

Chapter 5

Digital Broadband Content: Developments and Challenges

Digital content is an increasingly important aspect of OECD economies as they shift their emphasis from manufacture of physical items to high-value intangibles. This chapter analyses developments in online games, music, scientific publishing, mobile and user-created content, discusses value chains and business models, analyses growth drivers, and draws horizontal lessons.

Introduction

Digital content plays an increasing role in OECD economies, which are shifting their focus from manufacture of physical items to high-value intangibles. Digital content is expected to provide new impetus for the digital economy, following and building on the infrastructure push that has provided widespread network access. Technological innovation and new forms of consumer demand and innovative use create opportunities for content creation and distribution, new or more direct forms of creative supply, and potentially improved access to knowledge and research. Digital content is now a major driver of telecommunications, information technology (IT) and electronics industries. At the same time, significant investments in the telecommunication and IT infrastructure are necessary to deploy content services.

The development and delivery of digital content is growing rapidly across a range of very different activities, reconfiguring existing ones (*e.g.* telephone handsets with online game capabilities, new business strategies for video downloading, the provision of government services over mobile devices) as new digital content developers and providers emerge. Digital content is also pervading sectors not previously considered content producers, and these may in fact prove much more significant than entertainment. Digital content development and delivery is increasingly common in:

- Content/entertainment industries, whose primary activity is the production and sale of content. These include publishing activities which produce content on physical supports such as books, journals, newspapers, software, audio and video products, all of which increasingly exist in digital form, as well as content services, such as audiovisual and broadcast services.
- Industries that are not content industries, but which increasingly produce digital content as secondary or ancillary activities, such as business and financial services.
- Social services (*e.g.* online education, health services), knowledge and cultural services (*e.g.* museums, libraries, broadcasting archives), research-related activities (*e.g.* digital research data) and government-related activities and public content (*e.g.* e-government, commercial re-use of public sector information).
- Content created by network users.

This chapter aims to improve the understanding of developments and challenges in the area of digital content, focusing on content and entertainment industries and to a lesser extent on network-user created content (see also Chapter 7, “Participative Web”). Content created as part of other activities, including business services, health and public sector information are treated extensively elsewhere (www.oecd.org/sti/digitalcontent; OECD, 2006a; 2006d). This chapter builds on studies of the digital broadband content sector for online computer and video games, music, scientific publishing and mobile content (OECD, 2005a, 2005b, 2005c, 2005d; Vickery and Wunsch-Vincent, 2005), part of the broader OECD project on digital broadband content, and draws on discussions and presentations from the OECD

conference on the future digital economy (2006a).¹ It provides an overview of these areas and describes the effect of digital content on industry structure and value chains, cost structures and business models, drivers of adoption, barriers to digital content development, delivery and use, and impacts of the development and delivery of digital content.

Evolution of digital content industries

Digital content industries are very dynamic and are the most rapidly growing segments of many established industries. Unfortunately, aggregate data are not available for all industries to enable cross-country comparisons. Estimates for digital content applications suggest that global interactive entertainment software sales will increase from USD 18 billion in 2005 to about USD 26 billion in 2010 with a total interactive entertainment market of around USD 42 billion (DFC Intelligence, 2005b; Online Publishers Association, 2006; Parks Associates, 2006). US consumers spent USD 2 billion on narrowly defined paid online content in 2005, up 15% from 2004, and entertainment (including digital music), research and games were among the leading content categories (Online Publishers Association, 2006). Projections suggest US consumer spending on online entertainment (games, music, video services) will increase from USD 2.4 billion in 2006 to USD 9 billion in 2010 (Parks Associates, 2006). Specific industry factors, such as the launch of the newest generation of game console systems, are likely to affect growth positively, and advanced mobile content services are also dynamic as content becomes an important component of mobile and wireless network services.

Content industries are migrating users to commercial digital content applications, with varying degrees of success. Along content value chains, new industry partnerships and selling arrangements are being experimented with as a way to adapt content to different delivery platforms (PC, mobile, online), to meet consumer demand (including interactivity), and to identify effective business models. New types of content have developed (e.g. online games) or are displacing traditional entertainment (e.g. television). While offline sales revenue is still essential for all industries, online sales are increasingly important and new business models are at early stages and take time to develop.

On the infrastructure side, and supporting the distribution of digital content, OECD countries had 158 million broadband subscribers at the end of 2005, equivalent to 14% of the OECD area population (Figure 5.1), and 271 million Internet subscribers. This infrastructure is increasingly ubiquitous and is being used for a wide range of digital content applications, including games, music, video and research.

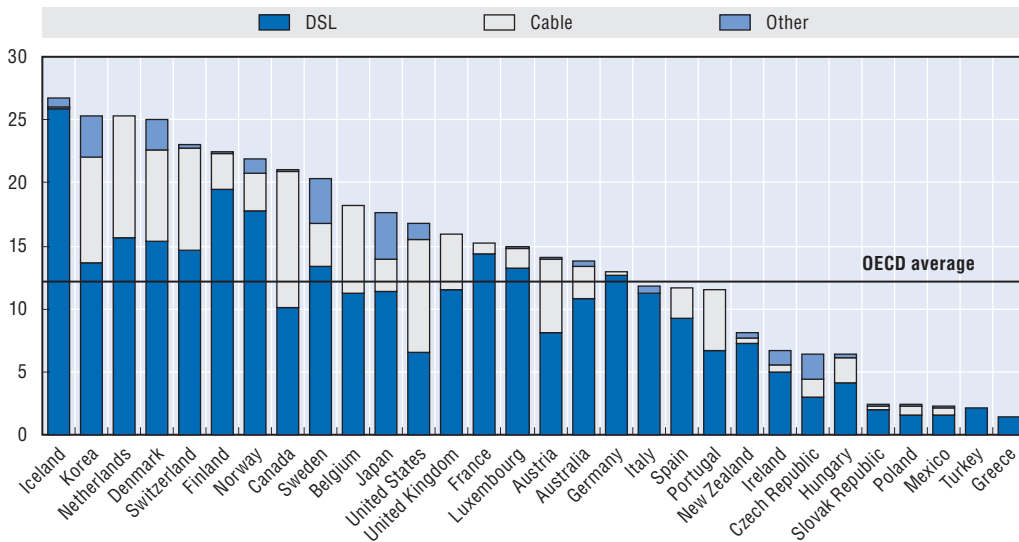
Computer and video games

Development

The computer and video game industry is a young industry whose rapid growth is underpinned by technological developments. The global video game market was estimated at USD 25.4 billion in 2004, and was projected to increase to USD 54.6 billion by 2009 (OECD, 2005a; Parks Associates 2005c).² Recent data for the United Kingdom show similar trends, with sales of interactive entertainment software of around GBP 1.35 billion (approximately EUR 1.97 billion) in 2005 (ELSPA, 2006). The most important regional markets for the games industry are Asia and the United States, with a games market in the United States of USD 11 billion in 2004, and computer and video game software sales of USD 7.3 billion in 2004 (CEA, 2005; ESA, 2006). The United States is the biggest market (39%

Figure 5.1. **OECD broadband subscribers per 100 inhabitants, December 2005**

OECD broadband subscribers per 100 inhabitants, by technology, December 2005

StatLink: <http://dx.doi.org/10.1787/266425563301>

of global sales), followed by Japan (15%) and the United Kingdom (12%), closely followed by Germany and France (ELSPA, 2006). US and EU games revenue in 2001 had already surpassed film box office ticket sales (but not total film industry sales, which are increasingly derived from other sources), and the turnover of the industry has been projected soon to be higher than that of the recorded music industry (DFC Intelligence, 2004; ISFE, 2006).

The industry is increasingly seen as strategic by major media, Internet and consumer electronics firms. It is also seen as an overall contributor to growth and employment. In the United States, for instance, direct and indirect contributions of computer and video game software to the nation's gross national output are estimated to have exceeded USD 18 billion in 2004 (Crandall and Sidak, 2006); in the United Kingdom the computer and video game industry is estimated to directly employ over 21 000 people with employment growing since 2000 (ELSPA, 2006). Online computer game development is highly R&D- and innovation-intensive, and game programming and design are highly skilled occupations. New, more sophisticated games with online capability are also a key driver for IT hardware sales as they require high-performance personal computers and advanced graphics. Finally, game software is increasingly used in non-game applications such as education (Behrendt, 2003), health care, advertising and defence.

The industry has four leading companies, Sony, Nintendo, Electronic Arts and Microsoft (DFC Intelligence, 2005a) and a large number of much smaller firms. As the industry matures, companies grow and absorb smaller operations; in markets such as the United Kingdom consolidation has halved the number of developers as the costs and risks of producing games for more complex consoles have increased (ELSPA, 2006). In the computer games industry the established business model is the sale of hard-boxed games. Until recently, online and wireless games were a relatively small part of overall sales (6.4% and 3.4%, respectively, in 2003). The console offline (73%) and PC offline markets (17%) were the

main segments. This is changing rapidly as interactive online games become available. A new industry which arose with the Internet and broadband and more connected video game systems, the online games industry does not have to deal with legacy systems and structures and has successfully developed ways of protecting intellectual property. There is also a trend towards online games for PCs and consoles: new games are released with some online capabilities, and it is expected that nearly all will become at least in part online. Market expansion is coming through the development of online network technology, diversifying content and developing large-scale online games.

Recent projections suggest that the market for online game services will rise from USD 3.4 billion in 2005 (with subscription-only revenue from online games of USD 2 billion in 2005) to over USD 13 billion in 2011 (DFC, 2006a, 2006b; IGDA, 2005), including wireless games. Over 50% of online game subscription revenue in 2005 came from Asian countries outside Japan, notably Korea, China and Chinese Taipei (DFC, 2006a, 2006b). Revenue of Korean firms such as NCSoft and Nexon and the Chinese firms Shanda and Netease is derived mainly from online games (see Box 4.2 in Chapter 4).

The leading online game category is expected to remain the high-end, massively multiplayer online games (MMOGs) which appeal to a fairly small portion of the total user base, although the industry is aiming to produce a wider variety of games to appeal to new audiences and broaden markets. Meanwhile, MMOG and casual games generate the most online revenue. However, they do so with very different audiences and business models. Further, as consoles are increasingly Internet-enabled, online delivery may become the major distribution channel, replacing packaged goods delivery, with online products (multiplayer and mobile online games) accounting for larger market shares (DFC Intelligence, 2005c; Parks Associates, 2005c).

Online capabilities and broadband are changing the established value chain from developer to publisher to distribution as the industry shifts from packaged goods to a service industry. The role of the distributor, and in some cases the retailer, is being taken by publishers either directly or via Internet service providers (ISPs) and game Web sites. This can be described as “disintermediation” due to digital delivery of games or through direct access to online multiplayer games. At the same time ISPs acting as content aggregators and multi-game Web sites and portals acting as retailers are new online distributors (“re-intermediation”). Developers and publishers are well placed in the new value chain, and the new intermediaries (portals and possibly ISPs) may also move back into game publishing and development. For online games, specialised software (middleware) firms have been providing some support for developer/publishers.

The spread of broadband is driving new distribution mechanisms and business models. New online-enabled revenue models include retail purchase, subscription fees, pay-per-play, advertising and new services including selling and/or renting digital objects and players. The most successful emerging model is the “pay monthly” subscription model (e.g. subscription-based access to premium casual games), but it is expected that most computer game companies will have to rely on a mix which includes advertising and support services to increase revenue. MMOGs currently rely almost entirely on subscriptions while casual games obtain revenue from advertising, digital distribution (downloading) and, increasingly, subscriptions. Significant changes in revenue models may occur if and when micropayments are more widely available for mass-market customers.

On the demand side, consumer demographics, income and preferences will structure the growth and shape of the industry. In the European Union 16-to-24 year-olds are the largest group of Internet users playing and/or downloading games or music (Eurostat),³ and this pattern holds for all OECD countries. However, among Internet users, online computer and video games is spreading to other age groups, including the 29-40 and older age groups (Pew, 2006a; ESA, 2006). According to industry figures, half of all Americans play video games although not all of them on line (ESA, 2006).

Barriers to development include availability of network infrastructure, the challenge of sustaining creativity and innovation as R&D costs rise, and market structures in which developers carry a large share of the risk of new product development, lack of skills and management challenges and financing issues, and the legal and payment infrastructure for enabling games software to be sold by producers and used by consumers. The policy framework affecting the industry includes R&D and technology; market and skills development; intellectual property rights (IPRs) and piracy issues; online business conditions including broadband quality and coverage, micropayments, standards and taxation issues; and social dimensions including culture, age and content issues regarding games in education.

Outlook

The online game market has begun to take shape with the generations that have grown up with broadband and interactive entertainment. While Asia (including China) is expected to be a strong market for online games, North America and Europe are also expected to grow. The growth of the console games market depends on the cycle of new game consoles; new game consoles are arriving in 2006 and 2007 with improved online capabilities (PlayStation 3, Xbox 360 and Wii from Nintendo). While the PC has been the dominant platform for online games, these new consoles with sophisticated online capabilities are likely to be a key driver for growth, but a steady stream of new online games with more advanced features is necessary to sustain it. In addition, with an estimated 2 billion mobile phone users worldwide in 2005, mobile games with online connectivity are expected to be an important growth driver. Finally, the use of online computer game and video software and applications in areas such education, health and other non-game environments remains promising.

