CHAPTER THREE

Trends in the Information Society

3.1 Overview

As explained in chapter two, the DOI has been designed to explore the trends in each economy's infrastructure, opportunity and usage that are shaping the new Information Society[1]. The DOI can be used to track progress, not only since the start of the new millennium in 2000, but also looking ahead, in the adoption of new technologies such as broadband and mobile Internet. This chapter identifies explores some of these trends, at the global level, as well as their likely impact on the evolution of the digital divide. In particular, the DOI can be used to monitor the transformation of the telecommunication sector towards Next-Generation Networks (NGN) that are all-digital, primarily based on an IP platform, and which increasingly use the airwaves rather than fixed lines.

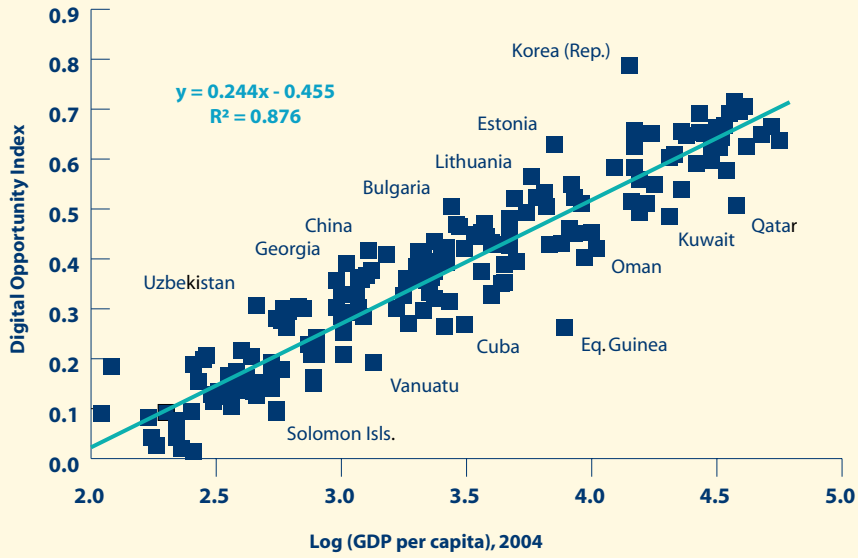
The main insights from the DOI are that many parts of the developing world are making strong gains in mobile telephony and, to a lesser extent, Internet access. Average prices of telecommunications are falling rapidly worldwide. Meanwhile, however, developed countries are forging ahead with new technologies and ever-faster access. The nature of the digital divide is therefore changing: from a disparity in the availability of ICTs towards differences in the quality of the user experience. Strategies to promote ICT development and digital inclusion must take these trends into account, as the next chapter shows.

3.2 ICTs and Income

Much has been written about ICTs as key drivers of national economic performance and the relationship between the DOI and income per capita is evident (see Figure 3.1). High income countries are associated with greater digital opportunity (and vice versa), suggesting that some countries have established virtuous circles, with high GDP per capita

Figure 3.1: How Digital Opportunity relates to national economic performance

The chart shows the relationship between DOI and national wealth, as indicated by GDP per capita, using a logarithmic scale.



Source: ITU/KADO Digital Opportunity Platform.

facilitating investment in ICTs, whilst ICT-intensive industries generate further income. However, it is difficult to identify the precise mechanics of the relationship between ICTs and improved economic performance, prove causation, or isolate the influence of other endogenous variables[2].

Positive and negative outliers fall around this trend line—economies that fare better and worse in the DOI than would be predicted on the basis of their level of wealth. The Republic of Korea, China and certain economies of the former Soviet Union achieve higher DOI scores than their income would suggest (Figure 2.4), while some of the Gulf States, Cuba and Equatorial Guinea have lower DOI scores than predicted by their national income (Figure 3.1). As shown in Chapter one, the DOI measures growth in new and innovative technologies, as well as 'technological leapfrogging'. Some of the positive outliers may be explained by high ratios of broadband to Internet subscribers, as discussed later. Some of the negative outliers may be explained by the fact that their GDP per capita is high as a result of oil production and other natural resources.

The average DOI score worldwide in 2004/05 is 0.37. However, there are big disparities in economies' prospects, with low income economies averaging less than half of this at 0.16. By contrast, the average DOI score for high-income economies is nearly four times the low-income score at 0.61 (see Figure 3.2, right). Europe is the most advanced region (0.55), followed by the Americas (0.4). DOI scores show that basic telecom access and affordability are the main areas of achievement for most countries (the dark blue area in Figure 3.2). In low-income countries, digital opportunity mostly derives from access to cellular service and affordable telecoms. Meanwhile, high-income countries are successfully realising digital opportunity through high-performance infrastructure (e.g., broadband) and the use of advanced technologies.

3.3 Digital Opportunity around the world

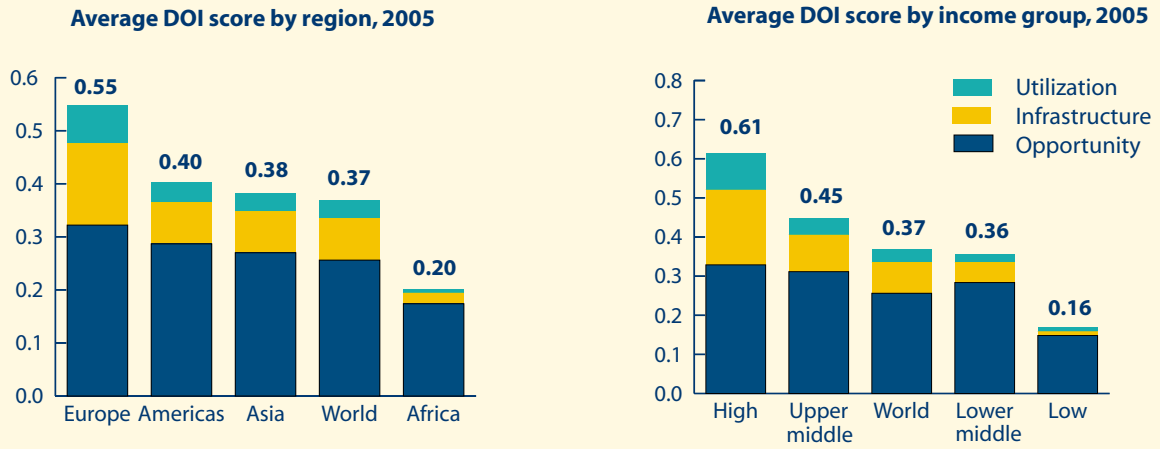
DOI scores are also sharply differentiated according to region (see Figure 3.2, left). Europe, the Americas and Asia all have average DOI scores higher than the world average of 0.37, while Africa has an average DOI score of 0.20, mainly due to limited Utilization and fixed line infrastructure. Economies can be divided into three different categories:

