



chapter three
**The Digital
Opportunity Index
(DOI)**

3.1 Using the Digital Opportunity Index (DOI)

The Digital Opportunity Index (DOI) has been designed to as a tool for tracking progress in bridging the digital divide and the implementation of the outcomes of the World Summit on the Information Society (WSIS). As such, it provides a powerful policy tool for exploring the global and regional trends in infrastructure, opportunity and usage that are shaping the Information Society.¹ As explained in Chapter one, the DOI is one of two tools adopted by WSIS as part of an agreed implementation methodology. It has a focus on the adoption of new technologies, such as broadband and mobile Internet. A time series has been developed to monitor implementation of WSIS targets since the first phase of WSIS and will continue until the WSIS review in 2015 (see Data Table 3).² The DOI thus complements the other WSIS-endorsed composite index—the ICT Opportunity Index—which has a stronger focus on traditional ICTs, such as fixed-lines and televisions, as well as on measures of literacy and educational achievement.³

This chapter explores key trends in the Information Society. Section 3.2 explains the structure of the DOI and indicators that are used to assess digital opportunity. Section 3.3 examines the latest DOI scores and rankings, for 2005/06. Section 3.4 reviews trends in the DOI over time. Section 3.5 uses the DOI to examine the key trends shaping the Information Society. It shows that many parts of the developing world are making strong gains in mobile telephony. By the end of 2008, over half the world's population should have access to a mobile phone. Meanwhile, however, developed countries are forging ahead with new technologies and ever-faster access. As shown in Chapter two, the digital divide is changing from inequalities in basic availability of ICTs to differences in the quality of the user experience. Policy-makers need to adjust their policy responses to take account of "quality", not just the "quantity" of access to ICTs.

3.2 Structure of the DOI

The DOI is a composite index comprising eleven separate indicators, grouped in three clusters of *Opportunity*, *Infrastructure* and *Utilization* (Figure 3.1d).⁴ The choice of indicators is notable, as:

- » The DOI includes price data for mobile telephony and Internet access relative to local

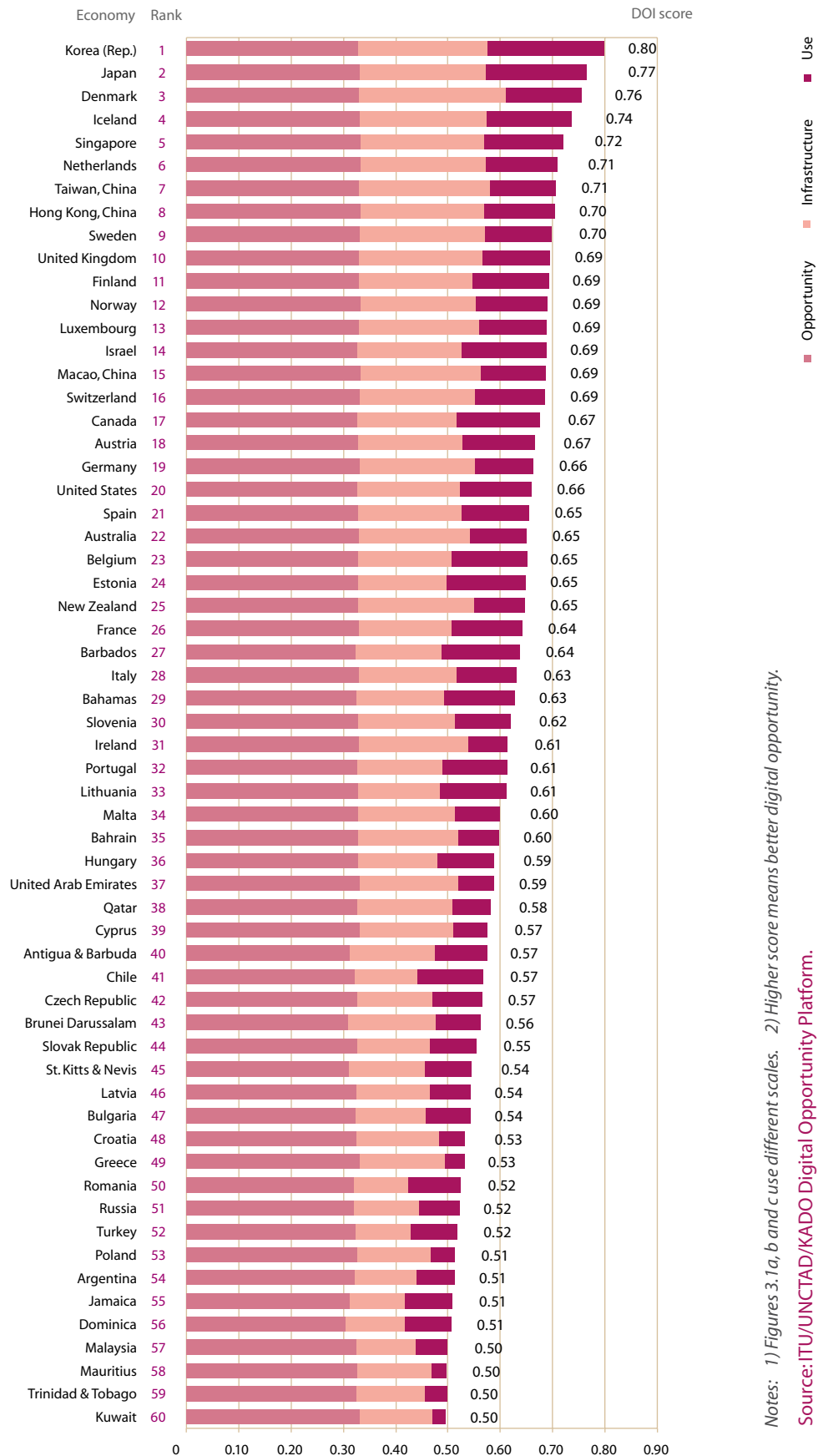
incomes to reflect the affordability of ICTs and whether consumers can pay for mobile phone or Internet access in different countries. The DOI is the only index to date that includes price data for 181 economies, which is vital in assessing effective market demand.

- » The DOI uses household penetrations (rather than per capita penetrations) for fixed lines, Personal Computers (PCs) and Internet access, as access to ICTs often begins in the home. Household penetration is appropriate for fixed lines, as they are provided on a household basis, while home access to the Internet is significant in many countries (Figure 3.7). Using household penetrations reflects more accurately the true state of access to ICTs in developing countries, where average family size is larger, so per capita penetrations appear artificially suppressed and are lower.
- » The DOI includes measures of more advanced technologies in broadband access (for both fixed broadband access and mobile broadband or 3G). This means that the DOI can reflect the startling growth in these markets. It can also be used to assess market maturity, in the proportion of Internet and mobile subscriptions that have migrated to high-speed broadband access (see Figure 3.4 on the "New Substitution").

Indicators in various data series are standardized on a scale of zero to one, by indexing relative to a reference value (data series and reference values are given in the Annex to this Chapter). For most indicators, this is 100 per cent, making the DOI simple and straightforward to calculate (simply dividing the indicator value by 100). Index scores in the three clusters are then averaged by simple average to give the overall DOI score for a country, between zero and one (no country achieves the upper or lower limit scores). Scores are directly comparable between countries and between years.

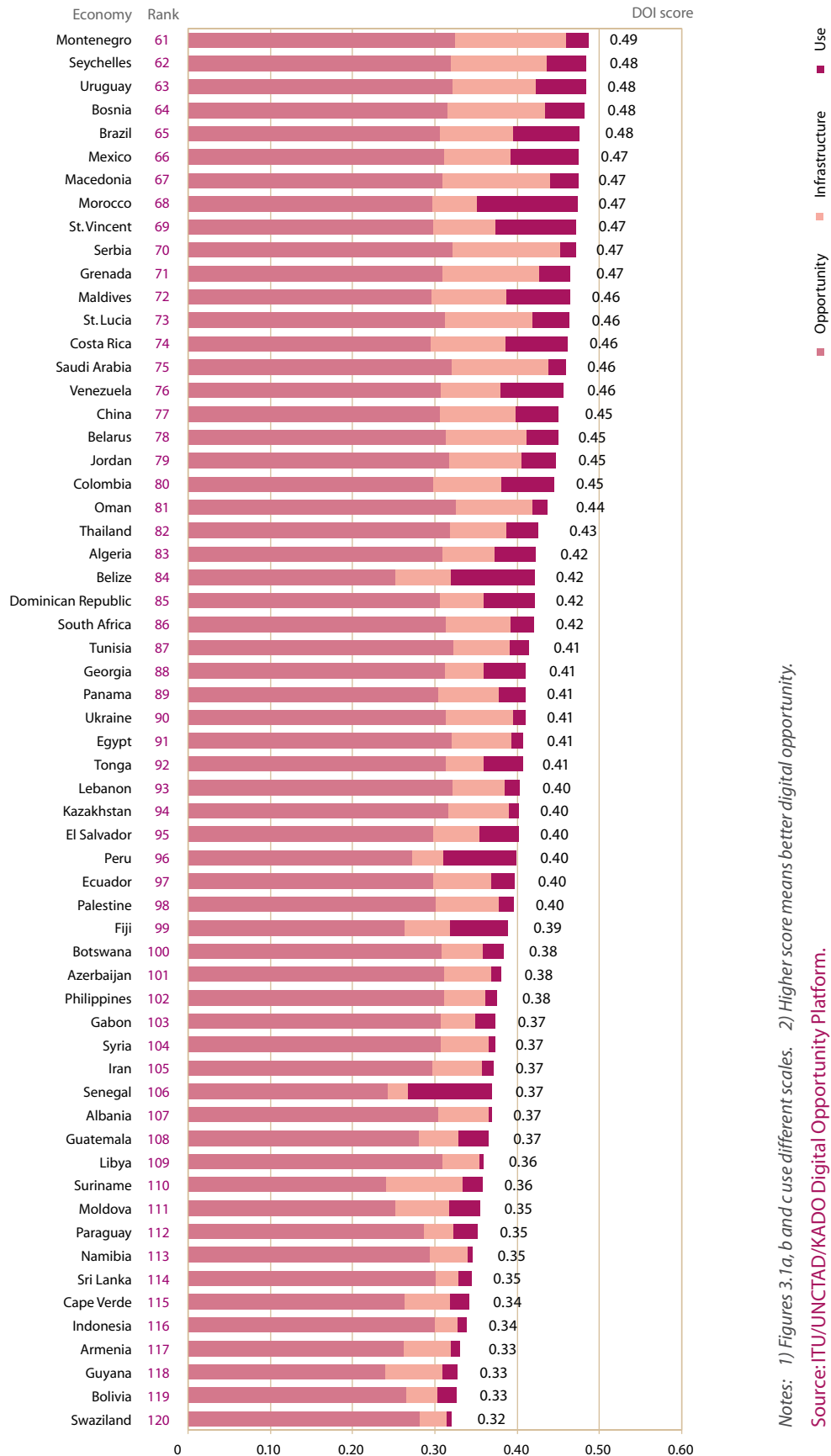
The results are remarkably straightforward and easy to use. Access to and the affordability of ICTs is condensed into a single index number between one and zero, permitting comparison of countries' scores in any one year, as well as over time. A time series has been established, stretching back to the start of the WSIS process in 2000/01. This Report presents the latest results for the DOI 2006 (Data Table 1 in the Statistical Annex). As explored in the next section, results for the DOI show strong gains in digital opportunity around the world.

