CHAPTER TWO

Measuring the Information Society

2.1 Overview

The first Phase of the World Summit on the Information Society called for the creation of a composite Digital Opportunity Index. In considering what such an index should comprise, it is useful to think about what digital opportunity means. In an ideal world, digital opportunity would mean:

- The whole population having easy access to ICTs at affordable prices;
- All homes equipped with ICT devices;
- All citizens having mobile ICT devices; and
- Everyone using broadband.

This chapter examines how progress towards such ideals can be monitored using the Digital Opportunity Index (DOI). Its starting point is the set of internationally-endorsed core ICT indicators agreed by the '*Partnership on Measuring ICT for Development*', comprising international organizations and national statistical agencies.[1]

This chapter overviews the core indicators chosen to create the DOI. The DOI adopts a fresh approach. Most ICT indices are based on a set of indicators selected by the index creator, while the DOI has been created from the set of internationally-agreed indicators.

The DOI is structured around three categories:

- The first is **Opportunity.** In order to participate in the Information Society, consumers must have accessibility to ICTs and must be able to afford them. The percentage of the population covered by mobile cellular telephony represents basic accessibility, while two tariff indicators, Internet access tariffs (as a percentage of per capita income) and mobile cellular tariffs (as a percentage of per capita income) measure affordability.
- The next category is **Infrastructure,** which includes the network indicators of proportion of households with a fixed line telephone, mobile cellular subscribers per 100 inhabitants, proportion of households with Internet access at home and mobile Internet subscribers per 100 inhabitants. It also includes the devices that provide the interface between the user and the network: here, this is represented by the proportion of households with a computer.
- **Utilization** shows the extent of ICT usage and includes the proportion of individuals that use the Internet. Quality is reflected in access with advanced degrees of functionality in the ratio of broadband subscribers among Internet subscribers (for both fixed and mobile technologies).

This classification is sequential, with each category building on the previous one (see Figure 2.1). In order to have access to infrastructure, users must be covered by the service and be able to afford it. Utilization depends on having both infrastructure and an access device. Finally, given all the prerequisites for connectivity, users may then aspire to higher levels of quality through broadband access.

The popularity of mobile communications and introduction of high-speed 2.5G and 3G (third generation) services make wireless technology a key component of the Information Society. Almost all the indicators chosen for the DOI have a mobile component. Mobile coverage and mobile subscribers explicitly relate to mobile, while others are embedded in indicators such as computers (e.g., smart phones, Personal Digital Assistants (PDAs)) or Internet subscriptions (which can include mobile Internet subscriptions). The DOI can thus be split into fixed technologies versus mobile (see Figure 2.2). This allows analysis of each country's path towards the Information Society. Evidence from country case studies and the trend toward ubiquity[2] suggest that countries should not sacrifice one path at the expense of the other, but that both should be pursued simultaneously.

