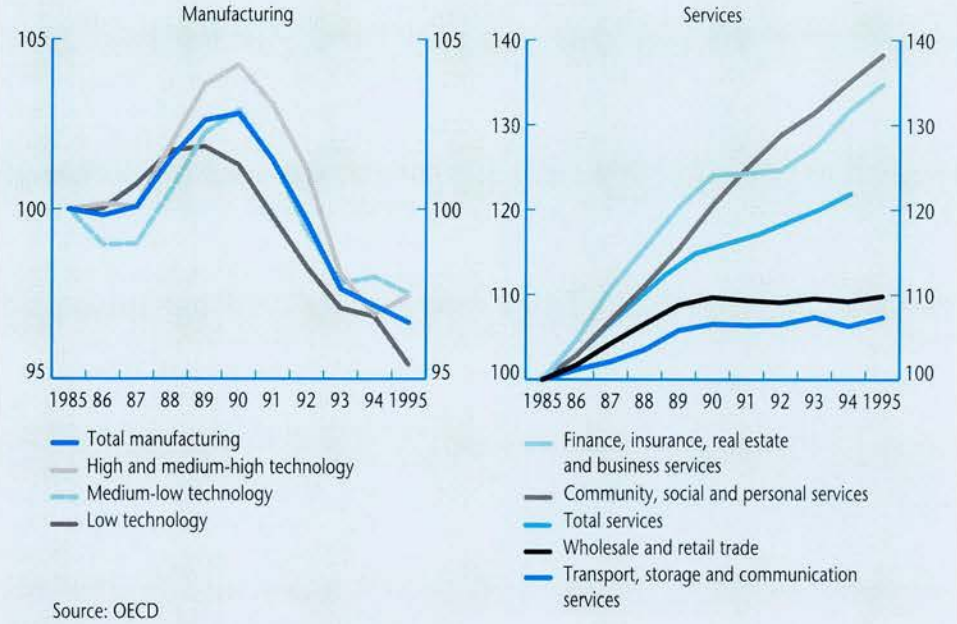
3. *Nicholas Vanston, 'The Economic Impact of Ageing',* ***The OECD Observer****, No. 212, June/July 1998.*

4. *Thomas Andersson and Patrick Hasson, 'Why Integrated Transport Systems?',* ***The OECD Observer****, No. 211, April/May 1998.*

5. *See pp. 19–22.*

6. *See pp. 16–19.*

Figure 2
OECD Employment Trends in Manufacturing and Services Industries
1985 = 100



Source: OECD

co-operate more closely with other companies, in formal joint ventures or in industrial clusters, as well as with universities and public laboratories.

Technologies to Watch

Although technological change is driving economic development, its full impact is nonetheless difficult to project. In recent decades, both governments and private research institutions have undertaken a range of studies in an attempt to anticipate its effects. 'Technology foresight' attempts to predict developments in the longer term. With the help of scientists and specialists, it tries to identify the emerging technologies that are likely to yield the biggest benefits for economies and societies. The OECD countries have been using this approach with increasing frequency to guide research and development (R&D) and to help with policy design.

Notwithstanding their imperfections, most foresight studies point to a limited number of technologies which will occupy centre-stage. Topping the list are information and communication technologies, particularly high-density components and new types of software, and health and life-science technologies, including biotechnology, genomics and combinatorial chemistry. In manufacturing, robotics and micro- and nano-scale fabrication are held to be among the core technologies, and the development of advanced materials – high-temperature, lightweight and bio-compatible – will also be important. So, too, will biotechnology applications for clean industrial products and processes and for the bio-remediation of air, water and soil. In addition, technologies to improve energy efficiency and power generation and those enabling the use of renewable energy will be key. Most foresight exercises also predict that interdisciplinary activities, including photonics, bionics and bio-electronics, have enormous potential.

A Question of Funding

This dynamic outlook reflects the pace of technological change across the OECD area, even though funding for R&D has declined considerably as a percentage of GDP over the period 1990–95 and has shown little sign of recovery over 1996 and 1997.[6] But in the next few years, public funding for R&D in the OECD area may increase slightly; budget projections for the United States, the leading supporter of R&D, suggest a slight rise (in real terms) in government funding between 1998 and 2003. Japan, another important supplier of resources for public R&D, aims to increase spending on science and technology by 50% between 1996 and 2001, with the proposed R&D budget for 1998 calling for a 5% increase in real terms. Government funding of R&D in the three major European R&D spenders (France, Germany and the United Kingdom) are expected to stabilise or even show a slight decline over the near term. The budgets of some other OECD countries with significant R&D spending (Canada and the Netherlands) will decline slightly. A small number of OECD countries, including Finland and Korea, are aiming for sizable increases. The short-term outlook for business funding, which is aimed at applied R&D

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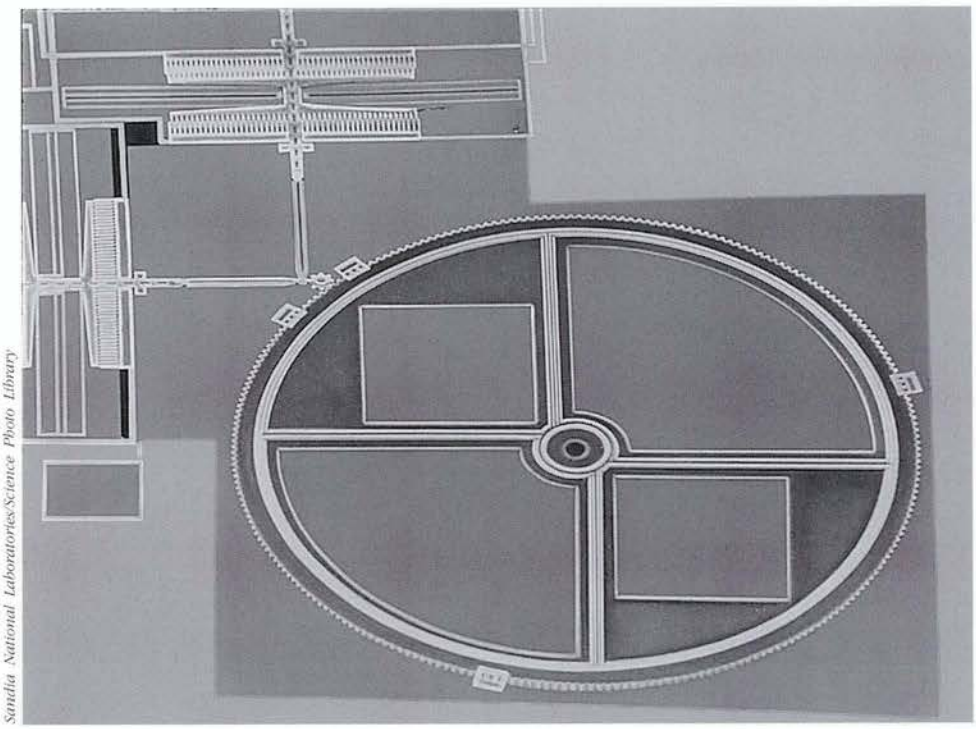
Biotechnology may hold the solution to the danger of drought.

The Economic Impact of Technology



Sandia National Laboratories/Science Photo Library

Getting smaller. The transmission unit of this nano-machine is finer than a human hair.

in particular, is buoyant, particularly in the United States.

Moreover, in spite of funding constraints, the scientific community continues to generate a stream of discoveries in biochemistry, genetics, high-energy physics and superconductivity. Their impressive progress was made possible partly because of information and communication technologies, which have opened many new areas for research and dramatically boosted performance.[7]

On the basis of current trends, firms and governments can be expected to maintain their support for basic, long-term activities. However, they will increasingly demand timely results from their R&D spending. The 'technology take-up' of firms is likely to intensify as global competition increases; and improvements in research efficiency – not least because of the closer integration of fundamental and applied research in areas such as biotechnology – will also give momentum to technological progress.

Science-industry partnerships will become a more integral part of national innovation strategies. The private sector will increasingly look to universities for the relevant skills and experience. It will also make more use of research results from universities and public research facilities to develop commercial technologies. Globalisation now drives all aspects of research and technological diffusion within and between countries.

Despite these broad trends, the exact future of technological change remains uncertain. In particular, research may not always lead to successful results. Non-technological factors can come into play, and these are very difficult to predict. For example, the success of personal computers in the home was quite unforeseen. Among the factors determining success are effective contact between science and industry, sufficient feedback as innovation changes demand, regulations, the organisation of the workplace, the availability of appropriate skills, as well as efficient markets, for factors (such as capital and labour) as well as products. Attention to these elements in government policy is crucial if the benefits of technological change are to be realised.

■ ■

The speed of technological change, globalisation and the increasing complexity of the economic environment pose new challenges to the capacity of OECD economies to adjust, forcing governments to take a critical look at the design of their policies. There is a growing awareness of the limits to the role of government in the economy, and the trend towards economic globalisation has reduced the effectiveness of domestic policy measures in many areas.

Together, these factors have forced a sea-change in industrial, science and technology policies. This is clearest in industrial policy, which is becoming less a matter of direct state intervention than a question of improving the environment for private industry. Science and technology policies are also changing, because of cuts in government R&D funding, the growing role of technological diffusion, and closer co-operation between governments, universities and industry.

But if governments want to see more flexibility, they will have to adjust their policy settings further still. That will require identifying and implementing 'best-practice' approaches capable of fostering growth in knowledge-based economies.[8] Failure to adjust could prove very costly. ■

7. *See pp. 9–12.*

8. ***Technology, Productivity and Job Creation – Best Policy Practices**, OECD Publications, Paris, 1998.*

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Information Technology Outlook 1997, 1997.

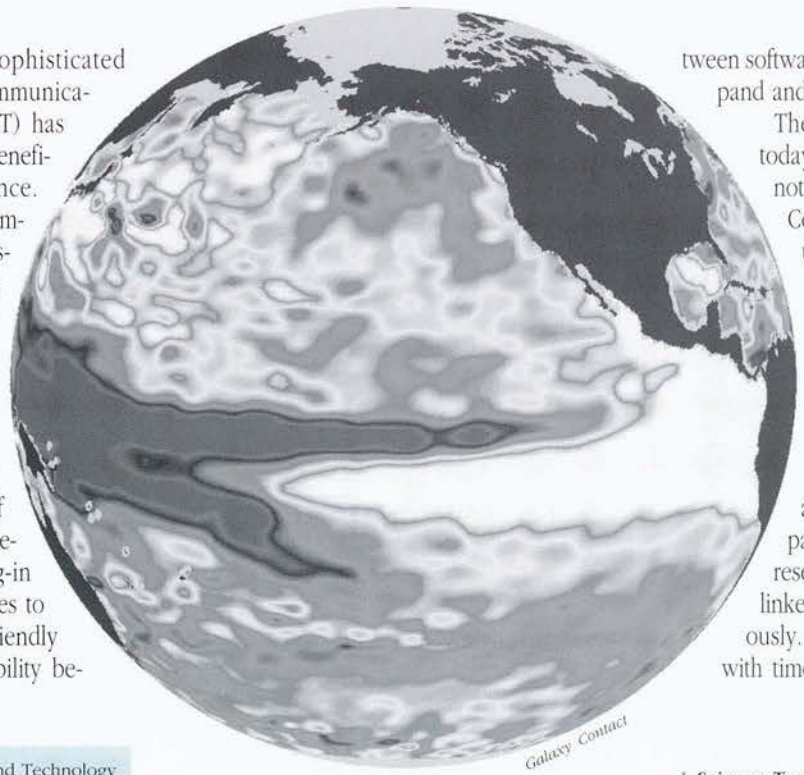
Information and Communications Technology in Science

Viviane Bayar

Information and communications technology has facilitated progress in research and development worldwide. Indeed, the way in which scientific research is carried out has been deeply influenced by the remarkable advances made in the development of these technologies.[1]

The emergence of sophisticated information and communications technology (ICT) has had a profound and beneficial impact on science. Ever faster and more powerful computing systems have made it possible to tackle complex scientific problems which only a few years ago were beyond reach. Technological innovation has improved the performance of successive generations of information systems, making them cheaper and easier to use. The size and cost of transistors continue to shrink; off-the-shelf components, such as plug-in cards, have added new capabilities to personal computers; and user-friendly software and improved compatibility between software programmes have helped to expand and multiply uses.

There is little doubt that many of today's scientific achievements would not have been possible without ICT. Complex modelling to help in the understanding of natural phenomena is now possible, as is the graphical representation of large amounts of satellite data. One of the better-known applications of ICT, the use of the Internet for electronic mail and data transfer, has revolutionised communication and its impact on scientists has been particularly striking. The number of researchers around the world who are linked by networks has grown tremendously. Many of the barriers associated with time zones and language have been



Galaxy Contact

El Niño, as seen by computers.

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1. ***Science, Technology and Industry Outlook 1998***, *OECD Publications, Paris, 1998;* ***The Global Research Village: How Information and Communication Technologies Affect the Science System***, *OECD Publications, Paris, forthcoming 1998.*

Information and Communications Technology in Science

FOCUS

Advances Made Possible by ICT

- *155 divided to 0: researchers have made this mathematical breakthrough by using the processing power of networked workstations across the globe. It is a complex computation problem – factoring a large number – that could previously not be solved.*
- *Quarks by computer: year-long computations have helped to confirm the fundamental theory behind quarks and, using its principles, to identify a new particle. These central problems in the theory of elementary particles would not have been surmountable without very powerful computers.*
- *Data-streaming from a variety of dispersed sensors, as well as from Doppler-radar observations that measure precipitation and air movement, are combined by a specially developed programme and made available to meteorologists and other researchers in numerous countries.*
- *Global databases on the Internet have facilitated research into cancer genes, infection-causing proteins and the keys to a whole host of genetic abnormalities.*
- *'Virtual labs' have accelerated product design, with three-dimensional modelling software computerising the prototyping process, which enables researchers to design and analyse complex products before fabricating physical parts.*
- *Computers can screen potential drugs for development, helping to create three-dimensional computer images of molecules as an alternative to animal or cell testing.*

overcome, and the communication costs of distance reduced. Not only have the links between geographically dispersed scientists grown, but so have the frequency and volume of communications. Long-term experiments which can take years to organise and run are easier to co-ordinate and manage with ICT. Moreover, information flows between scientists and technicians who work in shifts to ensure the continuous operation of certain scientific instruments have improved.

The effect of ICT on communication among scientists reflects the degree of interdependence in the branch in which they are working. Interdependence between research collaborators is typically high, for example, in mathematics, physics and aerospace, and low in ornithology, a field where the pace of discovery is relatively slow. By broadening contact between scientists, ICT tends to lead to more multidisciplinary work. On the other hand, it could cause science to fragment, with researchers focusing more on their individual needs. It is too early to determine which trend will influence scientific achievement most, or whether fragmentation is indeed happening at all.

Generally today, the decision to collaborate on a project is influenced more by the research subject itself than by traditional questions of geography or distance. The tendency is therefore towards more 'virtual' research teams with fluid work structures, although face-to-face contact is still necessary in the early stages of research. Social relations and research practices that existed before the use of ICT are typically reproduced over an expanded network of researchers. In other words, the effect is to broaden science, rather than to alter the hierarchy of scientific institutions.

Digital Desktops

With ICT, vast quantities of scientific data and digital information can be handled more easily, quickly and cheaply than before. High-quality information can be searched for and retrieved at the desktop. Other advances in technology are improving information storage capabilities.

Research databases produced by scientists in almost any discipline can be made available over the Internet to colleagues around the world. Scientists in different countries working in biological and earth sciences can combine local data sets to create global ones, such as with the Human Genome Project and the International Geosphere-Biosphere Programme. Databases containing huge quantities of intelligence on, for example, the functioning and evolution of genes, double in content every year and provide microbiologists with previously unimagined research opportunities. Web sites containing data on gene sequences report about 100,000 'hits' or visits every day from as many as 5,000 different user sites.