3.3.1 High DOI scores (0.45 and above)

These economies are mostly developed economies from Europe, North America, East Asia and the Pacific. They include all the OECD member states, except Turkey and Mexico. These economies provide good digital opportunity for most of their inhabitants, with extensive infrastructure, generally low prices and widespread use of new technologies. Seychelles and Mauritius are the highest-ranking African economies. Chile is the highest-ranking Latin American country at 40th, followed by Argentina at 51st. Several of the Arab States achieve notably good rankings, such as Bahrain at 33rd place, the United Arab Emirates at 35th place and Qatar in 44th place. Caribbean states also generally do well in the DOI. This may be due to an 'island effect', where small islands may specialise in ICT-intensive offshore industries reliant on telecommunications. Barbados, Jamaica and Antigua and Barbuda all have high DOI scores. However, this is not so apparent in the Pacific, where island effects appear to be countered by the fact that many small island developing states have only small local markets and thus lack economies of scale and are not served by submarine fibre optic cables. Most High-DOI economies have an Opportunity score far in excess of 0.95 (Hong Kong, Macao and Singapore have the greatest opportunity, due to full mobile coverage and affordable prices). High-DOI economies also have good infrastructure, with an average Infrastructure index of 0.51.

Figure 3.2: The Digital Opportunity Index worldwide

The different make-up of the DOI worldwide, world average and by income region.



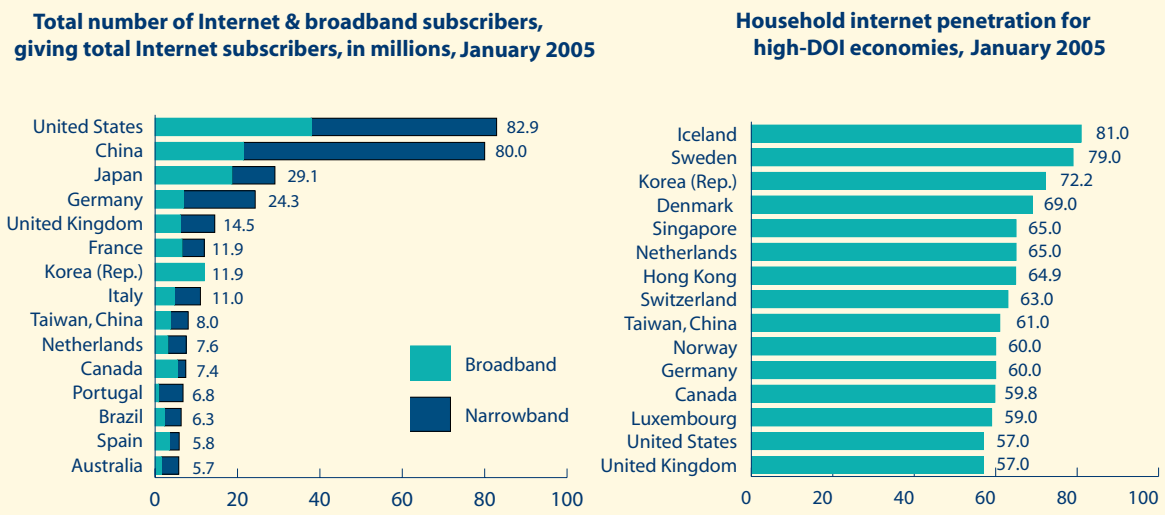
Source: ITU/KADO Digital Opportunity Platform.

The factor that really sets these countries apart, however, is their high Utilization averaging 0.25, due to their high Internet and broadband subscriber penetrations. The Republic of Korea stands out with an overall DOI score of 0.79 ahead of Japan at 0.71 and Denmark at 0.70. This is partly due to its pioneering take-up of 3G mobile technology (see Figure 3.9) and leading broadband penetration in 2004 (see Figure 3.3, left). The Asian Tigers and Scandinavian countries lead in Internet subscriptions, with around a third of their population subscribing to the Internet, but only half of these subscribed to broadband services. This is in contrast to the Rep. of Korea, where virtually all Internet users are broadband subscribers, with access to faster, advanced services such as video, teleconferencing, multiplayer gaming and triple play. These different profiles of Internet usage could result in the development of more varied skill sets and contrastingrates of innovation and, over the longer term, may shape the Information Society differently, according to the type, speed and capacity of Internet access available.

and usage. For example, some countries have good levels of infrastructure, but score somewhat lower in usage.

It is rare for an economy to have higher Utilization than Infrastructure (as would be predicted from the sequence of sub-indices). Utilization exceeds Infrastructure in only six countries: Maldives, Morocco, Peru, Myanmar, Senegal and Venezuela. Apart from Myanmar, these are medium-DOI countries and they all have DOI scores above expectations based on income (see Figure 3.1). These countries are leveraging their investments in infrastructure well to yield more advanced forms of usage. Morocco and Peru rank highly despite their weak Infrastructure scores, due to their high ratios of broadband subscribers as a proportion of Internet subscribers. This is an example of technological 'leapfrogging'.

Figure 3.3: Different profiles of the Information Society in High-DOI economies



Source: ITU/KADO Digital Opportunity Platform.

3.3.2 Medium DOI scores (0.30-0.45)

This group consists of diverse economies from Latin America, the Caribbean, Asia and North Africa. The upper middle income African states of South Africa, Botswana and Gabon feature in this category, as well as Namibia and Senegal. Poorer European countries generally also have medium DOI scores (e.g. Albania, Belarus, Turkey and Ukraine). Malaysia is the highest-ranked developing country from Asia in the group. Medium-DOI countries also include the developing giants of China, Brazil and Indonesia, but interestingly, not India. These countries have high average Opportunity, at around 0.90, due to good mobile coverage and relatively low prices. What distinguishes this group from the low DOI economies is reasonable infrastructure and some use of advanced technologies, but only at levels around a third of those achieved by high DOI economies. Within this group, economies often differ in their balance of infrastructure

3.3.3 Low DOI scores (0.30 and less)

Digital opportunity in these countries is still mostly expressed in terms of potential access to the Information Society, that has not yet been realized. These countries are among some of the poorest in the world, with low levels of infrastructure, limited availability of the Internet and broadband and high prices as a proportion of local incomes. An hour's Internet access per day exceeds the average daily income in most of these countries.

India and Swaziland stand out in this category due to their high Opportunity scores of 0.80. India is enjoying strong and sustained reductions in the price of telecommunications, as measured by the Telecommunication Regulatory Authority of India (see Figure 2.11 in Chapter 2). India also has a relatively high Utilization index, with rapidly growing cellular and Internet users. However, its large and growing population

means that strong gains in the number of subscribers translate into relatively small increases in penetration and infrastructure. Nicaragua has a comparatively high usage index, due to its relatively high proportion of broadband subscribers from Internet subscribers, at around 15 per cent. However, it has no mobile broadband. What many of these economies share in common is relatively expensive telecommunication services, as a proportion of income. In order for these countries to fully participate in the Information Society, prices must be dramatically reduced so that telecom services become more affordable.