Figure 3.1a: Digital Opportunity Index 2005/06 – World



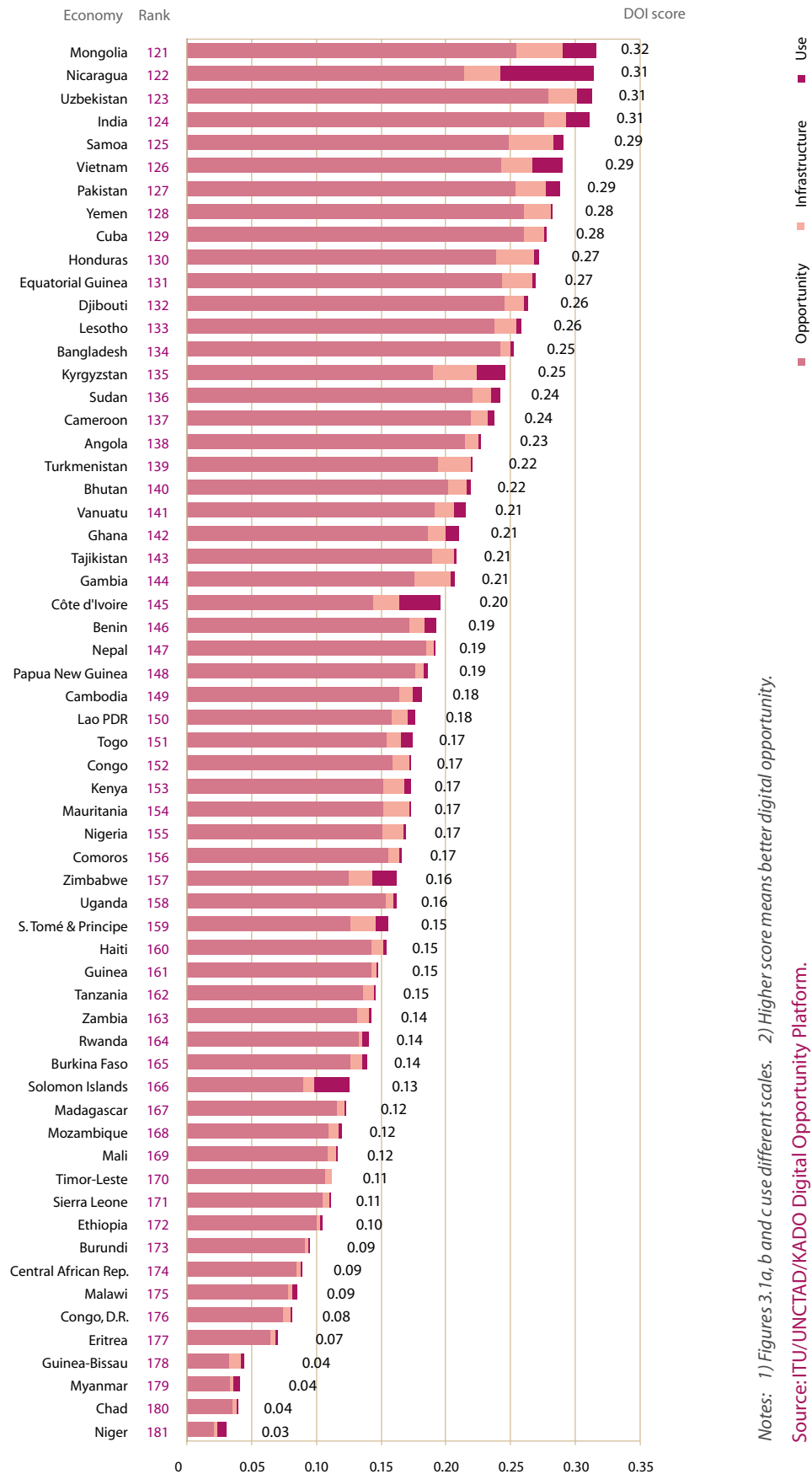
Notes: 1) Figures 3.1a, b and c use different scales. 2) Higher score means better digital opportunity.
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.1b: Digital Opportunity Index 2005/06 – World



Notes: 1) Figures 3.1a, b and c use different scales. 2) Higher score means better digital opportunity.
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

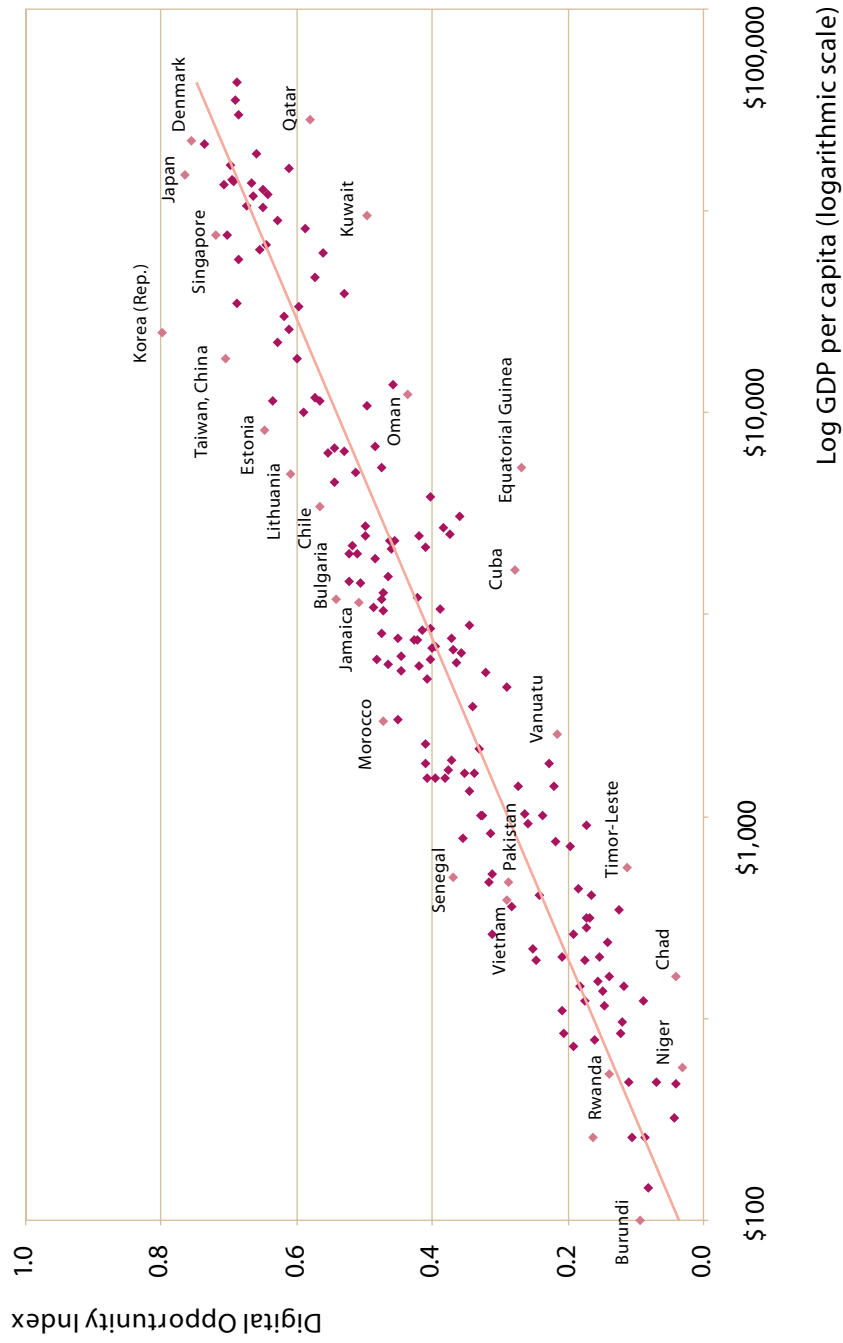
Figure 3.1c: Digital Opportunity Index 2005/06 – World



Notes: 1) Figures 3.1a, b and c use different scales. 2) Higher score means better digital opportunity.
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.1.d: How Digital Opportunity relates to national economic performance

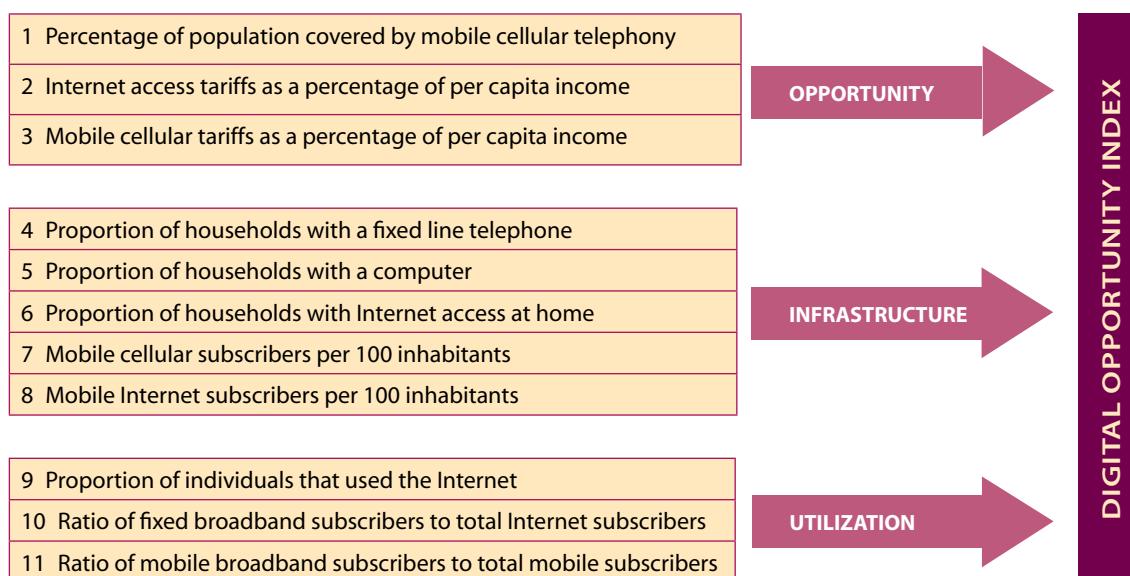
The chart shows the relationship between DOI and national wealth, as indicated by GDP per capita, using a logarithmic scale.



