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OECD Information Technology Outlook 2006

Information Technology Outlook 2006 Highlights

ICTs continue to grow strongly, with very rapid growth outside the OECD area

Growth in the ICT sector and investment in ICTs are advancing solidly…

Worldwide, the ICT sector is expected to grow at 6% in 2006, with growth more balanced across the OECD area than at the time of the 2004 *Outlook* when the United States led the recovery from the slump. With improved macroeconomic performance, aggregate investment is now increasing across the OECD area and ICT is a significant and growing share of this investment. Some ICT segments are very dynamic (Internet-related investment, portable and consumer applications), with the major share of venture capital continuing to flow into ICTs. Merger and acquisition (M&A) activity is high. Overall the prospects for continuing balanced and sustained growth at a relatively high rate are good, but a return to the unsustainable annual rates of 20-30% growth of the late 1990s is unlikely.

… with spending on ICTs increasing most rapidly in certain emerging non-OECD economies.

IT spending, ICT market data and forecasts confirm expectations of moderately strong and widespread growth worldwide in 2006. With the emergence of new growth economies, world ICT spending was up 5.6% a year over 2000-05 in current USD. OECD spending was up 4.2% and the OECD world market share dropped from 89% in 2000 to 83% in 2006. ICT spending is increasing most rapidly in certain emerging non-OECD economies. China's 2005 ICT spending is estimated at USD 118 billion, following growth of 22% a year in current USD since 2000. In addition to China, nine non-OECD countries had the top spending growth rates over the 2000-05 period, including Russia (25% a year) and India (23%). Indonesia, South Africa and OECD eastern European countries were in the next group of high-growth countries. Dynamic growth in these economies is reflected in their growing shares of world trade, direct investment and M&As.

As the ICT industry reshapes itself to adjust to changes in technologies, delivery mechanisms and markets…

The ICT industry contributes over 9% of total business value added and employs 14.5 million people directly in OECD countries, but it is adjusting to growth rates below those of the 1990s. As many ICT products become commodities, very rapid growth is confined to new and niche goods and services and to emerging geographical markets. Open source (the "Linux effect"), online delivery of IT services (the "Google" effect) and new digital products are also disrupting how technology is developed and delivered. Widespread restructuring is expected to continue in IT services, telecommunications and digital content as industries and firms adapt to changing technologies and markets.

… emerging Asian countries are rapidly becoming leading producers of equipment, software and services.

The top ICT firms have recovered strongly and revenues are now over 20% above the 2000 figures; profits are up strongly, following the sharp downturn in revenues and large losses in 2001-02. However, their employment is still flat. Equipment producers from elsewhere in Asia have emerged strongly – particularly electronics manufacturers from Chinese Taipei – as Japanese electronics conglomerates have slipped in the revenue rankings. Firms from China and India play increasingly important roles in ICT goods and IT services, respectively. Semiconductors are a key intermediate input into ICT equipment and a leading indicator of ICT market trends, and their sales have also grown particularly rapidly in Asia, although world growth is likely to slow somewhat in 2006 from the rapid pace of 2004-05.

To meet these challenges the industry's R&D performance remains dynamic.

ICT R&D is a major driver of growth and change in the sector itself and more broadly. R&D performance is dynamic despite some signs of slowdown. R&D expenditures increased by the equivalent of 0.1 percentage point of GDP over the last decade to over 0.4% according to official R&D data for 19 OECD countries. They have increased particularly for electronic components and software and IT services. The top ICT firms have become more R&D-intensive, with large expenditures in electronics and components and communications equipment.

Global restructuring of ICT production and services

As firms seek new export locations and markets, they increasingly look to rapidly growing developing countries…

Eastern European and non-OECD developing countries play a significant and increasing role as both producers and growth markets for ICT. This new wave of globalisation is largely driven by efficiency-seeking competition as firms take advantage of cost differences

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and the rapid development of production capabilities in developing economies and they are now increasingly seeking a market presence in economies that are growing faster than those of the OECD area.

… with clear impacts on international trade in goods and services.

Following the strong recovery in 2003-04, ICT goods trade settled back to steady growth in 2005 and is expected to grow at around the same rate as manufacturing trade in 2006. However, rapidly increasing commodity prices, coupled with ongoing price declines for ICT equipment, disguise the solid performance of ICT goods trade (in volume) in 2005 and 2006. In 2004, OECD exports of ICT goods reached a new peak in current USD, driven by growth in electronic components, audio and video and other ICT-related equipment. OECD imports also achieved a new high, driven by growth in communication, audio and video equipment. However, at 13.2%, the share of ICT goods in total goods trade is only a little above that of 1996. Computer and information services trade has been more dynamic in value terms. Ireland is by far the leading OECD exporter of these ICT services and software goods, with combined exports of over USD 20 billion in 2004.