3.4 Tracking the Mobile Revolution

The communication technology offering the strongest potential for developing countries is arguably cellular telephony. The DOI can track the transformation of the telecom industry and shows the rapid expansion of mobile telephony. This makes it a useful and development-orientated tool that can be used by developing countries to chart their own path towards the Information Society and to adapt national policies to their own needs and national circumstances, as called for by Paragraph 28 of the *Geneva Plan of Action*[3].

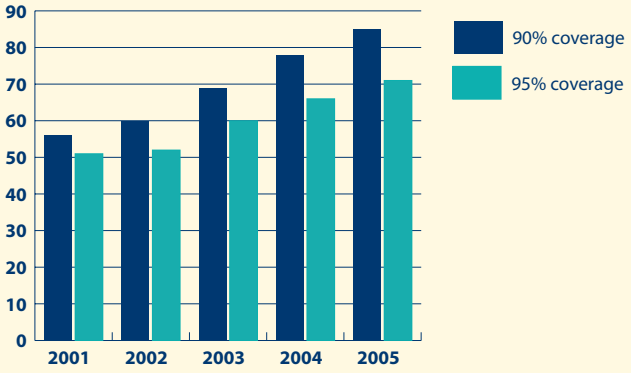
Worldwide, mobile telephony continues to grow explosively. By the end of 2000, there was a total of 740 million mobile subscribers. Just five years later, at the end of 2005, the number of mobile subscribers had reached 2.14 billion, over one third of the world's population. In other words, the market had almost tripled in size in just five years. Meanwhile, mobile telephony is growing in coverage (see Box 3.1) and capabilities, with rapid growth in mobile Internet access and 3G services (see Figure 3.9).

As shown in Figure 2.2 in Chapter two, the DOI has been constructed so it can be split into separate fixed and mobile components. In this way, the relative contributions of the fixed and mobile sectors within a country can be compared. This has the advantage of allowing developing countries to

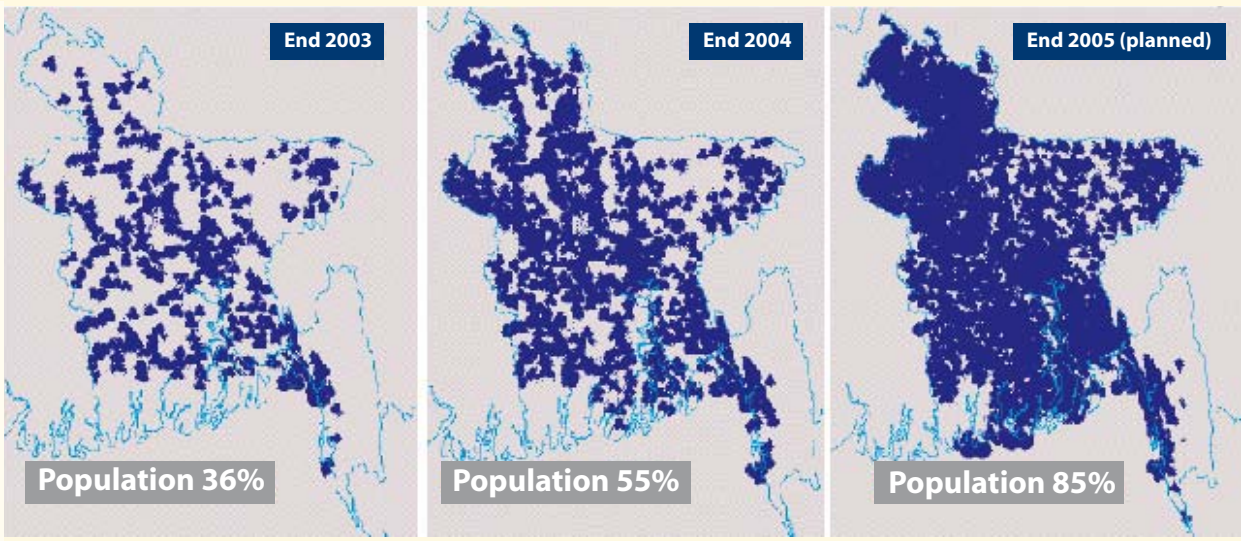
Box 3.1: Growth in mobile coverage

Mobile coverage is a basic determinant of access to telecommunications. It depends on the geography, terrain and distribution of the population within a country, but its cheapness and ease of installation mean that mobile coverage is growing rapidly in many countries, as illustrated by Bangladesh, where mobile coverage has grown from 36% in 2003 to a planned 85% coverage by the end of 2005. Around the world, 51 countries had achieved 95% mobile coverage of their population by end 2001. By 2005, 71 had achieved 95% (or near universal) coverage.

Box Figure 3.1a: Number of economies reaching 90% and 95% mobile population coverage

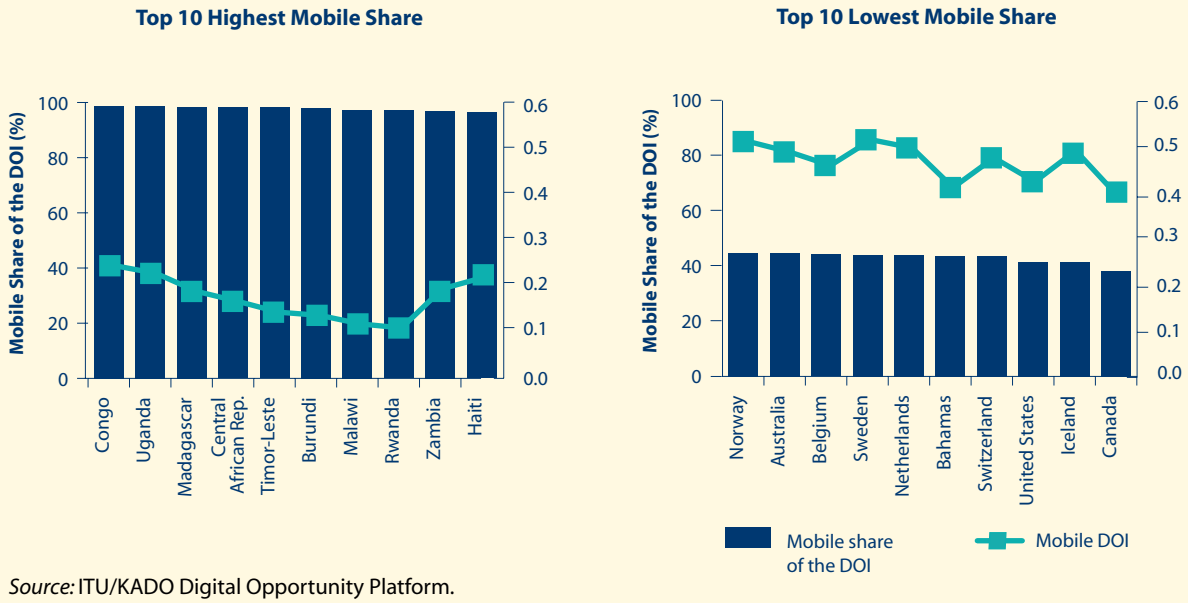


Box Figure 3.1b: Mobile coverage of population in Bangladesh, 2003, 2004 and 2005.