Note: Economies shown above the line have a higher DOI score than would be predicted by their GDP per capita. Economies below the line have a lower DOI score than would be predicted by their GDP per capita.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.1e: Structure of the Digital Opportunity Index



Note: The indicators are averaged within each category and categories are averaged to obtain the Digital Opportunity Index value.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

3.3 Digital Opportunity around the world

The average DOI score worldwide in 2005/2006⁵ was 0.40, up from 0.37 a year earlier (an increase of 8 per cent: See Data Table 3). However, there are big disparities, with low-income economies averaging less than half of this, at 0.18. In contrast, the average DOI score for high-income economies is more than three times the low-income score at 0.65 (Figure 3.2, left). Basic access to telecommunications and affordability are the main areas of achievement for most countries (the purple area in Figure 3.2, left), especially for low-income countries. High- and upper-middle income countries have made the strongest gains in digital opportunity since 2004, mainly through growth in high-speed broadband infrastructure and use of advanced technologies (Figure 3.2, right). However, small increases in average income have a much greater impact in raising digital opportunity at lower levels of income – a ‘logarithmic’ relationship (Figure 3.1e). This is similar to the relationship observed with Internet user penetration and average income (Figure 2.8). The larger gains achieved by the higher income groupings⁶

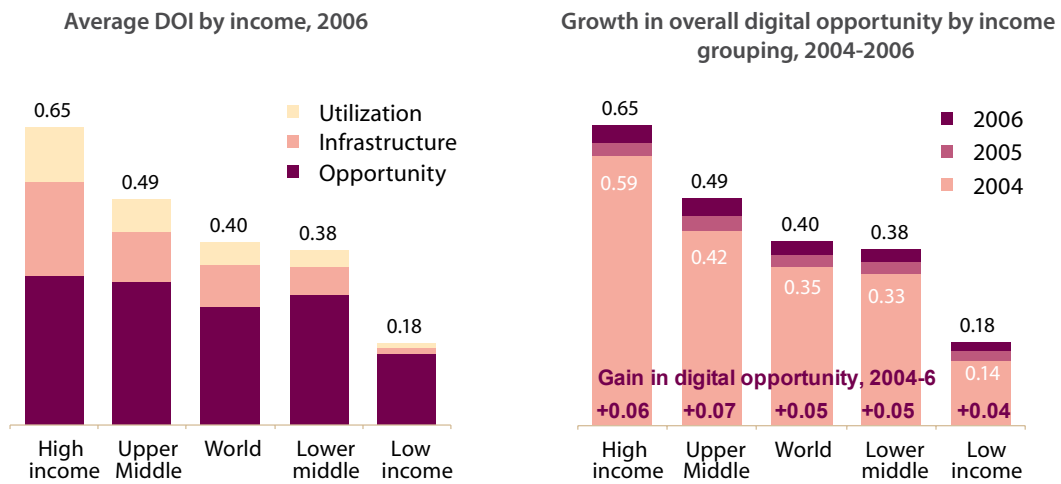
since 2004 suggest that absolute inequality⁷ (measured in percentage points) in digital opportunity may be growing.

DOI scores are also sharply differentiated according to region (Figure 3.3, left). Europe and the Americas have average DOI scores higher than the world average, Asia’s is equal to the world average, while Africa has an average DOI score of 0.22, mainly due to limited utilization and fixed line infrastructure. Europe has achieved the largest overall gain in digital opportunity over the last two years, followed by the Americas, which made especially remarkable progress in 2006. Asia and Africa have witnessed smaller gains in digital opportunity (Figure 3.3, right). The implications for the digital divide are clear: digital opportunity is becoming more sharply divided by region, not less.

3.3.1 Economies with High DOI scores (0.49+) – Surge in High-Speed Access

Economies with high DOI scores are mostly developed economies in Europe, North America, East Asia and the Pacific. They include all 30 OECD member states except Mexico. These economies

Figure 3.2: Digital Opportunity by income grouping

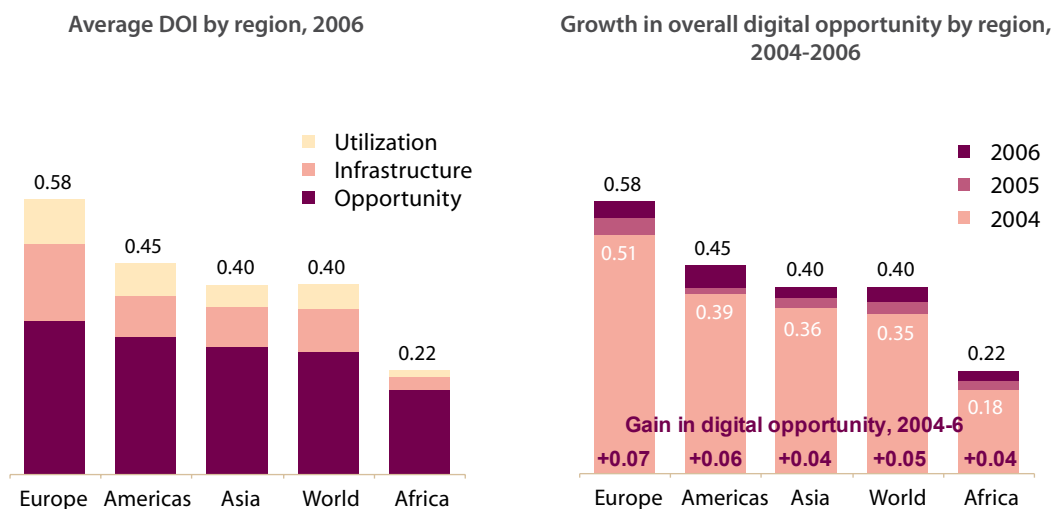


Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

provide good digital opportunity for most of their inhabitants, with varied and extensive infrastructure, relatively low prices and widespread use of new technologies. Virtually all high-DOI economies have high Opportunity, in excess of 0.99, except for a few Caribbean island states (Antigua & Barbuda, St. Kitts & Nevis and Dominica, with somewhat lower mobile coverage). High-DOI economies generally also have widely available infrastructure, with an average Infrastructure index of 0.54.

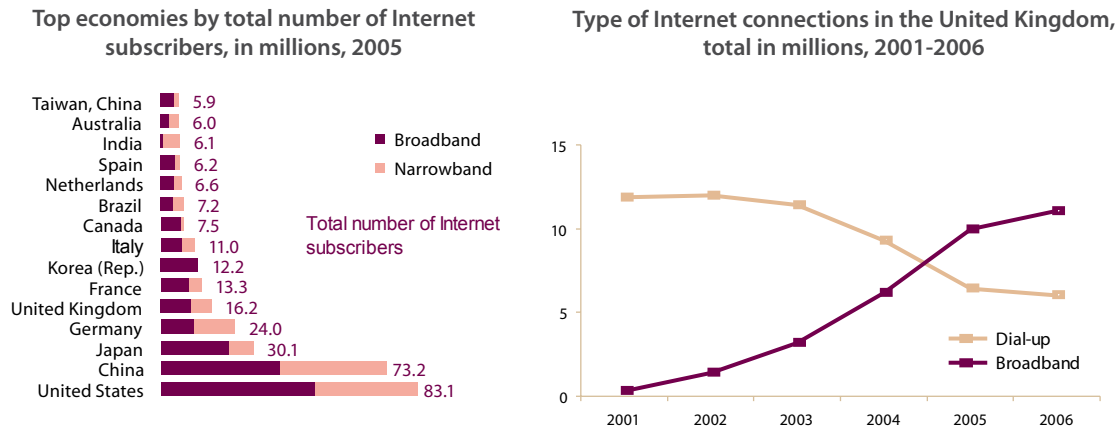
The factor that continues to set this group of countries apart, however, is their high Utilization averaging 0.33 (up from 0.25 last year), due to their high Internet usage and broadband subscriber penetrations. The Rep. of Korea stands out with an overall DOI score of 0.80, ahead of Japan at 0.77 and Denmark at 0.75. Japan and Denmark have made strong gains in digital opportunity and, if their current growth rates continue, it is likely that they will overtake the Rep. of Korea in digital opportunity in 2006/07.

Figure 3.3: Digital Opportunity worldwide



Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.4: The New Substitution



Source: ITU/UNCTAD/KADO Digital Opportunity Platform (left chart); OFCOM (UK), "The Communications Market 2006", at: www.ofcom.org.uk/research/cm/cm06/ (right chart). See also Table 10 in the Statistical Annex.

The top 25 economies in the DOI have been remarkably stable over the period 2004-2006. Indeed, the only economy to drop out of the top twenty-five was Slovenia, replaced by Estonia (studied further in Chapter four, Section 4.2.2). Rankings within the top twenty-five are consistent (suggesting the index is robust), with generally changes of only a few places up or down – the only exceptions are the United Kingdom (which rose eight places due to strong gains in broadband, with subscribers renouncing their dial-up connection – see Figure 3.4, right chart), and Canada (which falls seven places, due to its relatively weak cellular mobile penetration). Mauritius is the highest-ranking African economy, at 59th. Chile remains the highest-ranking Latin American country at 41st, followed by Argentina at 54th. The Gulf States continue to do well (including Bahrain at 35th place, the United Arab Emirates in 37th rank and Qatar in 38th rank), as do the Caribbean and other small island states.