Figure 2.1: Classifying the DOI

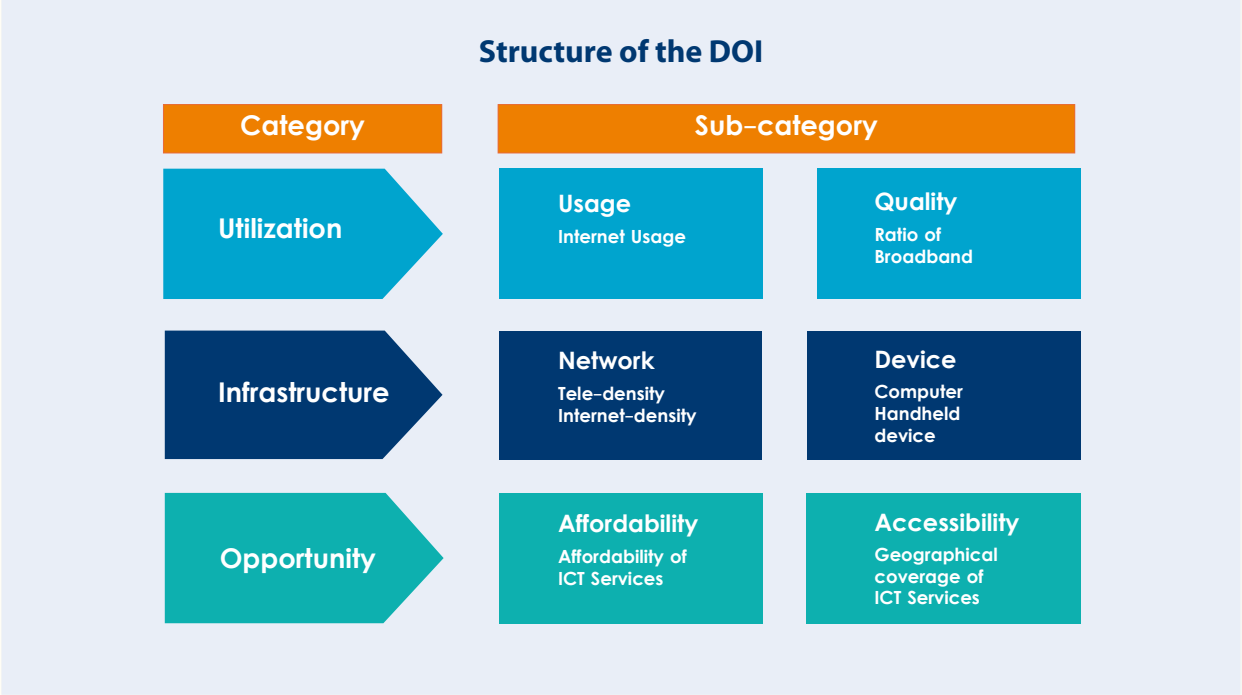
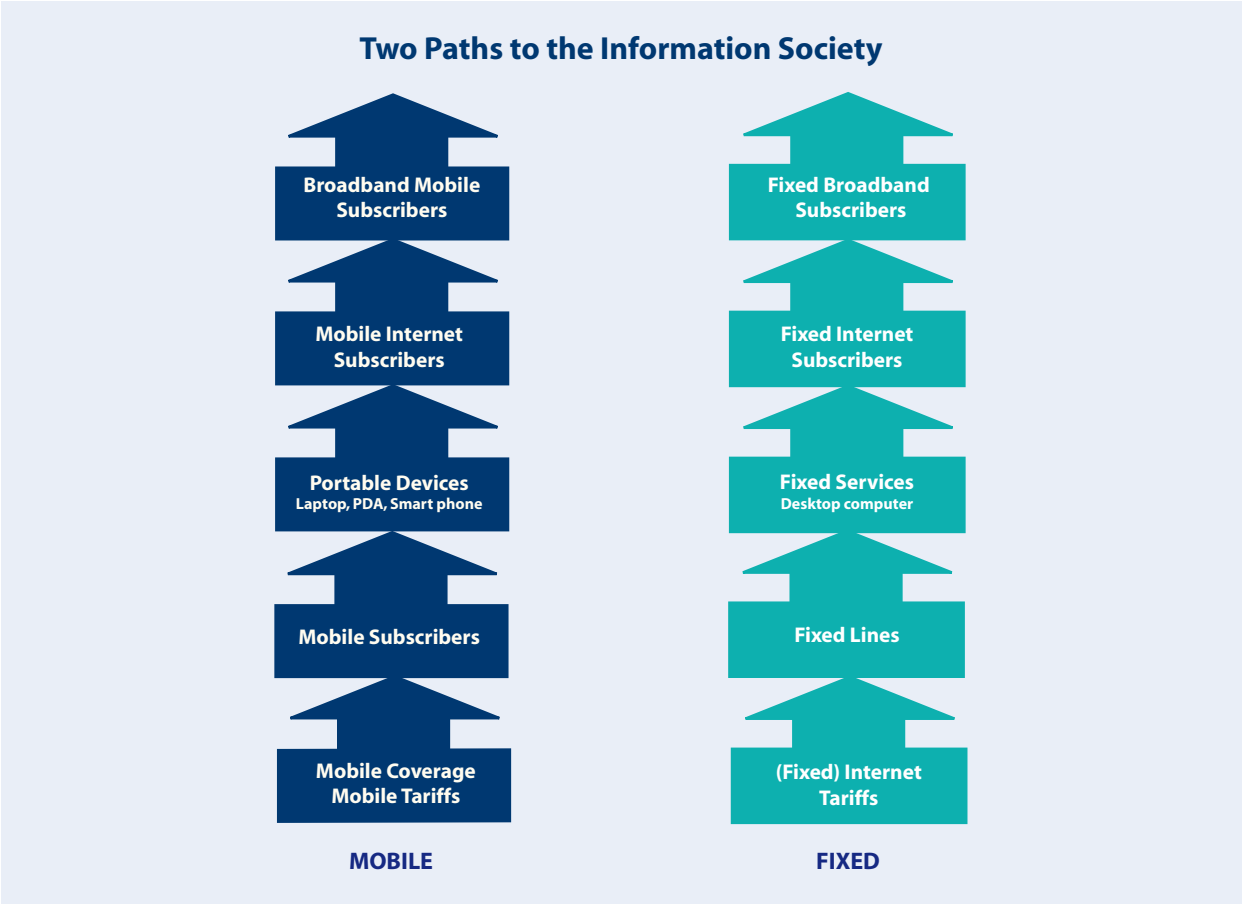