Music

Development

In 2005, global retail music sales were USD 33 billion; however, global CD album sales were down 6% in value and 3.4% in units. The United States, Japan and the United Kingdom were the largest markets and per capita spending was highest in Norway and the United Kingdom (IFPI, 2005c, 2006; OECD, 2005b). The industry has four major firms: Warner Music, Universal Music Group, EMI Recorded Music and Sony/BMG Entertainment. After a period of sustained growth, the music industry experienced a pronounced fall in overall revenue (by 20% from 1999 to 2003). The downturn during this period was not uniform in all OECD countries. While the United States, France and the Netherlands experienced large declines, the United Kingdom experienced steady or growing sales.

Broadband presents opportunities and challenges for music and the impact of digital distribution is high on both the supply (artists, music industry) and the demand side (new

music consumption, consumer choice, network users as content creators). The digitisation of music, changing ways of listening, the diversification of delivery platforms and sharing are likely to have increased the time listening to music. Digital music and other content are also drivers for technology markets, including consumer electronics and PC manufacturers. However, the unauthorised downloading of copyrighted content over the Internet has raised considerable concerns. Finally, the potential impact of online music on artists and their recognition, on the industry business model and value chain, and on users seems significant.

The music industry has had difficulty in working out how to use the potential of low-cost digital delivery to provide low-volume music tracks to consumers while ensuring adequate revenue streams to develop new artists and protect the intellectual property of established ones. Nonetheless, digital delivery is currently the fastest-growing channel for music, and Internet and mobile phone delivery has grown rapidly since 2003. The music industry is licensing content to new online ventures and also taking legal action against unlicensed and unauthorised use and increasing consumer awareness of digital piracy.

In 2005, global digital music sales nearly tripled from USD 380 million to 1.1 billion and from 160 to 470 million single units, led by the United States, Japan, the United Kingdom, Germany and France (Table 5.1; see also Digital Music News, 2006).⁴ While the share of online music is still small (about 6%), it was zero in 2003. Digital music is characterised by rapid entry of new providers and a fast-growing supply of available tracks. For some record labels, such as Warner, digital sales accounted for 11% of revenue for the first quarter of 2006. In Japan digital has already made up for the decline in physical sales. In the medium term, overall demand for music may be increased through digital distribution and new forms of music consumption.

Table 5.1. **Top 10 digital music markets, Internet and mobile phone sales, 2005**

	Digital sales as % of total music sales	Total digital market (million USD)	Digital sales by channel (% of digital sales)	
			Online	Mobile
United States	9	636	68	32
Japan	7	278	9	91
United Kingdom	3	69	62	38
Germany	3	39	66	34
France	2	28	47	53
Italy	4	16	31	69
Canada	3	15	71	29
Korea	n.a.	12	42	58
Australia	2	7	41	59
Netherlands	2	5	82	18

Source: IFPI (2006), Total world music sales statistics, March.

StatLink: <http://dx.doi.org/10.1787/227486253230>

Total digital sales are split roughly equally between music sold over the Internet and music sold to mobile phones, with Japan and continental Europe leaning towards mobile rather than Internet sales (IFPI, 2006). In 2005 when mobile sales took off, ringtones were the largest segment of the mobile market, accounting for roughly 90% of sales. Mobile music now accounts for approximately 40% of record company digital revenue (based on IFPI figures, see also OECD, 2005b). But other mobile music formats, such as full track

downloads to mobile and music videos, are growing fast. New handsets enable the hosting of the software of online music providers (including music storage, ringtone capabilities) and portable subscription-enabled mobile phones will encourage this trend.

On the Internet, new business models are mainly built around digital download/pay-per-track, streaming subscription models and portable subscriptions. Per-track downloading and payment (*à la carte* business models) still dominate; Apple's iTunes accounts for 86% of global sales, with a billion songs sold up until February 2006. Although music labels favour variable pricing, Apple will continue to deliver its uniform, 99 cent price for paid downloads as part of its renewed agreements with music record labels in 2006. The other main competitors are Napster, Yahoo!, Microsoft's MSN and RealNetworks, and many other online music services have emerged. By the end of 2005, there were 335 sites offering over 1 million tracks on line worldwide (IFPI, 2006). Some music services are experimenting with providing users with new ways to search for music; for example, Napster allows its users in the United States to stream full tracks in its catalogue up to five times at no cost. It is not clear whether the pay-per-track model will be successful for stand-alone online music services and record labels, and the impact of purchasing individual songs as opposed to albums on artists and the creative supply of music remains uncertain.

The creation of an online music store requires the digitisation of content, the clearing of rights, the settling of technological issues, including digital rights management (DRM) systems, the creation of online music storefronts, secure billing systems and delivery networks. Thus, the digital music value chain is different in some ways from the traditional one but certainly not less complex. Importantly, there is a new set of companies that were traditionally not involved in the distribution of music. These are firms that have always had links to the content industries (*e.g.*, the consumer electronics industry) and are now moving upstream, but also those that were traditionally not related to the distribution of music (*e.g.* ISPs, consumer brands). Furthermore, the new digital music value chain produces an array of new digital intermediaries (*e.g.* digital rights clearance, software, DRMs, online billing).

Different strategies are being adopted by participants as they try to integrate upwards or downwards in the value chain. In their move to becoming triple-play providers (voice, broadband and TV content), network operators are moving into more value-added services, such as the provision of content and information. There have also been efforts to integrate some of the different functions along the value chain (from the creation of content to the devices used to listen to music, often with proprietary standards, *e.g.* by Apple and Sony). Digital music and the rise of portable audio players are also redefining the boundaries between PC, software, mobile handset, content and consumer electronics.

In the new digital model, artists, record companies and publishers have so far retained their creative roles. Direct sales from artists to consumers or purely online career building are still rare. Nevertheless, the Internet allows new forms of advertising and other financing possibilities that lower entry barriers for creation and distribution. The music discovery process is also changing, with digital delivery altering the market conditions of artistic start-ups. Established distribution networks gave the big record companies a significant competitive advantage, but (smaller) independent labels may be able to move more quickly in reaction to technological change. Nonetheless, digital distribution is a complex and far from costless delivery channel and entails building a multitude of new business relationships (including potentially for artists).

A major challenge is to reduce online piracy and to develop business models that are attractive to consumers and provide revenue streams from the creation and legitimate distribution of original recordings. Other barriers to development include the lack of standards (music format and DRM standards), differing and hard-to-understand usage rights, incompatibilities between content and playing devices, difficulties associated with securing rights for online music distribution which are complicated by cumbersome licensing processes for different national territories (*e.g.* for a pan-European release). Business and government efforts to facilitate licensing are ongoing (*e.g.* in the United States via a blanket licensing process for clearing sound recording rights). Interoperability between digital music and playing devices has also been on the agenda in some OECD countries (France, Norway, Sweden, Denmark and Japan).

Outlook

There will be continued development of subscription-based business models, such as those of Rhapsody and Napster, which increased their worldwide user base to 2.8 million in 2005, and, increasingly, subscription-based streaming radio. Subscription services were previously mainly limited to the United States, but they have increasingly developed in Europe and elsewhere. Advertisement-based business models and trials with legal peer-to-peer services (*e.g.* iMesh) are also being tested. Communities such as MySpace.com and marketing on these networks are becoming more important to users when searching for music. Some independent artists are achieving visibility from Internet marketing and distribution (*e.g.* through sites such as Indiestore.com which sells music of unsigned bands), a trend that is likely to continue.

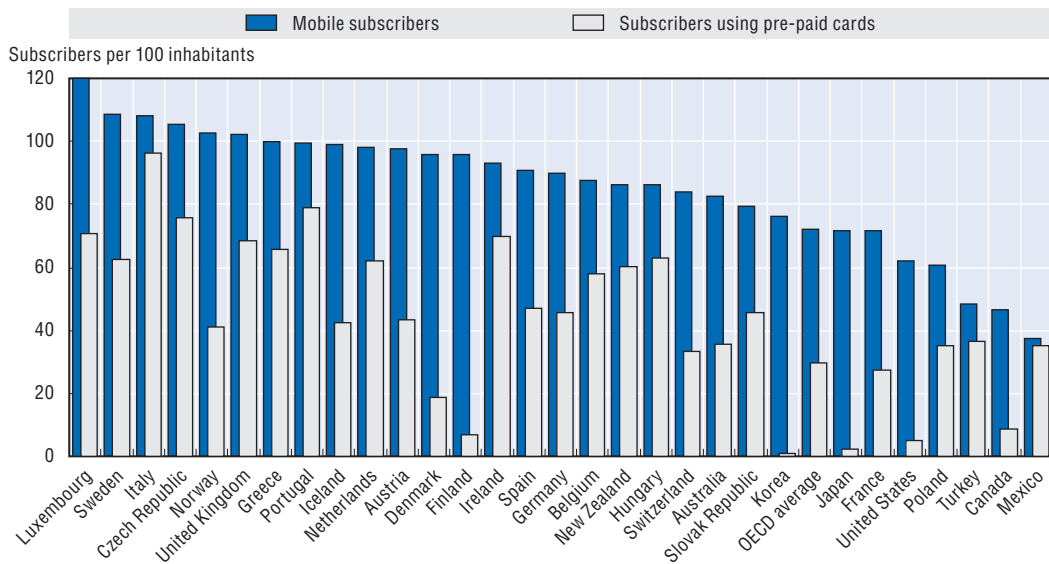
Mobile content

Development

Digital content sales via mobile devices are increasing, and this is a dynamic sales channel, particularly for music and games (OECD, 2005d). A central driver is the very large user base of mobile subscribers, with mobile phones surpassing 2 billion worldwide in mid-2005, or equivalent to nearly one third of the estimated world population (ITU World Telecommunication Indicators Database). Figure 5.2 shows the penetration of mobile phones in OECD countries, with an OECD average of over 70 mobile subscribers per 100 inhabitants. Earlier generation wireless networks have seen increasing demand for content such as ringtones, music downloads and simple games, and broadband wireless networks, particularly 3rd generation (3G), provide the bandwidth necessary to deliver increasingly sophisticated content. Technologies crucial for enabling broad dissemination of content, including marketing, distribution and billing technologies, are increasingly available and will encourage further development of mobile content.

Mobile content, developing from a low base, is expected to be a major driver of growth for the telecommunications and media industries. Voice communication revenue is growing slowly owing to competition and market saturation in many countries, and attention is shifting to mobile content, in part owing to experience in lead markets such as Japan and Korea. Popular mobile content includes ringtones, music, video clips, and wallpaper and personalisation services.

Figure 5.2. **Mobile subscribers and pre-paid card users per 100 inhabitants, OECD countries, 2004**



Source: OECD ICT Indicators database, 2006.

StatLink: <http://dx.doi.org/10.1787/865832616682>

Except in Japan and Korea, the most popular content for mobile phones continues to be ringtones and wallpapers. However, music downloads, video content and such other data-rich digital content as mobile TV are increasingly available. Games are increasingly developed for mobile platforms and are shifting from fairly simple embedded games to more complex interactive and multiplayer mobile games. Other content includes video, enterprise and information and location services (digital maps and related services) and gambling.

Estimates on current and future sales of mobile content vary, although almost all agree on the large potential. For example, one study of users in Europe, Asia-Pacific, North and South America projected the market for mobile downloads to be EUR 7.6 billion in 2006, with 60% of mobile users spending regularly on mobile content (TNS, 2005). Others project the mobile content industry (including messaging) to be worth USD 42.3 billion by 2010 (Informa Telecoms and Media, 2006), and high growth has been projected for mobile TV (see Box 5.1).

No single dominant mobile content value chain has emerged, and it is likely that different ones will prevail for different types of mobile content, reflecting the differing nature of content industries, different market structures and competitive conditions, and different policy frameworks for different types of content. Participants are vying to control various parts of a complex and changing value chain and to establish “ownership” of large numbers of users. These include content developers, content aggregators, mobile operators, handset manufacturers and other companies that offer enabling technologies. Mobile portals provide many of these capabilities and occupy a central position. Currently, most users obtain content from their mobile operators’ branded mobile portal, with content coming from providers with whom the mobile operator has an established relationship (operator as content broadcaster and gatekeeper to the consumer). Business models for mobile content are still developing but the two most familiar ones are subscription and pay-as-you-use; advertising-based models are still rare.

Box 5.1. **Mobile TV: who pays?**

Mobile TV is being developed and trialed in many countries. 3rd generation (3G) telephony is now available in almost all OECD countries and has sufficient bandwidth to allow mobile video applications despite the limitations of its point to point (“unicast”) architecture. Broadcasting technologies (“multicast” or point to many points, such as Digital Video Broadcast and Digital Multimedia Broadcast) are being made available for mobile. Hybrid architectures are being developed that use unicast cellular technologies (3G) for on-demand services and a back channel for interactive services and multicast technologies for live or near on-demand video content applications. A wide range of video-based services is becoming available and interactivity is developing, but mobile TV is still a niche market, except in Korea and Japan.