Source: ITU/KADO Digital Opportunity Platform and GrameenPhone, Bangladesh.

Figure 3.4: Tracking the Mobile Revolution



Source: ITU/KADO Digital Opportunity Platform.

be assessed according to their strengths in mobile telephony, rather than by their relative weaknesses in the area of fixed-line infrastructure. It also means that a country's telecom sector can be analysed over time, to assess the evolution of the two sectors. For many developing countries, wireless communications are indeed driving digital opportunity. Analysis of the mobile components of the DOI shows that the economies where mobile components contribute the highest share towards the overall DOI score are mostly African countries, where the mobile sector accounts for nearly all digital opportunity, although mobile DOI scores overall remain low at around 0.2 (see Figure 3.4, left chart). For Africa as a whole, the mobile components of the DOI contribute between 80-90 per cent of digital opportunity (see Figure 4.1 in Chapter four). The African strong-performers of Mauritius, the Seychelles and North African countries (Morocco, Algeria, Tunisia and Egypt) have mobile contributions of around 70 per cent, with some 25-30 per cent of the DOI score from fixed-line components. Their higher overall DOI score reflects the role that both fixed and mobile play in a balanced Information Society. By contrast, mobile communications account only for around 40 per cent of the overall DOI score in the countries with the smallest mobile contribution, which are mostly OECD member states (see Figure 3.4, right chart).

3.5 Trends over time in Digital Opportunity[4]

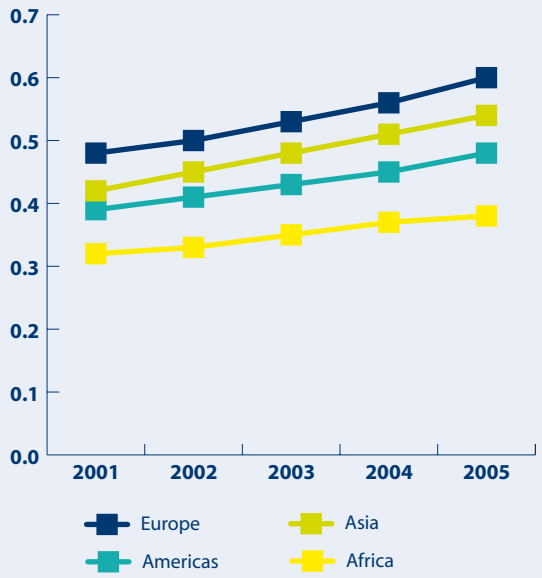
Scores in the Digital Opportunity Index are increasing rapidly, in line with the explosive growth of the telecom sector (see Figure 3.5). The major gainers in the DOI include the 'BRIC' giants of Brazil, Russia, India and China, as well as Egypt (see the Table in Figure 3.5). Gainers in the DOI come from virtually every region: Asia, Latin America, Africa, Europe and the CIS. Improvements in DOI score over time for the regions are shown in Figure 3.5. The scores for Egypt, China and Russia coincide closely, as do Poland and Chile, demonstrating that it is possible for nearly any country to show dramatic improvements in digital opportunity, despite the different profiles of their Information Societies. There are, however, very different drivers underlying these gains.

Analysis of the DOI over time shows that countries are gaining in strength in different areas. Some countries, such as Brazil and Peru, have succeeded in promoting a balanced development in all three aspects of digital opportunity - Opportunity, Infrastructure and Utilization. In high-DOI countries, such as Japan and the Republic of Korea that generally already have high Opportunity, national broadband strategies are successfully boosting Infrastructure and Utilization[5]. These economies are not complacent about ICT take-up, but are following coordinated action plans to boost just and equitable ICT development, promote innovation and facilitate a ubiquitous Information Society.

China's meteoric rise in the DOI since 2001 derives from its strong gains in Infrastructure, in part due to universal access obligations defined by China's State Council in 2000, as well as central and local government plans for infrastructure roll-out.[6] The Government has committed significant resources to the 'Cun-Cun Tong' programme to extend connectivity to rural areas and connect villages with basic telecom services.[7] Egypt has also experienced similar strong gains in infrastructure under its Masterplan I (covering 2000-2004, now extended by Masterplan II for 2004-7), which aimed to provide nationwide connectivity via an integrated telecom backbone[8]. Egypt pioneered the 'Free Internet Plan', which abolished separate Internet Service Provider (ISP) charges under a revenue-sharing agreement between Telecom Egypt and ISPs and radically slashed the cost of Internet access. These initiatives have been supplemented by the programme, 'A PC for Every Household', which offers subsidies on PCs

Figure 3.5: Gainers in the DOI, 2001-2005

Trends in regional average DOI score for the top 15 economies among those countries for which data are available, 2001-2005



Note: Data availability means that regions are not wholly representative.

Major gainers in the Digital Opportunity Index, 2001- 2005

	Economy	DOI 2001	DOI 2005	Change 2001-2005	Drivers (+.0.2)
1	India	0.17	0.29	73%	O
2	China	0.29	0.42	46%	I
3	Russia	0.32	0.44	41%	I
4	Hungary	0.40	0.55	37%	I, U
5	Peru	0.28	0.38	37%	O, I, U
6	Indonesia	0.24	0.33	36%	O
7	Brazil	0.32	0.43	35%	O, I, U
8	Poland	0.39	0.52	34%	I, U
9	Japan	0.54	0.71	33%	U
10	Venezuela	0.32	0.43	33%	U
11	Chile	0.40	0.52	32%	U
12	Egypt	0.29	0.38	32%	I
13	Rep. of Korea	0.60	0.78	31%	U, I
14	Israel	0.50	0.66	31%	U
15	Spain	0.47	0.61	28%	U
	Average	**0.37**	**0.50**	**37%**	
	40 economies	**0.43**	**0.54**	**27%**	

Note: O = Opportunity; I = Infrastructure; U = Utilization sub-index. A driver is defined as a sub-index where there is an improvement of score of 0.2 or more over the period 2001-2005.

Source: ITU/KADO Digital Opportunity Platform.

for Egyptian families, as well as a Universal Service Fund to promote universal access in telephone services.[9] These programmes have had some success in developing the fixed-line network outside Cairo. Although state roll-out plans can prove inflexible and carry risks of misallocation of resources, at lower levels of infrastructure, plans to extend fixed-line connectivity will generally never prove misguided.

