OECD Global Forum on Knowledge Economy - The Digital Economy

OECD-IPS Workshop on Promoting Knowledge-Based Economies in Asia

BACKGROUND PAPER

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TOWARDS A KNOWLEDGE BASED ECONOMY- RECENT TRENDS AND POLICY DIRECTIONS FROM THE OECD

Background Paper for
the OECD-IPS Workshop on Promoting Knowledge-Based Economies in Asia
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This background paper has been prepared by the OECD Secretariat for the OECD-IPS Workshop on Promoting Knowledge-Based Economies in Asia, 21-22, November 2002, in Singapore. It provides the context, rationale and conceptual framework for a comprehensive and coherent policy approach to promoting a knowledge-based economy. Drawing on recent OECD work, notably the two-year Growth Study and its follow-up, this background paper gives the OECD perspective based on current trends of policy developments in the OECD countries. The four areas recommended for policy reforms are: information infrastructure and ICT, science and innovation, human resources and education, and firm creation and entrepreneurship.

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1. CONTEXT

The capacity of countries and firms to develop and manage knowledge assets has become a major determinant of economic growth and competitiveness. Despite the economic slowdown that spread across the world economy in recent years, investment in and exploitation of knowledge remains a key driver of innovation, economic performance and social well being. Over the last decade, investments in knowledge – as measured by expenditures on research and development (R&D), higher education, and information and communication technologies (ICTs) – grew more rapidly than gross fixed capital formation. Admittedly, the pace and depth of this transition have varied considerably across countries, notably in regard to relative investments in R&D, higher education and software. Nevertheless, the general trend continues apace, as is clear from the rising share of technology and knowledge-based industries in total gross value added and employment in the OECD area. Thus, the trend in transition towards a knowledge-based economy is continuing.

The OECD, notably through the work of Directorate for Science, Technology and Industry (DSTI), has extensive experience in the analysis of factors and policies that underpin the development of a knowledge-based economy. This experience, mainly shared with OECD Member countries, has contributed to the identification of best policy practices. However, over the last years, this experience has begun to be shared with non-member countries or regions in the world. This was notably the case for the OECD Emerging Market Economy Forum on Electronic Commerce in Dubai 2001, which highlighted the potential utility of placing the existing corpus of the Organisation’s research and expertise at the disposition of emerging market and developing countries.

Stakeholders in the Southeast Asia region have recognised the importance of the evolution toward a knowledge-based economy, and are increasingly moving toward knowledge-based development strategies. However, most of the envisaged participating Asian countries are at different stages of their transition to knowledge-based economies, partly due to differing levels of economic development and capabilities for producing and using ICT. They have different visions of how to develop knowledge-based economies as well as varying governmental traditions and styles. Thus, their strategies tend to emphasise different aspects of the transformation into knowledge-based economies. Their approaches reflect differences in the social institutions, cultural values and capabilities that underpin the political and economic systems of individual Asian societies. Despite these differences, experiences can be usefully shared among the Asian economies and the OECD member countries.

The Workshop “Promoting Knowledge-Based Economies in Asia” aims to construct a dialogue between the OECD and non-Member economies of the Southeast Asia region on important issues related to a knowledge-based economy. It will be organised mainly by DSTI, within the framework of the OECD Centre for Co-operation with Non-Members (CCNM)’s Programme of co-operation with non-Members, especially with its Emerging Asian Economy Programme. The Workshop contributes to the CCNM activity “OECD Global Forum on the Knowledge Economy”. It will be conducted in close co-operation with the Institute of Policy Studies (IPS), Singapore, with the generous support from the Knowledge for Development Program of the World Bank Institute, infoDev program of the World Bank, and Singapore Government agencies including Economic Development Board (EDB), InfoComm Development Authority (IDA), and Ministry of Trade and Industry. The Workshop may in effect serve as pre-event to the

**Objectives of the Workshop**

The objectives of the Workshop are to: 1) stress and document the importance of a comprehensive policy framework in using knowledge for economic development covering ICTs, innovation and human resources; and 2) provide a setting for policy dialogue among stakeholders, allowing a sharing of experiences on policy frameworks for the knowledge-based economy among OECD and non-OECD countries.

The Workshop will provide participating non-Member economies with an overview of policy developments that reflect the increasing role of knowledge development and management. Specific attention will be given to policy areas concerning the knowledge-based economy: knowledge assessment and qualification of a country’s knowledge capacity for formulating strategies and policies, information infrastructure including telecommunications and e-commerce; science, technology and innovation; human resource and education and development of knowledge-based industries and entrepreneurship. It will also raise awareness of the need for a comprehensive approach that links such policy developments in specific areas to overall economic and social goals. These objectives will be achieved through sessions at which experiences and lessons of OECD and non-OECD countries would be presented, and discussed. Discussion would also concern the importance of the knowledge-based economy, the costs of non-participation, the economic benefits of ICTs and innovation, and the main human resource and policy requirements for change.

**Key issues**

Areas of substantive issues to be discussed at the Workshop will include:

- The need for a comprehensive policy approach for promoting knowledge-based economy;
- Knowledge assessment and benchmarking performances as basis for policy making;
- Policies and challenges for developing information infrastructures;
- Policies and challenges for enhancing skills, education and human resources, more broadly;
- Policies and challenges for improving innovation and technological capabilities, and
- Policies and challenges for creating conducive business environment for ICT and knowledge-intensive industries more broadly.