Evolution in Internet subscriptions depends on both growth in the total size of the market, as well as the speed (quality) of connections. 2005 was a year of startling Internet growth in many countries, thanks to the boost from broadband, although the United States still remains the largest Internet market in terms of number of subscribers (Figure 3.4, left). Growth rates in Internet subscriptions are lower in high-DOI economies, but substitution is strong, with subscribers exchanging narrowband dial-up for a broadband connection. One example is the substitution of broadband for dial-up in the United Kingdom (Figure 3.4, right). In the United States, some 60 per cent of all Internet connec-

tions are now broadband, while in Japan and Spain, efforts by operators to encourage consumers towards broadband have resulted in three-quarters of Internet subscribers now using broadband. In the Rep. of Korea and Canada, virtually all Internet users are already broadband subscribers and enjoy access to faster, advanced services such as video, teleconferencing, multiplayer gaming and triple play. Substitution of broadband for dial-up has also been observed in Qatar, where broadband now accounts for two-thirds of all Internet accounts.⁸

3.3.2 Economies with Medium DOI scores (0.30-0.49) – Rounded growth

The group with medium DOI scores comprises diverse economies from Latin America and the Caribbean, Asia and North Africa. Notably, it includes the developing country giants of China, Brazil, Egypt and Indonesia, as well as India, which joins the medium-DOI countries for the first time in this year's release of the DOI. It also includes the upper-middle income African states of South Africa, Botswana and Gabon, as well as Namibia and Senegal (Box 3.1). Non-OECD European countries generally also have medium-DOI scores (e.g., Albania, Belarus, Bosnia and Ukraine). China and the Maldives are the highest-ranked developing countries from Asia in the group. Medium-DOI countries have high average *Opportunity* at around 0.89, due to good mobile coverage and relatively low prices. What distinguishes this group from the low-DOI economies is their reasonable infrastruc-

ture and growing use of advanced technologies, but only at levels around a third of those achieved by high-DOI economies. They are also growing very fast - Brazil is now the tenth-largest Internet market in the world, while India appears in the top fifteen largest Internet markets for the first time.

One interesting observation among the medium-DOI group is that there are a growing number of countries where *Utilization* scores exceed *Infrastructure*. Last year, *Utilization* exceeded *Infrastructure* scores in only six economies.⁹ This year, *Utilization* exceeds *Infrastructure* scores in nineteen economies, thirteen of which are medium-DOI economies. The strong growth in broadband worldwide means that some economies are successfully leveraging their investments in infrastructure to yield more rounded growth and more advanced forms of usage across a broad Information Society. For example, in Morocco, broadband now accounts for 98 per cent of all Internet connections in 2006 due to an aggressive marketing campaign between operators fighting for market share, resulting in high utilization

more than twice its infrastructure index (Box 3.2). This may represent a new form of technological 'leapfrogging', where operators investing in Internet infrastructure are able to adopt the latest technologies.

3.3.3 Economies with Low DOI scores (0.30 and less) – Mainly mobile

Digital opportunity in low-DOI economies is still expressed in terms of potential access to the Information Society that has not yet been fully realized. Low-DOI economies include many lower-income African and Asia-Pacific countries, 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. In order for these countries to fully participate in the Information Society, prices must be reduced so that telecommunication services become more affordable.

Box 3.1: Senegal – Reaping the Rewards of Early Reforms

Senegal has succeeded in raising its DOI score from 0.22 in 2004 to 0.37 in 2006, whilst its ranking has risen 22 places to 106th in 2006. This makes it the third-fastest rising economy worldwide in terms of increase in ranks (Table 3.3) and second-fastest in Africa. It is interesting to examine how Senegal has achieved this.

The Government undertook early reforms in important areas. The incumbent operator, SONATEL, was partly privatized in 1997, the first African telecommunication operator to be listed on a stock exchange. In 2001, Senegal established the Telecommunications and Posts Regulatory Agency (ARTP). In 2004, the Ministry of Posts, Telecommunications and New Information Technologies was created. The Government aims to make ICTs a driver of economic growth and modernization. The Government issued a sector note on telecommunications in January 2005 which calls for an increase in telephone subscribers to 3 million by 2008. This target is likely to be achieved, with 2.5 million telephone subscribers by June 2006 already.

Senegal was also connected to two submarine fiber optic cables, dramatically increasing its international connectivity. SONATEL doubled traffic bandwidth on Internet services in less than 2 years surpassing in September 2006 the mark of 1.24 Gbit/s, according to SONATEL. By 2006, Senegal had 775 Mbit/s of international Internet bandwidth, one of the highest per capita capacities in Africa. Senegal hopes to leverage its abundant bandwidth by serving as a hub for western Africa. SONATEL has launched ADSL and, by the end of 2005, some 89 per cent of all Internet connections were already broadband, suggesting a successful "technological leapfrogging" strategy.

Despite these impressive accomplishments, Senegal needs to go further if it is to be successful at using ICTs for development. Although the growth of broadband subscribers has averaged 2'000 per cent over the last five years, Internet subscriber penetration is just 2.3 per 100 inhabitants, due to widespread use of community multimedia telecentres (Box 6.3 in Chapter six). The growth in Internet traffic reflects the boom in the number of users in Senegal in recent years. As broadband prices fall, more people are using the Internet, both at work and home. Standard broadband subscriptions cost EUR80 for installation and EUR40 per month for the service, although cheaper deals are becoming available. The real key to growth in Internet use has been the surge in popularity of cybercafés, which offer a high speed Internet line for as little as EUR0.45 per hour (Box 6.3).

Source: UNCTAD, adapted from Agence de Régulation de Télécommunications (ART, Sénégal), "Le marche de l'Internet", web page, at: www.artp-senegal.org/telecharger/Fiche_Internet_2005.pdf

For many developing countries, wireless communications are driving digital opportunity. Many low-DOI economies are in sub-Saharan Africa. As a region, Africa's mobile market was the fastest-growing market over the last five years, with a 50 per cent annual average growth rate over 2000-2005, more than twice the global average over the same period (24 per cent). Mobile phones now outnumber fixed phones by nearly five to one in Africa, with some 137.2 million mobile subscribers by the end of 2005. This ratio is even higher in Sub-Saharan Africa, where nine out of every ten subscribers are using a mobile. African mobile penetration doubled from 6.5 per 100 inhabitants in 2003 to 13.1 per 100 inhabitants in 2005.

The DOI can be used to compare the fixed and mobile sectors separately, allowing policymakers, especially in developing countries, to adapt national policies to their own national circumstances, as called for by Para 28 of the Geneva Plan of Action.¹⁰ The economies where mobile components contribute the highest share towards the overall DOI score are mostly in Africa, where the mobile sector can account for as much as four-fifths of digital opportunity, although DOI scores remain generally low overall at around 0.22 (Figure 3.5). Prepaid has been a major driver

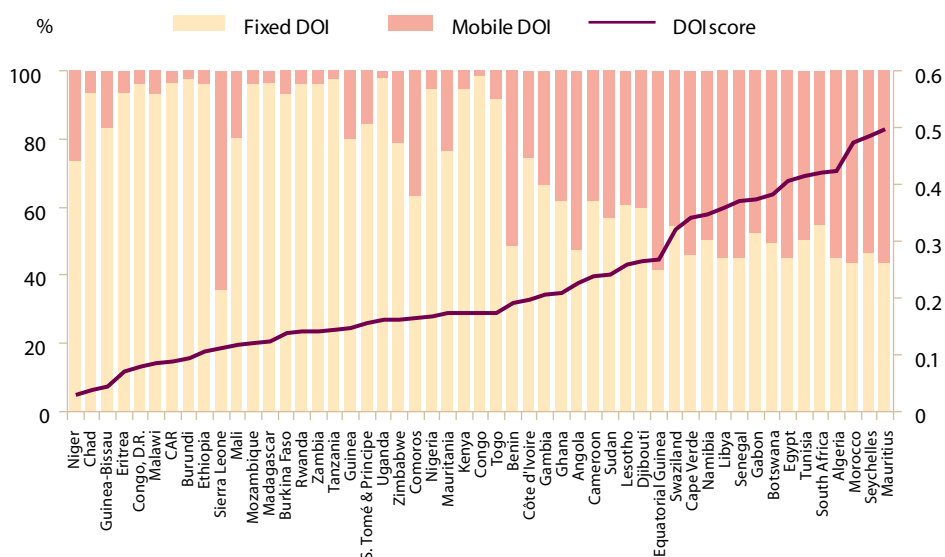
in Africa's mobile growth, with some 92 per cent of African subscribers using a prepaid package in 2005. Large African mobile strategic investors (such as Celtel, MTN and Vodacom) have emerged (Table 3.1), enjoying subscriber growth rates far greater those found in mature mobile markets. These pan-African operators have been able to exploit the growing demand for mobile telephony across many countries to build large-scale operations with significant economies of scale, negotiating group-wide purchases of equipment at lower costs.

Figure 3.5 also implies that, for African countries with strong mobile sectors, cell phones could be leveraged to also provide Internet access. There is substantial work within the industry to promote mobile Internet use beyond simple applications for chatting, email or simple browsing:

"A cellphone, despite its small screen size, 12-digit keypad (in most cases), and potentially slower connection speed, has the ability to provide the most popular web-based services. According to Jupiter Research, the most popular online activities are sending and receiving e-mails, researching and purchasing products online, obtaining local news, listings, maps and traffic information, using instant messaging,

Figure 3.5: The Mobile Information Society in Africa

Strength in mobile is the main driver of digital opportunity in Africa, where the mobile sector (represented by the pale yellow area) accounts for over half of total digital opportunity (purple line) in the majority of African countries, 2005.



Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Table 3.1: Africa's mobile strategic investors

| Strategic investor | Subscribers (000s) 2006 | Subscribers (000s) 2005 | % change 2005/06 | Revenue (m US\$) 2005 | % change 2004/05 | Yearly ARPU (US\$)* | African Countries where the Investor has Operations |
|--------------------|------------------------------------|-----------------------------|------------------|-----------------------|------------------|---------------------|---|
| MTN | 24'300 (Mar 2006) | 15'600 (Mar 2005) | 56% | \$4'545 (Mar 2005) | 21% | \$291 | Afghanistan, Benin, Cameroon, -, Congo, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Rwanda, South Africa, Swaziland, Sudan, Syria, Uganda, Yemen. |
| Vodacom | 23'520 (Mar 2006) | 15'483 (Mar 2005) | 52% | \$5'328 (Mar 2006) | 25% | \$227 | Congo (DR), Lesotho, Mozambique, Mauritius, South Africa, Tanzania |
| Orascom | 21'128 Africa (total 46'522) | 17'500 (total 30'383) | 53% (total) | \$3'216 | -0.30% | \$69 | Algeria, Egypt, Iraq, Pakistan, Tunisia, Zimbabwe. |
| Celtel | 15'270 (Sept 2006) | 5'375 (Sept 2005) | 184% | \$953 | 60% | \$62 | Burkina Faso, Chad, Congo, Congo (DR), Gabon, Kenya, Niger, Nigeria, Madagascar, Malawi, Sierra Leone, Sudan, Tanzania, Uganda, Zambia. |
| Orange | n/a | 5'188 (Sept 2005) | n/a | n/a | n/a | n/a | Botswana, Cameroon, Côte d'Ivoire, Egypt, Eq. Guinea, Madagascar, Mali, Mauritius, Reunion, Senegal. |
| Millicom | 12'800 (Sept 2006) | 8'929 (Sept 2005) | 43% | \$1'084 | 6% | \$85 | Chad, Congo (DR), Ghana, Mauritius, Senegal, Sierra Leone, Tanzania. |
| Etisalat | n/a | 4'534 | n/a | \$3'512 | +23% | \$775 | Benin, Burkina Faso, Central African Rep., Côte d'Ivoire, Gabon, Niger, Pakistan, Qatar, Saudi Arabia, Sudan, Tanzania, Togo, UAE. |
| Total | 97'018 | 72'609 | n/a | \$18'638 | 18% | \$145 | |

Source: ITU, abridged from company reports.

* Estimated by ITU – not operators' official figures.

utilizing search portals, banking and reading news. Most of these activities can be done fairly easily on the average cellphone with a data connection today. Cellphones do not require a consistent power supply, can be charged every few

days, and can be carried securely in a pocket, an important feature in developing countries. Moreover, data and voice can be purchased in small increments."¹¹

Source: rcnew.com

3.4 Growth in Digital Opportunity over time

As emphasized in Chapter one, the main purpose of the DOI is to track progress towards bridging the digital divide and meeting the WSIS targets. This release of the DOI includes a three-year time series for 181 economies from 2004-2006. As shown in Figure 3.2, scores in the Digital Opportunity Index have been increasing steadily over the last couple of years. Virtually every economy has succeeded in improving access to ICTs in some way. It is only by making international comparisons that it is possible to identify those policies that have been the most effective resulting in above average growth. For this reason, an approach based on comparative rankings is more meaningful than one that uses absolute growth rates.¹²

Table 3.3 lists the top ten gainers in terms of increases in ranks (see also Data Table 3). Economies with lower ranks tend to exhibit more mobility in the index (both up and down). Analysis of changes in DOI scores over time shows that economies are gaining in strength in different areas. Five of the top ten gainers come from Africa (Table 3.2). Morocco has the greatest overall gain in rankings this year due to its remarkable improvements in Utilization (Box 3.2). Senegal has also made strong inroads in broadband access,

with 89 per cent of all Internet subscribers subscribing to broadband in 2005 (Box 3.1), as well as widespread Internet access through multimedia telecentres (Box 6.3 in Chapter Six).¹³ The other African economies in the top ten (Ghana, Gabon and Côte d'Ivoire) have witnessed increased mobile coverage and greater access to telecommunications at reduced prices.

Other major gainers in the DOI include the Russian Federation and Romania, which have made strong gains in Utilization, mainly through growth in Internet usage and broadband access. Only the Russian Federation and Antigua and Barbuda have succeeded in boosting Infrastructure by an increase of more than 15 percentage points over the three-year period, suggesting that improved infrastructure is a longer-term goal for most economies. Overall, however, Table 3.2 suggests that improvements in the DOI are not limited to any particular region – varied countries with different profiles in the development of their Information Society have enjoyed gains in digital opportunity.

In many countries, growth in digital opportunity is being driven by reductions in price of telecommunication services. ITU has measured the price of different telecommunication services since 2002 notably for mobile, Internet and broadband services. Prices for mobile, Internet and broadband services have fallen since 2003¹⁴, due to grow-

Table 3.2: Top Ten Gainers in the Digital Opportunity Index, 2004-2006

| | Economy | DOI 2004 | DOI 2006 | Rank 2004 | Rank 2006 | Δ ranks | Drivers |
|----|-------------------------|-------------|-------------|------------|-----------|-------------|---------|
| 1 | Morocco | 0.33 | 0.47 | 104 | 68 | +36 | U |
| 2 | Russian Federation | 0.38 | 0.52 | 78 | 51 | +27 | I,U |
| 3 | Senegal | 0.22 | 0.37 | 128 | 106 | +22 | O,U |
| 4 | Ghana | 0.10 | 0.21 | 161 | 142 | +19 | O |
| 5 | Antigua & Barbuda | 0.44 | 0.57 | 58 | 40 | +18 | I,U |
| 6 | Gabon | 0.26 | 0.37 | 121 | 103 | +18 | O |
| 7 | Belize | 0.34 | 0.42 | 100 | 84 | +16 | U |
| 8 | Bhutan | 0.12 | 0.22 | 155 | 140 | +15 | O |
| 9 | Cote d'Ivoire | 0.12 | 0.20 | 158 | 145 | +13 | O |
| 10 | Romania | 0.42 | 0.52 | 63 | 50 | +13 | U |
| | Average (top 10) | 0.27 | 0.39 | 113 | 93 | + 20 | |
| | Average (world) | 0.35 | 0.4 | | | | |

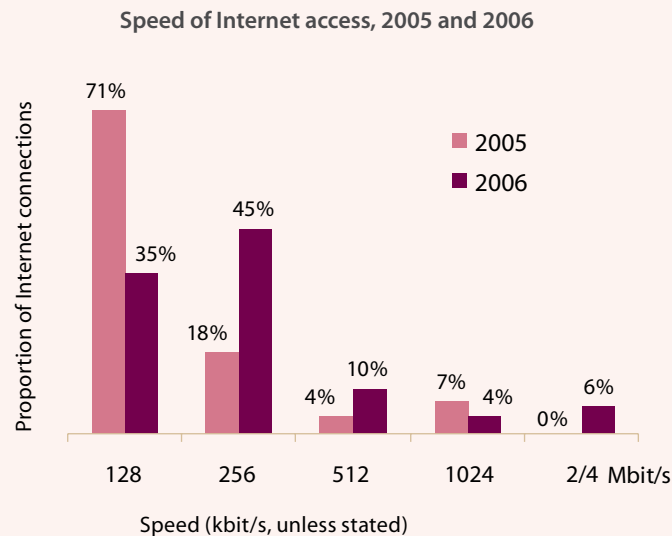
Note: O = Opportunity; I = Infrastructure; U = Utilization sub-index. A driver is defined as a sub-index where there is an improvement of score of 0.15 or more over the period 2001-2006.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Box 3.2: Morocco – An African Success Story

Morocco initiated market liberalization relatively early. In mobile communications, it became one of the first North African countries to introduce competition when it licensed a second mobile operator, Médi Telecom, in July 1999. A few months later in December 1999, the government sold 35 per cent of incumbent Maroc Telecom to Vivendi of France (see Box 4.2 in Chapter four). Intense competition between the two operators led to mobile phones overtaking fixed lines in August 2000, just six months after the second operator had launched its network. By June 2001, Médi had 755'000 customers and a population coverage of 70 per cent. Maroc Telecom responded by investing US\$ 275 million in its network and innovating with its price strategy. It achieved a client base of one million customers in June 2000, two million in November 2000 and three million by May 2001. The recent growth in Morocco has significantly surpassed all its North African neighbours.

Box Figure 3.1: Evolution in the speed of Internet access in Morocco



Source: Agence Nationale de Régulation des Télécommunications (ANRT).

Now, some of the same dynamism is reaching the Moroccan Internet market. Helped by Morocco's proximity to fibre networks in the Mediterranean, Maroc Telecom and the ISP Menara have launched a range of high-speed packages at comparatively low prices, including the highest speed broadband package in Africa at 4 Mbit/s. Surveys of the residential market carried out by the regulator, the National Agency of Telecommunication Regulation (ANRT), show that broadband connections are moving to progressively higher speeds. With nearly 400,000 ADSL connections at the end of 2006, Morocco is the top country in Africa in terms of the total number of broadband subscribers, well ahead of South Africa (although Mauritius had the highest broadband penetration). At the end of 2006, ADSL accounted for 98 per cent of all Moroccan Internet connections (including dial-up and leased lines). Broadband connections increased by 58 per cent over 2005-2006, compared to dial-up, which lost ground with a 40 per cent drop. These changes in the Sector all helped Morocco to take the position of "fastest gainer" in the DOI between 2004 and 2006.

Source: Moroccan household survey 2006, Moroccan regulator, the Agence Nationale de Régulation des Télécommunications (ANRT), available in French from: www.anrt.net.ma/fr/.

ing liberalization and more competitive markets. For example, in South Africa in February 2007, the operator MTN increased data capacity and reduced broadband prices by up to 20 per cent, seeking "to bring mobile data within reach of a larger proportion of our population".¹⁵ Broadband providers in South Africa are innovating with a

greater range of packages, pay-as-you-go or contract options for broadband, extended contracts and 'shaped' or 'unshaped' offers (prioritizing traffic according to consumers' specific needs) to attract customers. In some countries, reductions in prices for telecommunication services have directly resulted in a growing number of subscrib-

ers: the UAE incumbent Etisalat reports that after rates of its high-speed Internet service Al Shamil were reduced by 46 per cent in 2005, the number of subscribers grew by 140 per cent.¹⁶ Greater choice of products, pricing and access platforms has fuelled growth in broadband in the UK.¹⁷

3.5 Key Trends in the Information Society

3.5.1 Cutting the cord

The DOI measures the proportion of households with access to fixed lines (widely available from surveys or by derivation, i.e., residential telephone lines per 100 households). Fixed lines have historically been important for voice, faxes, text and data communications. The DOI shows that fixed lines in homes are declining, mainly in response to the rise of mobile communications. This trend makes it likely that countries will never achieve 100 per cent fixed household penetration.