Large scale trials suggest that average viewing times may be as little as 30 minutes per month, but interested users are willing to pay. Successful established TV programmes appear to have the best potential, including popular series and live TV, particularly news and sports. Mobile TV is expected to complement traditional TV by allowing viewing away from home, for example when commuting. In terms of business models, traditional TV is a mix of subscription, advertising, revenue sharing and other transactions. Mobile TV will probably follow this structure but advertising revenue potential is more limited, and pay-TV subscription-based systems are the most likely development. However in most countries mobile TV applications are yet to be developed and who pays, and how, are key to successful development.

Achieving the forecasted high growth is slowed by the fact that access to 3G services and mobile content is still confined to early adopters. Relatively few users subscribe and use services such as video. In the United States, only 10% of mobile subscribers download a ringtone each month, and fewer than 4% download games, although text messaging is used monthly by around 33% (based on data from M:Metrics). It remains a challenge to adapt and package content to suit mobile platforms and to increase interactivity and sharing. Slow consumer demand has also been attributed to what is perceived as high-priced content, and lack of transparent price information can leave customers unsure of total costs, owing in part to data transfer costs. Mobile payments are also an issue. Users are unwilling to provide information such as credit card details for one-off transactions, but micropayment and prepaid card models have been slow to develop, and there are security issues and fears of fraud.

Outlook

The overall potential is high and content other than music and games is likely to become increasingly important. Possible futures include a shift away from the established operator-centric content distribution models; as new technologies are introduced, the position of operators may change. Examples include new entrants such as mobile virtual network operators (MVNOs) which aim to differentiate their markets by providing exclusive content,⁵ as in the case of Amp'd Mobile. New consumer-to-consumer (C2C) relations are also likely along with peer-to-peer functions (recommending content to others and being able to deliver directly) and development of user-generated content beyond the already very popular photos and images. This will require further deployment

of broadband wireless, and infrastructure policies for broadband, wireless and spectrum are essential to ensure that network developments keep pace with, and provide a platform for, the content being transmitted. Competition is also necessary to ensure that mobile content is not restricted to certain technological platforms. Payment and micropayment systems and associated policies need to specifically consider mobile content markets.

Scientific publishing

Development

Scientific publishing has some distinctive characteristics compared with the three entertainment-based industries above (see OECD, 2005c, for a fuller discussion). Most importantly, research outputs are essential for innovation and have an important impact on growth. The efficiency of the system for diffusion of, and access to, research results and data is an important contributor to overall technological advances and economic performance. The scientific publishing industry is mainly but not exclusively involved in the production of academic and educational journals and books. The core science, technology and medicine publishing market was estimated at USD 7-11 billion in 2003 (OECD, 2005c; European Commission, 2006; EPS, 2004; Simba, 2004). OECD country expenditures on R&D were USD 687 billion in 2004 (current purchasing power parities, OECD, 2005e).

Three different kinds of institutions publish science and research content: i) commercial, for-profit publishers, such as Reed Elsevier, Blackwell and John Wiley are to varying extents involved in publishing research content; ii) membership-based societies which are mainly interested in scholarship and its dissemination, such as the American Chemical Society, the Institute of Physics Publishing and the European Physical Society; iii) institutional publishers which are frequently related to universities, research centres, schools or international organisations, such as Oxford University Press and the United Nations.

As for media and publishing in general, this industry was an early adopter of ICTs, e-commerce, digitisation and digital delivery, and it has used various forms of electronic publishing for almost 30 years. Most research and technical information is now delivered electronically, changing the roles of and interactions between authors, publishers, intermediaries (libraries, sales entities) and end users. Features of the adoption and use of digital content in scientific and research publishing include digitisation and digital delivery, the changing role of large and small publishers, high transaction costs for small publishers and distributors in the more complex value chain and changing roles of intermediaries, development of open access and open archive models, and a continuing if not greater role for libraries and institutional and business users of research results.

With digitisation and the pervasive adoption of digital delivery by publishers and the research community, the roles of traditional distributors of research results are evolving, particularly since the advent of open access and open archive models, the development of new hybrid models for access to knowledge, and as established publishers experiment with complex publication unbundling and bundling strategies. There are also considerations of the benefits of spreading research results widely because of the public good dimension of scientific content and its importance for future research and for tertiary education. For producers of research content, the main objective is usually to disseminate results as rapidly and widely as possible and achieve recognition within the research community. This is a different incentive structure from that of the entertainment industries.

Research is built on the exchange of knowledge and collaboration, and researchers look to the publishing system for three main things: speedy dissemination, economical access and quality (i.e. peer review by other experts). With the increasing volume and rapid evolution of research and the development of high-speed communications systems, the traditional scholarly journal model is under increasing strain to deliver this combination. As a result, alternative models, especially open access (OA) or new forms of licensing, have evolved.

There are two primary forms of open access. In the first, known as open access publishing, journals grant access to articles immediately upon publication; one example is the Public Library of Science (PLOS). Second, there is open-access self-archiving, whereby authors make copies of articles they have published openly accessible, such as in a database or repository. Both open access publishing and open access archiving have attracted a substantial share of research results. For example, there are over 2 200 journals at the Directory of Open Access Journals and over 7.5 million articles available in the OAIster repository, many of which are scientific in nature (Directory of Open Access Journals, 2006, OAIster, 2006). Open access journals often publish solely on line, thereby saving the costs of paper publication.

Funding models vary, but subsidisation dominates; generally the institution or research body with which the author is associated funds the publication, but grants and donations contributed directly to the publisher or archive are also used to cover costs. There is thus a question of the viability of these financial models, as it is unlikely that all research publication can be subsidised. Hybrid open access journals are experimenting with new forms of access and determining cost and revenue models, and recent evidence has suggested that articles published as open access from the start had a higher impact than articles not published as open access, which researchers had “self-archived” on other Web sites (Hebden, 2006). A growing number of commercial and institutional publishers make back files freely available after a specific period of time (delayed open access), enabling those who desire the most up-to-date research to pay for it while allowing public access to less recent research that is still of use to researchers and scholars.

A major issue for open access journals and repositories is establishing and maintaining high standards. Traditional publishers have invested in quality assurance, and the cost of peer-reviewed articles in established highly ranked journals is high. Thus, while access to OA journals and articles may be “free”, the cost of establishing and maintaining quality, actual publication and dissemination is not. Another potential issue is that authors who publish papers may not list their articles on open access repositories, resulting in a lack of efficient localisation or aggregation.

Many government and private funding bodies and an increasing number of individual research organisations and institutions have started to mandate or encourage open access or special rules on data, e.g. publishers should not claim ownership of data associated with journal articles and are encouraged to make data included in articles retrievable and re-usable.

Outlook

Pricing and payment models are evolving and continue to present challenges to the organisation of delivering research results. The effect that open access will ultimately have on the scientific publishing industry has yet to be determined. While there are potential

problems regarding funding, maintaining high-quality standards and content aggregation, OA may very well be an influential subset of research publishing. Traditional publishers are increasingly concerned that the creation of OA repositories and journals may replace paid journal subscriptions, thus posing a threat to their current business models. Databases alone may not suffice, though, because there is still value in the journal's function of selecting and collecting articles of interest and relevance to a particular community. In the case of such repositories, there may be other ways of adding value such as by linking articles and providing better metadata, search functionality and enhanced imagery. There is also a major role for establishing and implementing digital content standards that will enable more efficient classification, archiving, retrieval and use (e.g. digital object identifier and metadata standards).

User-created content

New forms of expression (users as content creators) have developed with the rapid spread of high-speed broadband (see OECD, 2004a for a previous assessment of individual and household Internet use). It has become easier to post content on the Internet; many sites provide ways to create Web pages and blogs which often require no programming skills (e.g. Blogger). Furthermore, digital cameras and mobile phones and steep decreases in the cost of home video and music editing have made it easier to produce content which can be put on line directly. The popularity of photo-sharing sites such as Flickr.com and video-sharing sites such as YouTube, with community-based properties, illustrates this growth. Podcasts and audio files, often created by individuals, which may be downloaded and subscribed to, have also contributed (see Chapter 7). Yet despite the popularity and apparent contribution to creativity and cultural values of user-generated content, its size and impact and whether it is an enduring phenomenon or an ephemeral fashion are still unclear.

Users contribute content to Web sites, keep online diaries and blogs, and share photos and artwork. Younger people are more active; for example United States online teenagers aged 12-17 were active content creators, with more than half of all teenagers involved in such activities in 2004 (Pew, 2005). In early 2006 in the United States, 35% of all Internet users (around 48 million people) reported having posted content to the Internet (having a blog or own Web page, working on group blogs or Web pages, sharing self-created content such as a story, artwork or video), and 42% of home broadband users (around 31 million people) had posted content to the Internet, with sharing own creations on line being the most popular activity (36 million Internet users). The distribution was fairly even by income group, but was more frequent among young home high-speed users (Pew, 2006b).

One very popular development involves the blogs and other interactive online communities which are part of the participative Web, with blog numbers and postings increasing very rapidly (see Chapter 7; Pew, 2004, 2005 and data from Technorati). Social networking sites enable users to interact with others, join communities, and create and share content. MySpace, the most popular of these sites, has nearly 80 million registered users (Waters and van Duyn, 2006) and is one of the five most visited sites on the Internet (Alexa, 2006).

It is very uncertain how the participant digital economy will develop. A central issue is the "value" of this content and whether amateurs contribute high-quality work that can compete with professional content. An example is the free online encyclopaedia Wikipedia, which has currently more than 3.8 million entries (Wikipedia, 2006a) in

230 languages (Wikipedia, 2006b). Anyone can contribute articles and edit existing entries; nearly 10 000 new articles are added daily (Wikipedia, 2006c). The project also has successful user take-up; it is among the 20 most visited Web sites (Alexa, 2006). However, as anyone can contribute articles on any topic and as there is no formal editing process, a much debated issue is the actual value of its content.

A comparison of the quality of Wikipedia's with Britannica's coverage of science found that, although Wikipedia contained more mistakes (on average four *versus* three for Britannica) and had other shortcomings, the online collaborative encyclopaedia still performed relatively well (Giles, 2005).⁶ Wikipedia can also update rapidly information which may be particularly useful in the fields of technology and current events. Another example is free software collaboration, with volunteer programmers contributing to various software projects such as those on SourceForge. Anyone can modify the source code of this software, and popular programmes such as the FireFox browser and the Linux operating system were produced in this way.

The relation between producers and users changes as users become content creators. This is relatively straightforward when users are the original creators. For example, specialist services such as Scoopt and Spy Media are developing for user journalists to negotiate their content rights (Twist, 2006). A more difficult question arises when user-created content is a mix of original and existing material. In some cases, the underlying copyright is disregarded and copyright holders are not compensated directly. At the same time, a growing number of creators are choosing to make their content available under flexible licences such as Creative Commons, thereby enabling outside parties to share and/or remix their work. There are many outstanding issues associated with the rapid rise of user-created content and its impacts, whether there are unnecessary bottlenecks to creativity and use, and how and in what forms this content will continue.

Changing industry structures and value chains

Radical changes in content industries and their value chains due to digitisation and digital delivery include new competition across platforms and industries, cross-industry convergence and alliances between digital content producers (television, cinema, music, games and other content producing-industries), Internet portals, IT firms and consumer electronics firms. The interests of participants are often radically different, especially between network operators and content owners, but also those of new participants such as portals and search engines. Different kinds of convergence are shaping the market: content convergence (telecommunications, broadcasting, video on demand and Internet Protocol TV (IPTV) delivered to PCs and other devices over the Internet, business convergence (telecommunications, broadcasters and triple play services), network convergence (unified networks for telecommunications and broadcasting) and terminal convergence (with different terminals being used for the same reception or the same terminal for different transmissions).

Different firms are increasingly involved in content distribution (e.g. telecommunications firms, ISPs, portals, mobile operators, etc.); distributors are increasingly packaging content themselves (pay TV and free TV operators are creating branded video on demand [VOD]) and mobile TV services, IPTV operators are creating branded subscription VOD services, and mobile operators are creating branded TV/VOD services); distributors create or commission enhanced content (content for mobile

services); content owners are extending or creating distribution brands; and the role of search engines is increasing.

Impact of digital content

Because industry characteristics, market structures and competition vary, no single simple value chain has emerged for content industries. Firms that are able to expand services to a wider audience are likely to realise economies of scale and scope, as initial product development is costly while subsequent distribution tends to have low marginal costs.

Four structural trends can be identified across digital content industries:

- Established value chains are changing, particularly at the distribution level.
- This has resulted in disintermediation and frequently re-intermediation as old (physical) distribution mechanisms are replaced by new (digital) ones.
- New intermediaries are often participants in established value chains.
- Transformations are increasing further up the value chain in content development and access.