Best policy practices based on country presentations will be discussed to contribute to:

- Setting the foundations for a knowledge-based economy
- Developing a comprehensive policy approach for knowledge-based development,
- Resulting in policy implications and shedding light on the way forward.
2. ICT IS A MAJOR CONTRIBUTOR TO GROWTH IN THE KNOWLEDGE-BASED ECONOMY

ICT is transforming economic activity, as the steam engine, railways and electricity have done in the past. ICT has already had important economic impacts. It has contributed significantly to high growth in several OECD countries and non-OECD economies in the past few years. It has been a catalyst of change in business, improving work organisation for instance, helping firms to reduce routine transaction costs and rationalise their supply chains. It has spurred innovation in services and made manufacturing and design more efficient. Inventories and overheads have become more manageable. Moreover, ICT has spawned value-generating networks between producers and consumers. Such benefits are long-term in their effects, and will continue to develop.

To compare to previous new technologies, it is important to note that ICT appears to be an important transformational technology today. OECD Growth Study suggested that governments have to ensure they have the policies in place to seize the benefits of ICT, as well as limit any negative effects. As with any technology that is based on networks -- and the Internet is that par excellence -- the more people that use it, the more benefits it generates. Encouraging the use of ICT, by increasing competition to bring down costs and by building confidence, should therefore be an important policy aim. It is also important to recall that the development of ICT partly resulted from policy efforts in some OECD countries to create a more innovative economy. Governments should help to build an environment that is both conducive to innovation and adaptable to future technological breakthroughs.

The investment and diffusion of ICT do not just depend on the cost of the investment goods themselves, but also on the associated costs of communication and use once the hardware is linked to a network. Increased competition in the telecommunications industry, thanks to extensive regulatory reform, has been of particular importance in driving down these costs. It has led to more entrants, greater technology diffusion, improved quality and a higher rate of innovation. This has benefited the industry, as well as the economy as a whole. Countries that moved early to liberalise their telecommunications industry now have much lower communications costs and, consequently, a wider usage and diffusion of ICT technologies than those that followed later on. While deregulation of telecommunication markets are being implemented in many countries, there is clearly more to be done before competition in telecommunications markets takes hold, including in many OECD countries.

When national and international telecommunications markets are clearly opening up, the next step is to introduce competition at local level. More competition in the local loop would surely drive prices down further and would help to change the pricing structure of the Internet. The introduction of competition in local markets typically involves “ unbundling”, i.e. the separation of the local network and infrastructure from the services that are provided over that network. In other words, the operator of the local network should not have to be the same as the phone service provider. Unbundling enables new entrants to offer such services as unmetered Internet access to their customers should they so wish. Most OECD countries are now implementing unbundling, and the European Commission has mandated unbundling of the local loop for its member states as of the beginning of 2001. But this will not be simple; it will require further regulatory reform and better enforcement of competition law to promote vigorous competition and to create the conditions for future investment by new entrants.

Another important policy challenge is to promote greater competition between different networks, e.g. fixed networks, cable television networks, satellites and wireless networks, so that users can choose. Both unbundling and competition between different networks will help in stimulating the development of
high-speed access options, e.g. broadband technologies that enable access to multi-media applications. The competitive development and diffusion of these technologies would also help to spur e-commerce.

**Competition encourages ICT investment and use**

Despite the emerging benefits of ICT, some OECD countries have been slow to embrace it. There are several reasons for this, a lack of ICT skills, limited capacity to adjust the production process to ICT technologies, or poor access to finance, being just three typical ones identified by the OECD Growth Study. Insufficient competition may be another factor, because this can harm efficiency and slow the adoption of new techniques. Globalisation has added to this process, by forcing firms to look more and more to innovation and technology to help them restructure and thrive.

Firms in the United States and Canada have enjoyed considerably lower costs of ICT investment goods in the 1990s than firms in European countries and Japan. These low costs may have helped to stimulate investment in both countries. Barriers to trade, in particular non-tariff barriers related to standards, import licensing and government procurement, may partly explain the cost differentials. The higher price levels in other OECD countries may also be associated with a lack of competition within countries. In time, however, international trade and competition should erode these cross-country price differences. Policy could help to accelerate this trend, by implementing a more active competition policy and measures to promote market openness, both domestically and internationally.

Policies to increase competition will not on their own boost the diffusion of ICT or the use of e-commerce. An appropriate regulatory and legal environment is required too, particularly in the areas of privacy, security and consumer protection. The key word here is confidence, among consumers, business providers, and government. Progress is being made, but concerns remain, for example, over divulging sensitive private information, such as customer databases, over the Internet, or ensuring that transactions across the Internet are safe from fraud, malicious hacking and other criminal acts. Authentication and certification mechanisms are being developed to help identify users and safeguard business transactions. If e-commerce is to be an important way of doing business in the future, it will have to be reliable, secure and safe to use under all conditions. Electronic commerce and ICT also creates new challenges to policy, including challenges to traditional consumer laws and practices, such as in the area of taxation of goods and services, or consumer rights in the event of receiving defective goods.1

Some of the slowness to do business (personal or otherwise) via the Internet is to do with attitudes. Governments can help to change these by using ICT applications themselves. Tendering public services, information, collecting taxes or procuring goods and services online can help increase government efficiency while having the additional benefit of building public confidence.