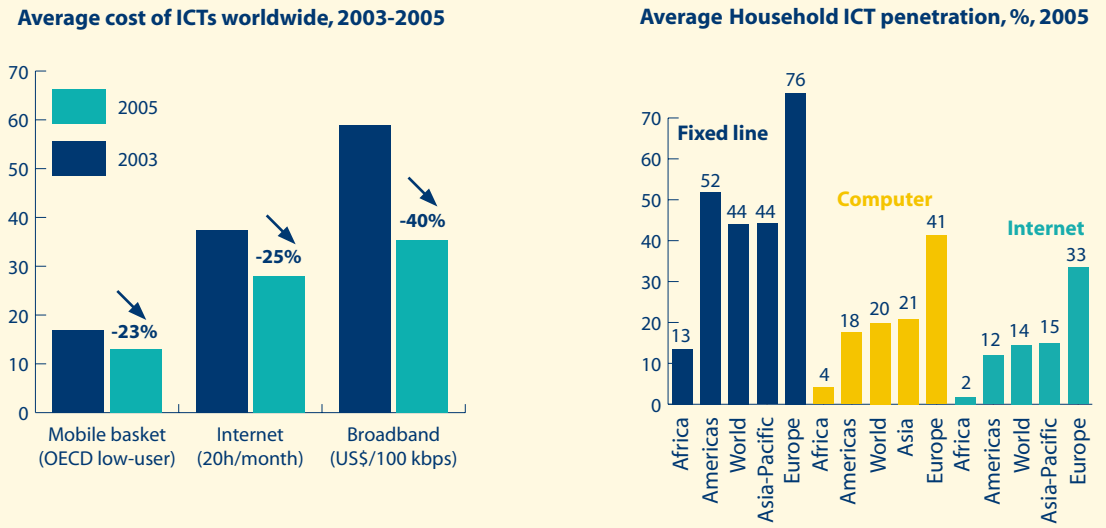
Such state-led gains in basic infrastructure are in contrast to the Latin American countries of Chile and Venezuela (as well as Poland) where early policies for privatization and a vibrant private sector have successfully promoted telecommunications and the higher-margin broadband segment, resulting in strong gains in Utilization.

The single largest overall driver behind these gains, according to the DOI sub-categories, is the reduction in telecommunication prices. ITU monitors telecom prices by different methods, according to the service:

- For mobile tariffs, the OECD low-user basket10 is used as the most representative for developing countries and low-income users;
- For internet access, the cost of 20 hours' Internet access is used, taking either dial-up or broadband, depending on which is cheaper. Where dial-up Internet is cheapest, the cost of 20 hours' local telephone calls is also taken into account (in terms of twenty calls, of duration one hour, split between peak and off-peak rates).
- For broadband, the monthly cost of access is measured according to monthly subscription price in USD per 100 kbps capacity. This allows for comparison among packages with different capacities and also allows for different technologies to be compared (e.g. ADSL, cable modem, Fibre to the Home).

Figure 3.6: The cheaper the service, the more people subscribe

Reductions in the worldwide average price for ICTs, 2003-2005 (left); and regional average household penetration rates for mainlines, computers and Internet, 2004/2005 (right).



Note: The data on regional average household penetration are based on most recently available data for 2004/2005 (right chart).

Source: ITU/KADO Digital Opportunity Platform.

All three services (mobile, Internet and broadband) show strong reductions in average price worldwide since 2003, mainly due to growing liberalisation and more competitive markets (see Figure 3.6, left chart[11]). In mobile telephony, worldwide, prices have been falling by an average of 10 per cent per year. The impact of prepaid telephony has increased the popularity of mobile telephony as the communication medium of choice. Internet access has fallen by a similar amount and in 2005, cost only three-quarters of its price in 2003. As the most recent technology, broadband Internet access is the most expensive, but it has also fallen the most – broadband has enjoyed a 40 per cent reduction in price since 2003 due to growing competition and changes towards flat-rate, unmetered pricing packages. Regardless of trends in income, significant reductions in telecom prices have added to the growing number of subscribers and household subscriptions to ICTs over the same period (see Figure 3.6, right chart).

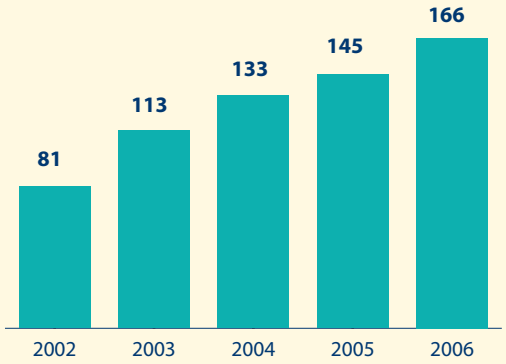
3.6 The changing face of the Digital Divide

And what of the digital divide? As we have seen, the DOI suggests strong gains in mobile telephony in the developing world, offering the prospect of greater access to telecommunications for more of the world's population. And yet the digital divide is continuing to evolve in new ways. The Digital Opportunity Index tracks access to broadband technologies, both fixed and wireless, in the proportion of Internet subscribers and mobile subscribers with access to high-speed networks offering advanced services. It could be argued that broadband is currently not relevant to developing countries, but this is not the case. Broadband and mobile Internet are increasingly important methods of ICT access for developing nations, as their rapid expansion prove. By April 2006, ADSL at speeds of 256 kbit/s and above was commercially available in 166 countries, more than twice the number of broadband economies four years earlier (see Figure 3.7).

Some developing countries, such as Senegal and the Maldives, have already had broadband for several years.

Figure 3.7: Expansion of Broadband, 2002-2006

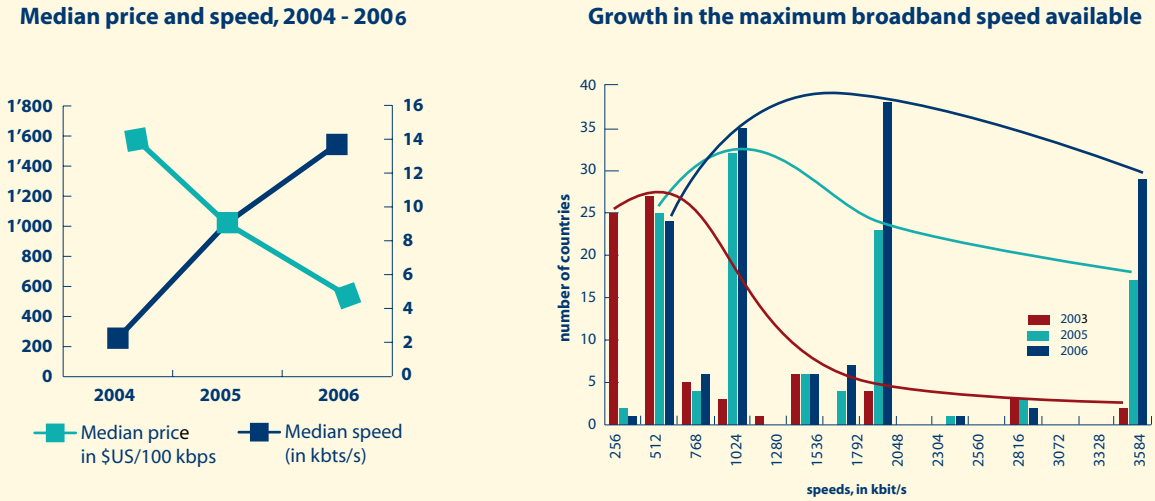
Number of countries with commercial broadband at speed 256 kbit/s or more, 2002-April 2006



Source: ITU/KADO Digital Opportunity Platform.