Content industries all still rely heavily on revenue from traditional sales, but a large and increasing range of products is available on line or via mobile platforms. Digital content services are sold directly to consumers via firm Web sites (games, music), and publishers deal directly with libraries (scientific publishing). But disintermediation, whereby producers bypass all intermediaries (wholesale or retail) to sell to end users, has not taken place to the extent initially expected.

In general, with the notable exception of retailers, many traditional participants remain important players in altered value chains. For small retailers, the role of traditional stores has been challenged, but larger physical retailers have often successfully expanded services to become online as well as offline intermediaries (e.g. Virgin Megastores). ISPs, mobile operators and specialised content distribution portals (e.g. HighWire Press) are increasingly important, and established firms in other sectors (Starbucks in music, Coca Cola in games) have entered some digital content markets as new intermediaries. Re-intermediation involves different participants, and it also requires, for example, DRM and payment providers, content marketing, rights acquisition and management, advertising, billing management, and access management.

Relations between network service providers, technology suppliers and content providers are changing, possibly moving towards more complex relations within value chains. Intermediaries such as ISPs that have successfully entered distribution have moved up the value chain towards content development. Network operators also increasingly play new upstream and downstream roles, for example in supporting games distribution, and evidence suggests that a higher share of online content sales of games goes to developers and publishers than previously.

New products

The online environment also offers possibilities for providing different and improved products to customers. Initially, there was no product adjustment; physical products were offered on line, but it was possible to offer a wider variety of products and content than physical retail stores. Moreover, products themselves have changed to varying degrees

(e.g. massively multiplayer online games). Value-adding features (e.g. reader ratings, links to related work, different search possibilities) are also increasingly provided on scientific content sites.

To some extent digital content products are complements to established products; in the games industry, for example, they may add to an existing traditional game and provide additional information or the possibility to play with other players that are online. However, they frequently become substitutes, as in the case of scientific articles which can be downloaded rather than searched for in a library. Access to news has also changed with younger people consulting online sites rather than physically printed products. This suggests that, especially for younger people, digital products substitute for offline products. Moreover, some are neither complements nor substitutes but new products made possible by technological progress, e.g. interactive games.

Cost structures and business models

New technologies, particularly broadband, are challenging established business models and value chains, with some content areas more successful in developing successful new models than others. For example, the speed of technological and business innovation in the new online games industry has been faster than in other established entertainment industries. While online music services have developed, film and video services are still, for various technological, business and other reasons, scarce.

There is still considerable flux between subscription-based and advertisement-supported business models. While “on-demand” delivery is increasingly common, possibilities include pay-per-track and pay-per-play (*à la carte*) models, subscription-based models (sold in package) and/or advertisement-based business models. The selling of logos, ringtones, and merchandising linked to content is also part of the new business models. Online games companies increasingly generate revenue by item sale and co-promotion partnerships with global brands. There is also the potential (for example in music and publishing) to shift to the “long-tail” business models enabled by digital distribution and make available back catalogues and specialist items with relatively lower sales volumes. Digital technology also enables content creators to charge different consumers different access prices. Online sellers can gather and share large amounts of information about their customers and price accordingly, although this raises consumer resistance and privacy issues.

Subscription and pay-per-use pricing are both popular. Subscription models, whereby users pay a certain fee to access content over a specific time period, are generally used for complex games and scientific journals. In the United States, subscription services were the dominant form of payment for all digital content in 2004. Single-item payments accounted for only 15.4% of content sales. However, pay per item is increasingly popular with users for downloads of music and similar entertainment content (Online Publishers Association, 2006). There is also some evidence that music users favour single-track purchases; a 2005 survey found that 40% of respondents wanted to buy individual songs and only 8% preferred subscription services (Parks Associates, 2005a). Further, pay-per-item pricing has been popular for mobile content purchases. One of the challenges for the wider success of pay per use is that it depends on the existence of suitable (micro)payment mechanisms.

One of the commercially most successful digital content business models has been developed by the games industry. Users pay a monthly subscription fee to participate in

large-scale online interactive evolving games. The very high user uptake of games such as the World of Warcraft and Korean online games has demonstrated that these models can work. The music industry has also experimented with different pricing models, but for many music download services margins from per-track sales are still low.

In scientific publishing there is considerable debate over providing free access to research publications and repositories, sometimes through author-pays models. Much scientific research is publicly funded, and there is increasing pressure to make results freely available. Recognised quality control mechanisms such as peer review will be important for successful take-up of free online sources.

Online advertising

Online advertising is beginning to account for a significant share of advertising revenue, a shift that is putting pressure on traditional business models. Advertising's role in providing free entertainment will probably not change, i.e. consumers are unlikely to pay directly for all content. However, mass marketing is being replaced by targeted and sometimes interactive advertising, with placements in films, television programmes, games and even blogs becoming more common. More transparent ways of paying for advertisements will develop as advertisers gain a better sense of the value generated from advertising.

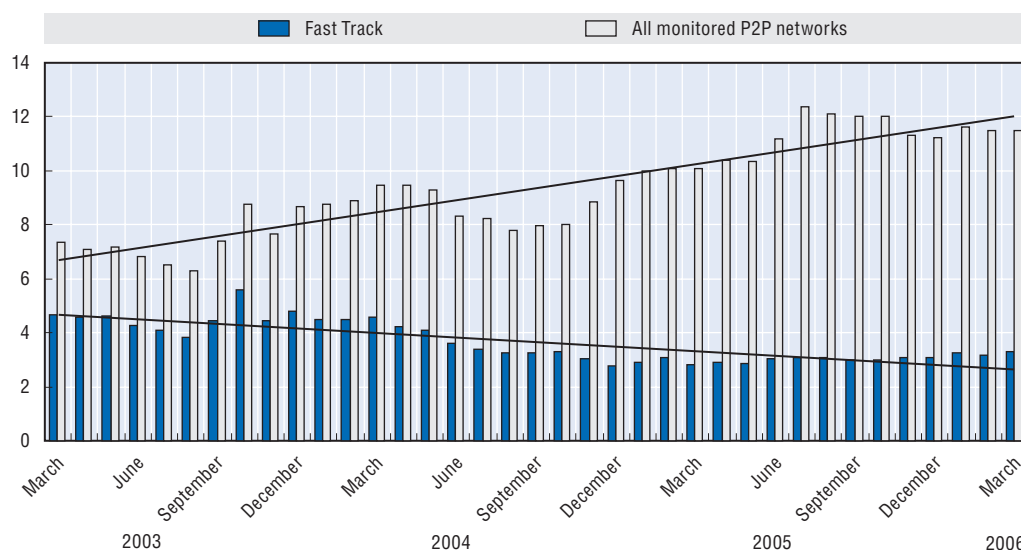
Advertising still represents a relatively modest share of content industries' revenue. Advertisements have been integrated into online games, but currently for less than 10% of console games (*The Economist*, 2005a). Games are also specifically designed for advertising purposes. About USD 90 million was spent by US firms on such advertising in 2004, and large firms such as Coca Cola have increasingly invested in their development. It has been projected that spending on Internet advertising will increase, and online music and games are seen as interesting alternatives to traditional advertising (e.g. Parks Associates, 2005d). With some exceptions (e.g. medical journals) similar opportunities do not generally arise for scientific content.

Monetisation of peer-to-peer networks

Peer-to-peer (P2P) networks open new opportunities for commercial and non-commercial content production and delivery (OECD, 2004b). Content, Internet service and technology providers are looking increasingly at ways to "monetise" P2P networks (EITO, 2006). This involves using P2P networks in legitimate ways rather than for unauthorised downloading of copyrighted works.

Available data suggest that the use of P2P networks is on the increase. The number of simultaneous P2P users on all monitored networks rose to 11.5 million in March 2006, up from 7.3 million in March 2003 (Figure 5.3).⁷ At the same time the world's P2P users on FastTrack file-sharing networks (distributed networks, such as used by KaZaA, with a decentralised base, not relying on central servers or master lists of files) peaked in October 2003 at about 5.6 million and have since fallen to less than one-third of all P2P users in March 2006. This shows a clear shift away from fast-track networks such as KaZaA towards networks such as eDonkey, eMule, Torrents and other non-fast-track networks (confirming the trend noted in OECD, 2004b). There has also been a shift to use of P2P networks which are less easily tracked (Karagiannis *et al.*, 2004) and the sharing of video files is increasing.

Figure 5.3. **Global use of peer-to-peer network (fast-track and all monitored networks), measured in simultaneous audience at peak volumes (in millions), March 2003-March 2006**



Source: OECD, based on BigChampagne data. Trend lines added.

StatLink: <http://dx.doi.org/10.1787/212066538340>

In terms of the distribution of P2P users, 66% originate from the United States. Germany accounts for 5%, France for 3.5% and Canada for 3.2% (Table 5.2; note that less popular sites and some Asian sites may not be tracked). When weighted by population, the share of simultaneous P2P users in OECD countries has increased significantly from 2003 to 2006. Luxemburg appears to have the most intensive per capita use (roughly 12% of total population at peak times and 7% on average), followed by Iceland, Finland, Norway, Ireland and the United States. On average, 1% of the OECD population is logged on to a P2P network (four times the value in 2003). If the data were weighted by number of Internet users rather than by population, average use of P2P in the Internet user population would be higher.

The majority of files traded are audio files (Figure 5.4). Nevertheless video and other files, including software, make up 35% of total files exchanged, and their share has significantly increased. Downloading of video files has become faster and simpler, and the film industry is increasingly looking at ways to contain unauthorised downloading of film content.

Figure 5.4 shows the breakdown of file use for the popular P2P network, KaZaA, for individual OECD countries. Germany had the highest share of video files downloaded via fast-track networks (close to 40% of the total), followed by Italy (37%), Belgium (33%), Norway (31%), Canada (30%) and the United Kingdom (29%). From 2003 to 2006, the percentage of video downloads has slightly increased in all OECD countries (except Iceland). Australia and Norway rank first in terms of percentage increase.

Table 5.2. Distribution of simultaneous P2P users in OECD countries, peak use April 2006

Percentage of all users and percentage of the total population (value for 2003 in brackets)

	P2P users in country	April 2006 (%)		Users in total population (%)
1. United States	7 601 324	66.2 (55.4)	Luxembourg	11.7 (0.4)
2. Germany	549 749	4.8 (10.2)	Iceland	7.6 (0.1)
3. France	406 430	3.5 (7.8)	Finland	3.7 (0.2)
4. Canada	365 991	3.2 (8)	Norway	2.7 (0.3)
5. United Kingdom	363 557	3.2 (5.4)	Ireland	2.6 (0.1)
6. Austria	203 361	1.8 (0.5)	United States	2.6 (0.9)
7. Spain	202 821	1.8 (1.1)	Austria	2.5 (0.3)
8. Finland	195 110	1.7 (0.2)	Hungary	1.9 (0.02)
9. Hungary	189 403	1.7 (0.1)	Belgium	1.6 (0.4)
10. Belgium	167 588	1.5	Czech Republic	1.5
11. Czech Republic	154 496	1.3	Slovak Republic	1.3
12. Norway	121 919	1.1	Canada	1.1
13. Ireland	107 116	0.9	Switzerland	0.9
14. Italy	82 232	0.7	Denmark	0.8
15. Japan	81 676	0.7	Germany	0.7
16. Slovak Republic	72 654	0.6	France	0.7
17. Switzerland	64 956	0.6	United Kingdom	0.6
18. Poland	55 042	0.5	Spain	0.5
19. Luxembourg	52 859	0.5	Portugal	0.4
20. Australia	48 416	0.4	Sweden	0.3
21. Denmark	41 853	0.4	Australia	0.2
22. Korea	37 856	0.3	Netherlands	0.2
23. Portugal	37 491	0.3	Greece	0.1
24. Mexico	30 217	0.3	Poland	0.1
25. Sweden	26 864	0.2	Italy	0.1
26. Netherlands	26 813	0.2	New Zealand	0.1
27. Iceland	22 142	0.2	Korea	0.1
28. Greece	16 148	0.1	Japan	0.1
29. Turkey	7 405	0.1	Mexico	0.0
30. New Zealand	5 558	0.0	Turkey	0.0
OECD countries	11 339 047	98.8	OECD average	1

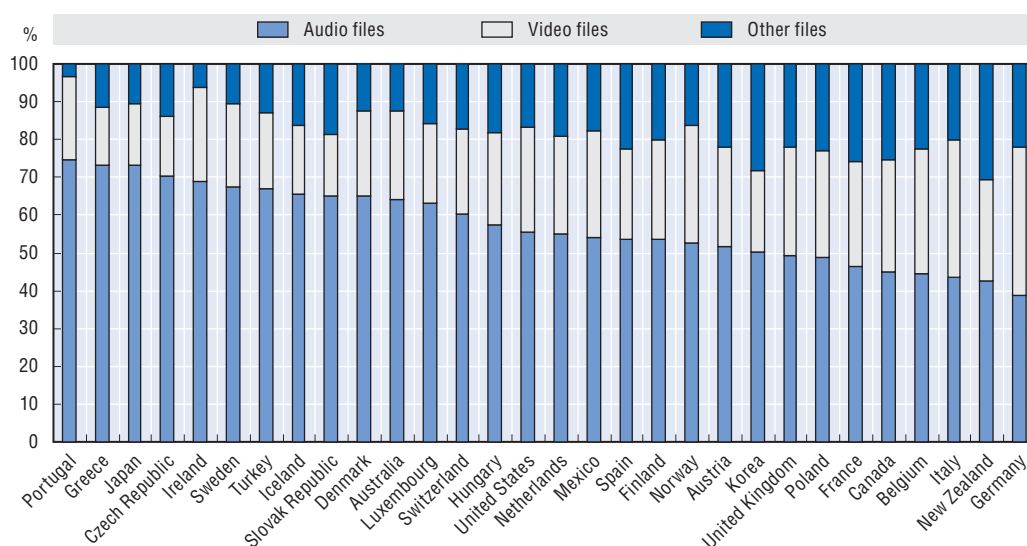
Source: OECD based on BigChampagne data.