Figure 2.2: Fixed and mobile paths to the Information Society



Source: Adapted from C. M. Cho (upper chart); ITU/Korea Digital Opportunity Platform (lower chart).

2.2 Exploring the DOI

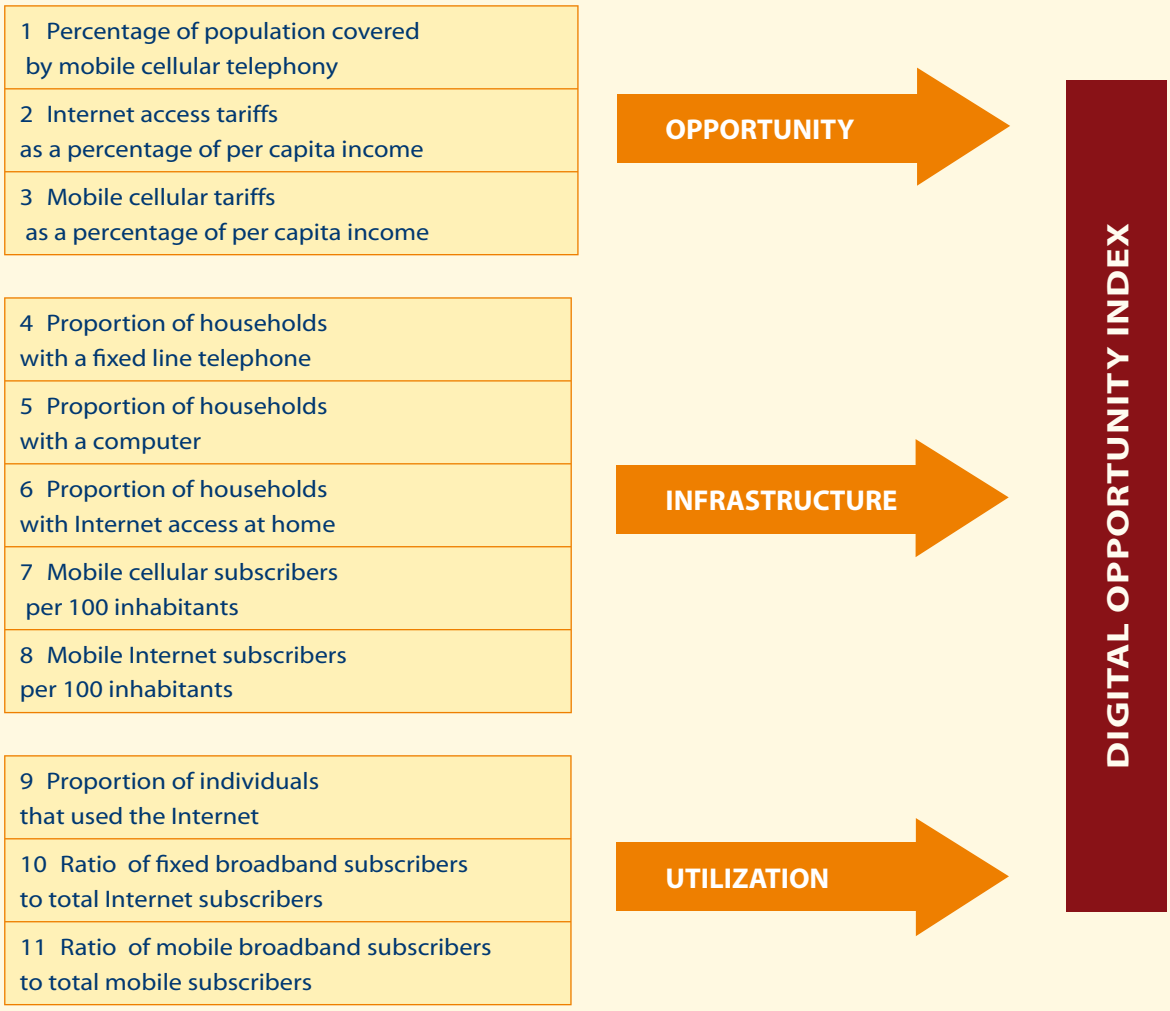
The core ICT indicators represent international agreement on the main statistics to be used for analyzing the Information Society. Eleven indicators—of which six have a fixed line orientation and five are geared to mobile—have been selected for the DOI (see Figure 2.3). The next sections review the choice of indicators, give real world examples and illustrate how the indicators are used in different countries to monitor Information Society development.