Figure 3.8: Trends in broadband price and speed, 2003-2006

Trends in median speed and price for the 133 countries for which data are available, 2004-6 (left); trends in maximum broadband speed available, number of countries, 2003-2006 (right).

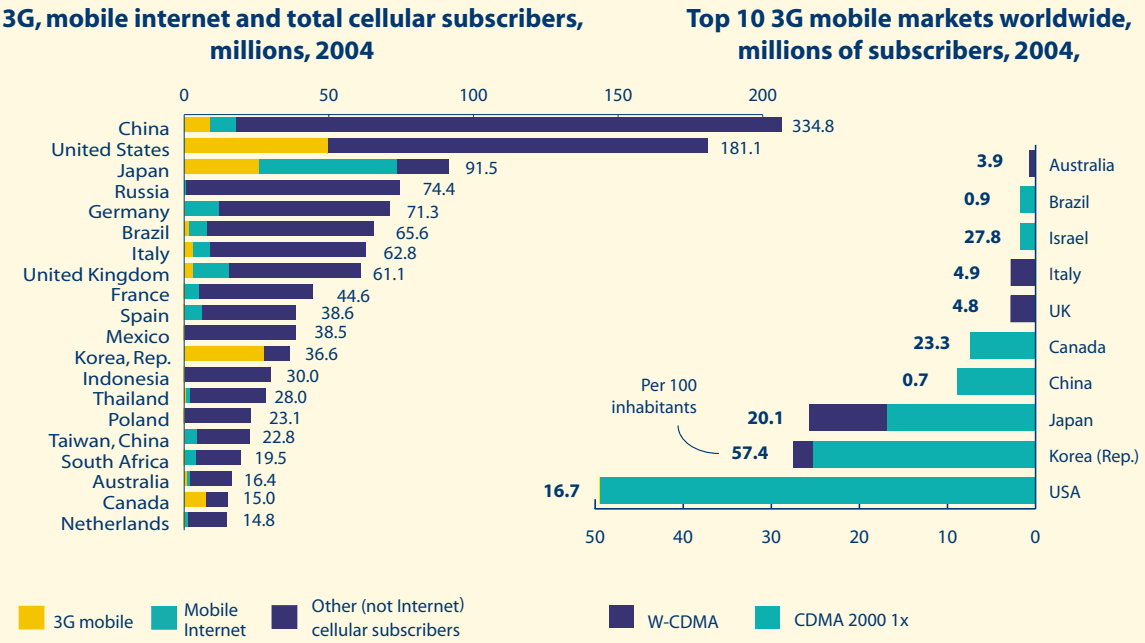


Note: Broadband speeds were sampled in August 2004, August 2005 and March 2006.

Source: ITU/KADO Digital Opportunity Platform.

Broadband ADSL service is spreading further, and being rolled out in Botswana (mid-2005 onwards[12]), Ghana (March 2006[13]) and Libya (where ADSL is being introduced over Libya Telecom and Technology's ATM network[14]). In Rwanda, 700 subscribers[15] enjoy ADSL service in Kiyovu, with service being rolled out in Kigali, Gitarama and Butare in 2006.[16] In Lebanon, a Memorandum of Understanding was signed by the Ministry of Telecommunication in January 2006 for the commercial launch of DSL from March 2006 onwards.[17] Meanwhile, the choice of services available over ADSL is growing. At the end of May 2006, Maroc Telecom launched IPTV over DSL, a first for Africa.[18] Far from being a 'developed world' technology,

Figure 3.9: Expansion of mobile Internet and 3G



Source: ITU/KADO Digital Opportunity Platform.

DSL services are rapidly expanding in reach, speed, services and capability.

Worldwide, both entry-level and average prices are falling (see Figure 3.8, left chart) due to competition (most often between cable and DSL providers, but also between DSL and Fibre To The Home, Premises, Office or Kerb: FTTx[19]) and the introduction of flat-rate pricing packages. Furthermore, speeds are increasing, with higher maximum speeds offered in many more countries (see Figure 3.8, right chart[20]). In 2003, only Japan and the Rep. of Korea offered speeds over 3 Mbps (26 and 20 Mbps respectively). By April 2006, 29 countries had commercial offers in excess of 3 Mbit/s. These were mostly OECD member states, but included some transition and developing economies. However, developed countries generally enjoy greater and more varied data services, at faster speeds and lower prices.

area in Figure 3.9, left). The DOI registers a steady expansion in the number of mobile Internet subscribers, reflected in the steady increase in Utilization over time. Most notably, the DOI shows that mobile Internet and 3G services are no longer the preserve of high-income countries and are now offered in many developing countries throughout central and eastern Asia, Latin America and the Caribbean.

The standards recognized by ITU as IMT-2000 compliant (W-CDMA, CDMA 2000 and TD-SCDMA) are making steady gains among developing markets. Markets are strongly differentiated according to technology, with W-CDMA the technology of choice for Europe and some Asian countries, while CDMA 2000 1x has been adopted throughout Latin America and many of the Commonwealth of Independent States (CIS). TD-SCDMA has yet to be launched, but is expected to feature prominently in China.[22]

Table 3.1: Lowest broadband prices, per month, and change, mid-2005 - early 2006

Economy	Company	Speed kbit/s	Price per month US$	US$ per 100 kbit/s	Change 2005-2006
1 Japan	Yahoo BB	51'200	31.19	0.07	-12.5%
2 Rep. of Korea	Hanaro	51'200	40.59	0.08	...
3 Netherlands	Internet Access	20'480	27.97	0.14	-81.3%
4 Taiwan, China	Chunghwa	12'288	22.67	0.18	...
5 Sweden	Bredbandsbolaget	24'576	56.08	0.23	-6.5%
6 Singapore	Starhub	30'720	73.17	0.24	-85%
7 Italy	Libero	12'288	37.23	0.30	-73.8%
8 Finland	Elisa	24'576	85.64	0.36	-51.4%
9 France	Free	10'240	37.29	0.36	-90.1%
10 United States	Comcast	4'096	20.00	0.49	...
11 Germany	Freenet.de	6'016	30.95	0.52	...
12 United Kingdom	Pipex	8'128	50.89	0.63	-53.6%
13 Hong Kong, China	Netvigator	6'144	51.17	0.83	...
14 Portugal	Sapo	8'128	75.82	0.93	...
15 Canada	Bell	4'096	41.26	1.01	-3.93%
Average		**18'287**	**44.33**	**0.42**	**-50.8%**