Complex software specifically designed to handle a given type of data can also be downloaded from electronic networks, and libraries of free software for scientific purposes have become available on the Internet. Requests for software programmes relating to research in mathematics and computational science from Netlib, a software library, have increased sharply with the development of the World Wide Web, from 250,000 in 1993 to more than 3 million in the first six months of 1996. In the United States the National HPCC Software Exchange funded by the High Performance Computing and Communications (HPCC) programme is a collection of software and software descriptions for high performance computing systems and is available on the Web.

ICT has expanded the methods of accessing the bibliographies of published research, and Internet-based delivery is constantly being upgraded. Research libraries are also being transformed. Universities and other research organisations can now store their least-used books and documents in less costly remote warehouses to clear space for newer services, including computer stations and multimedia rooms. Scholars can search for titles by browsing electronic databases which contain more information than traditional card catalogues.

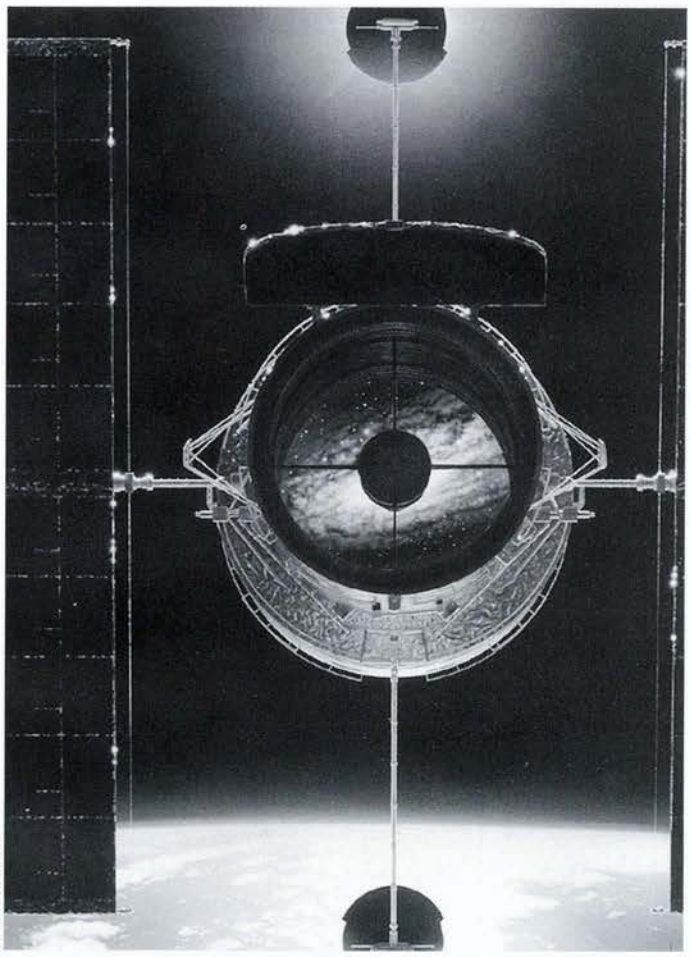
Information resources on the Internet, hypertext links to relevant reference materials, computer software and digital libraries are but a few examples of how ICT has enriched the range of resources available for the education and training of scientists. New tools have been devel-

oped, such as the *Earth System Visualiser*, which gives university students access to Earth observation data over the Internet.

The Virtual Lab

ICT has made data collection and remote control of scientific instruments over vast distances a reality. Space physics, meteorology and oceanography have benefited considerably, as their instruments are necessarily in remote locations and can be reached only infrequently. The Hubble Space Telescope is a good example. Versatility is improving all the time and remote instruments can now be adjusted to modify instructions as data is being collected, taking account of new intelligence as it is transmitted and analysed. This 'real-time' management is routine practice at some radar stations.

One of the biggest contributions information technology has made is in computation. Problems can now be solved that would have been impossible to tackle before. Massive computing power is required to carry out repetitive calculations on huge sets of data – for example, modelling the global climate, weather forecasting or molecular modelling. Even the simulation of car crashes has become possible. Simulating 150 milliseconds of a relatively simple crash would take more than 250 hours of computing time on a Pentium-powered computer running at 200 megahertz, but only eight hours on fast high-end computers.



L. Bret/Eurelios

The Hubble Space Telescope is an example of remote technology.

ICT has transformed benchtop instruments in the laboratory. In the past, measurement of temperature or pressure, for instance, was typically done by specialised instruments, often supervised by an assistant; now sensors connected to general-purpose computers with programmable software can perform the same tasks. Software technologies for visual programming have markedly improved the ability of scientists and engineers to acquire data using icons. They can design, simulate, analyse and solve complex mathematical problems more quickly and work can be used across projects. *Visual Science* is a programme which provides more than 100 extremely reliable math functions, by passing the corresponding programme code each time.

The Fast Lane in Scientific Publishing

Electronic publishing has opened up new opportunities for the scientific community. Software for the visual representation of huge amounts of data make report preparation easier. Lead-times between the submission and publication of a manuscript have been shortened from as many as 300 days in traditional scientific publishing to three days. The enormous time gain has been made possible by electronic mail transfer. With electronic publishing, individual articles can be published quickly, once thoroughly scrutinised, without being held up by the processing of other articles or having to put up with routine printing delays.

Reducing lead-times in publishing across all the sciences would be impossible, however. For a start, work practices differ sharply between disciplines. In high-energy physics, for example, scientists involved in a research project tend to be few and well-known, with privileged access to equipment. The research will have been thoroughly reviewed by the time a manuscript is submitted for publication. Pre-prints are often made available. In biology, on the other hand, research is quite fragmented. Facilities are common and affordable and, in fields closely linked to commercial applications, research may involve the private sector. Consequently, researchers are often unwilling to release reports before publication in order to maximise attention.

Other benefits of ICT include wider access to scientific literature and 'custom' publishing by authors. Furthermore, moving around the World Wide Web is facilitated by hypertext links to related information, thereby accelerating research and improving focus. Electronic publishing is often mistakenly seen as cheaper than subscribing to conventional scientific journals. There may be savings in paper costs, for example. But estimates tend initially to overlook the costs associated with operating full electronic information services, developing and maintaining software,

and validating and handling subscriptions. So far, electronic publishing has generally constituted a more up-to-date complement to print which can be accessed sooner, rather than a complete substitute.

Barriers to Progress

There are still numerous technical, economic and legal barriers to the broader and more efficient use of ICT by scientists. Some arise from the still limited access to electronic infrastructure and IT support, particularly in peripheral institutions and developing countries. Other pressing problems, such as 'traffic jams' on electronic networks, are probably caused by the rapid growth in demand. Such overcrowding can cause not only minor nuisances, such as slowing down data transfer, but it can interfere with the handling of remote control instruments.

Sharing electronic resources compiled in disparate databases poses a number of challenges, including standardisation of formats, quality control, and developing software tools for efficient and improved global access, storage and compression. Higher costs and new pricing practices are a cause of concern to the scientific community. In electronic publishing, there are issues associated with scrutiny, intellectual property rights, archiving, permanence and access.

Accommodating Diversity and Change

The overall impact of ICT differs substantially from discipline to discipline. In some fields, a new form of organisation of scientific work known as a 'collaboratory' has emerged, bringing together virtually all of the advantages of ICT. In a field like particle physics, where research is highly capital-intensive and centralised, ICT greatly enhances collaborative research. And in fragmented and less capital-intensive fields, such as some sub-disciplines of biology, there is an increasing amount of sharable data. But in disciplines with relatively straightforward commercial applications, such as biology, chemistry and computer science, research results are often treated as confidential information.

ICT developments substantially reduce the time needed to execute certain scientific tasks and can cut costs, such as by allowing scientists to specialise and collaborate, as well as sharing data and instruments. They may also help to break down the barriers between sciences. But there are costs, for example, in teaching new methods and techniques. Moreover, while the relative costs of research may have fallen compared with traditional systems, new leading-edge technology can be expensive to acquire or access.

■ ■

The pace and importance of change in ICT demands that governments be flexible and responsive in their policies towards scientific research. They must ensure that scientists have access to high-speed, low-cost and seamless research networks, even where developments might be driven by commercial considerations. Governments will also have to provide the regulatory framework for access to databases, the protection of intellectual property and the development of collaboratory structures. As they consider the funding of the sciences, they must take ICT requirements into account, whether it be the establishment of electronic databases, technical support or training. If a global scientific system is to become a reality, further effort will be required to improve telecommunications infrastructure and to strengthen the human-resource base, particularly in countries outside the OECD. ■

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What

Dirk Pilat

Improvements in productivity are essential to increase income and boost growth. The combination of labour productivity and the amount of labour used in an economy determines the real income achieved. So the considerable differences in productivity performance across the OECD area – which remains disappointing overall – are attracting the attention of policy-makers.[1]

Sectoral analysis shows that many parts of the economy – in both manufacturing and services – have achieved substantial gains in productivity over the past three decades. Distribution services, telecommunications and transport are among the best performers in the services sector; and high-technology industries (computing equipment, aircraft, pharmaceuticals and telecommunication equipment) tend to have the highest rates of productivity growth in manufacturing. Difficulties in measurement – for instance, in financial services – may disguise some of the advances that have been made. In other parts of the economy and in many services (such as legal, community, social and personal services), productivity growth has been slow.

Real income in an economy can be raised by increasing labour utilisation – for instance, by enhancing the participation of the population in the workforce, or by reducing unemployment – or by improving its productivity. National economic performance varies considerably, despite the advances of recent years, and the OECD area still shows considerable diversity in real incomes

Drives Productivity Growth?

from country to country, reflecting substantial discrepancies in labour productivity and in the amount of labour used (Table).

The difference between labour productivity – as measured by gross domestic product (GDP) per hour worked – and GDP per capita can be broken down into a number of factors.[2] First, working hours per person employed vary substantially across the OECD area. They are very high in the Czech Republic, Korea and Mexico, and very low in the Netherlands and Norway, partly because of high rates of part-time employment in these two countries. This variation explains the difference between labour productivity in terms of GDP per hour worked and per person employed.

The difference between GDP per person employed and GDP per capita is explained by the amount of employment in the economy. Three factors can be distinguished:

- the ratio of the working-age (15–64 years) population to the total population
- the ratio of the labour force to the working-age population (the participation rate)
- the ratio of those employed to the labour force.

The first ratio is closely linked to the age-structure of the population. The other two are more important in an economic sense, since they largely reflect how well an economy is able to use its workforce. The relative income levels in 1996 in Belgium, France, Greece, Ireland, Italy, Mexico and Spain were all substantially below the corresponding figure for productivity, indicating a low degree of labour utilisation. In most of these countries, the gap between income and productivity performance mainly reflects low employment rates, although high unemployment in Spain also adds to the difference. Several OECD countries, principally Denmark, Iceland, Japan, Luxembourg, Norway, Switzerland and the United States, have higher relative income than relative productivity, thereby indicating a degree of labour utilisation above the OECD average.

Differences in incomes and productivity between what are now the OECD countries have narrowed markedly over the past half-century. But the 'catch-up' in incomes in Europe, Japan and other parts of the OECD area with US levels can be ascribed less readily to increased use of labour than to more rapid rises in labour productivity. This diagnosis is particularly accurate for a number of European countries, where employment rates have deteriorated over the past two decades and where unemployment rates have increased substantially. Consequently, productivity in these countries has caught up with the United States more rapidly than income has.

Decout/RÉA

Obstacles continue to slow productivity in transport.

A Measure of Industrial Performance

Apart from its role in determining income, productivity is also an important yardstick of industrial performance. It indicates how well firms are able to combine input factors to produce output and is a major determinant of production costs and therefore of competitiveness. The indicators of sectoral productivity required to make this analysis show that productivity differs considerably here, too.[3]

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1. ***Science, Technology and Industry Outlook 1998***, *OECD Publications, Paris, 1998.*

2. *GDP is adjusted for the purchasing power of national currencies. See also 'Understanding Differences in Economic Performance', Perspectives on a Global Economy, Report No. 1187-97-RR, Conference Board, New York, Summer 1997.*

3. *Dirk Pilat, 'Competition, Productivity and Efficiency',* ***OECD Economic Studies****, No. 27, OECD Publications, Paris, 1996.*

Table
Breakdown of GDP Per Capita into Contributions of Labour Productivity and Labour Force Participation, 1996

	GDP per hour worked as % of OECD average[1] (1)	Effect of working hours (2)	GDP per person employed as % of OECD average (3) [1 + 2]	Effect of unemployment[2] (4)	Effect of labour force participation[3] (15–64) (5)	Effect of working-age population (15–64) over total population[4] (6)	Total employment effect (7) [4 + 5 + 6]	GPD per head of population as % of OECD average (8) [3 + 7]
Australia	105	–5	100	–2	6	1	5	105
Austria	112	–10	102	3	1	2	6	109
Belgium	143	–13	131	–7	–14	1	–20	110
Canada	107	–4	104	–3	5	3	5	109
Czech Republic	35	7	42	1	1	2	4	46
Denmark	104	–6	98	0	12	2	14	112
Finland	103	–5	99	–10	4	1	–5	94
France	136	–16	120	–7	–6	–1	–14	106
Germany	121	–16	105	–2	–1	4	0	105
Greece	75	–1	74	–4	–9	2	–11	63
Hungary	..	..	42	–1	–7	1	–7	34
Iceland	..	..	97	3	20	–3	20	117
Ireland	118	–2	116	–6	–11	–2	–19	96
Italy	132	–19	113	2	–18	3	–13	100
Japan	94	5	98	4	8	6	18	116
Korea	41	25	66	3	–5	5	3	69
Luxembourg	..	..	136	10	14	3	27	163
Mexico	43	8	51	0	–5	–7	–12	39
Netherlands	132	–33	99	0	0	4	4	103
New Zealand	77	5	81	1	5	0	6	87
Norway	139	–24	115	3	14	–3	14	129
Poland	..	..	38	–2	–2	0	–4	34
Portugal	63	–1	62	0	1	2	3	65
Spain	95	9	104	–17	–13	3	–27	77
Sweden	103	–9	94	–1	6	–3	2	97
Switzerland	105	–5	100	3	17	3	23	123
Turkey	40	0	40	0	–8	–1	–9	31
United Kingdom	111	–15	96	–1	5	–1	2	98
United States	131	–6	125	2	12	–1	13	138
Averages:								
OECD	100	0	100	0	0	0	0	100
North America	110	0	110	1	6	–4	2	112
European Union	117	–12	105	–3	–5	2	–7	98

1. Weighted averages based on 1996 purchasing power parities. Hungary, Iceland, Luxembourg and Poland are excluded, since estimates for hours worked were not available for these countries.
2. The difference between GDP per person employed and GDP per member of the labour force.
3. Compares GDP per member of the labour force with GDP per person of working age.
4. The difference between GDP per person of working age and GDP per capita.
Source: OECD

In manufacturing, average productivity in the United States continues to outrank that of the other major economies (France, Germany and Japan), although Japan has made considerable gains over the past four decades. Labour productivity, particularly when measured in terms of hours worked, is high also for Belgium, Finland, the Netherlands and Sweden. The manufacturing sectors in these small economies tend to be more specialised than those of the large countries and are often relatively capital-intensive, which contributes to high labour productivity. In the middle of the OECD productivity range are a number of countries (Australia, Canada, Korea, Spain and the United Kingdom) with somewhat weaker productivity, although Korea, Spain and the United Kingdom have made substantial progress. At the bottom of the range are the Czech Republic, Hungary, Mexico, Poland and Portugal.

Inefficiency and low productivity are widespread in the services sector throughout the OECD area and could be improved.[4] The poor performance of services in many countries and the diversity across OECD countries may indicate that in some sectors, such as air transport, telecommunications and distribution services, structural barriers, such as regulations, inhibit productivity growth.