An example of applying the DOI to the West Asia sub-region is given in Figure 2.4.

2.3 Opportunity

The starting point for an Information Society is ensuring that citizens live within easy distance of ICTs and can afford them. Basic opportunity is an essential platform for developing higher levels of access. Access and affordability are key measures of the opportunity to use ICTs, as shown below.

Figure 2.3: The DOI indicators



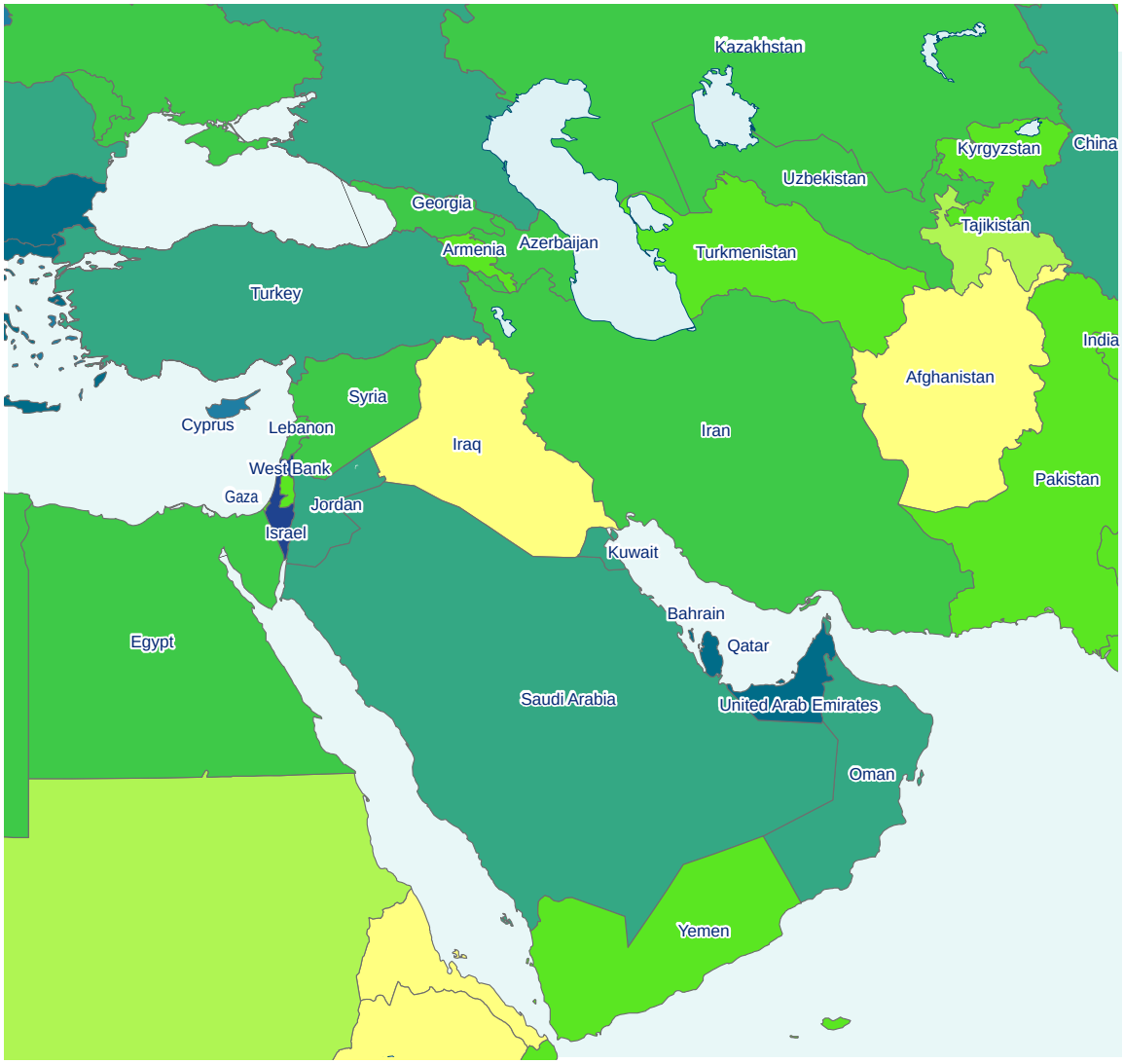
Note: The indicators are averaged within each category and categories are averaged to obtain the Digital Opportunity Index value.