There is a new wave of ICT globalisation, as manufacturing and services FDI shifts strongly to developing countries, increasingly in higher value activities.

The direction of trade and foreign direct investment has undergone a major change as ICT manufacturing and, to a lesser extent, services activities shift to non-OECD countries, with China, India and a number of eastern European countries joining countries such as Korea and Ireland as major ICT producers and exporters. To date, these new actors have focused on relatively low-value process and assembly and services activities for export. However, international investment trends suggest that this may be changing as higher value manufacturing and services functions move offshore and as markets develop in these countries.

Worldwide FDI flows increased in 2004 and grew even more strongly in 2005, recovering from the depressed levels of 2002 and 2003. The outlook for 2006 is generally positive. Mergers and acquisitions are a major component of FDI, and they have also risen sharply: the value of cross-border deals in which the ICT sector was the target was up 47% in 2005, and around 20% of all cross-border M&As have targeted the ICT sector. The first half of 2006 saw intense M&A activity, the strongest in current USD terms since the dot.com boom. The outlook for the medium term is good, although there are concerns about sustainability if company balance sheets deteriorate and as interest rates rise.

Globalisation of ICT-enabled services

The supply of ICT-enabled services is globalising rapidly…

Rapid technological advances in ICTs have increased the tradability of services and make it possible to provide from remote locations many ICT-enabled services that do not require

face-to-face contact. Although OECD countries still account for most services activities and services trade, growth is very rapid in many non-OECD countries. India and China already account for around 6.5% of exports and almost 5% of imports of computer and information services and other business services. Some eastern European and Baltic countries are also increasing their share in ICT-enabled services supply and they are often growing most rapidly.

…and firms from OECD and non-OECD countries increasingly compete in the global services market.

The widespread development of ICT infrastructure and enabling business frameworks makes it clear that there is great scope for increasing the supply of services from and to emerging countries. This is a two-way process. Services firms from these countries, especially India, are adopting global business models and services operations, establishing a presence in OECD countries and increasingly competing with firms from OECD countries. But as these countries' domestic demand grows and they open their markets to international competition, services firms from OECD countries are also expanding activities in their markets.

Emerging economies are working to build their capacity to provide IT and software services and improve the quality of service.

Countries that are building up their international services supply are also actively pursuing strategies to improve domestic capabilities and the competitiveness of their IT and software services suppliers. Firms and countries developing international services sourcing activities are aware that their future development and growth depend on the quality of services supplied, and information security and privacy, for example, are attracting greater attention. Finally, most countries have seen adjustment to international sourcing as part of more general adjustment policies.

China: A new competitor and engine of growth

China is a foremost location for assembling and exporting ICT goods. It is rapidly developing technically more complex domestic ICT production and export capacity and is investing abroad.

China has developed rapidly by hosting foreign ICT firms or third-party contract manufacturers to undertake final ICT product assembly, a strategy different from that of other major Asian ICT producers. It overtook the United States as the biggest exporter of ICT goods in 2004, and its ICT exports continued strongly in early 2006. Exports from China are mainly computer and related equipment which depend significantly on imports of electronic components, increasingly from other Asian countries. Export-oriented ICT manufacturing, coupled with a rapidly developing Chinese domestic market, has resulted in high levels of inward investment. In 2005 ICT-related FDI inflows into China were worth around

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USD 21 billion. Value added per employee of foreign affiliates in the ICT sector has risen steadily, and technically more complex activities, such as design and testing and R&D, are increasingly shifted to China.

The challenge for China's ICT industry is to produce increasingly higher value-added products and services and integrate ICTs into domestic value chains.

Chinese ICT firms are rapidly developing their production and export capacities despite their relatively limited size and technological know-how, and they are investing overseas to obtain technology, brands and distribution channels. Despite the rapid growth of its capabilities, the ICT industry must make the transition from low-cost manufacturing to higher value-added goods and services. More generally, Chinese firms need to integrate ICTs into their value chains. The government is focusing on accelerating structural change in the domestic information industry, the creation of national ICT firms and the improvement of domestic innovative capabilities, and fostering Chinese ICT-related standards.

China's domestic market for ICT goods is growing rapidly, but domestic users remain a small minority of the population.