The Role of The Firm

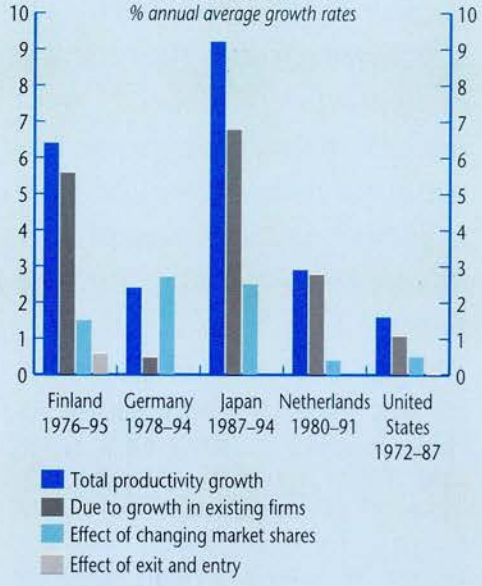
There is broad agreement on many of the determinants of productivity growth, although their precise contribution is less clear. Private investment in physical capital, training and technology is vital, and it can be supported by public investment in education, research and infrastructure. The organisation and management of these factors of production within the firm are also important. And dynamic operating conditions, such as the relative openness to trade and investment and a high degree of competition in the economy, can press firms to improve their performance.

Although some sectoral analysis has been undertaken, so far it is mainly aggregate data covering many countries which have provided most of the insights into the causes of productivity growth. Yet some recent research based on data from individual manufacturing firms highlights some key determinants of productivity which do not show up in macro-economic statistics.[5] It was this new approach to dealing with individual firms which underlined how much competition stimulates productivity growth. Although most improvements in productivity occur within existing enterprises, a substantial part is generated by competitive factors outside the firm, such as the battle for market shares among high-productivity firms, the exit of those that perform poorly and the entry of new ones (Figure).

The entry and exit of firms makes an important contribution to productivity growth. New entrants are generally more productive than businesses that close down, and the ones that leave tend to have below-average productivity. The effects of entry take time to be felt, of course, since firms gain market share and become more productive as they grow. In most cases, market entry does not have a very large effect since new entrants generally do not account for a large share of output. In exceptional cases, though, such as in the restructuring of Finland's manufacturing sector between 1985 and 1995, exit may provide an important contribution to productivity growth, as inefficient companies abandon their market share to leaner, fitter ones.

Productivity growth in manufacturing is almost equally caused by upsizing, where firms take on labour, as it is by downsizing, where they shed it. As a rule, large firms tend to be the main downsizers, whereas small and medium-sized firms are more likely to expand their labour force. Businesses that increase productivity and hire more workers are often active in markets where demand is expanding and returns to scale are increasing, or where technological innovation is being felt. This allows prices to fall and thus stimulates demand further. Firms that reduce employment while increasing productivity are often in markets with inelastic or falling demand and it is technological investment that enables these industries to become more efficient.[6] But firms with falling productivity are often unable to adjust to changing conditions.

Figure
Breakdown of Manufacturing Productivity Growth in Five OECD Countries[1]
% annual average growth rates



1. Based on firm data, covering varying proportions of the manufacturing sector.
Source: OECD

Individual firms can have remarkably different experiences within a single industry. The demise of integrated steel mills in the United States during the 1980s, for instance, was accompanied by the growth of new mini-mill companies. Analysis of why these differences occur has allowed economists to identify the causes of productivity growth more clearly. Within existing firms, technical changes and the accumulation of human capital within the firm are usually the main reasons. But the value of that insight is limited: firms that adopt advanced technologies and invest in skills already performed better than the average firm before they made these investments. So more will have to be learned about why some firms do well and others fail. The organisation of the workplace may be an important element of success: flexible firms can adapt more rapidly to change and can more readily tap into their intangible assets, such as their human skills, to bolster performance.[7]

■ ■

There is no simple way for governments to boost productivity growth. They can help by paying attention to framework conditions, including the degree of competition and market openness, since policies to enhance productivity growth within firms require a competitive environment, where a process of renewal enables entry and exit, allowing successful firms to grow and unsuccessful ones to fail. If government policies hinder this process, productivity growth will be lowered. However, government action can help: in supporting education and training, physical capital formation and public infrastructure, and in promoting technological change. But the responsibility for improving productivity lies ultimately in the hands of the private sector. ■

*4. Dirk Pilat, 'From Competition to Growth', **The OECD Observer**, No. 202, October/November 1996.*

5. Macro-economic statistics can, for instance, not show the enormous turn-over of firms within the economy and the role such turn-over plays in spurring economic performance.

6. Mature industries, such as steel and textiles, are good examples of such industries; see pp. 19–22.

*7. Graham Vickery and Gregory Wurzburg, 'Flexible Firms, Skills and Employment', **The OECD Observer**, No. 202, October/November 1996.*

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How R&D

Vladimir López-Bassols

Technology is the main engine of economic growth and structural change, and is transforming the OECD countries from industrial economies to knowledge-based ones. The decisive impact of technology on industrial performance and international competitiveness means that continual improvements in the innovation process are essential for gains in productivity, the creation of jobs, economic growth and higher standards of living.[1]

One of the most important inputs into the process of innovation – in the creation, diffusion and use of technology and knowledge – is expenditure on research and development (R&D), covering three main types of activity:

- basic research – experimental or theoretical work undertaken to acquire new knowledge without any particular application or use in view
- applied research – original investigation which is directed primarily towards a specific practical aim or objective
- experimental development – systematic work drawing on existing knowledge and directed at producing new materials, products, processes and systems, or substantially improving existing ones.

Recent surveys of companies confirm that R&D expenditure is only one part of the innovation effort of countries; marketing and product design are other important factors. In addition, it appears that an increasing share of national R&D effort is being undertaken by small firms which are often not included in these surveys, and that R&D is still imperfectly measured in certain parts of the economy, not least in the services sector. In spite of this shortcoming R&D expenditure remains the best and most broadly available indicator of innovative activity.

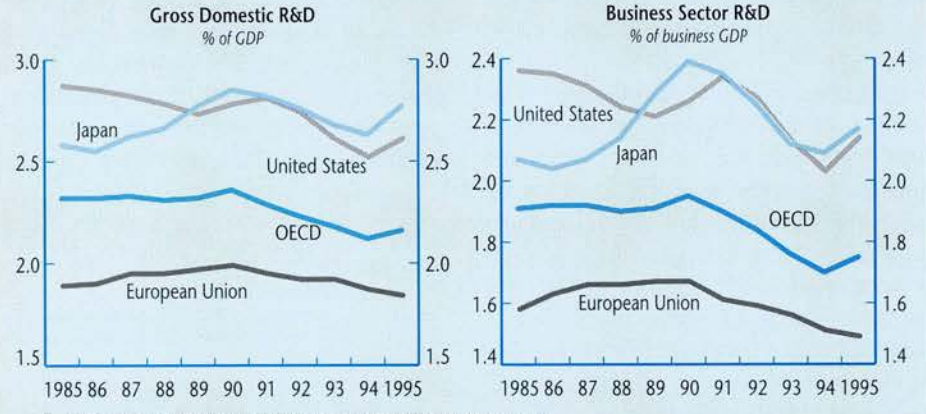
Is R&D Declining?

There is deepening concern in many OECD countries that R&D expenditure is declining and that short-term decisions to reduce R&D spending – in both the public and private sectors – may have serious adverse consequences for economic growth.

R&D expenditure continues to grow in absolute terms, but at a slow pace: in the OECD area as a whole, the annual growth rate of gross domestic expenditure on R&D was 6.5% in real terms over the period 1981–85 and only 0.5% during 1991–95. And R&D intensity, which is R&D expenditure as a percentage of value-added, has been falling, reaching 2.2% of OECD area GDP in 1995 after a period of decline in the early 1990s (Figure). Tighter government policies and increased competitive pressures are leading away from innovative, risky research to more applied research, with shorter time-horizons and a stronger emphasis on economic relevance and return on investment.

Traditionally government has funded basic and applied research, while letting private firms pay for most development-related R&D. But these distinctions are becoming increasingly blurred in some new areas of scientific research, such as biotechnology. There are a number of economic arguments to explain government support of some types of R&D activities, particularly basic, 'exploratory' research. Some research findings are seen as a public good, in that their consumption by one person does not preclude consumption by another. Firms tend to under-invest in this area of research, since they cannot fully ap-

Figure
R&D Intensity in the OECD Area[1], 1985–95



1. R&D Intensity: R&D expenditure as a percentage of value-added.
Source: OECD

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is Changing

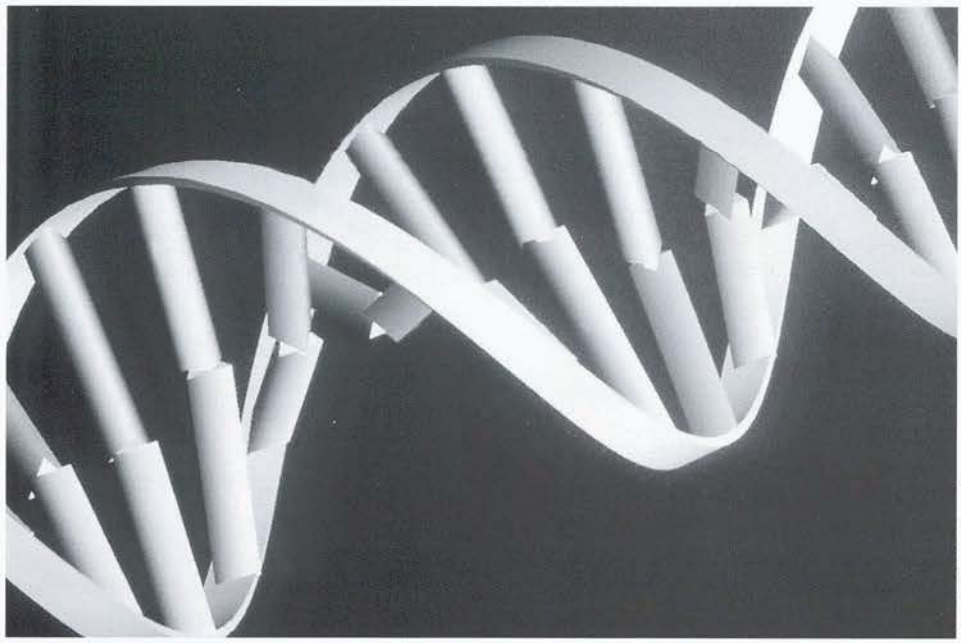
propriate its financial benefits, but have to share them with competitors.

The kinds of research that attract government funding generally have high social rates of return, in that returns also accrue to those who do not pay for these investments. An example is 'generic' or 'infrastructural' technologies, such as design-automation tools, which improve the technological capabilities of a large number of companies, but whose benefits cannot be easily captured by a single firm. The results, too, usually bring substantial, often unforeseen economic rewards to particular industries. Examples of such pioneering technologies include electric cars and high-temperature superconductivity.

Government-funded R&D has been declining in the large OECD countries. It averaged between 0.6% and 1.0% of GDP in 1995, with its annual growth rate in the OECD area as a whole decreasing in real terms from 4.7% during 1981–85, to a drop of 0.4% in 1991–95. Some smaller European countries, such as Iceland, the Netherlands, Norway and Sweden, have bucked the trend by maintaining a high degree of government funding of R&D. Basic research, which in most OECD countries accounts for 15–20% of total R&D expenditure, has remained immune to this decline. Over the last decade, the share of basic research spending in total R&D has risen in some larger countries, including France, Italy, Japan and the United States. The explanation lies in part in sizable cutbacks in public spending on defence R&D, which tends to be applied, rather than basic, in type.

Businesses both finance and carry out about two-thirds of all R&D in the OECD area. It is the single largest R&D funder and performer in most OECD countries. In New Zealand and Iceland the government sector is both the most important funder and performer of R&D. In some other OECD countries, the government is the largest funder of R&D, with the actual research being carried out either in the private sector (as in Australia, Hungary and Poland) or higher-educational establishments (as in Greece, Portugal, Turkey and Mexico).

During the early 1990s, business R&D as a share of GDP fell substantially in almost all G7 countries. Data for 1995–97 show a resurgence, particularly in Japan and the United States, which together account for between 60% and 70% of all the business R&D undertaken in the OECD area. The changes reflect cyclical conditions, as much corporate spending on R&D is financed from internal sources, such as retained earnings and depreciation allowances, which are tied to the business cycle.



Ph. Plailly/ESRF/Eurelios

DNA shows the way forward for medical technology.

In high-technology industries such as chemicals and pharmaceuticals, R&D can account for a sizable share of a firm's costs. The ratio of R&D to sales in these industries often exceeds 10%, more than twice the average of that in the 300 largest R&D-spending firms. Sharp drops in cash flow can therefore affect investment decisions, with a substantial adverse impact on research, mostly for short-term development projects. Structural changes – such as a decline in a knowledge industry – would also affect business R&D, since most expenditure is concentrated in a few high-technology industries such as chemicals and pharmaceuticals, computers, motor vehicles and aerospace (Table).

What is Driving Change?

A high proportion of military spending is in R&D. It was inevitable, therefore, that the sharp cuts in defence spending after the end of the Cold War and the collapse of the former Soviet Union would result in a decline in R&D in several large OECD economies. R&D fell from 12.5% of central government spending in 1985 to 8% in 1995 in the OECD area as a whole, and in the United States (the largest military spender) from 25.7% to 17.4% over the same period. Governments have shifted their focus on the development of so-called 'dual-use' technologies, such as laser devices, radar systems and advanced engineering materials, in other words, output which may have other commercial spin-offs.

In all areas of research, budgetary and debt constraints in many OECD countries are forcing governments to review areas of discretionary spending. R&D funding is one item being closely

1. ***Science, Technology and Industry Outlook 1998***, *OECD Publications, Paris, 1998;* ***Technology, Productivity and Job Creation – Best Policy Practices***, *OECD Publications, Paris, 1998.*

Table
World's Largest R&D Spending Firms in 1996

Company	Country	Sector	R&D as % of sales	R&D spending (billion $)
General Motors	United States	Automotive	5.6	8.9
Ford Motors	United States	Automotive	5.8	6.8
Siemens	Germany	Electronic & electrical equipment	7.7	4.7
Hitachi	Japan	Electronic & electrical equipment	6.1	4.3
IBM	United States	Electronic & electrical equipment	5.2	3.9
Daimlez-Benz	Germany	Automotive	5.2	3.6
Matsushita Electric Industrial	Japan	Electronic & electrical equipment	5.9	3.4
Fujitsu	Japan	Engineering	9.2	3.0
Nippon Telegraph & Telephone	Japan	Telecommunications	4.0	2.7
Novartis	Switzerland	Chemicals	10.1	2.7

Source: Company Reporting, *The UK R&D Scoreboard*, 1997

scrutinised and evaluated to reduce duplication and increase focus on areas of particular interest for governments, such as in technologies which have broad economy-wide applications.

The situation for universities has changed, too: the share of university research in R&D expenditure increased slowly in most OECD countries in the late 1980s but levelled out, and even declined in some countries; in Canada, for example, it fell from more than 26% of national R&D in 1991 to less than 22% five years later. In all OECD countries, the bulk of university research funding comes from the public sector. Lower government funding has posed a serious challenge for higher education. Universities have had to improve their efficiency, find alternative sources of funding and increase co-operation with business as well as with other universities.[2] There is nevertheless some concern that the decline in funding will affect future contributions to the body of knowledge by undermining the ability of universities to fulfil their vital role in carrying out basic, long-term research.