**Developing a strong ICT production sector is no panacea**

Should countries aim to build up their ICT sectors? Not necessarily, OECD countries' experiences suggest. True, some OECD countries that have a large ICT-producing sector, such as Ireland and Finland, have benefited from rapid technological progress in this sector. Having a strong ICT sector may help firms that wish to use ICT, since their close co-operation might have advantages when developing technologies for specific purposes. By definition, having a strong ICT sector should generate the skills and competencies needed to benefit from ICT use. And it should also lead to spin-offs, as in the case of Silicon Valley or in other high technology clusters.

1. OECD work covers many of these issues. See [http://www.oecd.org/subject/e_commerce/](http://www.oecd.org/subject/e_commerce/)
But having an ICT sector may not be a prerequisite for growth based on new technology for three reasons. First, proximity to hardware producers may not be as important for ICT users as proximity to software producers and service providers, which are useful to firms needing skills and advice to implement ICT-related changes. Second, much of the production of ICT hardware is highly concentrated, because of its large economies of scale and high entry costs: establishing a new semi-conductor plant cost some USD 100 million in the early 1980s, but as much as USD 1.2 billion in 1999.\footnote{And those parts of ICT hardware production that can easily be set up, such as the assembly of PCs, are likely to have less technological spin-offs than the high-tech production of semi-conductors.} In other words, a hardware sector cannot simply be set up, and only a few countries will have the necessary comparative advantages to succeed in it. The third, and most compelling, point is that several OECD countries characterised by high ICT investment and use, as well as high MFP growth, do not have a large ICT sector. And one or two other countries that do have a large ICT sector have not been among the high growth OECD countries of the 1990s. In sum, governments should resist believing that deliberately developing an ICT manufacturing sector would be a sure route to improved economic growth.

Source: MFP from OECD; OECD (2000a).
New policy challenges due to ICT

Every period of radical technological change brings its new challenges and adjusting to ICT is no exception. If anything, as economic and social changes are likely to continue in the years ahead as new technologies come on stream, regulations and policies will have to be kept flexible to adjust to new circumstances. It is too early to say precisely what impact ICT will have on competition and competition policy, intellectual property rights (IPR), trade or taxation, for example. But informed judgements can be made.

First, consider competition policy. On the one hand, ICT could have pro-competitive effects by reducing search costs and thus improving market transparency, or by helping to create a truly global market place. On the other hand, the web might lead some firms to collude in such a way as to limit competition. Moreover, the web may be characterised by strong network effects, where a single firm could come to dominate the network and establish a monopoly over certain lines of business. This is not necessarily a problem, as some degree of monopoly is normal in markets with a very high rate of innovation. The market should eventually break such monopolies as alternative networks develop, new innovations kick in or consumer tastes shift. Nevertheless, firms can be deft and competition policy authorities should be vigilant to ensure that such dominance does not arise except where it is the most efficient market solution.

Governments have a key role to play in the protection of IPR. The Internet makes it possible to copy and distribute any type of digital information, such as books, music, video and software, immediately and at zero or very low marginal costs. These possibilities may require some rethinking of existing IPR regimes, as they run the risk of dissuading firms from innovating. Many creators of digital information, or content, are seeking stronger legislation and enforcement of IPR. The policy response to this issue is not yet clear. For a start, stronger legislation might limit the spread of information to libraries with weak purchasing power for instance. And it is not clear to what extent these companies actually suffer from the infringement on copyright; indeed, stronger legislation might do little more than increase their profits. In any case, the main problem may not be so much about new legislation, but about enforceability; each computer linked to the Internet has the potential to distribute unlawful copies. Technology and the market may also provide its own self-regulating answers, such as CD-ROMs that are more difficult to copy.

ICT also raises challenges for trade policy. E-commerce, for example, blurs the geographical boundaries of place of supply and residence, which are key to determining jurisdiction and tariff revenue rights. And it blurs other differences too. Take a book, for instance, which is a good in the physical world; oddly, there is no agreement on whether a book is a good or a service when it is downloaded via the Internet. Work is underway to address these issues, particularly at WTO.

Electronic commerce raises an important challenge for tax policy, namely that of establishing a fiscal environment which businesses have faith in, while not undermining the ability of governments to raise revenues for public goods and services. OECD ministers agreed Taxation Framework Conditions in 1998, which set out the taxation principles that should apply to electronic commerce. Since then, considerable progress has been made; a consensus has emerged on how to interpret permanent establishment rules that are fundamental in deciding where profits on the conduct of e-commerce can be taxed. Progress has also been achieved in identifying pragmatic ways of achieving effective taxation in the place of consumption. And governments have also reached agreement on the main challenges and opportunities for tax administrations. More progress is needed though, notably on improving international co-ordination and co-operation.
Box 1. Key policy messages: ICT production and use

While it is important to resist hype when talking about new technologies, **ICT** is an enabling technology that is transforming economic activity. Governments should take it seriously as a harbinger of growth and economic change:

- **Focus policy efforts on increasing the use of new technology, rather than its production:** Developing an ICT manufacturing sector is costly and would not necessarily lead to faster economic growth. What counts more is how ICT is used to improve productivity and innovation.

- **Increase competition and continue with regulatory reform in the telecommunications industry to enhance the uptake of ICT:** Improving the conditions of access to local communication infrastructures is particularly important, and will require effective policies to unbundle the local loop and establish interconnection frameworks. Such policies will also help enhance access to high-speed communication services.

- **Ensure sufficient competition in hardware and software to lower costs:** Effective competition policy frameworks, lower barriers to international trade and investment, and national and international IPR regimes are important in this context.