Source: ITU

The DOI also measures mobile Internet subscribers[21] (both as a proportion of population and as a share of total cellular subscribers). Mobile Internet has attracted attention as a next-generation communication market with the convergence of mobile and wired Internet technology. The introduction of 3G widely failed to meet early expectations due to problems with handset availability, system reliability, limited content offerings and the lack of a 'killer application' to arouse consumer interest. Thus, 3G only accounted for a small share of total cellular subscribers by end 2004 (green area in Figure 3.9, left). However, these problems are being overcome and the industry is forging ahead with new, advanced mobile services. A growing number of people are now enjoying mobile multimedia services. Mobile Internet also includes other 2.5G technologies such as WAP and GPRS (turquoise

For mobile broadband, by the end of 2005, there were 67 million mobile broadband subscribers in 51 countries, served by 95 operators (see Figure 3.10, left). Japan and the Republic of Korea have the highest ratios of mobile broadband subscribers, due to their early start (see Figure 3.10, right). However, mobile broadband networks have proliferated over the last few years, and other countries are fast catching up. But just as nations reach the goalpost of all of their subscribers being 3G broadband, fourth generation mobile technology may be ready, posing new challenges.

Like fixed wireless technologies, Internet access through mobile broadband networks may be the best hope for many developing countries of achieving a broadband Information Society. Many developing nations have yet to launch

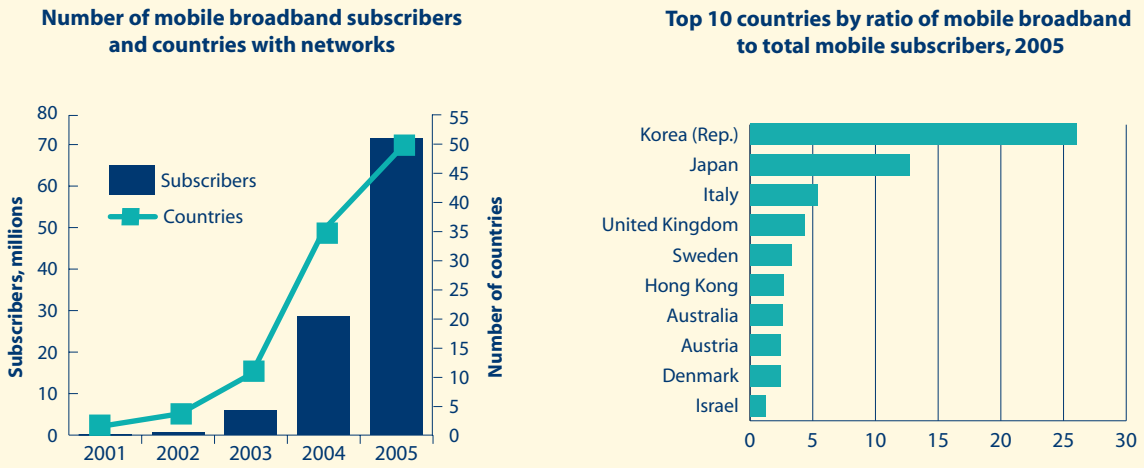
broadband mobile networks, due to a variety of factors. One major reason is that plain second generation mobile technology is still booming and operators are reluctant to make the necessary investments in broadband mobile. Another problem is spectrum complications, particularly in the Americas. However, over time these bottlenecks will be resolved, with many more countries making the transition to mobile broadband before the end of this decade.

W-CDMA networks were operational in 42 countries at the end of 2005, with 10 HSDPA networks by the end of 2005[23]. Five economies had separate networks supporting both W-CDMA and CDMA 2000 1x in 2004 (Australia, Israel, Japan, the Republic of Korea and the United States), with the roll-out of networks in both technologies in four countires (Czech Republic, New Zealand, Romania and Taiwan (China)) during 2005.

As the private sector introduces new, advanced mobile services, operators now derive a greater proportion of their revenues from data services (see Figure 3.11, left). In some countries where 3G services have been introduced, 3G has succeeded boosting the use of data services and revenues. In 2004, Hutchison 3 reported that Average Revenue Per User (ARPU) for postpaid subscribers declined in most of its operations, although ARPU increased in some markets 'reflecting the growing usage of 3G non-voice services'[24]. Hutchison 3 reports that its 3G non-voice revenues (including video-calling, content downloads and messaging) averaged 20 per cent of total revenues for 2004, compared to ten per cent in 2003.

This means that the digital divide needs to be considered in terms of services and mobile capabilities, as well as subscriber numbers and market penetration rates. Data on transmission rates for the most pervasive and popular of all mobile services - text messaging or SMS - reveal large disparities between developed and developing countries, as well as between developing countries. However, in most countries of the world, SMS are growing rapidly (see Figure 3.11, right). Given the strong lead in innovation of the leading mobile economies, the adoption of 3G and mobile Internet services may in fact reinforce inequalities and 'deepen' the digital divide, rather than bridge it. The DOI measures both basic cellular subscribers, as well as the uptake of mobile Internet and 3G, which enables it to evaluate both aspects of inequalities in access. This makes it an ideal tool for policy analysis for addressing the digital divide.

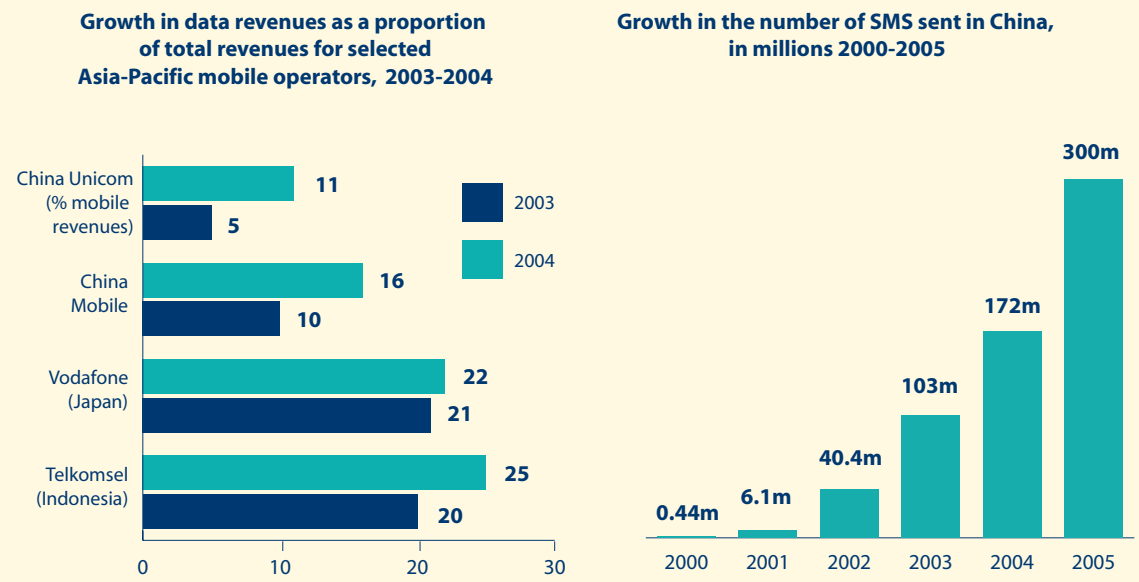
Figure 3.10: Mobile broadband status



Note: Includes only mobile broadband services in excess of 256kbit/s (ie excluding CDMA 2000 1x services).