Although direct funding by industry to universities remains modest in most OECD countries, at less than 5% in half of them, a variety of links exist between universities and private firms, mostly in the area of technology transfer, including centres of excellence and science parks. Many universities are stepping up their collaboration with private firms in joint research projects. There is, for example, the Co-operative Research Centres Program in Australia, the Research Partnerships Program (RPP) sponsored by the National Science and Engineering Research Council (NSERC) in Canada, and the Industry/University Co-operative Research Centers (I/UCRC) program in the United States. In some OECD economies, for example, Mexico and Turkey, the lack of adequate R&D infrastructure has led to a heavy use of university facilities by private firms. Universities are also increasing their collaboration with government laboratories through a variety of joint management arrangements and with other universities via inter-university research groups.

High-technology industries account for over 40% of manufacturing R&D in the OECD area. Competition is forcing firms to reduce the time they spend on product development: firms in rapidly changing industries, such as computer equipment and semi-conductors, must bring new products to the market much more swiftly, thereby reducing costs. Although aggregate data are very poor, surveys of R&D managers suggest that this approach is increasingly widespread, with many firms shifting towards more short-term research.

But this might not necessarily be a bad thing. Reductions in expenditure may mean that firms are conducting research more efficiently than before. IBM, for instance, reduced its R&D budget from about $5 billion in 1991 to less than $4 billion in 1996 and yet increased the number of patents it registered during that time from 679 to 1,867; its research output had not suffered from lower R&D spending. Recent studies suggest that the competitive turn-around of US firms in many high-technology industries in the 1990s can be ascribed mainly to improved strategies for integrating technology into their operations, rather than to any increase in R&D investment.

With globalisation, firms will have to operate in a new research environment: technology development is increasingly interdisciplinary and international; knowledge flows and technology diffusion/absorption are gaining in importance; developments in information and communications technologies (ICTs) have facilitated co-operation in research activities.[3] By the same token, these processes may also diminish a firm's ability to appropriate some of the benefits of its R&D investments.

■ ■

Rather than a genuine and consistent decline in R&D investment, it appears from the gathered evidence that a new framework for research is emerging. Productivity has increased and the efficiency of R&D spending has improved.

Firms are increasingly relying on external sources of knowledge, such as foreign R&D embodied in high-technology imports, or international strategic alliances in the form of joint

Genset 1997/Hubert Raguet/Eurelios

Working together in R&D.

2. ***University Research in Transition***, *OECD Publications, Paris, 1998.*

3. *See pp. 9–12.*

4. ***National Innovation Systems***, *OECD Publications, Paris, 1997.*

Revitalising Mature Industries

Yukiko Fukasaku

In the middle of the 20th century large textiles, steel and car industries were symbols of national economic muscle. Since then, at least in the OECD area, these industries have matured and restructured, with production shifting to other countries and new industries, such as computers and telecommunications equipment, rising to occupy their position of glory. But thanks to technology, mature industries have continued to grow in increasingly competitive markets.[1]

The textile, steel, automotive and construction industries in the OECD countries have undergone substantial restructuring over the last 30 years. Rising energy prices, the saturation of demand and increasing international competition, combined with a partial withdrawal of government subsidy, eroded profitability. The result was a stagnation or decline in output and employment. The shares of textiles and steel in total OECD manufacturing have since declined and much of the world's production in these industries has shifted to the non-OECD area. The automotive industry is reaching maturity, though both value-added and employment shares have been stable.

A slow rate of innovation and a high degree of product standardisation are generally held to be characteristics of an industry which has reached 'maturity'. Yet in the four sectors discussed here rapid technological change is taking place. And although each sector is very different, the kinds of change exhibit striking similarities.

New Processes

In the textile sector, the introduction of 'open-end' spinning machines and shuttle-less looms has, where technically and economically appropriate, replaced older ring-spinners and shuttle looms. This new generation of equipment has radically changed the traditional process of the

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1. ***Science, Technology and Industry Outlook 1998***, *OECD Publications, Paris, 1998.*

ventures and other collaborative agreements. These allow cost-sharing on large-scale projects or research with longer-term outcomes. Co-operation between the public and private sectors is becoming more important as industrial patents increasingly rely on basic, publicly supported research performed at academic, governmental and other public institutions. The traditional – or linear – model of technological development is thus becoming increasingly obsolete; the process of innovation is becoming more complex, occurring at many stages and through many agents.

As governments begin to understand more clearly how innovation works, they will be able to focus their effort on resolving systemic failures, by highlighting mismatches and by strengthening linkages and networks to improve national innovation.[1] Important changes to their R&D policies should occur in three areas. First, as well as investing in national capacity, they should facilitate co-operation between the different bodies involved in research and encourage linkages with foreign sources of innovation. Second, they should work on enhancing the efficiency of state spending and increasing the focus on core competencies, such as the funding of basic research. And third, they should work to establish and strengthen the underlying national research infrastructure by protecting intellectual property rights, raising the skills of the workforce, facilitating the mobility of scientists and researchers, and developing regulatory frameworks that stimulate innovation and growth. ■

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Revitalising Mature Industries

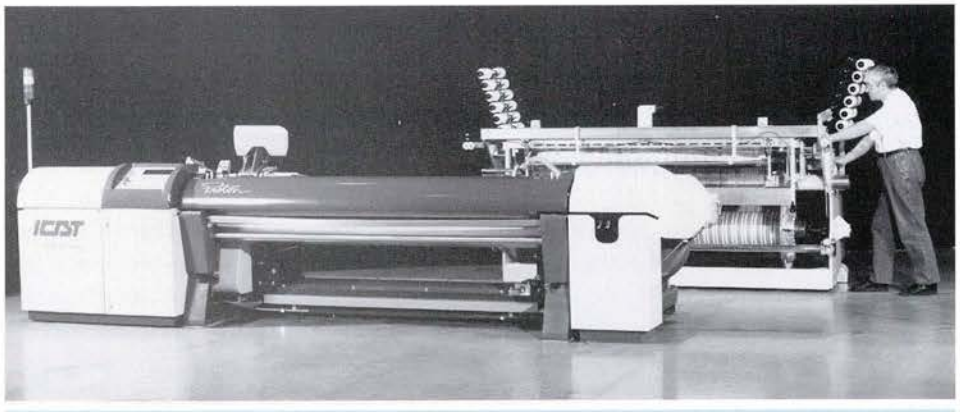
textile mill by increasing the speed of production, enhancing automation in material transfers and improving product quality.

In the steel industry two major technological innovations have spread rapidly over the past few decades. One is the electric-arc furnace (EAF) in 'mini-mills', whose minimum efficient scale of operation is considerably smaller than that of the integrated mill. Integrated mills smelt processed iron ore and coke in a blast furnace to produce molten iron, and then produce steel in the basic oxygen furnace. Mini-mills, which produce steel by melting steel scraps in the EAF, have higher productivity because they bypass the iron-making process. They have spread rapidly in the United States, where they have helped to revitalise the industry, profiting from abundant supply and low prices in steel scrap and electricity and environmental regulations that have made integrated steel-making more expensive. Another major innovation in the steel sector, continuous-casting technology, has replaced the conventional ingot-casting process. By casting steel directly into semi-finished shapes, this technology reduces energy consumption by permitting fuller utilisation of the heat contained in the molten steel. It also increases yield, improves quality and reduces pollution.

Changes to on-site technologies in the construction industry have been more incremental, but new programmable machines, mechanical handling equipment and more powerful hand-held tools have enhanced automation, increased speed and accuracy and reduced the demand for manual dexterity. New materials, such as plastics and 'mastics', composite-board products and alloys have improved aesthetic quality and durability. Faster and more accurate fixing technologies enable quick-fit, clip-together assembly of parts. These techniques are all based on better components, and have underpinned the improved performance of the construction industry.

The Impact of Computerisation

Information technology (IT) and advanced manufacturing technologies (AMT) based on IT have penetrated all of these industries. They improve control and speed in processing, production management and retailing.



ICBT International

Textile revolutions: where technology has improved quality.

In textile mills computer controls and robots have enhanced operation linkages and flexibility in production. Stock management has improved, helping to cut inventory costs. The entire textile mill has been transformed into an IT-based automated system, integrating spinning and weaving with more flexibility than before.

In clothing manufacture computer-aided design and manufacturing systems (CAD/CAM) and computer numerically controlled (CNC) cutting systems have replaced highly skilled manual operations in the pre-assembly stage. These systems have led to substantial savings in materials and production costs. Training time has also been reduced. They have also increased speed and precision, and improved quality. They allow flexibility in the planning, sourcing and design of products, and smaller quantities of a wider range of goods are now possible.

In the steel industry, the impact of computerisation has been of a similar magnitude. Computerisation developed most rapidly in the giant integrated steel mills built in Japan in the 1960s, and has spread to most OECD steel mills since then. New applications of computers constantly emerge, for instance, that of artificial intelligence (AI), such as 'expert systems'. These simulate the process control carried out by human experts and thus allow the optimisation and standardisation of operating practices and procedures.

Since value-added in the construction sector depends on the ability to co-ordinate and integrate technologies developed elsewhere, information systems have become crucial in supplying appropriate, accurate information to the right people at the right time and place. Co-ordination by IT systems has improved information flows, automated routine information-processing and communication within project teams and improved transparency, leading to gains in performance. Simulation techniques, such as virtual reality (VR), can be used to brief clients or to involve interest-groups in planning and can also replace the costly construction of prototypes. Speeding-up and enlarging the flow of information through IT reduces uncertainty, lowers costs and saves time. Some firms have used information systems to expand their markets. In 'best-practice' examples of the use of IT systems (often closely linked to the introduction of new business practices), decisions are made more rapidly. Information becomes available when and where required, and the process becomes more transparent.

IT has also penetrated the downstream segments of mature industries and affected their structure. In the clothing industry, the shift in competitive conditions – from price to variety, style, flexibility and rapid response – has enhanced the role of the retailer, whose relations

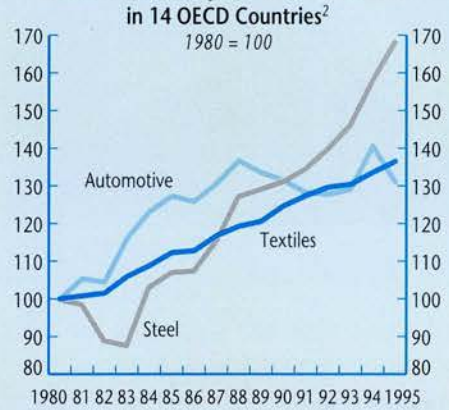
with clothing manufacturers and textile firms have become closer and more stable. IT is used to provide accurate information to suppliers about consumer demands, enabling the production of optimum quantities of the right type of product and thus keeping inventories low. The technique has shortened the period required from production to retailing. Another advantage is that producers can respond to seasonal fashion trends and avoid mark-downs in prices.

In car retailing electronic data-systems provide information to help match production to customer demand. A US second-hand car chain, CarMax, uses computer technology for inventory and cost control, and to inform customers about their products. GM's Saturn Corporation uses IT to monitor market trends and to bring retailers into the corporate decision-making process. This new openness encourages customer feedback in the manufacturing process.

Organisational Change is Key

Organisational innovation – mainly the introduction of the so-called 'lean' production system in the automotive industry – has had a major influence on mature industries. The lean system is a radical shift from the Fordist mass-assembly approach. Based on product standardisation, the use of special-purpose equipment and the de-skilling of labour, Fordist technology had contributed to a sharp rise in productivity over the older 'hand-craft' technology. It has dominated the automotive industry for most of this century. But it had some major drawbacks: the need for numerous specialists to support assembly workers; production and maintenance of large inventories of component parts; and frequent 'reworking' to correct defective products. After the Second World War, faced with limited resources and a small domestic market, car producers in Japan attempted to eliminate these drawbacks by transforming the Fordist technology to the 'lean' production system through organisational changes. The new method helped to reduce costs, improve quality, make production more flexible, humanise labour practices and drive up productivity.

Figure
Labour Productivity[1] in Mature Industries in 14 OECD Countries[2]



1. Constant price value-added/number employed.
2. Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Mexico, Netherlands, Norway, Sweden, United Kingdom, United States.
Source: OECD

A well-known organisational principle of the lean production system is the 'just-in-time' method, which originated in the automotive sector and eliminated recourse to large inventories. Information flows about the precise quantity of specific parts required were important, helping to re-organise the supply chain to allow the smooth and timely delivery of 'defect-free' components. 'Autonomation', which allowed workers to stop the assembly line to rectify faults, markedly reduced defects and eliminated reworking. It also gave rise to teams of multi-skilled, flexible workers who performed specialist operations. Rather than producing large volumes of standard products, technology allowed the industry to produce smaller volumes of a wide variety of products.

The adoption of the lean system paved the way for further increases in productivity and manufacturing flexibility through the integration of IT-based AMT. This replaced simple automating devices with numerically-controlled (NC) tools, industrial robots and flexible-transfer machines, and eventually computer-integrated manufacturing systems. A combination of the lean system and IT-based innovations is being adopted throughout the world, and the resulting improvement in competitiveness is forcing the automotive industry to restructure.[2]

Organisational changes in the construction industry have been limited, because of its project-based nature. Competitiveness in construction depends on the ability of firms to manage complex networks efficiently and to accumulate and diffuse technical knowledge within and between firms and projects. New management approaches developed in other sectors, such as 'just-in-time' delivery, have also been adopted. And as in textiles, organisational changes are slowly affecting the structure of the industry. Value-added as well as technical change and design work are migrating upstream into components manufacturers. Thus they are now able to invest in long-term R&D and are capable of engineering and testing standard, pre-assembled components. These components reduce on-site work, improve quality, speed and accuracy of installation. The move upstream is also a response to recent market trends, which are shifting towards increased choice and flexibility in life-style, including functional buildings with sophisticated equipment.

■ ■

Rapid technological change has brought about striking increases in labour productivity in three of the manufacturing industries discussed (Figure).[3] Many labour-intensive processes have been automated and accelerated. New generations of plant and machinery, integrating IT and AMT, have increased process speed and yield and reduced cost. In the construction sector, productivity gains have been more limited, possibly because of its project-based nature. There is nonetheless considerable potential for improvement in this industry, thanks to IT and AMT, and the benefits of new technologies may still lie ahead.

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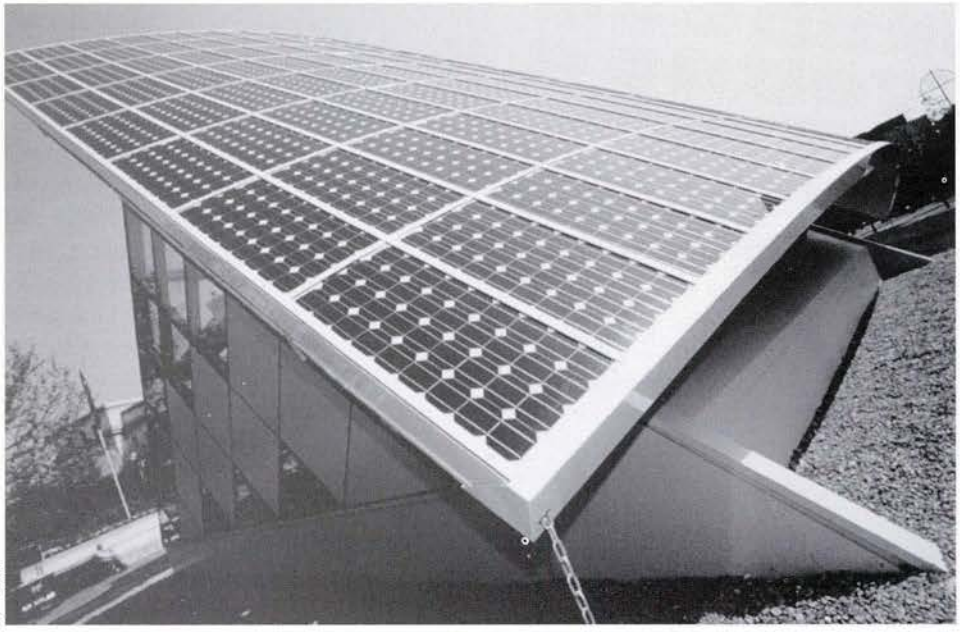
2. Denis Audet, 'Market Access in the Automobile Sector', ***The OECD Observer***, No. 209, December 1997/January 1998.