On the demand side, China is the sixth largest ICT market and about two and a half times that of India, but in 2005 its market was still only about one-tenth that of the United States. China is already the world's largest mobile phone market, and the second largest PC market, with penetration in urban households roughly doubling every two years between 1997 and 2003. These trends are likely to accelerate in the run-up to the 2008 Olympic Games. However, there remains a striking urban-rural digital divide.

At the end of 2005, China had 64.3 million broadband and 111 million Internet users. More than half and sometimes up to three-quarters of Chinese firms surveyed use the Internet and e-commerce has grown rapidly. Nonetheless, only about 4% of the Chinese population are broadband users, only 8% are Internet users and e-commerce is comparatively less developed than in OECD countries.

Digital content creation, distribution and access

Digital content drives growth in all areas of the ICT industry, challenging established value chains and leading to new business models.

Digital content is now an important driver of the ICT industry. Technological innovation and new consumer demand are leading to new or more direct forms of creative supply, new distribution methods and potentially improved access. Research results, for example, are becoming more directly accessible, and digital content is pervading many sectors, with applications that may prove more significant than those for entertainment.

Content industries are migrating to commercial digital content applications, with varying degrees of success. The games, music, scientific publishing and mobile content industries have very specific and different characteristics, but digital content is the major driver of growth for all. New types of content have developed (*e.g.* online games) or are displacing traditional entertainment (*e.g.* television). The development of digital content has challenged established non-digital value chains. New digital value chains are increasingly complex and diverse; for example in downstream distribution, both disintermediation and re-intermediation have occurred, with new value chain participants entering as new intermediaries or to supply infrastructure services. New business models are being tested, including subscription (games) and pay-per-use (music). Advertising is becoming less important in some areas (mobile TV) and more important in others (search). As numbers of simultaneous peer-to-peer users rise, trials of commercial applications for this large user base are under way.

Advances in mobile services and content protection encourage development, but payment systems, interoperability and compatibility are needed.

Continuous technological improvements in networks, software and hardware, including mobile and wireless services and content protection and delivery systems, have made possible the development of more advanced digital content. Greater co-operation is a significant challenge as production of digital content requires agreement among content developers, device manufacturers and distributors. Successful implementation will require suitable and cost-efficient infrastructure services, including payment systems and content protection technologies. Content interoperability and compatibility issues also need to be resolved.

Consumer demographics, income and new uses will structure the growth and shape of digital content industries. For users, there is more, and more diverse, content available on line than off line, and innovative new products provide customised services with greater interactivity. Increasing numbers of users are also becoming digital content creators, although it is unclear whether this will be a lasting phenomenon or an ephemeral fashion. Governments can develop general enabling factors for the creation and use of digital content, maintain a supportive business environment and are major producers and users of digital content.

ICT skills for employment and competitiveness

The workplace increasingly requires workers with various levels of ICT skills...

ICT skills are increasingly a workplace requirement. Up to 5% of total employment is in ICT specialist occupations and around 20% in ICT-using occupations. ICT specialist job definitions appear to be evolving, requiring some combination of ICT specialist skills with other skills, *e.g.* business or marketing. ICT skills are supplied in different ways for different populations. Basic skills needs are increasingly filled "naturally" through diffusion of ICTs and the use of ICTs in schools and at the workplace. Efforts are being made to improve the

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access of older workers to ICT skills through training programmes. Because ICT specialist skills needs are likely to change rapidly as technology changes, the formal education system may offer less flexibility for adapting curricula than private-sector schemes, usually set up as multi-stakeholder partnerships.

…and ICTs are changing job recruitment, via the Internet, and the workplace, through distance work.

Internet recruitment and distance work are driven by the broad diffusion of ICTs. Internet recruitment is gaining in importance but despite its potential to date seems fairly limited; its impact on the functioning and clearing of the labour market needs further evaluation. Teleworking has gained in importance, with more people now working remotely at least some of the time.

ICT-enabled offshoring may potentially affect up to 20% of employment, with managerial and professional occupations less affected than clerical ones.

Rapid technological developments in ICTs and ongoing liberalisation of trade and investment in services mean that many teleworking services can now be provided anywhere. Analysis suggests that up to 20% of employment is potentially affected by ICT-enabled offshoring. Potentially affected clerical occupations that can be codified are also likely to be affected by digitisation and automation, and their share in total employment is likely to decline, while the share of potentially affected managers, professionals and engineers appears likely to remain stable or increase. This does not mean that these jobs will necessarily be offshored but that around 20% of all employed workers carry out the kinds of tasks and functions that could potentially be carried out from any geographic location. ICT-enabled globalisation of services of course also means that countries may gain jobs in these functional areas. Given the sheer size of service-supplying countries such as India and China, they are unlikely to suffer, at least for any length of time, from a shortage of workers with ICT skills and tertiary education. Indeed there would seem to be scope for important further increases in these workers.