StatLink: <http://dx.doi.org/10.1787/214784537714>

In addition to the rise of legitimate online content provision (notably for online music but increasingly for video content), a series of court judgements against unauthorised file-sharing services in late 2005 and 2006 in the United States, Australia, Chinese Taipei, Korea and the Netherlands, legal proceedings against P2P users who have engaged in unauthorised uploading or down-loading of copyrighted content, and educational campaigns have all contributed to changing the market for digital music and consumer attitudes to unauthorised file sharing. Record industry associations such as the IFPI are announcing progress in the battle against unauthorised file-sharing of copyrighted material.

Content, Internet service and technology providers are beginning to develop commercial P2P networks and shift towards P2P technology for distribution. Warner Bros., for instance, is planning to license content through BitTorrent, marking the first distribution arrangement involving a major film studio. Links to films and television shows will be positioned in the BitTorrent.com Web site, and protected files will be transferred

Figure 5.4. **File format breakdown for OECD countries, based on FastTrack data, March 2006**



Source: OECD based on BigChampagne data.

StatLink: <http://dx.doi.org/10.1787/502058274412>

using the BitTorrent file-sharing protocol. In the United Kingdom, the BBC has negotiated terms with independent feature film, TV and animation companies for its P2P-based iPlayer service. This will allow programmes owned partly by the BBC to be shown on the iPlayer service immediately after they have been broadcast and up to seven days later (Faultline, 2006). Previously, the period for viewing broadcast works over the Internet was shorter, to protect DVD and other later service revenues (for more examples see EITO, 2006).

Drivers of digital content development and delivery

Various factors have stimulated the development of digital content; among the most important are technological developments, new products, changing access and higher efficiency and greater demand.

Technology

The development of digital content has increased with the wide diffusion of broadband and the growing potential user base for high-quality content. Technology has been the motor for new content development by many content industries and by individual creators. These developments include (OECD, 2005a, 2005c; Darlin, 2006):

- Rapid spread of broadband and its global scope, deployment of optical fibre and new and next-generation networks (Digital Video Broadcasting – DVB-H/T, 3G/UMTS, Wi-Fi/ Worldwide Interoperability for Microwave Access – Wimax), and the move to ubiquitous sensor networks (including radio frequency identification, RFID).
- Shift to Internet-protocol-based content distribution which is independent of time, device used and location, is subscriber-centric and allows for a high degree of interactivity and personalisation.
- Development of digital television (both satellite-based and Digital Terrestrial Television), XM satellite radio, new digital projectors and video downloading.

- Spread of new hand-held user devices and the expansion of wireless networks (including portable broadband services and portable broadcasting services such as Digital Multimedia Broadcasting, DMB) and mobile applications.
- The multiplicity of viewing device formats and resolutions, particularly mobile and portable ones.
- The “virtual living room” which connects different home entertainment devices as PCs, DVD players, hi-fi, games consoles and TV so that any can be used to view content stored on any other.
- Development of content protection and delivery systems, new security standards, authentication, accounting, and clearing technologies.
- Also important are industry agreements on common standards to enhance interoperability; however, more traditional distribution channels, such as broadband Internet connections, will remain important.

The creation of content is increasingly R&D- and innovation-intensive. In addition to the artistic and business risks inherent in different kinds of content creation, such as film production or complex media-rich applications, it also requires creative R&D input. The computer games sector draws on leading-edge R&D in areas such as imaging and interactivity. On the platform and delivery side, the design, format, accessibility, and searchability of Web sites and documents are of major importance. Online content delivery necessitates technologies for content packaging and management; compression and encryption technologies (*i.e.* codecs); digital asset, content and rights management; content distribution networks (including mobile services and digital broadcasting); payment systems; and new hardware. Audiovisual content and technological and business applications for the “new digital living room” and “ubiquitous networks” involve the development of open and interoperable platforms and delivery technologies. Technological tools (*e.g.* DRM, watermarking, fingerprinting, encryption) to assure secure and safe access to content and privacy are often required.

Suitability of content for digital delivery

Not all content is equally suitable for digital delivery and not all access platforms are equally appropriate for different types of content. Urgency, immediacy, mobility, file size and using devices are among the factors determining suitability. For example, it may not be very convenient to access large journal articles or data collections on small mobile devices; a physical copy may be preferable. Similar considerations may apply to other types of content, but technological developments and rapid improvements in network quality increasingly reduce these difficulties.

Low marginal cost of duplication and delivery of digital content and presentation in accessible formats which can be stocked, manipulated and searched more readily are among the reasons for the increasing push towards content digitisation in areas that were previously considered unsuitable. The digital environment makes it possible to address a wider audience than corresponding offline sales, and there are usually fewer constraints on physical space for stocking and distributing products. For example, if scientific content can be efficiently provided on line, there are cost savings over physical delivery and storage. Technology has also facilitated the production of creative content; for instance, musicians can record songs by using personal computers without the need for a recording studio.

Demand and use

Digital content development and delivery provides more personalised products, more flexible access to content and greater possibilities for interaction. For example, as many users want to access content while on the move, this has driven the development of mobile information services, interactive quiz shows and comedies as well as news. Most of those who use online news sites tend not to buy offline newspapers. Users increasingly want to listen to their favourite music wherever they are, find quickly the scientific papers they require and be able to interact with others while playing games. Interactive media are supplanting traditional entertainment media and the “long-tail” effect spreads the availability of niche products by reducing the cost of stocking and accessing digital products with small sales volumes.

Users are also specifically interested in customisable and interactive tools. They have been challenging established distribution arrangements, and new mass distribution and inter-community trading has grown, along with new forms of use and user-created content. They engage in new forms of consuming news and accessing information, participate in online games as part of a social network and seek to be part of a virtual community with similar tastes. In the traditional entertainment model, the creator of the content is in the middle and the audience is at the edge, but a more complex set of structures and content flows is developing.

In the United States, younger age groups typically use more online services than older generations (*e.g.* for their source of news), and they represent an important share of consumers of online video and computer games as well as of other entertainment content (Pew, 2006a). In Europe playing games and downloading music tracks were most popular among those aged 16-24 and increasingly less of interest to older generations (see Table 5.3; and Demunter, 2005). They are also more active creators of digital content than other age groups and there are differences across countries, with the Asian market one of the most important for mobile content.

Table 5.3. **Proportion of Internet users playing/downloading games and music, by age group, selected European countries 2004**

Age group	Percentage							
	Denmark	Germany	Finland	Sweden	UK	Greece	Austria	Poland
16-24	49.2	51.6	80.5	56.6	62.1	74.2	38.6	68.9
25-34	28.5	25.6	64.4	31.5	39.9	51.1	18.7	39.2
35-44	21.8	15.7	46.4	23.9	39.4	42.6	12.1	30.6
45-54	15.2	14.8	40.3	19.0	28.1	37.7	8.9	27.3
55-64	10.9	10.6	30.3	12.4	28.3	24.0	11.6	22.3
65-74	12.5	:	36.5	18.6	:	17.2	10.3	4.4
16-74	24.5	23.9	53.9	28.3	40.3	55.2	19.1	48.5

Source: Eurostat, Community survey on ICT usage in households and by individuals.

StatLink: <http://dx.doi.org/10.1787/472627008165>

Challenges to digital content development and delivery

Challenges for the digital content industries include finance, skills, market structures, infrastructure of various kinds, interoperability, regulatory frameworks and digital piracy.

Venture capital and financing issues

Production costs and investment risk are rising rapidly for some content development activities (especially audiovisual content such as films and games), and the development of digital content enterprises may encounter funding shortfalls. On the demand side, this is due in part to the intangible nature of content products and difficulties in assessing unknown markets and risk, and on the supply side to a lack of specialised expertise among finance and venture capital providers. In the games industry, it is also due in part to publishers that want partly or fully developed products before they sign contracts with developers, and this places a heavy financial burden on small firms that self-finance their development.

The high and rising cost and sophistication of content production has implications for the business environment and access to capital. Investment in a film or other content production is a risky undertaking, as there are significant sunk costs in audiovisual production, with no certain returns and strong possibilities of failure.

Skills and awareness

Skills and human capital development are crucial for all content industries as their rapid evolution requires up-to-date skills and the ability to adjust quickly to new developments. Games development requires skilled designers and programmers with specific skills, and there have been considerable mismatches between demand for and supply of skills, especially in this area (OECD, 2005c). This has been particularly challenging for smaller businesses, and similar issues have arisen in other industries. At another level, consumers need to be sufficiently aware of and able to use the Internet and other digital devices.

Market structures

Development of digital content services requires co-ordination of a wide range of industry participants (including creative artists, hardware and software firms, distributors, ISPs, mobile phone providers), some of which have not previously worked together. At least three different conditions have to be fulfilled. First, there must be an infrastructure that is adequate for the services and to which users have access. Second, suitable technical products must exist. Third, content services must satisfy consumer demand. Further up the value chain, established participants such as broadcasters, movie studios and other producers of entertainment have to be involved. It is unclear whether participants will agree on the conditions for entering such arrangements and optimising digital content product development and delivery. It may be that established industry participants want to ensure dominant positions in future e-content markets. They often demand very large shares of overall revenue for their services, and agreements are therefore difficult, particularly between network service providers with few competitors (despite entrants in other distribution systems such as cable services) and content providers which restrict content to certain established platforms. Recently, however, there has been an increase in industry partnerships to develop and deliver digital content.

Infrastructure for digital distribution

Digital distribution channels need to have in place:

- Technologies that protect digital works and appropriate DRM schemes. The challenge is to develop robust DRM programmes and technologies that ensure both that unauthorised copying is not possible, and that they do not inconvenience users, are inflexible or negatively affect service users.
- Adequate, efficient and secure payment systems (including micropayments). These would encourage a wider diversity of profitable business models, for example purchase of single music tracks, game plays or journal articles.
- Adequate protection of consumer information and privacy.
- It is important for providers of digital content to have systems that efficiently host and aggregate large amounts of content. It also has to be easy for consumers to access content and to update information and content offers. Additional requirements for successful portals include the use of efficient marketing tools which draw attention to the site, as in the case of physical retailers.

Infrastructure for micropayment systems

To pay for access to or download of single content items requires an effective and secure payment and authentication system, and the absence of reliable, widespread low-cost micropayment systems is therefore seen as a problem (OECD, 2006b). For example, fees for a USD 0.99 music download may exceed 25%. Credit card companies have minimum transaction charges even for micropayments, and micropayment models are not yet widespread, although payments via mobile phone billing or prepaid phone cards are possible in some countries. More appropriate regulation may be needed to accommodate the development of efficient payment systems by non-financial institutions which might play an important role. In Norway, for example, the government encourages micropayment systems and Japan has also been supporting the use and popularisation of “automatic payment systems”. Cross-border payment remains a further problem.

Basic processes for end-user identification, authorisation and payment must also be in place. There must be a mechanism for identifying the customer, recognising the device used, and authorising the end user to access a subscription or download single-use items.

Interoperability and standards

To develop competitive and efficient content markets requires a wide variety of interoperable and compatible standards for content and hardware. However, a range of different proprietary and incompatible formats, networks, services and consumer devices may hamper development of online content distribution (OECD, 2005b, 2006a). For digital music and mobile content in particular incompatible audio codecs, DRM formats and hardware devices reduce use possibilities. These differences make it difficult if not impossible to mix content from different services (de Lussanet and van Veen, 2005). There are also considerable lock-in effects owing to *de facto* standards. With vertical integration, lock-in may raise entry barriers for small and innovative players. There have recently been a number of initiatives in areas that would benefit from greater standardisation and interoperability, such as T-Mobile. supported by Universal Music, Sony Music, Warner Music and major mobile handset manufacturers to develop a standard platform for mobile music.

While there are benefits to adopting standards, there are also potential costs, as they may inhibit later innovation and limit possibilities for product differentiation. Because governments do not have the experience and technological or other foresight to pre-select standards in fast-moving areas, initial market experimentation is likely to be necessary to develop the best approaches. However, governments can provide frameworks for co-operation and can encourage business, experts and standards organisations to work together to develop better standards. The new Korean content growth strategy, for example, includes efforts to create digital content standards (including for DRM, e-learning) and enhanced co-operation with the International Organization for Standardization (ISO).