- **Build confidence in the use of ICT for business and consumers:** Governments need to continue working with business and civil society, and provide guidance, to establish flexible regulatory frameworks for privacy, security and consumer protection, so that ICT applications, such as the Internet, become safe and reliable to use.

- **Make e-government a priority:** Tendering public services, collecting taxes or procuring goods online can increase government efficiency while building public confidence in ICT applications.
3. HARASSING INNOVATION, AND TECHNOLOGY DIFFUSION

The importance of innovation

Innovation and technology diffusion are always important to economic growth. But their role has changed in recent years. Increased competition and globalisation has spurred a greater market orientation of funding, resulting in strong growth of business R&D, and scientific research now has a direct impact on innovation in key areas such as biotechnology and ICT. ICT has also played a role, by accelerating the process of knowledge creation; the mapping of the human genome would not have been possible without modern computing technologies. It has also enabled faster networking, and made science more efficient. But despite globalisation, growing competition and the diffusion of ICT, the degree of innovation differs considerably, even across OECD countries (Figure 2).

Figure 2. Innovation differs between OECD countries

Note: The graph shows the patenting in the US market -- the largest market for innovation -- by inventors (firms, universities, laboratories, etc.) from different countries, relative to the size of each economy in terms of GDP. Japan, the United States, Sweden, Switzerland and Finland, patent most relative to GDP. A considerable part of the patenting is in ICT and biotechnology. Patents are only a partial indicator of innovation. Many innovations are protected by other regimes of intellectual property rights, such as copyrights and trademarks, while others are protected by secrecy or first-to-market strategies. Countries with high growth in multi-factor productivity in the 1990s have typically had high growth in patenting.

Source: OECD, based on data from the US Patent and Trademark Office.

OECD work shows that R&D is an important driver of MFP (Figure 3). Many countries in the world are devoting more resources to R&D. After stagnating in the first part of the 1990s, OECD-wide R&D investments grew in real terms from USD 416 billion to USD 552 billion between 1994 and 2000, and R&D intensity climbed from 2.04% to 2.24% of GDP. Growth in R&D expenditures during the
1990s resulted almost exclusively from increases in industry-financed R&D, which grew by more than 50% in real terms between 1990 and 2000. Government-funded R&D grew by only 8.3% during this period. As a result, the share of total R&D financed by industry reached 63.9% in 2000, considerably above its level of 57.5% in 1990, while the government’s share declined from 39.6% to 28.9%.

Foreign R&D is particularly important for most OECD countries (the United States being an exception), since the bulk of innovation and technological change in small countries is based on R&D that is performed abroad. Due partly to this reason, international co-operation in S&T is also increasing, resulting in rising percentages of scientific publications with foreign co-author, patents with foreign co-inventor, foreign financing of R&D expenditures, etc. However, domestic R&D, i.e. business, government and university research, remains an important driver of MFP growth. It is also key in tapping into foreign knowledge; countries that invest in their own R&D benefit most from foreign R&D.

Figure 3. Increased R&D goes hand-in-hand with MFP growth

![Figure 3](image)

Note: OECD countries where business expenditure on R&D relative to GDP has increased most from the 1980s to the 1990s (the countries grouped in and around the top right-hand quartile) have typically seen the largest increase in MFP growth. But some countries with increased expenditure on R&D have seen no improvement in MFP, indicating that other factors matter. Statistical test suggest a significant relationship between the two variables: correlation coefficient = 0.57, t-statistic = 2.65.

Source: OECD Main Science and Technology Indicators 2000-II.

Governments are paying more attention to the contribution of science and innovation to economic growth and most of them have introduced a variety of new initiatives and reforms. Several OECD countries introduced comprehensive policy frameworks to guide developments in science, technology and innovation. In a number of countries, government institutions and agencies have been restructured in an
attempt to improve the governance of science and innovation systems, and policy evaluation has become more widespread. Public research systems are being reformed to better contribute to economic and social needs.

Linkages between industry and science and diffusion of knowledge within national innovation systems are emerging as primary foci for innovation policy. In many OECD countries, new initiatives target promotion of innovative networks and clusters, creation of centres of excellence, and greater use of public/private partnerships for innovation. Many governments have introduced initiatives to support research in SMEs and facilitate the commercialisation of public research through spin-offs.

Traditional public missions such as health, defence and environmental protection remain major areas for public funding of R&D, but most OECD governments have also identified priorities in specific fields of science and technology. In general, these involve enabling technologies that address a number of social objectives and are of value to fast-growing industrial sectors. ICTs and biotechnology have received special attention in most OECD countries and Non-OECD economies, noticeably in Asia, with nanotechnology also attracting considerable support. In many countries, there has been a noticeable shift towards basic research and an increase in the role of higher education in performing research.

To help realise that potential, policy has a key role to play in ensuring that new innovations continue to develop. Governments can help in four main ways: by establishing the right incentives for innovation, by ensuring the generation of new knowledge, by making their own investment in innovation more effective, and by improving interaction between the main actors in the innovation system, that is to say, universities, research institutes and firms.