3. See pp. 12–15.



BP Solar

Innovative organisation can lead to innovative construction.

Technological change has enabled improvements in product quality, and the structure of production has moved towards higher-quality goods and services, with more variety, mainly in response to changing consumer preferences. Fiercer international competition has forced firms in OECD countries to shift to the higher value-added end of the market, since technologies for mass, standardised goods are often easily adopted by international competitors. The production of standard textile goods, for example, has moved outside the OECD area, while firms in the OECD area have concentrated on style and keeping ahead in fashion trends. OECD steel products have likewise moved to a higher-quality output.

New technologies have improved skills. In textile and steel, the use of more efficient new-generation technologies has reduced demand for low-skilled workers, thus adding to unemployment. By contrast, the use of IT and AMT has increased demand for higher general skills and for versatility, blurring the traditional job-dividing lines in steel, automobiles and construction. Multi-skilled workers have become the norm, particularly in lean automobile production.

The pattern of concentration and vertical integration is changing as a result of technological progress. In consumer-goods industries, such as clothing and cars, retailers and distributors have taken on a bigger role in guiding technological change; and in construction and steel, upstream suppliers or large customers have often played a major role in guiding innovation.

Technological change has extended the range of commercially viable firms, and given a more prominent role to smaller enterprises, particularly in steel and textiles. It has helped small firms to thrive in niche markets, and large firms to survive by organising production in a way that is more responsive to market demands.

The success of lean production in the automotive industry and 'quick response' in the textile industry underlines the importance of organisational change in underpinning hard technology. Such 'soft' innovations can substantially enhance efficiency when combined with IT and AMT and can substantially improve performance. ■

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High risk and uncertainty are the principal reasons for government intervention in the health-care industry. People do not know when they will require health care or for how long. In addition, patients often lack the information and the capability to evaluate what is offered and the possible alternatives, particularly as rapid advances are made in medical technology. This is important, since ill-informed use of health-care may result in irreversible damage or even death.

OECD governments are faced with common problems for the provision and financing of health care and have much to gain in learning from each other. For example, by exchanging information they can share the burden of testing new medical products and procedures, and bring about a more timely assessment of their efficacy. This saves resources for both government and industry and accelerates the availability of important new therapies.

In biotechnology there is an additional reason for international collaboration and enhancing co-ordination: that of keeping pace with rapid developments in this field in an attempt to measure and anticipate world-wide impacts of biotechnological breakthroughs. Recent advances in the transplantation of viable animal cells, tissues and organs to humans give co-operation a particularly important dimension, since the knowledge to verify assumptions about the risks associated with these procedures is still inadequate.

The Imponderables of Transplantation

Transplantation is now an accepted treatment for patients with end-stage organ failure, where treatment with drugs or restorative surgery is not feasible. Some major breakthroughs in tissue typing and immuno-suppressant drugs have made it possible to transplant approximately 25 different organs and tissues, including bone and cartilage, bone marrow, skin, cornea, heart, heart-lung, kidney, liver, lung and pancreas. Over one million people world-wide have benefited from successful organ transplants, and survival

Challenges in Tissue Transplantation

Elettra Ronchi

The explosion in technological innovation in recent decades has been accompanied by a dramatic increase in the demand on governments to assess the safety and efficacy of new products and procedures. The likely growth of transplant technology – both of human and of non-human organs and tissue to humans – presents governments with two questions that are currently difficult to answer. How can regulation be revised to accommodate these technologies and the challenges they bring? And how can policy makers assure safety and adequate assessment of clinical efficacy without stunting the development of promising new drugs or therapies? International co-operation offers a way forward.

rates have dramatically improved. Some 80% of kidney-transplant recipients live for at least a year, and over 60% live for at least five years. Even in the least successful cases, more than 50% of recipients live for longer than five years.

Transplantation is therefore a life-saving procedure. It is also cost-effective. Kidney transplants produce an estimated saving of 63% compared with total medical expenses for a patient on lifelong dialysis treatment. In Spain, for example, every 10,000 patients now living with a functioning kidney graft is estimated to represent a saving of some $207 million each year.

But transplantation has become a victim of its own success. The rise in demand for transplantation and hence for human organs has led to a severe shortage of supply. In western Europe nearly 40,000 patients are at the moment waiting for a kidney, but the number of donors has remained stable, at around 5,000 for the past few years. Similarly, in the United States, there are about 39,000 patients on the waiting list, but only around 12,000 kidneys become available each year. In 1997 11,349 kidneys were transplanted, 3,579 from living donors.

A number of alternatives have been proposed to fill the gap between the supply and demand of organs. Among them is xenotransplantation – the transplantation of viable organs from one animal species to another. Xenotransplantation in humans dates back to the early twentieth century, with kidney xenografts from rabbits, pigs, goats, lambs and non-human primate donors (such as macaques, chimpanzees, marmosets and baboons). However, the rapid death of the transplanted organs – and, in most instances, the patient – after xenografting meant that the practice was soon abandoned.

Renewed Interest in Xenotransplantation

In 1963 Professor Keith Reemtsma and his colleagues in the United States revived xenotransplantation with six chimpanzee-to-human kidney transplants. Most of the patients died within a few days. In 1964 J. D. Hardy and colleagues at the University of Mississippi performed the first cardiac xenotransplantation, which was soon followed by eight other attempts by other groups, also in the United States. Five of the donors were non-human primates (two baboons and three chimpanzees) and three were farm animals (one sheep and two pigs). The patient who survived longest (20 days) was a new-born infant who made headline news as Baby Fae in 1984.

Eventually, attempts at xenotransplantation became rare because of the unacceptably early mortality from 'hyperacute' organ rejection, the expression used to describe the near-immediate effects of the response of the immune system against an incompatible xenograft. Recently, however, the introduction of novel immuno-

Bill Luster/Matrix/Cosmos

Getting better. Transplants are becoming increasingly successful.

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Challenges in Tissue Transplantation

suppressive regimens and advances in the knowledge of the immune system, and of organ rejection in particular, have rekindled interest. In the early 1990s investigators at the University of Pittsburgh reported two cases in which they transplanted a baboon's liver into a human recipient, obtaining a 70-day survival in their first reported case and a 26-day survival in the second. In 1992 J. Czaplicki and his colleagues described a case in which they attempted a pig-to-human heart xenotransplantation. The patient survived for less than 24 hours. Their protocol included an unusual immuno-suppressive regimen and extra-corporeal perfusion of the pig's heart with the recipient's blood in an attempt to prevent rejection.

The past three years have seen the development of a number of other approaches to prevent or reduce rejection of xenografts; they derive from recent advances in biotechnology, and from transgenic technology in particular. Cloning has also been explored as a means of producing cells and tissues from sources suitable for xenotransplantation. Several of these approaches hold enormous promise, and xenotransplantation of cells and tissues has been approved for clinical trials in a number of OECD countries.

Pig tissues seem to be most appropriate for xenotransplantation – first, because this species shares many biological and physiological features with humans and, second, because pigs can be genetically engineered to produce organs which are compatible with the human immune system. The kidney and heart hold most potential, but the liver could pose problems since it is a major protein-producing organ, and pig proteins might differ too much from those of their human counterparts.

In 1994 a number of clinical trials in Sweden examined transplanted pig islet cells in insulin-dependent diabetics. Under low-power magnification these cells, first described within the pancreas by Paul Langerhans in 1869, look like clustered islands (hence the name islets) and include cells which make insulin. Results seem to indicate that porcine foetal islet cells can be safely transplanted into diabetics, provided that the amount of transplanted tissue is not excessive. After transplantation, the porcine cells can survive for several months and seem to be functional, even if the amounts of insulin produced are below the normal amount (about 20% of that of a healthy individual). Porcine foetal neural tissue has also already been transplanted in patients affected by Parkinson's disease. And in the United States, in December 1995, the first baboon bone-marrow transplant to treat an AIDS patient was carried out, albeit unsuccessfully.

Handling the Risk

Opinions about the risks from these early procedures and whether to proceed any further vary. In Europe there have been some calls for a hold on clinical trials until further research demonstrates that the technology is safe and offers unarguable benefits. Xenotransplantation raises a particularly wide range of concerns, and current national guidelines from OECD countries unanimously urge caution, in particular where non-human primates are involved.

One risk associated with the transplantation of animal organs into human beings is the possibility of new viruses spreading to humans. AIDS has heightened caution, as has the recent scare about a new strain of bird influenza in Hong Kong, China, which required the slaughter of some 1.25 million chickens. Because of this risk xenotransplantation might have to be seen as an experiment requiring life-long surveillance of early recipients. This raises important ethical issues. There is also the question of defining the acceptable degree of risk to the human population and how that risk should be evaluated, monitored and managed.

As yet unknown pathogens from non-human species might be transferred through xenotransplantation into a recipient. A major question is whether such pathogens, if they occurred, could spread to the human population. The answer is that nobody knows. The risk may be large or it may be very small. To date there are at least 150 patients world-wide who have received pig cells and tissues in emergency treatments. Samples from these patients are now being analysed, in particular for the presence of retroviruses, and the results might shed some light on this issue.

Meanwhile, other concerns will have to be resolved. In the aforementioned baboon-marrow transplant case, the AIDS patient involved, who expected to die despite the experimental treatment, had no objection to being subjected to life-long surveillance and substantial restrictions in his behaviour. But it is unlikely that public health officials will be able to enforce such compliance, in particular among young patients who have returned to good health and are looking forward to leading normal lives.

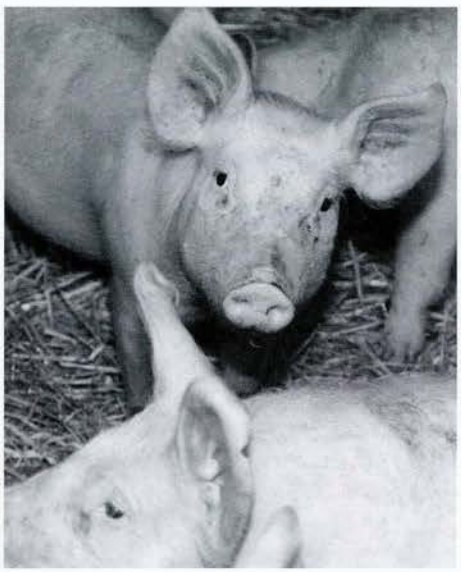
Taking Preventive Action

It seems that xenotransplantation technology is on the way in. The British biotechnology company, Imutran, for instance, has announced that, unless there is evidence of infection in the samples of the 150 patients treated to date with living pig tissues, it will go ahead with a programme of experiments which, pending approval from the UK government, could lead within five years to the first kidney transplant from its genetically engineered pigs. The World Health Organization therefore recently released a first working document for the prevention and management of xenozoonoses.[1] Zoonoses are diseases transmitted to humans by animals and xenozoonoses are infectious agents transmitted via xenografts of animal origin. Guidelines ad-

1. Xenotransplantation: Guidance on Infectious Disease Prevention and Management, *World Health Organization, Geneva, 1998*; Report of WHO Consultation on Xenotransplantation, *World Health Organization, Geneva, 1997*.

2. *'Transplantation Biotechnology: A Workshop on International Issues Including the Use of Non-Human Cells, Tissues and Organs', New York, 18–20 March 1998, joint workshop of the OECD and the New York Academy of Sciences.*

3. *The Chemicals Programme, under the Environmental Health and Safety Division, seeks to identify, prevent and reduce chemical risks to health and the environment; eliminate unnecessary distortions to trade by harmonising environmental policies and regulations affecting chemicals; facilitate optimal use of national resources available for chemicals management through cost-sharing of testing procedures and data sharing; promote integrated approaches to chemicals management; and transfer OECD experience and approaches to non-member countries.*



Silvia Thompson

Xenografting offers new hope.

dressing the issue of infectious agents that might arise from xenotransplantation are also being developed in several OECD countries.

In the United States, for example, the Department of Health and Human Services has developed draft guidelines, published for public comment in 1996. These delineate basic safety requirements for the procurement, screening and use of xenografts, as well as the clinical care and follow-up of xenograft recipients. A feature of the guidelines is that, in contrast to other countries, the United States does not specifically rule against the use of non-human primates, although it does emphasise the risks.

In the United Kingdom, in response to the report by the UK Advisory Group on the Ethics of Transplantation, the government established the United Kingdom Xenotransplantation Interim Regulatory Authority (UKXIRA) in 1997 to regulate the development and implementation of xenotransplantation.

Canada, on the other hand, has chosen to set up a regulatory framework based on the development of specific standards for the safe retrieval and use of all organs and tissues and for each transplantation group, including xenotransplantation. This 'standards-based risk-management', or SBRM, includes methods for verifying compliance and reporting adverse events, and addresses the need to update and revise practices as science evolves. Currently, xenotransplantation is not prohibited in Canada. However, under the general authority of the Canadian Food and Drugs agency, xenografts are considered as therapeutics, and the Canadian Department of Health (Health Canada) therefore has the authority to regulate xenotransplantation.

The Swiss government has presented a bill to regulate the transplantation of organs, tissues and cells of human and animal origin. The paragraph on animal organs has been submitted for consideration to the Swiss Federal Council. Other countries, such as France, Germany, the Netherlands, Spain and Sweden have formed expert committees to develop guidelines. Moreover, the Council of Europe has released a recommendation on xenotransplantation which was adopted by the Committee of Ministers on 30 September 1997.

■ ■

A common conclusion of the guidance working documents and discussion papers released to date is that xenotransplantation from pigs is ethically acceptable, provided the risk of possible transmission of infectious diseases and animal welfare issues have been adequately dealt with. There is no clear call for a total ban or moratorium. But a recent OECD workshop[2] revealed a substantial divergence of opinion among OECD countries. It drew attention to the importance of further dialogue and co-operation to achieve several aims, including:

- supporting the development of international standards for risk assessment and for monitoring adverse events, such as transmission of known and unknown viral infections
- setting a research agenda to respond to unresolved questions about infectious risk
- assisting the development of international databases and the management of registries and archives
- developing standards for animal husbandry and for the export and import of organs and animals.

To make co-operation work, governments will have to involve industry, where most of the research and development is carried out. They will also have to find ways of getting the public involved in the debate.

The participants at the OECD workshop – experts and delegates from 17 OECD countries, the Cameroon, Israel and the Sultanate of Oman, the European Commission and the World Health Organization – agreed that an international approach should be adopted immediately. A global initiative would be required to develop international norms, to assure that data are comparable internationally and to reach agreements on what information should be shared.

To achieve progress, OECD countries could build on the model pioneered by the OECD Chemicals Programme[3] and by the OECD Biotrack data system, developed in co-operation with the UNIDO BINAS data system. Biotrack is a database of field trials of genetically modified organisms which have taken place in OECD countries and their related commercialised applications and product approvals. It contains information on the ministry or agency in charge and the relevant laws, regulations and rules, as well as contact points. It is an internationally shared database which enhances information flows, facilitates harmonisation and improves expertise so that governments can keep up with the fast changes taking place in biotechnology. It could serve as a model for developing an important data resource on xenotransplantation. ■

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Governments

Margaret O'Shea and Candice Stevens

OECD governments are acting as venture capitalists by providing funding to small high-risk firms, with the aim of stimulating innovation and increasing employment. The plan is to raise the survival rates of high-technology start-ups, less than half of which last for five years. But critics charge that these schemes can lead to bad investments at high cost to the taxpayer.[1]

Small firms account for 60–70% of jobs in most OECD countries.[2] The world's venture-capital industry makes available some $100 billion a year to firms wishing to expand their activities. But companies, primarily technology-based, which attempt to produce innovative goods and services can be viewed sceptically by traditional providers of finance. Institutional investors, such as banks, prefer to entrust their money to larger companies with a proven track record. This reluctance to invest in the early life of a company[3] can be ascribed to the inability of venture-capitalists to assess potential returns, or to institutionalised risk-adverse behaviour. Many OECD governments are therefore mounting parallel programmes – to the tune of $3 billion a year – to fill the gaps in funding which prevent small businesses from obtaining the capital they require.