Digital piracy and file-sharing

The advent of digital technology creates major opportunities but also challenges for digital content. Extensive piracy may be an important impediment to creating and strengthening legitimate services for distributing copyrighted content on line. According to IFPI data, by the middle of 2005, 900 million music files were available on unauthorised networks and Web pages (IFPI, 2005b). Illegal P2P music file-sharing has had an impact on content industries and may have deterred the development of additional digital content. In the face of increasing piracy, OECD governments have worked to promote the protection of IPRs through legislation (national law and international treaties), enforcement and increased criminal sanctions, and awareness/education campaigns (including youth education programmes).

There is an ongoing debate about how important illegal file sharing will be in the future. It has been argued that authorised content services such as Apple's iTunes Music Store are the model for extensive authorised downloading (Nagel and van Kruijsdijk, 2005). However, other evidence suggests challenges remain. For example, in a survey of United States teenagers, more than four in five of those who downloaded music files agreed with the statement that music downloading and file sharing were easy and that it was unrealistic to expect people not to do it (Pew, 2005). The games industry has successfully developed products that are not easily copied, such as massively multiplayer online games which are not static so that there is no point to downloading a version at any specific time. Similarly, the provision of more advanced services (including the possibility of customising access to content and monetising P2P networks) by other industries may also limit illegal file sharing.

Digital rights management

Adequate protection mechanisms are a common challenge for digital content industries. DRM technologies provide three basic functions: i) they encrypt content to allow access only to authorised users; ii) they provide licence systems which control access to content and what can be done to the content; and iii) they provide authentication mechanisms to identify users (Schrock, 2004). Effective DRM technologies are seen as a means of enabling digital distribution of content, and, through their ability to create various ways to access content, they may facilitate the development of products tailored to consumer demand (e.g. the right to purchase time-limited access to songs) and increase consumer choice, satisfaction and overall economic welfare if price discrimination expands markets.

An enduring challenge for DRMs is to be sufficiently robust to ensure that digital content cannot be subjected to unauthorised copying or unintended uses. To this end, many governments, by signing World Intellectual Property Organisation (WIPO) treaties, have pledged to create “adequate legal protection and effective legal remedies against the circumvention” of technological protection measures such as DRMs.

Implementing DRM systems has proved challenging as the increased use of DRM technologies has raised a number of consumer issues [e.g. problematic limitation of usage rights or inadequate disclosure and impacts on privacy, see, for example, Beuc (2004) and the UK All Party Parliamentary Internet Group (2006); actions against anti-piracy software on music CDs; and academic research (Gasser, 2004)].⁸ OECD work has also analysed the disclosure issues raised by technically-imposed restrictions on the use of digital content (OECD, 2006e). Further research may be needed to throw light on the impact of DRM technologies on consumers, technological innovation and the effectiveness of DRM in protecting intellectual property rights holders. Market forces (*e.g.* consumer purchasing behaviour) and content and technology providers’ growing experience with DRMs may address some of these issues and become more sophisticated, more flexible and provide support for innovative business models.

Impacts

Digitisation, development of new digital content products and digital delivery have led to changes for producers and consumers of entertainment and scientific content. This section focuses on some of the economic impacts on digital content industries. However, these direct effects underestimate spillovers on the wider set of industries whose primary purpose is not the generation or distribution of digital content, and across society. Moreover, if new digital delivery and access mechanisms improve and facilitate research activities, this will have additional impacts on economic growth. Games innovations such as new imaging technologies, high-speed interactivity, and touch feedback can also have important applications in other sectors (KPMG for the Danish Ministry of Culture, 2002; OECD, 2005a).

Changing value chains

Changes in value chains have affected participants differently. For record labels and other content developers, digital content delivery has required adjustments to sell products to a wider set of users. The online environment gives artists and other content creators the possibility to make their content widely available and gain greater visibility, but so far few artists have been discovered on the Internet, despite some recent music successes (see below). ISPs and major Web portals have greatly benefited. Traditional intermediaries have been challenged by developments in the digital content industry, but some traditional distributors have successfully reshaped themselves to take advantage of new markets. Providers of infrastructure services (*e.g.* DRM technology and payment methods providers) will benefit from further developments regardless of how value chains change.

Hardware and services

Digital content industries are drivers for consumer electronics and PC manufacturers owing to consumer demand for constantly improved hardware and devices that enable them to access content, play increasingly complex games, download music and video, and

combine these attributes with greater mobility. Revenues from PCs and consumer electronic devices are sometimes larger than those from sales of related digital content. Further, if hardware products have network economies, providers of content and hardware products have a mutual interest in providing as much content as possible for a particular hardware product. Developments in content also have an impact on mobile handsets, as users will purchase new models with improved access to such digital content (e.g. games and video). Consumers will also be more interested in home networking if they are active users of digital content (Parks Associates, 2005b; CEA, 2005).

Internet and creative supply

New ways of creating, distributing and accessing content can affect creativity by opening up new commercial and non-commercial content creation and distribution channels, by interaction between creators, users and consumers, by lowering barriers to entry and driving down creation and distribution costs, by expanding markets and uses in ways that favour creativity and diversity, and by developing niche markets (OECD, 2006a). In the music industry, the potential of the Internet means that artists can package, present and distribute differently than in the past. In spite of the possibility of online distribution, traditional content industry firms, such as music publishers and record companies, often retain their key role in content creation and distribution. They provide essential services as producers, for tour planning and support, marketing to reach consumers, and negotiations with Internet-related service providers (e.g. firms such as Nokia, Vodafone, Verizon, Yahoo!, and AOL). Small independent producers play an important role, often in fragmented markets (language, culture), and, with low overheads and fewer sunk costs, they may have fewer problems breaking free from old business models.

Horizontal lessons

Although there are major differences between individual industries, there are also some common lessons. First, wider diffusion of broadband Internet has increased possibilities for the growth and development of digital content industries and innovative products. These developments have significantly challenged existing value chains. Specifically the position of traditional distributors has undergone changes (both disintermediation and re-intermediation), and more changes are also likely further up the value chain. Moreover, various new and traditional business models are being tested in the new environment; they range from subscription to pay-per-use, and the role of advertising is changing markedly in some content areas. In scientific publishing, access contributes effectively to information and data circulation and use and is a core issue.

Furthermore, the trend towards greater mobility is likely to have a major impact on digital content. As users increasingly use interactive tools and create different sorts of online content it is necessary to develop support infrastructure, including payment methods, DRM software, security, privacy and consumer protection. Overall the development of digital content has broad spillovers in related electronic and infrastructure industries and a strong impact on other industries because it changes how they deliver their content, with effects throughout the economy.

Government roles: Market participants create and develop digital content value chains and business models but governments play a major role in developing general “enabling factors” for the creation (e.g. creative environments, ICT skills) and use (e.g. ensuring widespread access to broadband) of digital content (see Chapter 8, and OECD, 2006c).

Governments act as facilitators, remove impediments to investment and create an appropriate business environment by addressing market failures that hamper R&D, innovation, access to capital, education and the development of skills. The development of non-discriminatory framework conditions can reduce barriers to entry and improve competitive conditions (especially for new and smaller firms). Competitive markets for content and telecommunication services are crucial for broadband take-up and content diffusion and use. Many OECD governments have developed a focus on digital content and/or related creative/content industries, either with overarching digital content policy frameworks (such as the UK's Digital Strategy/Digital Content Forum) or with programmes specific to certain digital content industries and/or applications (OECD, 2006c).

The public sector has a major role as producer and user of digital content and applications. On the producer side, this includes public sector information that can be commercially re-used and public sector educational, cultural (museums, archives), and other content for which public good and spillover arguments support a major government role. Governments also participate in or support the development of and digital access to content (*e.g.* archives of public broadcasters). On the consumer side, governments can support demand by improving access and diffusion of information in areas such as online health and education (OECD, 2006d).

Conclusion

The games, music, scientific publishing and mobile content industries have very specific and different characteristics, but digital content is increasingly important and is the major driver of growth for all of them. The rise of digital content markets has challenged established non-digital value chains and new digital value chains are increasingly complex and diverse. In downstream distribution, disintermediation and re-intermediation have both occurred, and new value chain participants have entered as new intermediaries or to supply infrastructure services. New business models are being experimented with, including subscription (games) and pay-per-use (music). Advertising is becoming less important in some areas (mobile TV) and more important in others (search). In scientific publishing more direct forms of free (to the user) access are developing.

Continuous improvements in technology for networks, software and hardware, including mobile and wireless services, have been important for the development of more advanced digital content. A further driver has been the fact that many of these industries' products are suitable for digital delivery, thus enabling online distribution to improve market access and lower costs. One of the main challenges is improved co-operation as production of digital content requires agreements among participants, including content developers, device manufacturers and distributors. To succeed, suitable and cost-efficient infrastructure services, including payment systems and DRM technologies, have to be in place and content interoperability and compatibility issues resolved.

For users, more, and more diverse, content is available on line than off line, and innovative new products provide customised services with greater interactivity. An increasing number of users are also becoming digital content creators (see Chapter 7), and although it is unclear whether this is a long-term development or an ephemeral fashion, it is stimulating content development and industry behaviour. Furthermore, developments in these industries have major spillovers into non-content industries and wider impacts across the economy. Finally, governments have a role to play in developing general

“enabling factors” for the creation and use of digital content, maintaining a supportive business environment as well as a major role in producing and using digital content (see also Chapter 8).

Notes

1. The OECD and Italian Minister for Innovation and Technologies, International Conference on “The Future Digital Economy: Digital Content Creation, Distribution and Access”, Rome, Italy, 30-31 January 2006; details available at: www.oecd.org/sti/digitalcontent/conference.
2. The video games market reflects consumer spending on console games (including handheld games), PC games, online games, and wireless games. The category excludes spending on the hardware and accessories used to play the games.
3. http://epp.eurostat.cec.eu.int/cache/ity_offpub/ks-np-05-040/en/ks-np-05-040-en.pdf.
4. United States: 353 million single tracks downloaded (up from 143 million) (Nielsen SoundScan); United Kingdom: 26.4 million single tracks downloaded (up from 5.8 million) (OCC); Germany: estimated 21 million single tracks downloaded (up from 6.4 million) (IFPI Germany); France: estimated 8 million single tracks downloaded (up from 1.5 million) (SNEP).
5. See www.mobilein.com/what_is_a_mvno.htm. For an example see Amp'd Mobile <http://get.ampd.com/>.
6. See *The Economist* (2006), “Encyclopaedia Britannica takes on Nature”, 30 March for a criticism of the study.
7. BigChampagne provides data on country-specific use of P2P networks, their evolution and determinants of use. It does so by indexing and searching shared folders on P2P networks and tracks some 50 million search queries a day to determine the activity and origin of P2P users. The data show the activity and origin of P2P users logged on to a given P2P network. BigChampagne began monitoring Napster in 2000 and now covers the most popular networks, including FastTrack (KaZaA, Kaza Lite, iMesh, Grokster, etc.), eDonkey, Direct Connect and all Gnutella-based client, as well as ScourExchange, AudioGalaxy, Morpheus, etc. However, it does not track less popular P2P sites, such as Soribada in Korea or FileRogue in Japan, or smaller ones in other OECD countries.
8. See also the INDICARE project at: www.ivir.nl/publications/helberger/INDICAREStateoftheArtReport.pdf. For analysis of the impact of Online Music Stores on user rights, see the Berkman Center's case study, “iTunes: How Copyright, Contract, and Technology Shape the Business of Digital Media”; and “British Music Fans Experience Digital Frustrations”, digitalmusicnews.com (26 April 2005).

References

- Alexa (2006), “Global Top 500”, www.alexa.com/site/ds/top_sites?ts_mode=global&lang=none, accessed 8 June.
- All Party Parliamentary Internet Group (2006), “Digital Rights Management”, Report of an Inquiry by the All Party Internet Group, www.apig.org.uk/current-activities/apig-inquiry-into-digital-rights-management.html.
- Behrendt, W. (2003), “Dossier on Digital Games and Learning – Paradigms, Markets and Technologies”, EP2010, September.
- Beuc (The European's Consumers' Organisation) (2004), “Digital Rights Management”, BEUC/X/025/2004, www.beuc.org.
- CEA (Consumer Electronics Association) (2005), “Digital America 2005”, www.ce.org/Press/CEA_Pubs/819.asp.
- Crandall, R. and J. G. Sidak (2006), “Video Games: Serious Business for America's Economy”, Brookings Institution and Georgetown University Law Center for the Entertainment Software Association (ESA).
- Darlin, D. (2006), “Data, Music, Video: Raising a Curtain on Future Gadgets”, *New York Times*, 2 January.
- Demunter, C. (2005), *Statistics in Focus*, Eurostat, European Communities.
- DFC Intelligence (2004), Review: Themis Report on Online Gaming 2004, at: www.dfciint.com/game_article/jan04article.html.