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<th>Box 2. Key policy messages: S&amp;T and innovation</th>
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<td>Overall, policymakers should look beyond the current wave of technological change and seek to foster the kind of <strong>innovative environment</strong> in which new growth can flourish:</td>
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<tr>
<td>• <strong>Give greater priority to fundamental research; future innovation will be jeopardised without it:</strong> Such funding should be competitive and emphasise scientific excellence and merit as key criteria.</td>
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<td>• <strong>Improve the effectiveness of government funding for R&amp;D:</strong> Government funding needs to focus on areas with high economic or social benefits, not vested interests. Public-private partnerships can help to share costs and may increase the leverage of government funding. Competitive procedures are important for such partnerships while the use of consortia may avoid that governments only support one firm as the “winner”.</td>
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<tr>
<td>• <strong>Make greater use of competitive funding and evaluation in supporting public research:</strong> Support for institutions remains important, but competitive funding instruments and strong evaluation are needed to improve the quality of research and focus on the areas of greatest value.</td>
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<td>• <strong>Tackle new challenges in intellectual property regimes:</strong> Governments should ensure that IPR regimes governing publicly funded research strike a balance between the diffusion of knowledge across research institutions and its application by the private sector.</td>
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<tr>
<td>• <strong>Remove barriers and regulations that limit effective interaction between universities, firms and public laboratories:</strong> To augment the flow of knowledge and workers between science and industry, governments should review rules and regulations that limit the mobility of public sector researchers or restrict institutional links between public and private sector organisations.</td>
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4. ENHANCING HUMAN CAPITAL AND REALISING ITS POTENTIAL

Renewed emphasis on human capital as an engine of growth

The role of human capital as a central pillar of the development process is not new. There is a well-established relationship between human capital, understood as the skills and competencies embodied in workers, and labour productivity -- and it is not surprising that improvements in one should lead to increases in the other. Consequently, recent empirical studies have found that human capital is a significant determinant of economic growth.

There is, however, renewed interest in the productivity-enhancing role of human capital. One reason is its complementarity with new technology: for ICT to be developed and used effectively, and network externalities of new technology to materialise, the right skills and competencies must be in place. One of the factors behind the good growth record of some countries has been the availability of a large pool of qualified personnel. And skilled labour shortages are rightly considered as a constraint to the growth process. This is why, increasingly, some OECD countries use foreign labour to fill in shortages of qualified personnel. For example, in the United States, foreign workers filled more than a quarter of qualified ICT-jobs created during 1996-1998.

The result is that the demand for "knowledge-intensive" employment has risen considerably. During the 1990s, in the OECD countries for which data are available, the rise in the number of knowledge workers (scientists, engineers and others, e.g. ICT specialists and technicians that generate knowledge), accounted for nearly 30 per cent of the net employment gains recorded during this period. Wages have followed a similar pattern. For example in the United States, the wage of knowledge workers has risen much faster than wages of other occupations. Between 1985 and 1998, real earnings of knowledge-intensive workers grew by almost 17 per cent, cumulatively, compared with 5¼ per cent for the average US employee. During the same period ‘goods-producing’ occupations suffered a cut in their real earnings of nearly 2½ per cent.

To take advantage of the growth potential of new technology, it is essential to intensify efforts to upgrade human capital. Policies have to ensure that formal education systems respond to changing requirements in a cost-effective way. But education policies, important as they are, need to be supplemented with action in the area of adult learning. A coherent life-long learning strategy is therefore required.

Ensuring a solid foundation in basic education

In the knowledge-based economy, providing everyone with at least a basic educational background has become more important. In many OECD countries, more than a fifth of every youth cohort leave the formal education system without the types of skills and qualifications that are valued in the labour market. Those who do not complete secondary education are more at risk of unemployment and, when they have a job, their wages and working conditions tend to deteriorate in relative (and sometimes absolute) terms. Non-completion of secondary education has a detrimental economic impact, while also raising a number of social concerns.

Early education and child care are key to reduce school under-achievement. Indeed, the bases for the skills needed in the knowledge economy, notably communication skills, are acquired early in life. Policies to improve early childhood education are generally cost-effective, in that they can reduce the need for more costly interventions to remedy school failure and anti-social behaviour later on. Furthermore, while early education policies have immediate financial repercussions, they deliver positive results in the medium
term. This is why improving access to early childhood education is a policy priority in all the countries that needs to be intensified.

Another reason for school under-achievement is the fact that knowledge opportunities are unevenly distributed across different socio-economic groups: the lower the educational inequalities, the better the school performance for the country as a whole. More specifically, children from disadvantaged groups have to be provided with adequate education opportunities to help reduce cross-country differences in educational attainment. The challenge is sizeable, even for OECD countries. For instance, in France, 62 per cent of the 15-year-olds coming from the poorest 20 per cent of the families have had to repeat at least one year in school compared with 17 per cent in the case of the children coming from the richest 20 per cent of the families. Education inequalities have even worsened in certain countries. Thus, in the United States, over the past two decades there has been a widening inequality in college completion between the children of low and high income groups. As the experience of some Nordic countries shows, targeted programmes can help break this "vicious circle" of educational inequalities. These programmes need to take into account the importance for school achievement of a trust-based environment and, more generally, social capital.

**Adapting higher education and making it more cost-effective**

Higher education is essential to innovation and technological change, especially now that the distance between research and its application is narrowing. Higher education is also important for ensuring an adequate supply of qualified labour, and thus to sustain the growth process. Given such requirements, the links between higher education and labour markets should be strengthened. This can be achieved through a wider provision of short-cycle courses, a larger involvement of the private sector in course design, increased learning possibilities for workers who need to update their skills and the application of effective financial mechanisms. The involvement of the private sector in higher education provision provides another occupationally-oriented option.

To help update workers' skills, higher education could be made more “adult friendly” and flexible, allowing part-time study, distant learning and on weekends. Access requirements take into account not only former education qualifications but also work experience. Furthermore, new technology can be better exploited to widen the learning opportunities of adults.