Governments have traditionally taken indirect measures to encourage venture investment.[4] These include the fashioning of fiscal and legal frameworks which can help markets channel resources to new and innovative enterprises. For example, governments can take steps to eliminate double taxation – of gains and dividends – in venture investment. They can tax capital gains at rates which encourage more risk-taking, and they can reform rules and regulations in the capital and securities markets to increase the attractiveness of investments and improve the availability of exit mechanisms. Governments can also devise and enforce provisions to protect intellectual property and thus the patents and innovations of start-up firms.

In the 1990s governments have increasingly gone beyond such framework activities to become more involved in the venture-capital business itself (box). They supply capital to firms directly, give financial incentives to investment by others and broaden investor rules. Government venture-capital schemes can play a pump-priming role in stimulating the supply of private capital through providing funds on a matching basis and lowering the risks of venture capital firms through guarantees. The long-term goal of most programmes is to create vibrant private-sector markets which will gradually make such schemes redundant.

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Financing Risk

Government investments and loans are the most prominent way of injecting venture capital into an economy; and these schemes are multiplying rapidly. In one approach the government supplies financing to private venture-capital firms, who in turn provide funding to small companies. Finland, for example, adopted this approach by setting up the state-owned fund, Suomen Teollisuussijoitus Oy in 1994.

Governments are also creating their own venture-capital funds to invest directly in small companies. These funds are usually privately managed by professionals. In Belgium the Investment Company for Flanders (GIMV), established in 1980, pioneered the concept of government-funded venture capital run by independent private management. Its strategy of taking equity stakes in techno-

Freddy Cats

as Venture Capitalists

logy-based companies produced attractive returns, and private capital is now being invested in GIMV.

The best-known hybrid scheme, using both public and private funding, is the Small Business Investment Companies (SBICs) in the United States. SBICs are privately managed firms which act as intermediaries between large investors and small enterprises. From their start in 1958 to 1992 SBICs received loans from the government; now their public funding comes in the form of 'participating preferred equity' – an investment which receives dividends and a share of long-term profits. For an SBIC with private funding of up to $15 million, the government will top up private money at a ratio of 3:1. For larger SBICs, the ratio decreases proportionately to 2:1.

Similar programmes are cropping up in several other OECD countries. Germany created a scheme in 1995 called Beteiligungskapital für kleine Technologieunternehmen to co-fund with the private sector small firms with a distinctly new product or service. Australia, too, is establishing an Innovation Investment Fund to increase financing to start-ups by leveraging private funds with public monies. The European Investment Fund, established in 1994 with financial support from the European Commission, is used to investing in equity in high-growth small and medium-sized enterprises (SMEs).

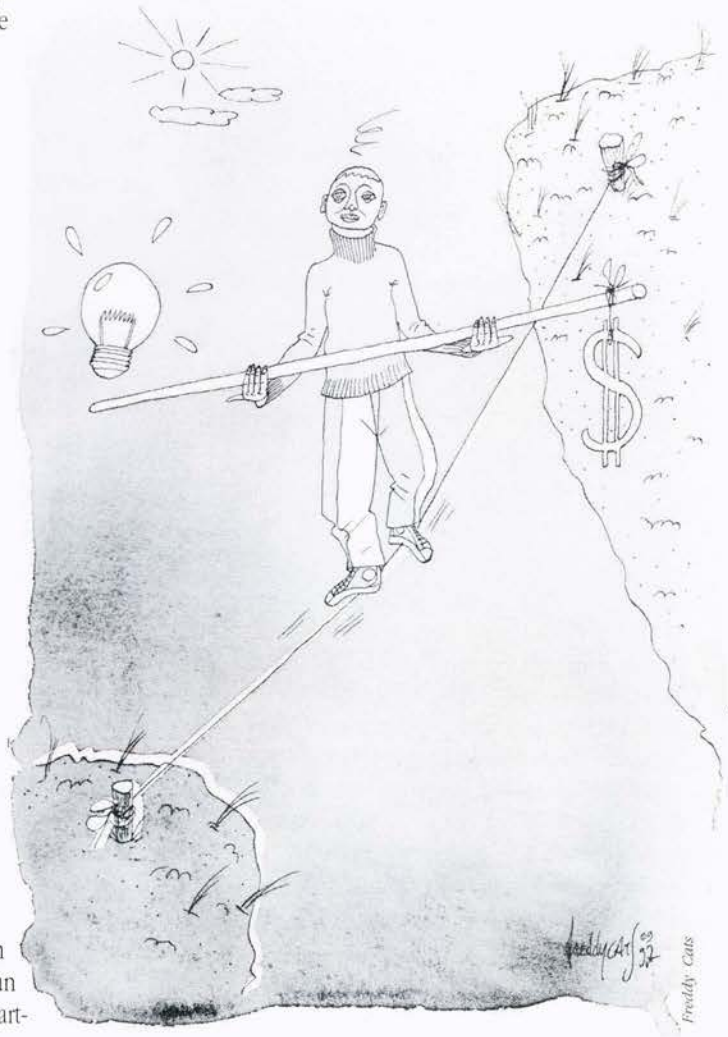
The loans which governments provide, and which may be unavailable from other sources, are often on more attractive terms than private funding. They may have lower interest rates or extended pay-back periods. And they can even be non-refundable. The government-funded VaekstFonden (Business Development Finance Loan Programme) in Denmark, for example, which gives loans to small firms for technology-development projects, offers debt-forgiveness in the event of failure. Similarly, in the Netherlands, the Technical Development Credits scheme provides ten-year loans to small firms which are forgiven in case of technical or commercial failure. In Sweden the government is majority owner of ALMI Foretagspartner AB, which extends 6–10 year loans to start-ups that are interest-free during the first two years and require no repayment of the principal for the first four years.

Guarantee Schemes

Government guarantee-schemes encourage financing of high-technology projects by lowering the risk assumed by investors. Most OECD governments guarantee particular loans made by financial institutions to small firms. If the borrower defaults, the loss incurred by the lender is only for the part of the loan not covered by the guarantee. Banks are thus encouraged to fund small firms which may have viable projects, but which cannot meet collateral requirements.

In some countries (Canada, the United Kingdom and the United States, for example), primary guarantees are given directly by the government, with the administration delegated to commercial banks. Since 1981 the UK Loan Guarantee Scheme has covered over 50,000 loans to small firms; in 1995, the most recent year for which figures are available, the default rate was 22%. In the United States the Guaranteed Business Loan Program of the Small Business Administration (SBA) covers up to 75% of an eligible commercial loan to start-up and high-potential companies. Evaluations show that the SBA-backed companies have a higher survival rate than the non-recipients. Since 1961 the Loan Guarantee Program of Canada's Small Business Loans Administration has extended lenders a 90% guarantee on loans to qualifying businesses.

Alternatively, as in France, Germany and Japan, loan-guarantee schemes may be funded by trade associations and financial institutions on a local basis, with a secondary guarantee provided by the government. The Kreditanstalt für Wiederaufbau in Germany, in place from 1989 to 1994, extended interest-free refinancing loans (with a 90% guarantee) to venture capitalists. The


Freddy Cats

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Governments as Venture Capitalists

FOCUS

Typology of Government Venture-Capital Programmes

Type	Purpose	Example
Direct Supply of Capital		
Government equity investment	To make direct investments in venture-capital firms or small firms	Belgium – Investment Company for Flanders (GIMV)
Government loans	To make low-interest, long-term and/or non-refundable loans to venture-capital firms or small firms	Denmark – VaekstFonden (Business Development Finance) Loan Programme
Financial Incentives		
Loan guarantees	To guarantee a proportion of institutional loans to qualified small businesses	France – Société Française de Garantie des Financements des Petites et Moyennes Entreprises (SOFARIS)
Equity guarantees	To guarantee a proportion of the losses of high-risk venture-capital investments	Finland – Finnish Guarantee Board
Tax incentives	To provide tax incentives, particularly tax credits, to those investing in small firms or venture-capital funds	United Kingdom – Enterprise Investment Scheme and Venture Capital Trust Scheme
Investor Regulations	To allow institutions such as pension funds or insurance companies to invest in venture capital	United States – modifications of Employment Retirement Income Security Act

Société française de garantie des financements des petites et moyennes entreprises in France, which is 42% government-owned and recently merged into the Banque du développement, guarantees up to 50% of bank and venture-capital financing of SMEs. Japan's Venture Enterprise Centre, which is part of the Ministry of International Trade and Industry (MITI), covers up to 80% of loans made by venture firms to research-oriented small firms.

A few OECD governments guarantee the actual investments of venture-capital firms and cover a percentage of any losses they might incur, for example, if a small firm goes bankrupt. One of the longest-running equity guarantee schemes was in the Netherlands – the Private Participation Guarantee Order Scheme set up in 1981. The government covered 50% of losses on investments (up to a ceiling) made from private funds in young companies. The programme was phased out in 1995 as venture capital became more widely available. Similar schemes have recently been initiated in Austria, Denmark and Finland.

5. Jean Guinet, 'Financing Innovation', **The OECD Observer**, No. 194, June/July 1995.

Stimulating Investment

Tax incentives are another popular way for governments to lower the costs of high-technology investment. These measures assume there is enough liquidity in the system which can be channelled towards particular types of projects. Tax credits for investors, the most common tax incentive, are usually extended to investments made in small firms and company start-ups. For example, the UK Enterprise Investment Scheme gives 20% tax relief to investors putting up to £100,000 a year in small businesses. In 1996 the Netherlands initiated a tax-compensation scheme for individuals or groups lending to companies in existence for less than eight years.

Tax breaks may also be available for investment in venture-capital funds and specific 'pooled vehicles', involving groups of investors. For example, the dividends, distributions and capital gains received by investors in the Pooled Development Funds in Australia are tax-exempt. In Canada investors receive both federal and provincial tax credits for investments in Labour-sponsored Venture Capital Corporations, which are hybrid funds managed by labour unions.

Governments can broadly affect the supply of venture capital by establishing the rules which determine who is eligible to invest. Some countries prevent pension funds and insurance companies from engaging in venture capital to safeguard their investors against the risk of default. The trend is to loosen such restrictions. Many countries are inspired by the US experience in the late 1970s and early 1980s after changes to the Employment Retirement Income Security Act, when pension funds were allowed to engage in venture-capital investments and a major new source of finance was created. In 1995 the Reserve Bank of Australia changed prudential rules so that banks could make equity investments in SMEs. And recent regulatory changes in Italy permit its pension funds to invest in small

Freddy Cats

firms. In 1995, after similar reforms, Finnish banks and pension funds accounted for 79% of the supply of venture capital; the equivalent figure only a year earlier was 20%.

The Importance of Design

Government schemes should seek to leverage private funds. Matching funds, which require private-sector input, are best at achieving this 'additionality', but they assume a sufficient degree of liquidity in the market. Poorly designed programmes risk displacing private venture capital through unfair competition. They can introduce distortions and inefficiencies into capital markets, particularly when considered permanent. One successful government programme which was phased out is Yozma in Israel, which takes much of the credit for creating the flourishing venture-capital industry there.

The most successful venture-capital programmes are funded by governments, but managed by professionals in the private sector. Although government should monitor and assess programmes, its involvement in investment decisions should be minimal. It is also useful to have a cadre of technically skilled intermediaries. Some governments have mounted training programmes for bankers and fund-managers to help in the appraisal of technology-based firms. And in Denmark venture-capital managers must take a seat on the boards of the companies in which they are investing.

The choice of programme and its design depend on the nature of its venture-capital market, business structure and technological profile.[5] Investment incentives can be aimed at the companies supplying capital or, if they are limited in number, directly at small firms, and tailored to early-stage, technology-based firms, the ones where shortfalls in funding occur most readily. These firms can benefit most from direct government investments, guarantees or tax-incentives. Loans and loan guarantees are less useful because most start-ups are unable to service their debt in the short term.

How programmes are designed also depends on the government resources available. Loan programmes tend to be less costly than equity-based schemes, since government outlays are smaller and paybacks are larger. Governments should always aim to make commercial rates of return, setting reasonable limits on the amount of funding provided or debt covered. One rule is not to provide more than 75% of financing or coverage for a small firm, since the enterprise itself should retain a sufficient degree of risk. And although governments might take on risks unacceptable to commercial banks, high failure rates can become unduly expensive and undermine the scheme as a whole. Low failure rates, by contrast, suggest that the government is not adding much to the private supply of capital and that the public schemes may be unnecessary.

Loopholes, obviously, should be avoided. Poorly designed tax incentives have led to behaviour largely motivated by a desire to benefit from the tax shelter. Over-generous loan guarantees have prompted lending at inappropriately low rates or without due diligence on the part of borrowers. Inadequate risk-sharing with the private sector can lead to investments that have been insufficiently screened or to the premature abandonment of marginal portfolios. And some government venture funds have mistakenly funded later-stage investments and buy-outs, which can easily be financed from traditional sources.

■ ■

Government venture-capital funds, like their private counterparts, should supply companies with more than just money. Start-up firms require advice about management, strategy and finance. Government programmes have the advantage that they can link firms into an entire array of public services – technical assistance, management training, information networks – thus nurturing young companies over the longer term. ■

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Poland

Privatisation as the Key to Efficiency

Vincent Koen

A thriving private sector is the force behind Poland's buoyant economy, which is now in its seventh year of continuous expansion.[1] The number of new private firms soared in the first half of the 1990s and has continued to increase rapidly since. Meanwhile, privatisation has reduced the size of the public sector, which nonetheless is still quite prominent across the economy, with a strong presence in mining, fuels, power generation, defence, heavy chemicals, telecommunications, air and rail transport, sugar, spirits and insurance.

Corporate performance in the public sector has been much weaker than in private enterprises and has acted as a brake on the economy as a whole. Profitability has improved in the private sector since 1995 and deteriorated in the public sector, and while investment in the private sector has soared, it has stagnated in public enterprises. Yet the firms in the public sector have received most of the subsidies. This difference in performance might be partly explained by the fact that privatisation began with the strongest companies, leaving the rest to struggle on under public ownership. However, some empirical studies suggest that there was no such selection bias.

Another possible reason lies in the inherited liabilities carried by some traditional heavy industries which the newly emerged private firms do not have, such as an antiquated capital stock and environmental drawbacks. Arguably a more important cause of the discrepancy in performance is poor corporate governance in the public sector. Even unprofitable public enterprises can award relatively high wages, and spending priorities are not always geared to restructuring, as documented by Poland's Supreme Board of Inspection, which recently published a list of cases of ill-judged expenditure.

In short, financial discipline is an ingredient in short supply in Poland's public enterprises. Wages are negotiated according to a national norm established between social partners. This practice is not that unusual in Europe, but in Poland the leverage of the unions in the negotiations is particularly strong, limiting the influence of market forces on public pay deals. As a result, the national norm, which is intended to act as a ceiling to wage deals, in fact works as a floor. Also, in some firms, the remuneration of managers is set as a multiple of the workers' average wage rather than as a function of corporate performance. Moreover, a number of public enterprises do not honour their tax and social security obligations, which is a *de facto* and quite perverse form of subsidy. Admittedly, such arrears, and more importantly, outright evasion, are also observed in the private sector.