A good example is Finland, which has seen a dramatic drop in the proportion of homes with fixed telephones from 94 per cent in 1990 to 64 per cent in 2003 (Figure 3.6) and an estimated 57 per cent by 2005.¹⁸ Nearly all Finnish from homes that do not have a fixed line nevertheless own a mobile phone or have access to one. Remarkably, over 80 per cent of Finnish homes with a fixed telephone

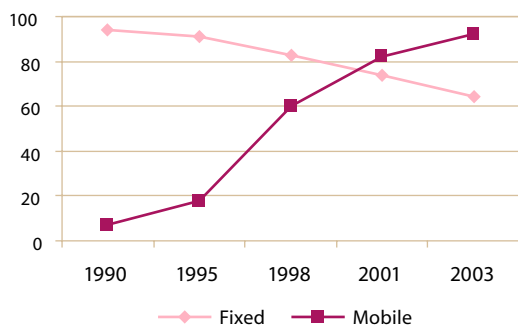
line are connected to DSL broadband service - many Finns are keeping their fixed telephone line mainly for broadband access.

Given the preference of many users for mobile rather than fixed telephony, this indicator could be adapted to measure the existence of a telephone in the household, regardless of whether it is fixed or mobile. However, the DOI already measures mobile penetration through a per capita subscription indicator, since mobile telephones are personal and are less likely to be shared. While mobile telephone networks are evolving in their ability to offer higher-speed Internet access, high-speed wireless networks have yet to be widely launched around the world. There are, in general, only a small proportion of households that currently use high-speed mobile networks to access the Internet, although fixed usage of 3G wireless for broadband Internet service is increasing. One example is the Czech Republic, where more than a third of the one million broadband subscribers at the end of December 2006 were using fixed wireless broadband.¹⁹ Despite this reduction in fixed lines in developed nations and lower rates of growth in developing ones, an indicator measuring the availability of telephony and potential home access to the Internet is vital for policy analysis.

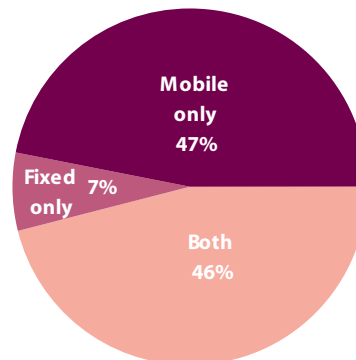
The growing use of Voice over Internet Protocol (VoIP) worldwide suggests that over time, fixed voice services will be provided over broadband

Figure 3.6: Abandoning fixed lines

Proportion of Finnish households with telephones



Proportion of Finnish households with fixed lines, mobile phones and both, 2005



Source: Adapted from Statistics Finland (left) and Eurobarometer (right).

connections.²⁰ In the future, it would be interesting to include subscriptions to connections capable of providing broadband access to the household. This would include not only fixed telephone lines, but also cable television and suitable equipped wireless connections, such as third generation mobile or fixed wireless access.

3.5.2 Getting connected to the Internet

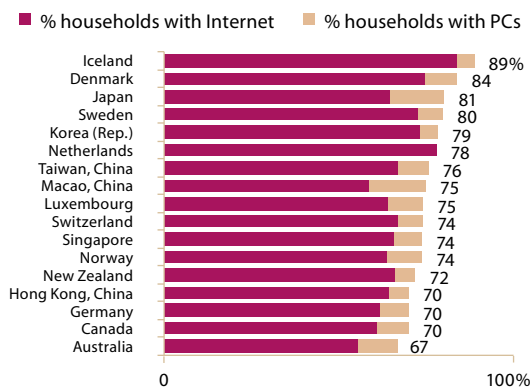
The price of computers remains a major obstacle to wider household penetration, especially in developing nations. However, one would assume that, having bought a computer, most households would then want to connect it to the Internet. In developed economies, access to the Internet is more likely to be from home than from the workplace, with high household Internet and PC penetrations in all high-DOI economies (Figure 3.7, left). Iceland leads the world, with a household penetration of Internet access at 84 per cent and PCs at 89 per cent. In many developing countries, home is not the main place of access for users. There has been an explosive growth in public Internet facilities in many countries to cater to those without home Internet access (see the examples given in Chapter six). In fact, access from public facilities may be so successful that it may even be constraining growth in home Internet access in developing nations.

However, intriguingly, not all home computers are connected to the Internet. The ratio of home computers with Internet access differs widely. The ratio of home computers connected to the Internet ranges from 95 per cent in Estonia to 20 per cent in Lebanon (Figure 3.7, right). In the Baltic nations, Estonia and Latvia have computer to Internet ratios of some 95 per cent, yet in Lithuania, only 50 per cent of computers are connected to the Internet. Average income in Lithuania is lower than the other two countries, but Internet tariffs are cheaper and access is more affordable (See Data Table 9 in the Statistical Annex). Therefore, it is unclear why Lithuania has such a lower ratio of computers with Internet access. In Latvia, the ratio was just below 100 per cent in 2005 and exceeded it in 2006. The national statistical office reported that many households were accessing the Internet through mobile phones.

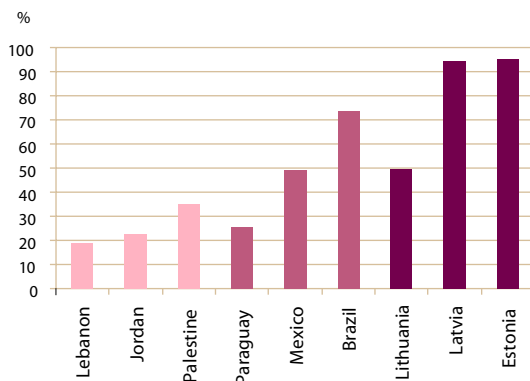
Japan has a high proportion of households with PCs without Internet (Figure 3.7, left) – partly due to the popularity of mobile Internet access in Japan. Mobile Internet access could result in relatively limited functionality in the passive web experience of cell phones, instead of positive participation in online web intelligence. These different patterns of Internet usage could result in the development of different skill sets and could shape the Information Society differently, according to the type, speed and capacity of Internet access available.

Figure 3.7: Household Internet Access

Household Internet and PC penetration for the economies with highest household penetrations, 2005

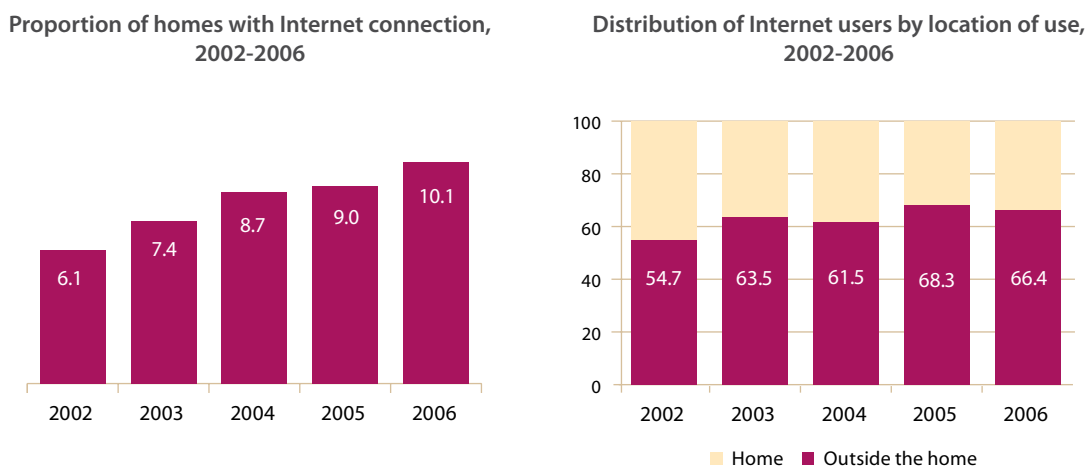


Ratio of household computers with Internet access, selected economies by region, 2005



Source: ITU/UNCTAD/KADO Digital Opportunity Platform, adapted from national statistical office data and ITU World Telecommunication Indicators Database.

Figure 3.8: Internet access, at home and elsewhere, in Mexico

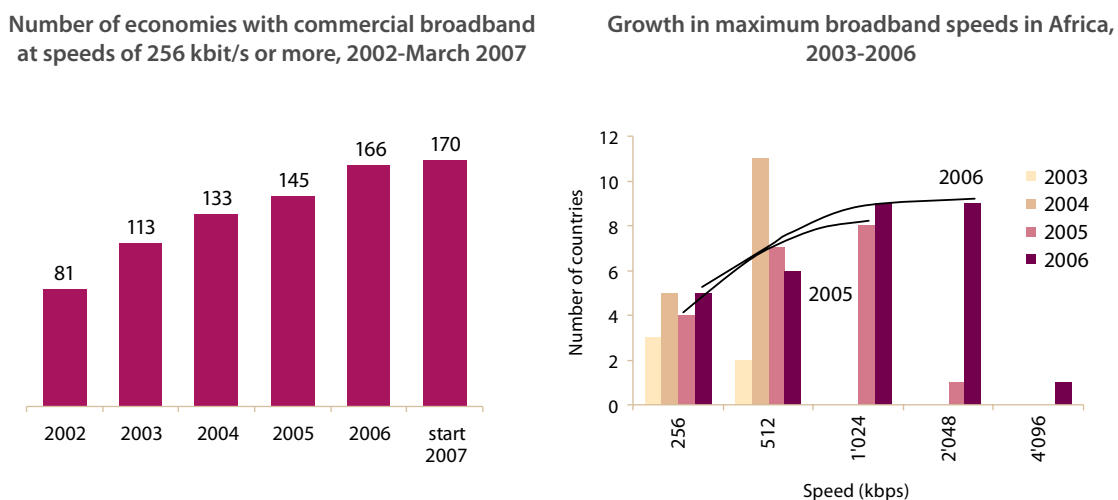


Source: Adapted from INEGI.