Looking to the future: Emerging technology applications

Many new technology applications may have major economic and social impacts. RFID and ubiquitous sensor technologies are finding commercial application…

Many new ICT applications have significant potential and may well have strong economic and social impacts in the near future; ICTs also play a fundamental role in the interlinking and convergence of different technologies. Among these emerging technologies are ubiquitous networks, which make it possible to follow persons and objects and provide real-time tracking, storing and processing of information. Applications of enabling

network technologies such as radio frequency identification (RFID) and other sensor technologies are increasingly affordable, investment is rising and applications are moving into commercial use. Location-based services use a variety of position-determining technologies to follow the location of objects and users. The two most common applications are navigation and asset tracking.

Internet users are finding new ways to use this communication medium.

Natural disaster prevention and warning technologies (*e.g.* tsunami early warning systems) are becoming more important for preventing disasters that result in large economic losses (USD 170 billion in 2005). Participative web (Web 2.0) refers to the active participation of Internet users in creating content, customising the Internet and developing applications for a broad variety of fields. Blogs are one of the most popular forms, with around 50 million in mid-2006. In Asia, the number is disproportional to the general use of the Internet.

Convergence of nanotechnology, biotechnology and information technology holds promise in health care and robotics.

In another area, the convergence of nanotechnology, biotechnology and information technology is likely to provide major opportunities and challenges. Convergence in applications such as health care and robotics is leading OECD countries increasingly to assess the potential impact. Neurotechnology, for example, is the growing application of electronics and engineering to the human nervous system.

The interaction of technological opportunities, commercial development, and social acceptance determine which innovations and applications become widespread.

The increasing complexity of these new applications and the uncertainty surrounding their development paths makes it difficult to project their impact on the economy and society. The tendency towards greater interconnectedness and tracking of persons and objects, for example, allows fast reactions (*e.g.* in the field of disaster prevention and management) but can raise privacy concerns and even significantly transform social structures. Developments in the areas mentioned are still in their infancy, but offer a window onto changes that are on the horizon. However, the interaction of technological opportunities, commercial development, social acceptance and use will ultimately determine which innovations and applications become widespread and have positive economic and social impacts.

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Rising to new challenges: ICT policies in a time of strong growth and expanding opportunities

National ICT strategies are becoming better integrated with economic development policies, more targeted and growth-supporting.

ICTs are increasingly recognised as a source of innovation and economic growth, and national ICT strategies have pushed towards further integration of IT and economic development policies to meet emerging challenges. To maximise policy effectiveness, countries are increasingly co-ordinating policy both vertically, through the layers of government, and horizontally, across ministries and agencies, to achieve more coherent and effective cross-ministry and agency planning and improve delivery of more targeted policies and programmes. As countries have achieved higher levels of basic ICT access, skills and content, the focus has shifted to deepening these achievements through broadband, more advanced skills and more sophisticated content.

Reflecting these priorities, the focus is on R&D and innovation, technology diffusion, ICT skills, digital content, IPRs and broadband to enable and underpin growth.

The overall shift in policy priorities reflects these changes. There is a more specific focus on co-ordination and policy setting, with higher priority given to strengthening R&D, innovation and government applications (increasingly ICT-specific), increasing diffusion and use of ICT (especially in terms of broadband and online government), raising ICT skills and employment (especially ICT education), expanding digital content and applying intellectual property rights and promoting trust on line. The development of this policy framework and trends in policy priorities provide important general policy lessons for OECD and non-OECD countries alike.

Changing ICT policy priorities

Policy areas which are most widespread, with **high** and/or *increasing* priority

R&D programmes
Government development projects
Innovation networks and clusters
Technology diffusion to business
Government on-line
ICT skills and employment
Digital content
Competition in ICT markets
Intellectual property rights
Broadband
Promoting trust on-line

But more attention should be given to assessment and comparable evaluations of IT policies

Assessment and evaluation remain important weaknesses in most countries. Despite the emphasis on broadband rollout, for example, few countries report evaluation of broadband policies. Techniques for evaluating the effectiveness of IT policy need to be shared and improved. In particular, until there is more coherence of evaluation methodologies across governments, it will be difficult to compare assessments from one country to another.

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Table of Contents

Boxes

Tables

Figures