Although the state or the local government nominally owns those firms, in practice it fails to control them. Its inability to sanction mismanagement is in part due to political pressure from a broad range of sectoral lobbies. The fact that their demands are accommodated quite easily is helped by the lack of transparency in the handling of public money. This is a weakness which a new draft law is trying to correct. On top of

Table
Economic Performance, 1991–98
% change, unless otherwise indicated

	1991	1992	1993	1994	1995	1996	1997	1998
Real GDP	–7.0	2.6	3.8	5.2	7.0	6.1	6.9	*5.8*
Gross fixed investment	–4.4	2.3	2.9	9.2	16.9	20.6	21.9	*15.1*
Inflation (CPI, end-year)	60.4	44.3	37.6	29.5	21.6	18.5	13.2	*10.5*
Unemployment (% of labour force)[1]	11.8	13.7	14.9	13.9	13.1	11.5	10.2	*9.7*
Privatisation receipts (% of GDP)[2]	0.2	0.4	0.5	0.8	0.9	1.0	1.5	*1.3*

Figures in *italics* are forecasts.
1. End-year; registration in 1991, labour force surveys from 1992.
2. Receipts accruing to the state budget.
Sources: Central Statistical Office of Poland, OECD

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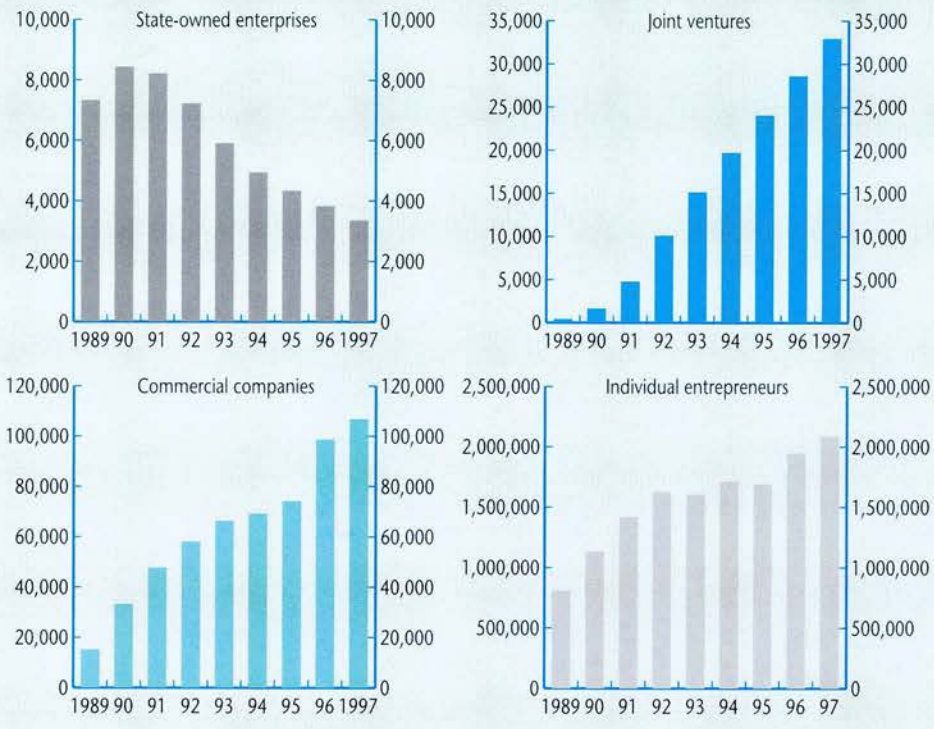
Figure
Number of Business Entities
end-period



Source: Central Statistical Office of Poland

that, the public administration is not equipped well enough, whether it be in logistics or skills, to be able to keep up with operations in the several thousand enterprises that are still in the public sector.

The Renewed Momentum

To overcome these problems the government, formed after the parliamentary elections in September 1997, has decided to accelerate privatisation. After all, private investors, be they foreign or domestic, would be in a better position than the cash-strapped state to provide the money, skills and know-how Polish firms need to boost their competitiveness. And these new stakeholders would obviously have strong incentives to impose hard budgetary constraints and would, if necessary, be freer to liquidate non-viable activities.

The menu of privatisation formulas on offer is an impressive one, but its diversity has not always helped to speed up the sales. Although the proliferation of schemes to transfer ownership reflects a multi-track approach with strong pragmatic merits, it has in some cases resulted in procrastination, slowing the process down. The new government is determined to push privatisation along quickly, since it faces strong budgetary pressures from ambitious reforms in pensions, health and education, as well as decentralisation. Moreover, the State still owes very large amounts to those whose property was illegally confiscated under communism and on account of past unpaid pension and wage hikes.

After the sale of a major bank and a large copper company last year, a whole series of important enterprises are to be privatised in the near future, particularly in banking, insurance, telecommunications, power supply and air transport. In addition, the government is considering sell-offs in sectors, such as mining, which were previously off-bounds. It is also contemplating removing some of the legal strictures which hold up privatisation, such as the approval of the Council of Ministers, which is obligatory even for some relatively small deals.

Although faster privatisation may be both feasible and desirable in Poland, it will not take place overnight. It is an inherently complex process, involving a redistribution of property and other rights on an enormous scale. It is intertwined with restructuring, deregulation and demonopolisation, each of which is a challenge on its own. Moreover, privatisation alone is not a sufficient condition of good governance; other factors include managerial skills, the existence of performance incentives, transparency and a sound legal and business environment. But can the government really afford delays? Probably not. Poland's own experience to date, as well as that of some other OECD countries, strongly suggests that the benefits of postponing the divestiture of state assets – even for prior restructuring or consolidation into larger entities – would be dwarfed by the costs. Privatising sooner, while the economy is growing strongly, rather than letting the costs build up further, would seem to be the best way forward. ■

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Indicators

Australia

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	1.7	5.1
Leading Indicator	May 98	-0.6	0.0
Consumer Price Index	Q1 98	0.2	-0.2
		current period	same period last year
Current Balance	Q1 98	-5.01	-3.50
Unemployment Rate	Mar. 98	8.2	8.8
Interest Rate	May 98	4.99	5.63

Austria

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q4 95	0.0	0.3
Leading Indicator	Apr. 98	0.3	5.7
Consumer Price Index	May 98	-0.1	1.0
		current period	same period last year
Current Balance	Dec. 97	0.54	1.11
Unemployment Rate	Apr. 98	4.4	4.3
Interest Rate	Jun. 98	3.64	3.40

Belgium

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q4 97	-0.4	2.6
Leading Indicator	May 98	-0.3	-1.9
Consumer Price Index	Jun. 98	-0.1	1.6
		current period	same period last year
Current Balance	Q1 98	2.58	3.04
Unemployment Rate	Apr. 98	8.9	9.3
Interest Rate	Jun. 98	3.65	3.27

Canada

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	0.9	3.8
Leading Indicator	Apr. 98	0.0	0.5
Consumer Price Index	May 98	0.4	1.1
		current period	same period last year
Current Balance	Q1 98	-5.40	-2.68
Unemployment Rate	May 98	8.4	9.4
Interest Rate	Jun. 98	5.00	3.22

Czech Republic

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	..	-0.9
Leading Indicator		..	..
Consumer Price Index	May 98	0.1	13.0
		current period	same period last year
Current Balance	Q1 98	-0.35	-1.07
Unemployment Rate	May 98	5.8	4.1
Interest Rate	Jun. 98	15.81	25.98

Denmark

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-0.3	3.3
Leading Indicator	Apr. 98	-0.4	5.2
Consumer Price Index	May 98	0.5	2.0
		current period	same period last year
Current Balance	Q4 97	-0.80	-0.91
Unemployment Rate	Apr. 98	4.7	5.6
Interest Rate	Jun. 98	4.02	3.60

Finland

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-0.5	6.4
Leading Indicator	Jan. 98	-0.2	1.6
Consumer Price Index	May 98	0.0	1.5
		current period	same period last year
Current Balance	Apr. 98	-0.01	0.28
Unemployment Rate	Apr. 98	12.6	14.5
Interest Rate	Jun. 98	3.73	3.07

France

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	0.6	3.4
Leading Indicator	May 98	0.3	6.1
Consumer Price Index	May 98	0.1	1.0
		current period	same period last year
Current Balance	Mar. 98	3.25	2.15
Unemployment Rate	Apr. 98	11.9	12.3
Interest Rate	Jun. 98	3.57	3.43

Germany

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	1.0	3.0
Leading Indicator	May 98	-0.5	4.5
Consumer Price Index	May 98	0.3	1.3
		current period	same period last year
Current Balance	Apr. 98	1.27	1.56
Unemployment Rate	Apr. 98	10.0	9.8
Interest Rate	Jun. 98	3.56	3.14

Greece

	period	% change from previous period	% change from previous year
Gross Domestic Product	1996		2.6
Leading Indicator	May 98	0.8	2.2
Consumer Price Index	May 98	0.4	5.3
		current period	same period last year
Current Balance	Jan. 98	0.16	-0.02
Unemployment Rate		..	..
Interest Rate	May 98	11.30	9.65

Hungary

	period	% change from previous period	% change from previous year
Gross Domestic Product		..	..
Leading Indicator		..	..
Consumer Price Index	May 98	1.1	15.8
		current period	same period last year
Current Balance		..	..
Unemployment Rate	May 98	9.7	10.8
Interest Rate	May 98	18.40	20.60

Iceland

	period	% change from previous period	% change from previous year
Gross Domestic Product	1996		5.5
Leading Indicator		..	..
Consumer Price Index	Jun. 98	0.2	2.3
		current period	same period last year
Current Balance	Q4 97	-0.05	-0.06
Unemployment Rate	Apr. 98	2.9	4.1
Interest Rate	May 98	7.30	7.00

Ireland

	period	% change from previous period	% change from previous year
Gross Domestic Product	1996		8.6
Leading Indicator	May 98	1.0	11.9
Consumer Price Index	Jun. 98	0.5	2.9
		current period	same period last year
Current Balance	Q4 97	0.92	0.82
Unemployment Rate	Apr. 98	9.3	10.3
Interest Rate	Jun. 98	6.20	6.25

Italy

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-0.1	2.5
Leading Indicator	May 98	-0.5	8.0
Consumer Price Index	May 98	0.2	1.7
		current period	same period last year
Current Balance	Feb. 98	1.70	2.41
Unemployment Rate	Jan. 98	12.0	12.1
Interest Rate	May 98	5.11	6.83

Definitions and Notes

Gross Domestic Product: *Volume series, seasonally adjusted except for Czech Republic and Portugal*
Leading Indicator: *A composite indicator, based on other indicators of economic activity (employment, sales, income, etc.), which signals cyclical movements in industrial production from six to nine months in advance*
Consumer Price Index: *Measures changes in average retail prices of a fixed basket of goods and services*
Current Balance: *$ billion; not seasonally adjusted except for Australia, the United Kingdom and the United States*
Unemployment Rate: *% of civilian labour force – standardised unemployment rate; national definitions for Czech Republic, Iceland, Korea, Mexico, Poland, Switzerland and Turkey; seasonally adjusted apart from Turkey*
Interest Rate: *Three months, except for Greece (twelve months) and Turkey (overnight interbank rate)*
.. not available
Source: **Main Economic Indicators**, *OECD Publications, Paris, July 1998.*

Japan

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-1.3	-3.7
Leading Indicator	May 98	-0.4	-5.4
Consumer Price Index	May 98	0.3	0.5
		current period	same period last year
Current Balance	Apr. 98	8.87	8.45
Unemployment Rate	Apr. 98	4.1	3.3
Interest Rate	Jun. 98	0.58	0.61

Korea

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-5.7	-3.8
Leading Indicator		..	..
Consumer Price Index	Jun. 98	-0.4	7.5
		current period	same period last year
Current Balance	Apr. 98	3.81	-1.52
Unemployment Rate	May 98	7.0	2.6
Interest Rate	May 98	18.30	12.80

Luxembourg

	period	% change from previous period	% change from previous year
Gross Domestic Product	1996		3.0
Leading Indicator	May 98	-0.5	4.3
Consumer Price Index	May 98	0.3	1.3
		current period	same period last year
Current Balance		..	..
Unemployment Rate	Apr. 98	2.3	2.6
Interest Rate		..	..

Mexico

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q4 97	-0.4	6.6
Leading Indicator	Feb. 98	-0.2	0.9
Consumer Price Index	May 98	0.8	15.0
		current period	same period last year
Current Balance	Q1 98	-3.45	-0.15
Unemployment Rate	May 98	3.2	3.9
Interest Rate	May 98	18.85	20.59

Netherlands

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q4 97	0.9	3.8
Leading Indicator	May 98	0.1	1.6
Consumer Price Index	May 98	-0.1	2.0
		current period	same period last year
Current Balance	Q4 97	6.08	7.51
Unemployment Rate	Mar. 98	4.4	5.4
Interest Rate	Jun. 98	3.54	3.23

New Zealand

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-0.6	2.3
Leading Indicator		..	..
Consumer Price Index	Q1 98	0.2	1.3
		current period	same period last year
Current Balance	Q3 97	-1.43	-1.35
Unemployment Rate	Q1 98	7.1	6.5
Interest Rate	Jun. 98	9.15	6.96

Norway

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-0.2	4.3
Leading Indicator	May 98	-0.3	2.3
Consumer Price Index	May 98	-0.1	2.1
		current period	same period last year
Current Balance	Q4 97	1.43	2.65
Unemployment Rate	Q4 97	3.7	4.8
Interest Rate	Jun. 98	4.82	3.51

Poland

	period	% change from previous period	% change from previous year
Gross Domestic Product		..	..
Leading Indicator		..	..
Consumer Price Index	May 98	0.4	13.1
		current period	same period last year
Current Balance	Nov. 97	-0.28	-0.13
Unemployment Rate	May 98	10.2	12.1
Interest Rate	Jun. 98	20.88	20.91

Portugal

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q4 97	1.9	4.8
Leading Indicator	Mar. 98	0.2	10.0
Consumer Price Index	May 98	0.6	2.6
		current period	same period last year
Current Balance	Q4 97	-1.01	-0.87
Unemployment Rate	Apr. 98	6.5	6.8
Interest Rate	Jun. 98	4.41	5.85

Spain

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	0.9	3.7
Leading Indicator	Mar. 98	0.0	4.1
Consumer Price Index	May 98	0.1	2.0
		current period	same period last year
Current Balance	Apr. 98	0.29	0.13
Unemployment Rate	Apr. 98	18.9	21.1
Interest Rate	Jun. 98	4.30	5.21

Sweden

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	-0.9	2.4
Leading Indicator	May 98	-0.1	2.9
Consumer Price Index	May 98	0.2	0.4
		current period	same period last year
Current Balance	Apr. 98	0.22	0.70
Unemployment Rate	Apr. 98	8.8	10.4
Interest Rate	Jun. 98	4.20	4.05

Switzerland

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	0.5	2.4
Leading Indicator	May 98	0.3	7.0
Consumer Price Index	Jun. 98	0.1	0.1
		current period	same period last year
Current Balance	Q1 98	5.37	5.19
Unemployment Rate	May 98	4.0	5.3
Interest Rate	May 98	1.51	1.53

Turkey

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	4.3	7.1
Leading Indicator		..	..
Consumer Price Index	Jun. 98	2.4	90.6
		current period	same period last year
Current Balance	Q1 98	-0.88	-1.27
Unemployment Rate	Q2 97	5.9	6.3
Interest Rate	Jun. 98	65.75	70.53

United Kingdom

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	0.8	3.2
Leading Indicator	May 98	-0.5	0.3
Consumer Price Index	May 98	0.6	4.2
		current period	same period last year
Current Balance	Q1 98	-5.30	2.23
Unemployment Rate	Feb. 98	6.5	7.4
Interest Rate	Jun. 98	7.62	6.66

United States

	period	% change from previous period	% change from previous year
Gross Domestic Product	Q1 98	1.3	3.9
Leading Indicator	May 98	-0.3	4.2
Consumer Price Index	May 98	0.2	1.7
		current period	same period last year
Current Balance	Q1 98	-47.21	-36.99
Unemployment Rate	May 98	4.3	4.8
Interest Rate	May 98	5.59	5.70

Employment Outlook

Towards an Employment-centred Social Policy

OECD area GDP grew by just over 3% in real terms in 1997, its best performance since 1989, in spite of the Asian financial crisis. Growth is projected to average about 2½% in 1998–99, though prospects are very different across the regions. Yet, the unemployment rate is likely to fall only very slowly in 1999 to about 7%, which represents more than 35 million job-seekers.[1]

Progress in tackling high unemployment has been quite mixed across countries. Over the 1990s, structural unemployment has declined in just six countries – Australia, Denmark, Ireland, the Netherlands, New Zealand and the United Kingdom. It has remained stable at a low level only in Norway, the United States and Japan, although in the latter, the unemployment rate has risen sharply recently and is causing concern. Therefore, reducing unemployment and expanding job opportunities remain a high priority and will require a range of measures, including sound macro-economic policies – a message reinforced at the OECD Labour Ministerial Meeting in October 1997. The ministers, in particular, requested the OECD to assign a high priority to monitoring and evaluating alternative approaches to an employment-centred social policy to increase employment, and reduce welfare dependency and poverty.