- DFC Intelligence (2005a), "Top Video Game Companies Generate Annual Revenue of 25 Billion According to DFC Intelligence", Press Release, 22 March.
- DFC Intelligence (2005b), "DFC Intelligence Releases New Market Forecasts for Video Game Industry", Press Release, 29 June.
- DFC Intelligence (2005c), "Interactive Entertainment Industry to Rival Size of Global Music Business", Press Release, 9 November.
- DFC Intelligence (2006a), "The Online Game Market Forecast", Report, March.
- DFC Intelligence (2006b), "The Online Game Market", Report, June.
- Digital Music News (2006), "Paid Downloads Enjoy Record Sales Week in US", January, available at: www.digitalmusicnews.com/010905dload.
- Directory of Open Access Journals (DOAJ) (2006), www.doaj.org/, accessed 10 June 2006.
- European Information Technology Observatory (EITO) (2006), "Peer-to-Peer (P2P) networks and markets", Part 2, EITO 2006.
- Electronic Publishing Services (EPS) (2004), "STM Book Publishing: A Sector in Crisis?", EPS Focus Report, London, May.
- Entertainment Software Association (ESA) (2006), "Essential Facts about the Computer and Video Game Industry, 2005 Sales, Demographics and Usage Data", May. European Commission (2006), *Study on the Economic and Technical Evolution of the Scientific Publication Markets in Europe*, Final report, DG Research, by Dewatripont, M. et al., Brussels.
- European Leisure Software Publishers Association (ELSPA) (2006), "Record Sales for Games Market", ELSPA Press Release, 9 January.
- Faultline (2006), "BBC Closes out Deal for Showing UK TV over P2P. Ground-breaking PACT", 8 June.
- Gasser, U. (2004), "iTunes: How Copyright, Contract, and Technology Shape the Business of Digital Media – A Case Study", June 2004, Berkman Center, Harvard University, <http://cyber.law.harvard.edu/media/uploads/81/iTunesWhitePaper0604.pdf>.
- Giles, J. (2005), "Internet Encyclopaedias go Head to Head", *Nature*, published online 14 December.
- Hines, M. (2005), Verizon Adds Disney to TV Package, *Eweek.com*, 21 September.
- Hebden, S. (2006), "Open-access research makes a bigger splash", *SciDev.Net*, 17 May.
- International Federation of the Phonograms Industries (IFPI) (2005a), *IFPI online music report 2005*, IFPI, London.
- IFPI (2005b), *IFPI Network: The Newsletter of the International Recording Industry*, October.
- IFPI (2005c), *The Recording Industry World Sales 2005*, London, 22 March.
- IFPI (2006), *IFPI Online Music Report 2006*, IFPI, London.
- Informa Telecoms and Media (2006), "The Mobile Content Industry", www.informatm.com.
- International Game Developers Association (IGDA) (2005), "2005 Mobile Games White Paper", presented at the Game Developers Conference 2005 by the IGDA Online Games SIG.
- Interactive Software Federation of Europe (ISFE) (2006), "The Economics of Gaming", www.isfe-eu.org/.
- Karagiannis, T., A. Broido and M. Faloutsos (2004), "Is P2P dying or just hiding?", University of California at Riverside, mimeo at www.caida.org/publications/papers/2004/p2p-dying/.
- KPMG for the Danish Ministry of Culture (2002), *The Interactive Culture Industry: Background Paper*, June, http://ep2010.salzburgresearch.at/knowledge_base/kpmg_2002.pdf.
- de Lussanet, M. and N. van Veen (2005), "Mobile Music Needs a Tune-Up", Forrester Research, 13 September.
- Nagel, B. and J. van Kruijsdijk (2005), "Online Media Needs to Mix Carrots with Sticks – UK Net Users are Willing to Pay Reasonable Prices for Legal Content", Forrester Research, 2 December.
- OAIster (2006), <http://oaister.umdl.umich.edu/>, accessed 10 June 2006.
- OECD (2004a), "Use of ICTs by Individuals and Households", Chapter 4, *OECD Information Technology Outlook 2004*, OECD Paris.
- OECD (2004b), "Digital Delivery", Chapter 5, *OECD Information Technology Outlook 2004*, OECD Paris.

- OECD (2005a), "Digital Broadband Content: The Online Computer and Video Game Industry", DSTI/ICCP/IE(2004)13/FINAL.
- OECD (2005b), "Digital Broadband Content: Music", DSTI/ICCP/IE(2004)12/FINAL.
- OECD (2005c), "Digital Broadband Content: Scientific Publishing", DSTI/ICCP/IE(2004)11/FINAL.
- OECD (2005d), "Digital Broadband Content: Mobile Content – New Content for New Platforms", DSTI/ICCP/IE(2004)14/FINAL.
- OECD (2005e), *Main Science and Technology Indicators*, 2005/2.
- OECD (2006a), OECD and Italian Minister for Innovation and Technologies International Conference on *The Future Digital Economy: Digital Content Creation, Distribution and Access*, Rome, Italy, 30-31 January, www.oecd.org/sti/digitalcontent/conference.
- OECD (2006b), "Online Payment Systems for E-Commerce", DSTI/ICCP/IE(2004)18/FINAL.
- OECD (2006c), "Digital Broadband Content: Digital Content Strategies and Policies", DSTI/ICCP/IE(2005)3/FINAL.
- OECD (2006d), "Digital Broadband Content: Public Sector Information and Content", DSTI/ICCP/IE(2005)2/FINAL.
- OECD (2006e), "Report on Disclosure Issues Related to the Use of Copy Control and Digital Rights Management Technologies", DSTI/CP(2005)15/FINAL.
- Online Publishers Association (2006), *Online Paid Content: US Market Spending Report*, March.
- Parks Associates (2005a), "Consumers Not Receptive to Music Subscriptions", Press Release, 10 February.
- Parks Associates (2005b), "Adoption of Digital Content Drives Home Networked Storage", Press Release, 8 March.
- Parks Associates (2005c), "Online Gaming Revenues to Triple by 2009", Press Release, 14 December.
- Parks Associates (2005d), "Internet Advertising Spending to Double its Share by 2010: Interactivity and Targetability Are Key Merits for Winning Ad Formats", Press Release, 10 December.
- Parks Associates (2006), "US On-demand Internet Content Revenues to Approach 9 Billion by 2010", Press Release, 17 January.
- PEW (2004), "Content Creation Online", Pew Internet and American Life Project, 29 February.
- PEW (2005), "Teen Content Creators and Consumers", Pew Internet and American Life Project, 2 November.
- PEW (2006a), "Generations Online", Report, 22 January.
- PEW (2006b), "Home Broadband Adoption 2006", Report, 28 May.
- Schrock, J. D. (2004), "Digital Rights Management – In Search of New Directions", Accenture.
- Simba (2004), "Global STM Market Analysis and Forecast 2003", Simba Information, Stamford, Connecticut, www.simbanet.com/publications/report_gstm.htm.
- The Economist* (2005a), "And Now, a Game from our Sponsor", 9 June.
- TNS (2005), "Consumer Demand for Mobile Content", research carried out for Logicacmg (6 July), at www.logicacmg.com.
- Twist, J. (2006), "The Year of the Digital Citizen", *BBC News Web site*, 2 January.
- Vickery, G. and S. Wunsch-Vincent (2005), "ICT Use in Services and the Growth of Digital Content Services", in *Enhancing the Performance of the Services Sector*, OECD, Paris.
- Waters, R. and A. van Duyn (2006), "MySpace Seeks Link with Google or Microsoft", *Financial Times*, 23 May, <http://news.ft.com/cms/s/b2f9a994-e9e0-11da-a33b-0000779e2340.html>.
- Wikipedia (2006a), "Wikipedia:About", <http://en.wikipedia.org/wiki/Wikipedia:About>, accessed 8 June 2006.
- Wikipedia (2006b), "Wikipedia Statistics", 10 May, <http://stats.wikimedia.org/EN/Sitemap.htm>, accessed 8 June 2006.
- Wikipedia (2006c), "Wikipedia Statistics: New Articles per Day", <http://stats.wikimedia.org/EN/TablesArticlesNewPerDay.htm> accessed 8 June 2006.

Table of Contents

Foreword	3
Highlights	13
Chapter 1. The IT Industry: Recent Developments and Outlook	23
Introduction	24
Recent developments in ICT supply	25
Top ICT firms	27
Semiconductors	35
Structural change in the ICT sector.....	37
Industry drivers	41
ICT markets and spending	44
Conclusion	46
Notes	47
References.....	48
Annex 1.A1. ICT Firms	49
Annex 1.A2. Tables	58
Chapter 2. ICT Trade and Globalisation of the ICT Sector	63
Introduction	64
ICT trade	64
Globalisation of the ICT sector.....	73
Conclusion	86
Notes	86
References.....	88
Annex 2.A1. Tables	90
Chapter 3. ICT-enabled Globalisation of Services and Offshoring	109
Introduction	110
The globalisation of ICT-enabled services	110
Scope and limitations of ICT-enabled globalisation of services	122
The Indian IT and ICT-enabled services sector.....	127
Conclusion	133
Notes	133
References.....	134
Annex 3.A1. Tables.....	136
Chapter 4. China, Information Technologies and the Internet	139
Introduction	140
China's global trade in ICT goods	140
The ICT supply side in China	153
Chinese ICT demand and use	161

Conclusion	171
Notes	171
References.....	175
Annex 4.A1. Figures and tables.....	179
Chapter 5. Digital Broadband Content: Developments and Challenges	183
Introduction	184
Evolution of digital content industries	185
Changing industry structures and value chains	197
Cost structures and business models	199
Drivers of digital content development and delivery.....	203
Challenges to digital content development and delivery	205
Impacts	209
Horizontal lessons	210
Conclusion	211
Notes	212
References	212
Chapter 6. ICT Skills and Employment	215
Introduction	216
Measuring ICT-skilled employment	216
How are skills needs evolving?	218
Supplying ICT skills	222
The rise of Internet recruitment	226
The trend towards distance work	228
ICT-enabled offshoring of services	231
Conclusion	239
Notes	240
References.....	241
Annex 6.A1. Figures	243
Chapter 7. Emerging Technology Applications	245
Introduction	246
Ubiquitous networks	247
Location-based services	252
Natural disaster prevention and warning technologies.....	258
Participative web	263
The convergence of nano-, bio-, and information technology	271
Conclusion	277
Notes	278
References	278
Chapter 8. ICT Policy Developments	283
Introduction	284
Developments and trends since 2003	285
Current ICT policy priorities and new directions	286
ICT policy environment: co-ordination and priority setting.....	287
Specific ICT policies and programmes	289
Policy assessment and evaluation.....	302
Conclusion	304

Annex A. Methodology and definitions	307
Notes	311
Boxes	
1.1. Methodology used to compile the ICT 250	28
1.A1.1. The shift of IT business activities to services	52
2.1. Measuring software trade	69
3.1. Trade liberalisation of potentially offshorable ICT-enabled services	111
3.2. Data discrepancies in trade in services with India	117
3.3. Chinese data on trade in services: Another statistical challenge?	118
3.4. Internationalisation of the Indian services delivery model	132
4.1. Bilateral ICT trade data discrepancies	145
4.2. Online computer and video games	158
5.1. Mobile TV: who pays?	193
6.1. Defining ICT specialists and ICT users	216
6.2. ICT specialist skills in the UK	220
6.3. Private-sector-initiated training and assessment of skills supply and demand	225
6.4. How does the Indian ICT industry tackle limited labour supply?	237
7.1. U-Korea and u-Japan: Policies towards a ubiquitous network	247
7.2. Tsunami early warning systems	260
7.3. Korea Disaster Warning System with Terrestrial Digital Multimedia Broadcasting	261
8.1. ICT as a key to broader goals	288
8.2. ICT as an agent of change	289
8.3. Government development projects and e-government in the Netherlands ..	290
8.4. ICT procurement and open source software	291
8.5. Venture finance initiatives in selected countries	292
8.6. Public Internet access points in Portugal	293
8.7. Technology diffusion in Ireland and the United States	293
8.8. ICT for business innovation, efficiency and value creation	294
8.9. Industry-based training in Portugal and the United Kingdom	297
8.10. General content initiatives	299
8.11. Public-sector content initiatives	299
8.12. ICT R&D support at the European Commission	301
8.13. A focus on widespread uptake and use of electronic settlement/payment ..	302
8.14. Promotion of a culture of security in OECD countries	303
8.15. ICT programme evaluation in selected countries	304
8.16. The business case for e-government	305
Tables	
1.A1.1. Top 10 communications equipment and systems firms	49
1.A1.2. Top 10 electronics and components firms	50
1.A1.3. Top 10 IT equipment and systems firms	51
1.A1.4. Top 10 IT services firms	52
1.A1.5. Top 10 software firms	53
1.A1.6. Top 10 Telecommunication services firms	54
1.A1.7. Activity of top 10 ICT firms by sector	54
1.A2.1. Countries represented in the top 250 ICT firms	58
1.A2.2. Top 250 ICT firms by sector	59