Upward pressures in public spending on education should be accompanied with a stronger emphasis on reinforcing the incentives for improving education outcomes, *i.e.* making the system more cost-effective. Subsidising institutions on the basis of their performance would introduce a healthy element of competition and probably improve school achievement. But this raises equity concerns, as well as a risk of “creaming” — which arises when education institutions tend to enrol students who are likely to complete the courses successfully, rather than those whose initial qualifications are far from the course objectives. In addition, it is advisable to delegate budgetary powers to the institutions to allow them to allocate the funds in the most efficient way, provided that managing the business side of education does not distract from actual teaching.

**Strengthening the incentive to invest in training and adult learning**

There is widespread agreement that incentives for adult learning, *e.g.* via direct public expenditure or tax exemption, are insufficient for today’s requirements. About two thirds of the adult population does not receive any formal training at all. In particular, the unskilled, older workers and those on precarious forms of employment, have relatively few opportunities to learn or upgrade their skills, thereby aggravating the risk of being left behind. It is important to develop policy measures to improve the distribution of
vocational training across different categories of workers. Also, the content of training needs to reflect the rising demand for "soft skills", like interpersonal and communication skills.

The problem is that employers may have weak incentives to provide on-the-job training resulting in firms to pursue a “buying strategy”. On the other hand, individuals themselves may be reluctant to engage in training in the absence of a certification system or clear evidence that their investments in training will yield sufficiently high returns. To reduce the tendency to under-invest in training, countries should build a well-functioning system of recognition and certification of competencies.

**A growing need for adapting labour market institutions to the changing nature of work**

To enhance the benefits of new technology and realise the potential of human capital, it is essential to reorganise work within firms. There is a marked association between ICT use and new work practices such as teamworking, employee involvement and flatter management structures. Social partners and government can work together to ensure that this virtuous circle of new work practices, new technology and productivity is set in motion. This crucially depends on workers being given a sufficient "voice" in the firm. Institutions, which allow a closer contact between management and employees, can indeed help build a high-skill, high-trust enterprise climate which facilitates change. New work practices are indeed much more prevalent among firms with worker representation institutions than among other firms.

**Bridging the digital and knowledge divides**

Unequal access to new technology and to learning how to use it effectively has become a matter of major policy concern. The significance of this knowledge divide is three-fold. On the one hand, there is a risk that those without access to ICT skills and knowledge will lag further behind as technology progresses, with whole groups of society becoming less and less capable of participating in the economy. This could add pressures towards wider income inequality, potentially eroding support for growth-enhancing policies and driving up costs of social programs. Moreover, one of the main advantages of ICT lies in its network effects, so that the more people that use the system, the greater the economic benefits of the new technology. And, given the importance of human capital to growth, closing the divides should by definition improve human capital and medium-term growth potential as well.

In many countries, including the OECD economies, large segments of populations do not yet have access to modern technologies. The incidence of Internet home access in rural areas, among older people and by low-income individuals and households is relatively limited. Policies to reduce costs and raise confidence will facilitate a wider diffusion of ICT, thereby narrowing the digital divide. As the new technology network expands, rural areas will be in a better position to participate in the network economy. There is also an issue of a digital divide between countries, the so-called "North-South" digital divide. To address some of the problems raised by this divide, G8 countries recently decided to create a digital opportunities task force (the dot force). Many of the policies recommended will apply to not only OECD but also developing countries, though most are starting from considerably lower base. Moreover, development co-operation policies have a key role to play in helping developing countries to create the right policy environment to attract ICT investment and to make use of ICT as part of achieving their poverty reduction goals.
### Box 3. Key policy messages: Human resources and digital divides

If strategies to boost growth are to succeed, whether via ICT or any new technology, policies to enhance **human capital** (the skills and competencies embodied in labour) must be prioritised. Properly managed, many of these policies will also help to narrow the **digital and knowledge divides**:

- **Invest in high-quality early education and child care**: these investments are more cost-effective than later interventions to remedy school failure and they help boost participation in the labour market.

- **Raise completion of basic education and improve the quality of the system**: Drop out rates from secondary education have to be lowered. ICT literacy has become part of basic competencies and has to be improved, notably by recruiting qualified teachers and making pay more competitive.

- **Improve school-to-work transition**: Create or strengthen pathways that combine education with workplace experience; to ensure cost-effectiveness of the system, establish mechanisms of co-financing between employers, trainees and government.

- **Strengthen the links between higher education and the labour market in a cost-effective way**: This can be achieved through developing shorter course cycles with a healthy orientation to job market requirements. Involving the private sector in the definition of curricula and funding can be valuable, as can strengthening performance-based financial incentives.

- **Provide wider training opportunities**: Increase possibilities for adults and workers to participate in higher education. Innovative instruments, like individual learning accounts and systems of recognition of competencies, can enhance incentives to engage in training while helping to control costs. Ensure that firm training is not penalised by tax systems.