The potential role that minimum wages and employment-conditional benefits can play as part of an employment-centred social policy merits some attention. The underlying premise is that social protection systems can alleviate family poverty, but they are insufficient for promoting wider participation in society unless they are closely tied to measures to promote labour-market integration.

Statutory minimum wages currently exist in 17 member countries and will soon be introduced in two others (Ireland and the United Kingdom). In other countries, minimum wages are established by collective agreement and, hence, tend to vary by sector. Analysis of statutory minimum wages arouses strong passions on both sides of the debate and there is a wide range of theoretical and empirical research available on the subject. In order to assess their usefulness to building an employment-oriented social policy, a dispassionate and on-going examination of their benefits and costs is required.

In the context of concerns about growing earnings inequality and in-work poverty in a number of OECD countries, statutory minimum wages can play a role in preventing earnings from falling below socially acceptable levels. Indeed, their basic purpose is often presented as ensuring fair pay in the labour market and helping reduce in-work poverty. They may also increase incentives to enter the labour market and find work ('making work pay'). On the cost side of the ledger, they may give rise to disemployment effects.

Following a brief look at the level and coverage of minimum wages in OECD countries, three questions are addressed:

- Who are the workers most likely to be affected by a minimum wage?
- What is the impact of minimum wages on earnings inequality and family poverty?
- What are the employment effects of minimum wages?

The level of statutory minimum wages varies widely across countries, ranging from 20–33% of the median earnings of full-time workers in the Czech Republic, Japan and Spain, to around 60% in Belgium and France. Not surprisingly, the higher the level of the minimum wage relative to average or median earnings is,

1. ***Employment Outlook 1998***, *OECD Publications, Paris, 1998.*

the lower the proportion of low-paid jobs in total employment. In addition, higher minimum wages are also associated with less inequality in earnings between men and women, and younger workers compared with adults.

The beneficiaries of minimum wages are low-wage workers. Youth and women are the groups most likely to be in minimum-wage jobs. And it is particularly women and the less-skilled who are most likely to be trapped in low-paying jobs, whereas for many youths they are often a stepping stone to better paying jobs.

However, a criticism of the minimum wage is that it fails to target those workers in families who really need help. Instead, it helps many workers in households with median incomes and above, while it fails to help households with no workers at all.

Do Minimum Wages Work?

There are large differences across countries in the overlap between low pay and low family incomes when all families, regardless of their work status, are considered. Around 20% of full-time/full-year low-paid workers live in poor households in European Union countries, rising to almost 40% in the United States. Thus, many poor people live in households with nobody in paid work: on average for the OECD as a whole, roughly 40% of low-income individuals live in such households.

The fact that the majority of low-paid workers are not in poor households suggests that increases in statutory minimum wages, in most cases, are likely to have a limited impact in cutting family poverty. The redistribution argument for minimum wages is, therefore, a weak one. However, it should also be emphasised that reducing the generosity of the welfare system, especially in tandem with cuts in minimum wages, would risk increasing the extent of in-work poverty.

One of the strongest criticisms of minimum wages is that, to the extent they are set at above market-clearing levels, they will price some people with low productivity out of jobs. A large number of country studies have produced a range of estimates. A few recent studies from the United States suggest no employment impact, although the balance of the evidence suggests some adverse effects on youth unemployment.

The evidence for nine countries presented in the OECD's *Employment Outlook 1998* suggests that higher minima adversely affect teenage employment: a 10% increase in the minimum wage is associated with a 1½–3% decline in teenage employment, the effects being essentially the same across countries regardless of whether they have high or low minimum wages. The evidence also shows that hikes in the minimum, on their own, can explain only a small fraction of the large falls in teenage employment rates observed over the past two decades in almost all countries. The cross-country evidence suggests that the minimum wage has no significant impact on overall adult employment.

Employment losses for young people lead naturally to the question of whether there should be flexibility in setting a separate minimum wage for young people. This is important because of the widespread desire to facilitate the transition from education to the world of work. There are large cross-country differences in the proportion of new school leavers who find jobs quickly, with the highest likelihood in countries such as Austria, Germany and Luxembourg, where many young people go through apprenticeship programmes, usually on a relatively low wage or allowance. A number of other countries have also begun to apply a lower minimum level for young people.

In truth, both opponents and supporters of the statutory minimum wage have overstated their respective cases. If minimum wages are set carefully, they can improve the material well-being of some low-wage workers, have some positive impact on work incentives and limit the extent of earnings inequality which has widened significantly in some member countries. But minimum wages on their own are not a cure for family poverty and low family incomes. And they can give rise to job losses, particularly among the young.

And Employment-conditional Benefits?

The overall effectiveness of statutory minimum wages as part of an employment-centred social policy depends crucially on how they interact with tax/benefit systems and the size of any disemployment effects. The policy debate on the role of statutory minimum wages as part of an employment-centred social policy encompasses a range of views. Some European countries have opted for fairly high minimum wages coupled with cuts in payroll taxes or wage subsidies

for low-income workers. Others support somewhat more modest minimum wages, with employment-conditional benefits to top-up the earnings of families with low incomes. They view these two instruments as being complementary. But some question the usefulness of minimum wages since they can reduce employment, whereas employment-conditional benefits can achieve redistribution goals more effectively.

A judiciously implemented policy of employment-conditional benefits has two major advantages. First, they are better equipped than minimum wages in dealing with in-work poverty among families. And second, they can act as a form of temporary earnings insurance, which is particularly useful in this era of job and earnings insecurity. One estimate of eligibility for the US earned income tax credit (EITC) suggests that, while in any single year only about one in six families qualifies, over a ten-year period two in five families have one or more years in which their wage income declines enough to make them eligible.

However, on their own, employment-conditional benefits are not a panacea either. They can be quite costly to the public purse – much more so than a minimum wage – and are paid for by taxpayers rather than by firms and consumers. They have also been criticised on grounds of 'moral hazard' in that they can cause behaviour to change in undesirable ways. While they are intended to subsidise workers, they may end up subsidising employers. In the absence of an effective wage floor, this could come about either by boosting the labour supply and pushing down wages or by collusion between firms and workers to keep wages low, knowing that the government will make up the difference. However, there is little evidence that current schemes have had this effect. Another risk with means-tested benefits is that they can create poverty traps from high effective marginal tax rates, where individuals have little incentive to work longer or harder.

Getting the Balance Right

In short, policies on minimum wages and employment-conditional benefits should not be considered in isolation. Rather, they have to be seen as complementary parts of an overall package for reducing work disincentives and alleviating the unemployment and poverty traps which many low-earners face. Their complementary nature underlines the importance of setting them jointly and at their correct respective levels.

While specifying optimum levels would be difficult, as a rule the higher the minimum wage and the lower the earnings thresholds for entitlement to employment-conditional benefits, the less likely these two measures are to complement each other. In other words, employment-conditional benefits are more likely to be used in countries where minimum wages are low relative to average or median earnings and where the distribution of earnings is unequal. On the other hand, when the distribution of earnings is more compressed, countries are more likely to use tax abatements or employer subsidies to stimulate hiring of less qualified workers, often at a high budgetary cost. The relationship between tax/benefit systems and minimum wages is a complex one, and designing the appropriate policy mix will depend on individual country circumstances.

A well designed package of economic policy measures, including an appropriately set minimum wage and complementary in-work benefits, would, on balance, be beneficial in the move towards an employment-centred social policy. More empirical work has to be done to help find the right balance. Ideally, the objective must be to improve labour market conditions so that the earnings insurance implicit in statutory minimum wages and in-work benefits becomes less necessary for unskilled workers. However, even a well designed policy package would leave no room for complacency. First, it is not clear how effective its work incentives would be. Second, those people who are unable to take full advantage of the incentives should not be excluded. Otherwise social cohesion would become little more than a slogan. Everyone who is able should be given the help they need to participate in the labour market. That might mean providing social and employment services, such as assisting with childcare costs.

The long-run well-being of individuals on the bottom rung of the economic ladder depends on increasing their employment opportunities and raising their productivity. It is only by developing long-term policies to train workers and encourage businesses to invest in them that the standards of living of disadvantaged groups in OECD countries will be improved.

6 May 1998

Publications

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See 'The OECD Economic Outlook – Highlights', **The OECD Observer**, No. 212, June/July 1998.

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The *Investment Guide for Latvia* has been prepared with three objectives in mind: first, to identify those areas of economic activity which present opportunities for foreign investors; second, to provide the investor with comprehensive information relating to the historical, political, economic, financial and legal framework essential for sound and secured foreign investment; third, to draw on the experiences of the foreign investors in Latvia, and to conclude with an assessment of the business, investment and regulatory environment. This assessment will focus on areas within the legal framework and structure which need more transparency, predictability and efficiency.
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OECD Proceedings

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May 1998
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This publication analyses in detail the nature and content of policies being implemented to promote the integration of immigrants in urban areas. It examines how the changing socio-economic context in cities may affect immigrants and the advantages and disadvantages of urban concentrations of immigrants, drawing on examples from cities in Australia, France, Germany, Italy, the Netherlands, Norway, the United Kingdom and the United States. It also highlights the importance of associating not only immigrants and key local actors, but the concerned wider population as well, in defining and implementing urban development and integration policies.
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June 1998

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No. 105

June 1998

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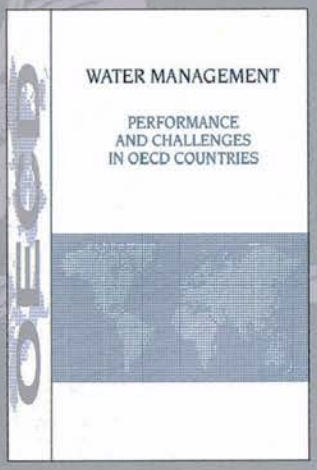

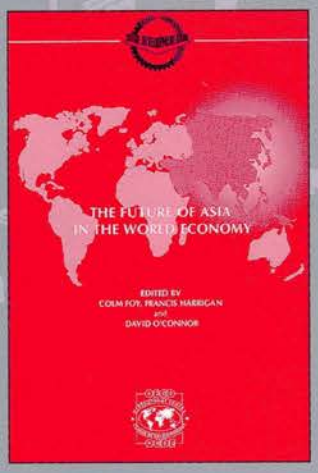

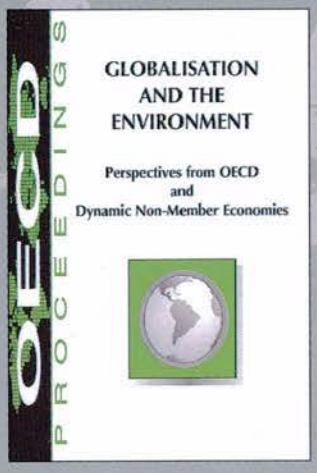

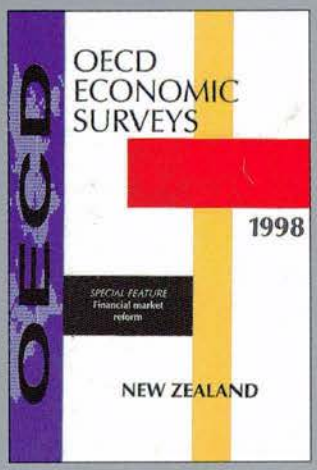

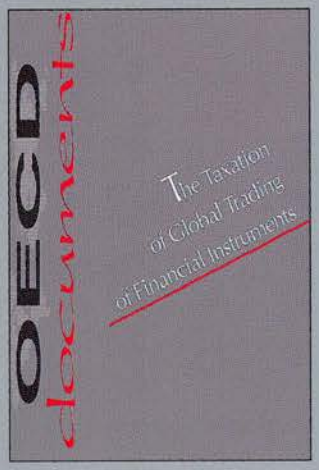

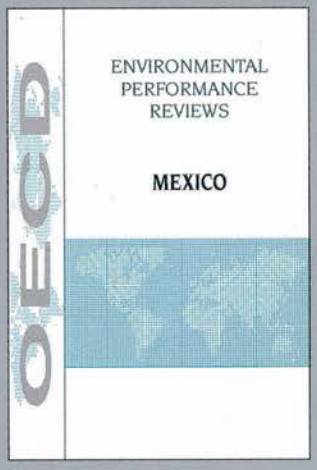

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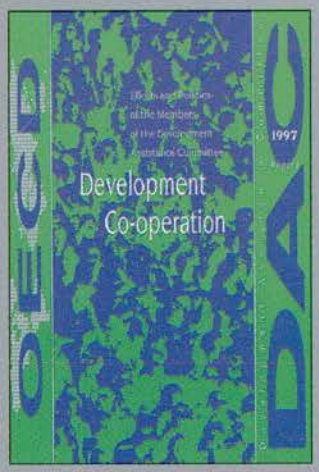

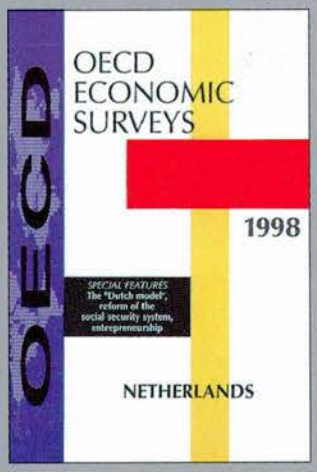

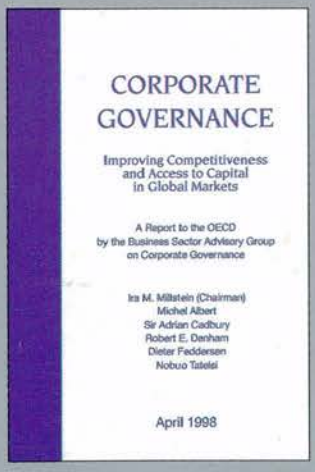

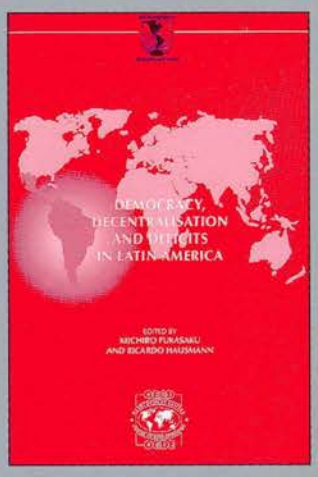

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