1.A2.3.	Top 50 ICT firms ranked by revenue	59
1.A2.4.	Share of Japan and the US in ICT sub-sector R&D expenditures, 2002.	60
1.A2.5.	ICT spending, 2000-05	61
1.A2.6.	Emerging economy ICT spending by segment, 2000-2005	62
2.1.	Annual growth in electronics goods production, trade and sales, 1994-2004	74
2.2.	US intra-firm trade in ICT goods and services, 2004	77
2.3.	Foreign-owned enterprises in Sweden's ICT sector, 2003	85
2.A1.1.	OECD trade in ICT goods, 1996-2004	90
2.A1.2.	OECD trade in ICT goods, 1996-2004	91
2.A1.3.	OECD trade in communication equipment, 1996-2004.	92
2.A1.4.	OECD trade in computer and related equipment, 1996-2004.	93
2.A1.5.	OECD trade in electronic components, 1996-2004	94
2.A1.6.	OECD trade in audio and video equipment, 1996-2004.	95
2.A1.7.	OECD trade in other ICT related goods, 1996-2004	96
2.A1.8.	OECD trade in software goods, 1996-2004.	97
2.A1.9.	Direction of ICT goods exports, 1996-2004	97
2.A1.10.	Direction of ICT goods imports, 1996-2004	98
2.A1.11.	China's trade in ICT goods, 1996-2004.	98
2.A1.12.	Trade in ICT services, 1996 and 2004	99
2.A1.13.	Share of ICT goods in total merchandise exports, 1996-2004	100
2.A1.14.	Revealed comparative advantage in ICT goods exports, 1996-2004	101
2.A1.15.	Worldwide FDI and activities of affiliates, 1990-2004	102
2.A1.16.	ICT sector cross-border M&A deals, 1995-2005	102
2.A1.17.	ICT sector cross-border M&A deal values, 1995-2005	103
2.A1.18.	ICT sector cross-border M&A values by country of target, 1995-2005	104
2.A1.19.	ICT sector cross-border M&A values by country of acquirer, 1995-2005	105
2.A1.20.	ICT sector foreign affiliates operating in the United States, 2003	106
2.A1.21.	US foreign affiliates operating overseas, 2003	107
2.A1.22.	Country origin of foreign-owned enterprises in Sweden's ICT sector, 2003 .	108
2.A1.23.	Swedish-owned ICT sector enterprises operating overseas, 2002.	108
3.1.	The share of FDI in services in total FDI, 1995 and 2003.	120
3.2.	Share of services FDI in GDP, 1995 and 2003	120
3.3.	Indicators of the stock of ICT-related infrastructure, selected countries, 2004.	123
3.4.	Business framework indicators in selected countries, 2004.	124
3.5.	Selected examples of data regulations	126
3.6.	The global delivery model and geographical choice	131
3.A1.1.	IMF balance of payments categories	136
3.A1.2.	Sectors distinguished in the OECD Direct Investment Statistics Database . .	137
3.A1.3.	Infrastructure indicators in selected countries, 2004	138
4.1.	Top five Chinese ICT import and export items by 4-digit HS code, 2004	144
4.2.	Eight ICT firms among top ten enterprises from abroad in China, by 2003 revenue.	149
4.3.	Main indicators for foreign funded communication equipment, computers and other electronic equipment enterprises in China, 2003 and 2004	149
4.4.	Examples of foreign ICT-related R&D centres in China, 2005	152
4.5.	Chinese production of integrated circuits, micro-computers and mobile phones.	154
4.6.	Top 10 Chinese electronic product providers in 2005	156

4.7.	Penetration of durable consumer goods in urban and rural households at year end	163
4.8.	PC ownership by income level, 2001, 2002 and 2004	164
4.9.	Total and .cn domain names in China, 2002-05.	166
4.10.	Aspects of Internet use which users find objectionable, December 2005 . . .	168
4.11.	Top five goods purchased over the Internet by Internet users with shopping experience, during the last 12 months	170
4.A1.1.	Share of foreign-invested enterprises (FIEs) in total exports and imports, 2002-05	180
4.A1.2.	Internet services most frequently used.	180
4.A1.3.	Preliminary Chinese ICT usage indicators,	181
4.A1.4.	Goods bought over the Internet by Internet users with shopping experience during the last 12 months	181
4.A1.5.	Barriers to purchasing on line	182
5.1.	Top 10 digital music markets, Internet and mobile phone sales, 2005	189
5.2.	Distribution of simultaneous P2P users in OECD countries, peak use April 2006.	202
5.3.	Proportion of Internet users playing/downloading games and music, by age group, selected European countries 2004	205
6.1.	IT jobs categories	219
6.2.	Salary and demand changes by job title	220
6.2.	Examples of job offers under IT related job categories.	221
6.2.	Top 25 IT specialist skills in demand in the United Kingdom in 2005Q4.	221
6.3.	Percentage of students reporting how well they perform routine tasks, Internet tasks and high-level tasks on a computer (OECD average)	223
6.4.	Markets shares of US and UK online recruitment sites, February 2006 (ranked by "visits")	228
6.5.	Importance of telework in selected EU countries and Japan, 2002	230
6.6.	Indicators of the presence of skills required for ICT-enabled offshoring, such as ICT and language skills, selected countries	236
7.1.	Overview of the main position-determining equipment	254
7.2.	Examples of participative web services and applications with varying levels of user involvement.	263
7.3.	Blogs and personal websites, net communities and chat monthly, UK rankings, February 2006	264
7.4.	Overview of microarray applications.	274
8.1.	Summary of OECD country ICT policy responses, 2005, 2003 and 2001	285
8.2.	Summary of country ICT policy priorities, 2005.	287
8.3.	Changing ICT policy priorities for growth and competitiveness.	306

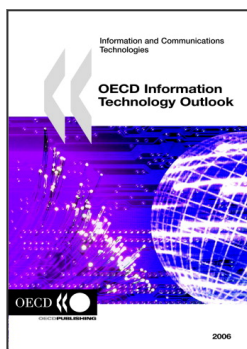
Figures

1.1.	Quarterly shipments of ICT goods by segment, United States, 2001Q1-2006Q1.	25
1.2.	Monthly exports of ICT goods (NACE 30+32), Ireland, January 1997-February 2006	26
1.3.	Growth of monthly sales by IT services industries, Japan, June 2002-April 2006.	26
1.4.	Top 250 ICT firms' performance trends, 2000-05.	29
1.5.	Top ICT firms' total revenue and income trends, 2000-05.	29
1.6.	Top 250 ICT firms' revenue by country of registration.	30
1.7.	Top 250 ICT firm revenue shares by sector, 2005	31
1.8.	Top 250 ICT firm revenue trends by sector, 2000-05.	32

1.9.	Top 250 ICT firms, trends in net income by sector, 2000-05	33
1.10.	Top 250 ICT firm R&D intensity by sector, 2000-2005	33
1.11.	Worldwide semiconductor market by region, 1990-2005	35
1.12.	Worldwide semiconductor market by segment, 1990-2005	36
1.13.	Worldwide market share of front-end semiconductor equipment manufacturers, 2004	37
1.14.	Share of ICT valued added in business sector value added, 1995 and 2003	38
1.15.	Share of ICT employment in business sector employment, 1995 and 2003	40
1.16.	ICT R&D percentage share in GDP	41
1.17.	ICT R&D percentage share in GDP by country, 2002	42
1.18.	ICT sub-sector R&D expenditures as a share of total OECD area ICT R&D	42
1.19.	ICT R&D personnel 2002 (full time equivalents)	43
1.20.	Worldwide ICT spending by market segment, 2000-08	44
1.21.	ICT spending by market segment, 2005	45
1.22.	ICT spending growth, 2000-05	46
2.1.	OECD trade in ICT goods, 1996-2004	65
2.2.	OECD communication equipment trade, 2004	66
2.3.	OECD computer equipment trade, 2004	66
2.4.	OECD electronic components trade, 2004	67
2.5.	OECD audio and video equipment trade, 2004	68
2.6.	OECD software goods trade, 2004	69
2.7.	Direction of OECD ICT goods trade, 1996-2004	70
2.8.	ICT goods exports by region, 1996-2004	71
2.9.	Computer and information services trade, 2004	72
2.10.	Communications services trade, 2004	73
2.11.	Share of ICT goods in total merchandise exports, 1996-2004	75
2.12.	Revealed comparative advantage in ICT goods, 1996-2004	75
2.13.	Value of cross-border M&As in ICT and non-ICT industries, 1995-2005	79
2.14.	Cross-border M&As deals in the ICT sector, 1995-2005	80
2.15.	ICT sector cross-border M&As deals by region, 1995-2005	81
2.16.	Foreign affiliates' share of turnover 2002 percentages	83
2.17.	US cross-border and affiliated services sales, 1990-2003	84
3.1.	Top 30 country shares of reported exports of other business services and computer and information services, 1995 and 2004	113
3.2.	Exports of other business services and computer and information services, absolute numbers and per cent of GDP, selected countries, 1995-2004	113
3.3.	Top 30 country shares of reported imports of business services and computer and information services, 1995 and 2004	114
3.4.	Trade balance for other business services and computer and information services as a percentage of GDP, selected countries, 1995 and 2004	115
3.5.	Countries with rapid growth in reported exports of other business services and computer and information services	115
3.6.	Countries with rapid growth in reported imports of other business services and computer and information services	116
3.7.	The share of services and manufacturing in the turnover of affiliates located abroad and controlled by the compiling country, 2002	121
3.8.	The share of foreign controlled affiliates in turnover of the ICT sector, 2002 ..	121
4.1.	Imports and exports of ICT goods	142
4.2.	China's trade balance by ICT goods categories, 1996-2004	143

4.3.	China's trade balance in ICT goods, 2004	144
4.4.	Bilateral ICT trade figures as reported by China and the United States for 2004	145
4.5.	China's ICT goods export and import destinations, 2004.	147
4.6.	US majority-owned foreign affiliates in the computer and electronic product and information sector in China, 1999-2003/04.	151
4.7.	Revenue of selected Chinese ICT firms, 2000-04	156
4.8.	Chinese software revenue and exports.	158
4.9.	Chinese Internet firm revenue, 2003-2005 and search engine market share in Beijing, 2005	159
4.10.	Chinese ICT spending, 2001-05 and distribution of Chinese and US ICT spending, 2001-05	162
4.11.	Internet and broadband penetration in China and the OECD area, 2001-2005. .	165
4.12.	Services most frequently used, December 2005	167
4.A1.1.	China's imports of ICT goods, 1996-2004	169
4.A1.2.	China's exports of ICT goods, 1996-2004.	169
5.1.	OECD broadband subscribers per 100 inhabitants, December 2005	186
5.2.	Mobile subscribers and pre-paid card users per 100 inhabitants, OECD countries, 2004.	192
5.3.	Global use of peer-to-peer network (fast-track and all monitored networks), measured in simultaneous audience at peak volumes (in millions), March 2003-March 2006.	201
5.4.	File format breakdown for OECD countries, based on FastTrack data, March 2006	203
6.1.	Share of ICT-related occupations in the total economy, narrow definition, 1995 and 2004	217
6.2.	Share of ICT-related occupations in the total economy, broad definition, 1995 and 2004	218
6.3.	The relative importance of unemployed ICT specialists and ICT users, selected countries, 1998 and 2004	219
6.4.	Proportion of Internet users looking for a job or sending a job application (past three months), by employment status, 2005	227
6.5.	Proportion of Internet users (employees) performing selected work activities outside the premises of their employer (past 3 months), 2004	229
6.6.	Share of employment potentially affected by ICT-enabled offshoring of services, 1995 and 2004	231
6.7.	The relative importance of the unemployed in occupations potentially affected by offshoring, selected countries, 1998 and 2004.	232
6.8.	The share of employment potentially affected by ICT-enabled offshoring of services: EU15, United States, Canada and Australia 1995-2003, broken down by clerical and non-clerical-type occupations	233
6.9.	Tertiary education attainment, 2003.	237
6.10.	Employment and export growth, 2000-2005.	238
6.A1.1.	The share of employment potentially affected by ICT-enabled offshoring of services, selected countries, 1995-2004	244
6.A1.2.	Number of doctorates in science and engineering awarded to foreign citizens in the US by citizenship, 2003	244
7.1.	Overview of different RFID applications	249
7.2.	The value chain of location-based services	253
7.3.	Number of people affected per disaster type per year	258

7.4. Economic and insured losses due to disasters: absolute values and long-term trends (2005 values).....	259
7.5. Ajax web application model.....	265
7.6. The total number of blogs March 2003 – April 2006	267
7.7. Posts per day September 2004 – January 2006	268
7.8. Language distribution of blogs indexed by Technorati	268
7.9. Internet users per language	269
7.10. Fields of applications of converging technologies.....	273
7.11. Mode of operation of cochlear implants.....	276
8.1. ICT policy framework	284



From:
OECD Information Technology Outlook 2006

Access the complete publication at:
https://doi.org/10.1787/it_outlook-2006-en

Please cite this chapter as:

OECD (2006), "Digital Broadband Content: Developments and Challenges", in *OECD Information Technology Outlook 2006*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/it_outlook-2006-7-en

This work is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of OECD member countries.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to rights@oecd.org. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at info@copyright.com or the Centre français d'exploitation du droit de copie (CFC) at contact@cfcopies.com.