In Latin America, Brazil and Mexico had the same household computer penetration of 18 per cent in 2005, yet in Brazil, 74 per cent of computers were connected to the Internet. In Mexico, only 9.4 per cent of homes had Internet access. In terms of affordability, Mexico's per capita income is twice as large as in Brazil and Internet costs consume a smaller proportion of income in Mexico. Furthermore, the home Internet penetration rate in Mexico grew only very slowly from 2002-2006

(Figure 3.8). Further, most new Internet users in Mexico access the Internet from outside the home. While home and outside-home use was roughly equal in 2001, two-thirds of all Mexican Internet users now access the Internet from public facilities (i.e., Internet cafes and schools). Mexico has flat-rate local call pricing, whereas in Brazil, local calls are charged on a timed usage basis. From an economic perspective, there should be more Mexican households connected to the Internet

Figure 3.9: Growth of broadband



Note (right chart): Maximum advertised broadband speeds may not be always available, depending on network congestion, latency, routing of data etc.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

than Brazilian ones, but this is not the case. More research is needed on the reasons why people living in households with computers may not connect to the Internet.

While the explosion of public facilities offering Internet access is admirable (see Chapter six), policy-makers should focus on the benefits of each household having its own, regular Internet access.

3.5.3 The death of dial-up?

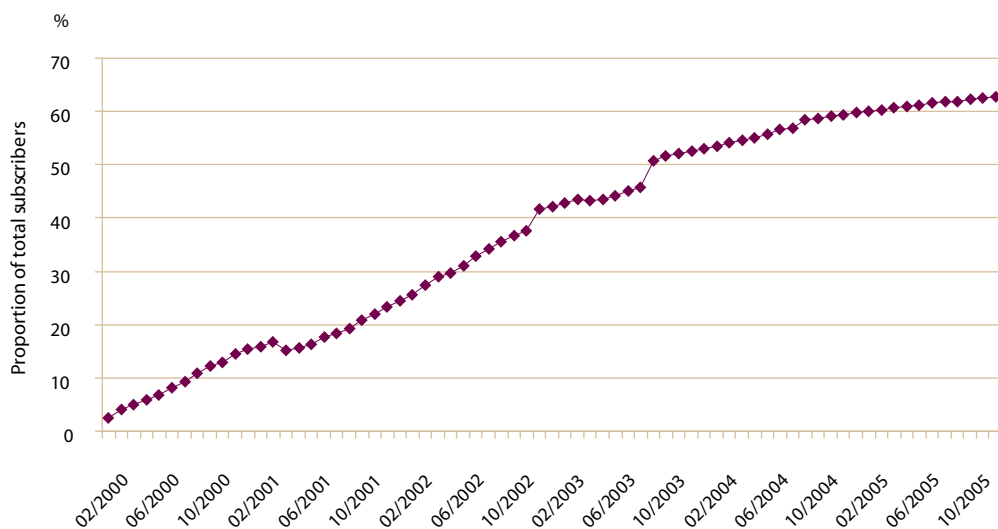
The Digital Opportunity Index tracks access to new and advanced technologies, including fixed and wireless broadband. The telecommunication industry reached a key milestone in 2005, when broadband subscribers exceeded dial-up for the first time as the primary way of accessing the Internet. By the end of 2005, there were nearly 218 million broadband subscribers around the world, accounting for 53 per cent of all Internet subscriptions. At current rates of growth, the vast majority of Internet subscriptions should be at broadband speeds (equal to or greater than 256 kbit/s) by the end of this decade.

There is a widespread perception that broadband is less relevant for developing countries, but this is not the case. Broadband is increasingly available in developing countries. By the start of 2007, ADSL at speeds of 256 kbit/s and above was available in 170

economies (Figure 3.9, left). DSL was rolled out in Ghana²¹ and Libya²² during 2006. In 2007, Telecom Lesotho will introduce ADSL to improve Internet services and has submitted its proposed tariffs to the Lesotho Telecommunications Authority, which launched a Public Consultation on ADSL tariffs²³, with a pilot project to be launched in Maseru.²⁴ As long ago as December 2003, Macedonia became the last unserved European country to introduce broadband, with an ADSL service. However, due to Maktel's monopoly over access to Internet bandwidth, Macedonia is focusing on wireless broadband, for example, for USAID's school connectivity project to connect 461 schools.²⁵

Meanwhile, the speed and choice of services available are growing. Maroc Telecom launched Internet Protocol Television (IPTV) over DSL in May 2006²⁶ and has recently launched the first four Mbit/s broadband package in Africa²⁷ (Figure 3.9, right). Qtel (Qatar) is one of the first telecommunication operators in the Middle East to have introduced a triple play offering over ADSL.²⁸ Meanwhile, for many developing countries, wireless broadband offers an attractive way of reaching greater number subscribers at reduced costs. In 2006, Africa Online Uganda introduced broadband wireless with a wider coverage, designed to suit both business and home users. Wireless broadband can be much cheaper compared to leased lines, as bills are based on usage, rather than fixed monthly payments.²⁹

Figure 3.10: Ratio of broadband to total Internet subscribers, Hong Kong, SAR



Source: Adapted from Office of the Telecommunications Authority (OFTA), Hong Kong, SAR.

Some economies are taking longer to convert their Internet subscriber base to broadband, however, especially where there is a competitive market and tariffs are relatively low. In Hong Kong SAR, the broadband market boomed after 2000 with the ratio of broadband to total Internet subscribers increasing by around one per cent a month (Figure 3.10).³⁰ However, broadband growth has stagnated recently and the ratio of broadband to total Internet subscribers only increased by four per cent in 2005 to 63 per cent.

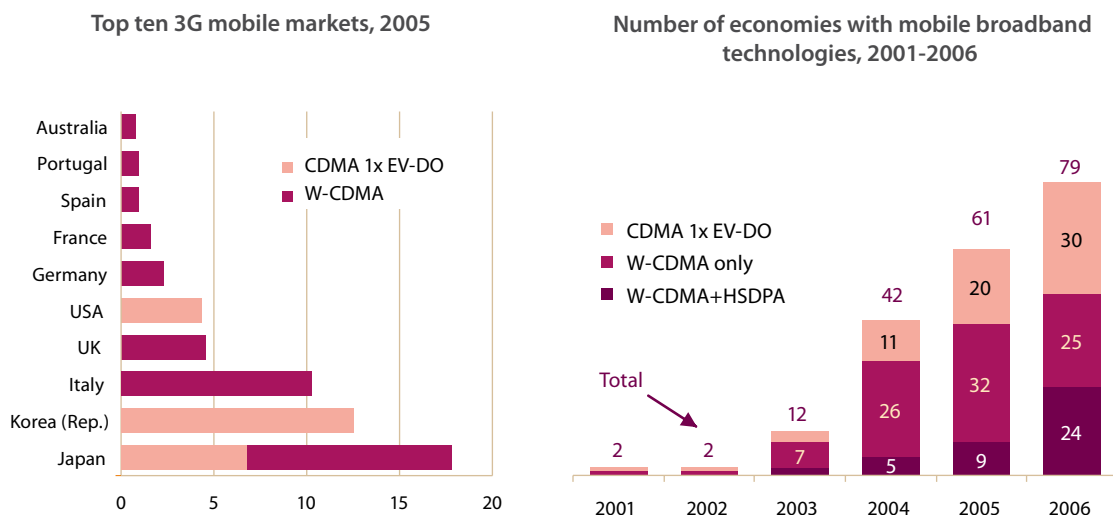
What explains this resistance to broadband?³¹ One factor is that even though broadband prices have dropped dramatically and bandwidth has risen, dial-up is still often cheaper in many economies, particularly those, such as Hong Kong SAR, that do not charge for local calls. Also, some users do not like the always-on feature of broadband, fearing it makes them more vulnerable to cyber-intrusion (an issue examined in Chapter five). Some users simply do not need broadband since they use mostly low-bandwidth applications such as email. Finally, there are users who do not have access to broadband because they live in remote areas, outside of the range of DSL or cable. This group of users is increasingly important as one focus of debates over universal service.

3.5.4 Growth in 3G mobile

There is strong growth in third generation (3G) mobile services, particularly in Asia and Europe, where nearly all the top ten largest markets are situated (Figure 3.11, left). Mobile broadband has grown in speed and by the first quarter of 2006, operators were advertising commercially available download velocities of between 384 kbit/s – 1.4 Mbit/s. The industry promises even higher speeds in the future. For example, Telstra, a mobile operator in Australia claims that it will soon be providing peak network speeds of 14.4 Mbit/s over its High Speed Download Packet Access (HSDPA) network. Mobile broadband (3G) services are now offered in many developing countries throughout central and eastern Asia, Latin America and the Caribbean (Figure 3.10, right). Wideband CDMA networks were operational in 49 countries by the start of 2007, with 24 HSDPA networks. Twelve economies had separate networks supporting both W-CDMA and CDMA 2000 1x in 2006.³²

As operators introduce these advanced mobile services, they are now deriving a greater proportion of their revenues from data services. In Africa, data revenues are small, but growing. Vodacom

Figure 3.11: Expansion of mobile broadband and 3G mobile



Source: ITU/UNCTAD/KADO Digital Opportunity Platform and ITU Internet Report 2006: digital.life.

reports data revenues of 2 billion Rand for 2006 (USD 0.3 bn), up 52 per cent from 1.3 bn Rand in 2005 (USD 0.2 bn). Data revenues constituted 7 per cent of total service revenues for Vodacom Group in 2006, up from 5.6 per cent in 2005.³³ Vodacom considers that it is in an excellent position to take advantage of growth opportunities in the cellular and converged communications industry and recently launched “mobile TV on the move” over its HSDPA network. Vodacom plans to continue to grow mobile data revenues by mobilizing office tools and software applications such as 3G, HSDPA, Vodafone Mobile Connect Cards and live TV-streaming Blackberry at acceptable prices.³⁴ Data revenues represent a much higher proportion of total revenues in the mature markets of Asia-Pacific, where consumers are at ease with using their mobile for mobile gaming, m-commerce and access to news and sports alerts.

However, there are some concerns that in the development of the global Information Society continues to be uneven. Although the developing world is making strong gains in mobile telephony and, to a lesser extent, Internet access, Europe and Asia are gaining ground in the adoption of new technologies such as broadband and mobile Internet. This suggests that discrepancies in access to ICTs between countries are not only measured in terms of basic penetration and access, but are taking on new dimensions in speed, mobility and capacity of access. Through its measurement of mobile/fixed components and new technologies, the DOI can measure all these trends and can be used to improve and enrich policy-making. Speed and quality of access considerations must be taken into account in future assessments of the digital divide, as well as in the broader debate over provision of universal service.

3.6 Conclusions

This chapter has tracked progress in WSIS implementation, with regards to the three clusters of the digital opportunity index (DOI) namely Opportunity, Infrastructure and Utilization. It has shown that the Information Society has grown steadily since the start of the WSIS process in 2003.