Source: ITU/Korea Digital Opportunity Platform.

Figure 3.11: Growth in data services and SMS



Source: ITU from company reports (left); China Mobile Annual Report (right).

3.7 Conclusions

This chapter has shown how the DOI can be used to explore trends in each economy's Infrastructure, Opportunity and Utilization of Information and Communication Technologies.[25] The DOI can be used to track progress, not only since the start of the new millennium in 2000, but also looking ahead, in the adoption of new technologies such as broadband and mobile Internet. In particular, the DOI can be used to monitor the transformation of the telecommunication sector towards next-generation networks.

This chapter has also considered how these trends impact the digital divide. Discrepancies in access between countries can no longer be measured only in terms of basic penetration and access, but are taking on new dimensions in speed, mobility and capacity of access, which must be taken into account in assessments of the digital divide. Many parts of the developing world are making strong gains in mobile telephony and, to a lesser extent, Internet access. However, developed countries are forging ahead with new technologies and faster access. Through its measurement of mobile/fixed components and new technologies, the DOI can capture and measure both these trends and can be used to improve and enrich policy-making. The next chapter shows how the DOI can be used to close the policy loop and inform policy-making, in policies to promote ICT development and digital inclusion.

Endnotes

[1] More information and detail on the Digital Opportunity Index is available from: www.itu.int/doi.

[2] Many studies have explored the relationship between ICTs, income and economic growth (as well as productivity), such as Roller and Waverman (2002), Madden and Savage (1998) and Nadiri and Nandi (2003). These studies collectively suggest a strong relationship between ICTs and income, but causation has proved harder to determine, with significant endogeneity between ICTs and income. For a discussion of some of the key issues with regards to mobile telephony in particular, see Vodafone Policy Paper Series, Number 2, March 2005 issue, at: www.vodafone.com/assets/files/en/AIMP_09032005.pdf.

[3] The *Geneva Plan of Action* can be downloaded from: www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=1160|0.

[4] The DOI measures digital opportunity relative to an economy in a fully-equipped Information Society in which all households have Internet access and where telecommunications are accessible and cheap, relative to income (or 'free' in an ideal world). This reference is independent of country data, fixed and invariable, so countries' progress and digital advancement can be measured over time. DOI scores have been extended back in time until 2001 for the 40 Economist countries, where good data are available over this period.

[5] The Republic of Korea launched its Korea Information Infrastructure (KII) project in 1995 to drive gains in infrastructure and establish high-speed, high-capacity optical transmission networks in 144 regions by 2000. This was followed by the *Korea Internet White Paper* (2002) and regulations over the development of mobile Internet.

[6] 'China & the Knowledge Economy: Seizing the 21st Century', World Bank, Washington, www.info.worldbank.org/etools/ library/latestversion.asp?137742.

[7] Submission of the government of China to the WSIS Stocktaking database and Golden Book. Available from www.itu.int/wsis.

[8] 'Egypt Telecommunications Master Plan II Overview (2004)', the Ministry of Communications and Information Technology of the Republic of Egypt, available from www.mcit.gov.eg.

[9] 'Universal Service in Egypt's fast-developing competitive telecommunications market', presentation by Dr. Olfat Abd El Monsef of the Telecommunications regulatory Authority (NTRA) to TELECOM Africa, 2004, available from www.ntra.gov.eg.

[10] The methodology for the low-user OECD basket can be found at www.oecd.org.

[11] ITU has been measuring the price of different telecom tariffs since 2002. 2003 is taken as the earliest year all three technologies (mobile, Internet and broadband) have in common. Different sample sizes in different years complicate the comparison, so 2003 and 2005 were chosen as the years with the largest common sample size. However, the reduction in average price is clear.

[12] www.btc.bw/adsl/index.htm.

[13] www.ghanatelecom.com.gh/gt_aboutus/newsdetails.asp?pnum=3&id=228&catid=0.

[14] www.lttnet.com/english/coming.php and www.lttnet.com/english/sr_libyadsl.php.

[15] Issue No. 294, Balancing Act Africa, 2006, available from: www.balancingact-africa.com/news/back/balancing-act_294.html

[16] www.terracom.rw/services/internet/adsl/ and www.terracom.rw/services/internet/adsl/faq.php

[17] http://corp.terra.net.lb/Dial-Up/DSL.asp.

[18] See Maroc Telecom press release, 31 May 2006, available from: www.iam.ma/details.aspx?id=101 and www.iam.ma/fichiers/Maroc-Telecom-Communique-TVADSL-31mai06-VF(2).pdf.

[19] For example, in Japan, growing competition at deeper levels of infrastructure has eroded the incumbent NTT's market share in DSL broadband and resulted in low prices in the so-called 'broadband wars'. Competition in Japan has resulted in aggressive price reductions and sophisticated marketing strategies. It has also provided incentives for operators to move into fibre networks such as Fibre-To-The-Home (FTTH) to regain market share. See, for example, the presentation by Keiichiro Seki, Director of International Economic Affairs Division at the Ministry of Internal Affairs and Communications of Japan, at: www.itu.int/osg/spu/ngn/documents/presentations/seki-23-march-2006.ppt.

[20] Figure 3.8 shows advertised maximum speeds, which may not always available, depending on backbone load and network congestion, as well as signal attenuation, latency and routing of data. However, but data are not always available for these.

[21] Mobile Internet subscribers are defined as multimedia subscribers, WAP, GPRS, CDMA EV-DO and W-CDMA (IMT 2000 or 3G) subscribers.

[22] For a discussion of the growth of mobile multimedia services in China and Hong Kong SAR, see the country case study prepared for the ITU/BNetzA workshop on 'Defining the regulatory environment for future mobile multimedia services', Mainz, 21-23 June 2006, available at www.itu.int/osg/spu/ni/multimobile/papers/ChinaHKMobileMultimedia.pdf.

[23] According to a survey published in December 2005 by GSA, the Global Mobile Suppliers' Association, available from www.gsacom.com.

[24] Hutchison's Review of Telecommunications Operations, 2004 *Annual Report*, available from http://202.66.146.82/listco/hk/hutchison/annual/2004/telecom.pdf.

[25] More information and detail on the Digital Opportunity Index is available from: www.itu.int/doi.