**Reduce obstacles to workplace changes and give workers a greater voice**: Employee involvement and labour-management institutions are key to foster change and raise productivity – governments must recognise this. Ensure that working time legislation and employment regulations do not hamper efficient organisational change; adapt collective bargaining institutions to the new economic environment.
5. FOSTERING FIRM CREATION AND ENTREPRENEURSHIP

Every period of technological change is a period of opportunity. Indeed, risk-taking and entrepreneurial activity feed on change, but also drive it. The pace of business formation has increased dramatically in several countries over the past decade, thanks largely to ICT, but also other new technologies, such as biotechnology. Newly created firms have spurred innovation in many areas. They have been responsible for an increasing share of the growth in private R&D and patent activity in the United States and a number of other OECD countries3. The jobs they have created have tended to be knowledge intensive and highly skilled. Their working organisations has tended to be more flexible too, in terms of training, internal job mobility and reward. Overall, there is evidence that the contribution of start-ups in the ICT sector to overall MFP growth has increased in recent years.

At the same time, business failure among start-ups has also been marked. Not all entrepreneurs succeed, but far from being a sign of economic weakness, this dynamism in firm turnover (i.e. entry and exit) reflects the ability of countries to expand the boundaries of economic activity, shift resources and adjust the structure of production to meet consumers’ changing needs.

While new innovative firms are present in all countries, the level of new firm creation has differed widely among OECD countries. There is a wide range of reasons for this, covering financial support, regulatory and administrative environments, education and training, and cultural and social issues. Financial support, in particular the availability of risk-capital, is a problem in many countries. However, in countries where entrepreneurial activity is low, government regulations and cultural and social considerations also act as important constraints on entrepreneurship. Thus, OECD country governments have essentially moved away from past industrial policies to a new set of policies that aimed at creating enabling business environments for firm creation and entrepreneurship development.

3. This trend may also reflect strategies of larger companies towards the diversification of their R&D activities. They can do so either by transferring their research activities into a new entity which they finance directly, or by investing in innovative start-ups. In this case, the experience shows that large corporations tend to take them over when they succeed.
Figure 4. Major impediments to entrepreneurial activity in the OECD

Note: The pie chart illustrates the role of framework conditions for entrepreneurial activity in the OECD. Figures shown represent the frequency with which each issue was raised during interviews with entrepreneurs in 14 OECD countries. Access to financing represents an important problem for starting-up an enterprise, as do lack of education and training.

1. Unweighted average of 14 OECD countries participating in the study.

Source: Reynolds et al. (2000).

**Financing new innovative firms: venture capital and, high-risk capital markets**

As mentioned, one important impediment to entry for new innovative firms is the lack of financing. For reasons such as lack of track record and often very little collateral, start-up firms face difficulties to obtain bank loans or other forms of debt financing. For the recent wave of innovative start-ups, the main source of funding has tended to be equity finance, whether venture capital or from so-called business angels. These private investors do more than just supply funds, they help start-ups to develop as businesses, providing advice and even management. They become crisis managers when times turn bad and contribute to firms’ survival.

Empirical evidence suggests that innovative start-ups are hard to flourish in countries without a broad venture capital culture. Yet, regulations can inhibit the development of venture capital markets. For example, rules in some countries still prevent or discourage pension funds, insurance companies and other institutions from venture capital investment to protect certain classes of investors against over-exposure. Clearly, this points to the need for governments to find a better balance between safeguarding against serious default or systemic fragility and the need to stimulate the supply of venture capital funding.
Taxation can also act as a barrier to the development of risk capital and tax reforms aimed at reducing distortions in this area should remain a priority in many countries. First, high tax rates on capital gains effectively imply double taxation of corporate retained earnings and therefore may negatively affect the supply of venture capital investment. Such rates are relatively high in Japan, Canada and some EU countries. Second, tax rules generally tend to favour debt financing over new equity financing as corporate interest payments -- as opposed to distributed profits -- are usually deductible from corporate taxes. A few OECD countries, e.g. Denmark, Finland and Italy, have recently introduced changes to their tax systems to ensure more equal treatment to the two forms of financing. Third, in some countries, especially in Europe, tax structures may also hinder cross-border investment by discriminating against foreign venture capital investors, for example through the double taxation of dividends in cross-border investment.

The role of high-risk capital markets is another important factor affecting innovative start-ups. The degree of development of venture capital investment also goes hand-in-hand with the existence of well-functioning, accessible equity markets that facilitate the sale of assets, thus providing an exit mechanism that allows entrepreneurs and investors in early-stage risky projects to be compensated for their efforts. “New” markets, such as the NASDAQ in the United States or the Neuer Markt in Germany and the nouveau marché in France, play an important role in this regard. These markets typically have less stringent admission requirements and lower costs than the traditional main markets. Venture capital investors use them, through initial public offerings (IPOs), to pass along investments that have matured, re-liquify their assets and seek new investment opportunities. An active IPO market is thus important to foster innovation by providing capital to new enterprises and raising additional funds for expanding firms. Some volatility is to be expected in technology equity markets given the risky nature of activities of companies listed on them. The fact remains that high-risk capital markets still have a critical role to play in financing innovation in the years to come.

In those countries that have no new market, more effort should be made to reform stock market regulations, for instance by loosening overly restrictive qualification rules and procedures for registration and pricing methods. Such stock market reforms are particularly important to stimulate international venture capital flows, representing an important source of funding for start-ups. As US investment enters a slower period, these global trends could sharpen as investors look more closely at opportunities elsewhere, e.g. in Europe and Asia. Moreover, these start-ups could do better than some of those that featured in the past few years, as their access to experienced venture capitalists should reduce imprudent decision-making and expectations. International investors are becoming more selective, so that countries that offer the best overall conditions for successful innovation and the highest prospects for growth should attract the largest amount of foreign high-risk capital.