Notes for Chapter Three

- 1 More information on the Digital Opportunity Index is available from: www.itu.int/doi.
- 2 A time series has been calculated for the full set of 181 economies since 2004 and for sixty-two economies since 2001.
- 3 The use of the ICT Opportunity Index is explored in greater detail in a separate ITU publication, published in February 2007: “Measuring the Information Society”, available at: www.itu.int/ITU-D/ict/publications/ict-oi/2007/index.html.
- 4 For more practical information on how the DOI is constructed, see the DOI user guide at: www.itu.int/osg/spu/statistics/DOI/doi-guide.pdf and the methodology report “Measuring digital opportunity” (November 2005), at [www.itu.int/osg/spu/statistics/DOI/linkedddocs/Measuring_Digital_Opp_Revised_23_Nov_2005%20\(2\).pdf](http://www.itu.int/osg/spu/statistics/DOI/linkedddocs/Measuring_Digital_Opp_Revised_23_Nov_2005%20(2).pdf).
- 5 The DOI scores for each country have a mix of infrastructure indicators (valid for year end 2005) and tariff and coverage measures (valid for 2006). For that reason, the DOI scores presented here are classified as 2005/06 but, for convenience when making time-series analysis, they may be simply referred to as “2006”.
- 6 Income classifications are updated each year, based on Gross National Income. This comparison of digital opportunity uses the 2005/2006 income classification, applied to the DOI scores for 2004-2006.
- 7 As measured by the range in digital opportunity (high income – low income) and dispersion around world average.
- 8 “Qatar Internet and Datacomm Landscape”, report by the Arab Advisors Group, 21 February 2007, available from: www.arabadvisors.com.

- 9 Namely: Maldives, Morocco, Peru, Myanmar, Senegal and Venezuela; all of these were medium-DOI economies.
- 10 The Geneva Plan of Action can be downloaded from: www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=1160|0.
- 11 www.rcrnews.com/apps/pbcs.dll/article?AID=/20070326/FREE/70322019/1026/FREE.
- 12 P. 51, Chapter 4, World Telecommunication Development Report (2002), ITU, Geneva, available from www.itu.int/publications/
- 13 Agence de Régulation de Télécommunications (ART, Sénégal), "Le marche de l'Internet", web page, available at: www.artp-senegal.org/telecharger/Fiche_Internet_2005.pdf.
- 14 The 2006 World Information Society report noted that "In mobile telephony, worldwide, prices have been falling by an average of 10 per cent per year. Internet access has fallen by a similar amount and in 2005, cost only three-quarters of its price in 2003. As a more 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".
- 15 Press Release, 21 February 2007, available from MTN Press Release, at: www.mtn.co.za/?pid=9522&fullstory=382
- 16 Page 4, Etisalat Annual Report 2005, available from: www.etisalat.ae/assets/CCD/Digital%20Press%20Office/Financial%20Information/Etisalat%20E%20AR05.pdf.
- 17 P. 109, Chap. 3: Telecommunications, The Communications Market 2006, available from: www.ofcom.org.uk/research/cm/cm06/. In relation to the UK broadband market, Chapter 3 notes that "in addition to widespread availability, consumers now have an increased choice of broadband service providers... Together with the cable operators and the fast-growing wireless broadband sector, consumers have never had more choice of broadband products, pricing packages and access platforms. This in turn has fuelled the growth of broadband take-up and consumption", page 109.
- 18 The first two figures are from Statistics Finland Household Budget Surveys (www.stat.fi/tk/el/kulutustutkimus/kulutust_t4_1.html), while the latter is from the following report commissioned by the European Commission: Eurobarometer, E-Communications Household Survey, July 2006.
- 19 For more detail, see the OECD's December 2006 broadband subscriber estimates at: www.oecd.org/document/7/0,2340,en_2649_34223_38446855_1_1_1_1,00.html.
- 20 See for example, "Status of VoIP worldwide, 2006", Background Paper prepared for the ITU workshop, "The Future of Voice", 15-16 January 2007, available at: www.itu.int/osg/spu/ni/voice/papers/FoV-VoIP-Biggs-Draft.pdf.
- 21 www.ghanatelecom.com.gh/gt_aboutus/newsdetails.asp?pnun=3&id=228&catid=0.
- 22 www.ltt.net.com/english/coming.php and www.ltt.net.com/english/sr_libyadsl.php.
- 23 www.lta.org.ls/Consultations/Tariffs/29012007_TL_ADSL.html
- 24 Telecom Lesotho submission to LTA, Page 1, www.lta.org.ls/20070126082548627.pdf
- 25 www.dot-com-alliance.org/newsletter/article.php?article_id=127
- 26 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](http://www.iam.ma/fichiers/Maroc-Telecom-Communique-TVADSL-31mai06-VF(2).pdf).
- 27 The Moroccan regulator, the Agence Nationale de Régulation des Télécommunications (ANRT), available in French from: www.anrt.net.ma/fr/and Balancing Act Africa, www.balancingact-africa.com/news/back/balancing-act_340.html.
- 28 Annual report 2006, p.30, available at www.qtel.com.qa/documents/ar/ANNUAL%20REPORT%20ENGLISH%202006.pdf.
- 29 www.africaonline.com/country.news.php?mode=getitem&itemno=115&cid=12
- 30 ITU, "Broadband as commodity: Hong Kong, China Internet case study", April 2003, available at: www.itu.int/.
- 31 "The slow death of dial-up", The Economist, 8 March 2007, available at: www.economist.com/search/displaystory.cfm?story_id=E1_RSGGDSP.
- 32 Australia, Israel, Japan, the Republic of Korea and the United States, Czech Republic, New Zealand, Romania and Taiwan (China).
- 33 Page 11, Vodacom Annual report 2006, available from the Vodacom Group website at: www.vodacom.com/vodacom/investor_relations/docs/Vodacom%202006%20AR%20Full.pdf.
- 33 P. 12, Vodacom Annual report 2006, available from the Vodacom Group website at: www.vodacom.com/vodacom/investor_relations/docs/Vodacom%202006%20AR%20Full.pdf.

Annex: Methodological Note on Digital Opportunity Index

The definitions of the core indicators used to compile the Digital Opportunity Index (DOI) are available from the Partnership for Measuring ICT for Development. The latest available data (year-end 2005) was used, except where noted otherwise. Where 2005 data were not available, later data was used for tariffs while for other indicators, earlier data was used or an estimate was made. This section identifies the methodology used to compile the indicators for this version of the DOI, including the time period of the data, and where necessary, the estimation technique.

| Indicator | Core code | Note |
|---|-----------|---|
| Percentage of population covered by mobile cellular telephony | A-7 | The base year is 2005. This data is generally available from many mobile network operators. If national data are not available from an official source, the figure for the largest operator is used. In rare instances, this may understate actual coverage since different operators could cover different sections of the country. In the absence of data for a few countries, the percentage of the urban population is used on the assumption that it is less costly to install infrastructure in those areas and they have a greater number of potential clients that can afford service. |
| Internet access tariffs (20 hours per month) as a percentage of per capita income | A-8 | The base year is 2006 since this is the latest year for which a complete set of comparable data is available. Data are based on the cheapest available package for 20 hours of use per month and do not include telephone line rental. The basket is divided by 2004 Gross National Income per capita (from the World Bank). |
| Mobile cellular tariffs as a percentage of per capita income | A-9 | The base year is 2005, since this is the latest year for which a complete set of comparable data is available. A monthly charge is compiled based on a basket of peak and off-peak and on-net, off-net and fixed calls. The basket is divided by 2004 Gross National Income per capita (from the World Bank). |
| Proportion of households with a fixed line telephone | HH-3 | This indicator, which is based on 2005 data, should ideally be compiled from a household survey. If not available, administrative records can be used for the number of residential telephone lines divided by the number of households. |
| Proportion of households with a computer | HH-5 | This indicator, which is based on 2005 data, should be compiled from a household survey. If not available, data on the number of computers in the country could be used, adjusted for the estimated amount in homes. If that data is not available, then the data are estimated based on the per capita income of regional peers. |
| Proportion of households with Internet access at home | HH-7 | This indicator, which is based on 2005 data, should be compiled from a household survey. If not available, data on the number of Internet subscriptions, adjusted for the estimated amount in homes, can be used. If that data is not available, then the data are estimated based on the per capita income of regional peers. |
| Mobile cellular subscribers per 100 inhabitants | A-2 | The base year is 2005. Data are universally available for this indicator. |
| Mobile Internet subscribers | A-4† | The base year is 2005. Since mobile Internet access is relatively recent, many countries either do not report data on the number of subscribers or definitions vary. There are a variety of indicators used to reflect mobile Internet use. Some operators report the number of high-speed subscriptions and others report the number of subscriptions to their mobile portal services. Some users utilize mobile cellular networks to access the Internet using laptop computers. There is little consensus as to whether these types of users should be considered fixed Internet subscribers or mobile Internet subscribers. Finally, the concept of Internet access is seriously challenged when including mobile, since the users' experience is entirely different and many so-called mobile Internet users are not actually surfing websites per se but downloading logos and ring tones or sending picture messages. In general, either the number of Wireless Access Protocol (WAP), General Packet Radio Service (GPRS) or mobile portal subscribers is used. In the absence of data, estimates are based on the number of post-paid subscribers, the availability of mobile data networks (e.g., GPRS, EDGE, CDMA2000 or WCDMA) and regional trends. |
| Proportion of individuals that used the Internet | HH-8 | The base year is 2005. A growing number of countries have carried out surveys. In the absence of survey data, national estimates are used. If these are lacking, then estimates are derived from the number of subscribers. |
| Proportion of fixed broadband subscribers to total Internet subscribers | A-5† | The base year is 2005. There is a growing consensus that a service should be considered broadband only if it offers speeds of at least 256 kbit/s in at least one direction. Note that this indicator refers to 'fixed' type of broadband access such as DSL, cable modem, Ethernet LAN, fibre optic and Fixed Wireless Access. This data set is generally complete for most countries that have broadband service. |
| Proportion of mobile broadband subscribers to total mobile subscribers | A-5† | The base year is 2005. Mobile broadband subscribers refer to users of mobile networks providing speeds of at least 256 kbit/s in at least one direction. This data set is generally complete for countries that have mobile broadband service. |

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

† = Derivation of core indicator