**Amending administrative and bankruptcy regulations**

High administrative barriers to start-ups are key in this respect. In a number of countries, regulations in the registration of new businesses are either excessive or unnecessarily complicated and drawn-out. This obviously adds to the cost of firm creation and discourages entry. But it does not stop there; firms in their start-up and gestation phases may be disproportionately burdened by the non-transparency of tax and other administrative compliance procedures.

Some reforms have recently been introduced or are in the pipeline (in Italy, France and Portugal, for example), but much remains to be done in many countries to improve matters for new businesses. Initiatives taken in some countries to bring all administrative formalities together under one roof, providing clients with a “one-stop shop” and more centralised procedures represent steps in the right direction. Governments could also promote on-line registrations and filing to reduce establishment and tax compliance costs. In addition, they could improve matters in the field of information and communication through the wider use of Internet portals.
Would-be entrepreneurs can be put off not just by barriers to entry, but by costs and difficulties to exiting business as well. High bankruptcy and insolvency costs, in particular, are a problem in several countries. Moreover, an overly stringent bankruptcy policy, while perhaps conducive to prudent decision-making among managers, may limit incentives to undertake risky projects with possible high future returns, leading to less innovation and, indeed, slower growth in the long run.

Making government programmes more efficient

Governments have put in place a myriad of schemes to assist start-ups in recent years. These schemes, designed in principle to overcome market failures have at times led to the subsidisation of non-viable firms and impeded exit. As a general rule, governments should assess the relevance and effectiveness of their support programmes towards small enterprises with a view to streamlining or terminating those whose rationale and efficiency is questionable.

Local authorities can play a useful indirect role in encouraging private initiatives at the local level in partnership with local players. While proper evaluation of cost-effectiveness remains essential, these authorities can for example contribute to the development of incubators, which help provide infrastructure, on-site advice on the availability of skilled labour and training opportunities as well as information on venture capital suppliers. Similarly, they can lock-in some of the benefits of existing geographical clusters that have spawned naturally -- Silicon Valley is but one celebrated example, there are probably thousands of others located across the OECD area and Asia -- by promoting the establishment of inter-firm networks, such as suppliers' associations, and assuring effective public services.

The role of education and training and social attitudes

Better policies are a necessary but insufficient condition of entrepreneurship. Opportunities also need a sufficient pool of entrepreneurs. Surveys conducted in a number of countries show that only a limited share of the working-age population between 25 and 44 is engaged in firm start-up activity. Moreover, there are more men entrepreneurs than women, although countries with the highest level of entrepreneurial activity are also those where women are most engaged. In particular, there is evidence that over the past five years, women entrepreneurs have increasingly taken advantage of new business opportunities created by ICT to start up firms. Nevertheless, much remains to be done in many countries to promote a pro-entrepreneurial culture. This however is a complex matter which to a large depends extent on how entrepreneurs are perceived in society at large.

In addition, education and training systems have a key role to play in creating positive attitudes towards entrepreneurship and in providing adequate managerial skills targeted at start-ups. Levels of entrepreneurial activity are more depressed in countries where educational systems do not offer adequate programmes for training potential and practising entrepreneurs. Survey results indicate that entrepreneurship is low in countries where there are major shortages of the skills needed to convert business opportunities into market realities.

Graduate students enrolled in MBA programmes make up a significant proportion of the people that might potentially get involved in entrepreneurial activity and there is in fact a positive link between MBA enrolment and entrepreneurship. Secondary and tertiary schools and colleges could be encouraged to make more of an effort to offer courses and programmes on entrepreneurship to wider cohorts, not just MBA students. Programmes bringing together training providers, universities, business schools, as well as firms and private investors, could also be designed to identify best practices and propose changes to existing curricula. Finally, policies should encourage researchers to become more entrepreneurial too.
Box 4. Key policy messages: firm creation and entrepreneurship

Entrepreneurship has always been important, but its role stands out in the present time of innovative change. Fostering a climate to help instil greater dynamism in firm creation is fundamental.

- **Promote access to financing:** Reform those regulations and fiscal provisions that inhibit the development of venture and high-risk capital markets and limit the supply of capital for risky and innovative undertakings.

- **Facilitate firm entry and exit:** Eliminate burdensome administrative regulations and those features of tax systems that afflict particularly smaller, technologically driven, young firms; review overly stringent bankruptcy and insolvency provisions where they eliminate the possibility for entrepreneurs to have a second chance; ensure that tax systems are neutral towards the use of innovative employee ownership/remuneration schemes.

- **Review and assess the relevance and effectiveness of government support programmes:** Adapt policy orientations and programmes that risk becoming obsolete more quickly than before, hampering firm growth or slowing the exit of non-competitive firms; identify and encourage best practices in government programmes, *e.g.* “one-stop shops” for administrative formalities.

**Encourage an entrepreneurial spirit in society:** Instil a positive attitude towards entrepreneurship, through education and provision of managerial training.
The OECD Growth Study showed that polices identified in the above four areas to promote the transition to knowledge-based economy would not work well without sound economic fundamentals. Nor did those countries that registered rapid growth do so by chance. Indeed, they edged themselves into a position to better take advantage of the new growth opportunities thanks to their sound macroeconomic policies, well-functioning institutions and markets, and an orientation to build a more open and competitive economic environment. As importantly, in those countries that appeared to lag, some of the fundamentals were perhaps missing or at least made it difficult to harness the new dynamism, such as the institutional set-up for new business creation.
REFERENCES

OECD, 2000, A New Economy? The Changing Role of Innovation, and Information Technology in Growth, Paris