Source: ITU/Korea Digital Opportunity Platform.

2.3.1 Access

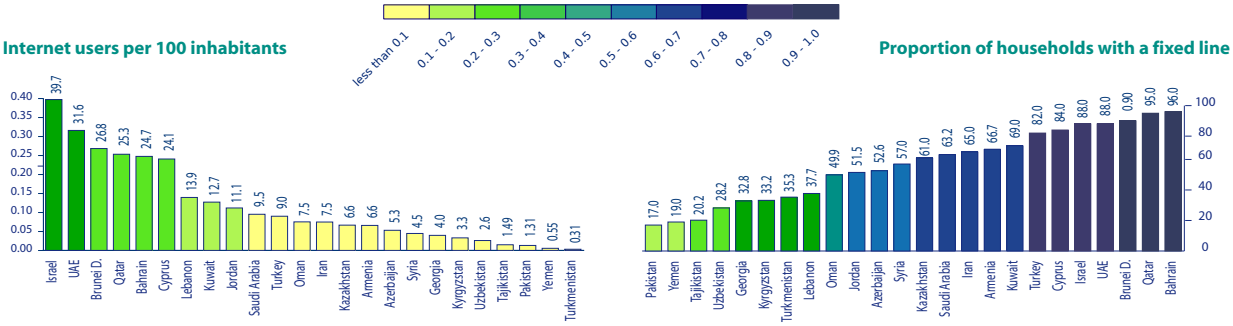
Policy-makers have historically measured universal access to communications in terms of fixed telephone lines, requiring subjective decisions about users' access in terms of distance or time from a fixed line. Take distance, for example, where universal access policies might call for citizens to be within two kilometers of a telephone. People have different ways and abilities of getting to a phone: while two kilometers may not seem far to a healthy young person, it may seem much

Figure 2.4: Digital Opportunity in West Asia



Source: ITU/KADO Digital Opportunity Platform

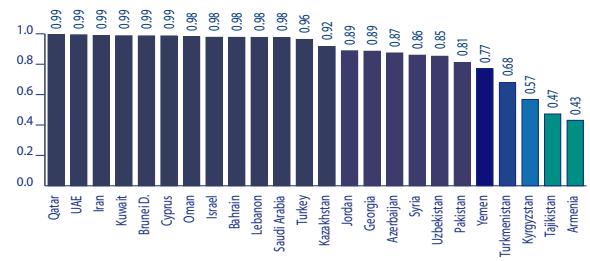
Denominations and classifications employed in these maps do not imply any opinion on the part of the ITU concerning the legal or other status of any territory or any endorsement or acceptance of any boundary.



Internet users per 100 inhabitants

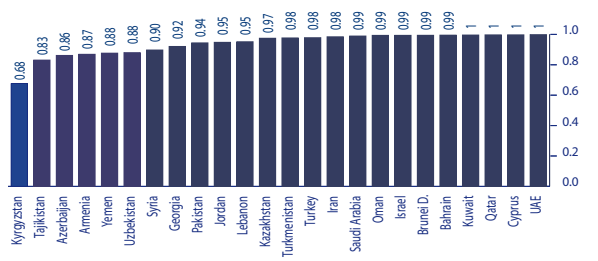
Proportion of households with a fixed line

Internet affordability (1 = affordable; 0 = not affordable)



Note: 0.00 means that the price of 20h Internet use is in excess of average montly GNI per capita

Mobile affordability (1 = affordable; 0 = not affordable)



Note: 0.00 means that the price of lower-user call basket is in excess of average montly GNI per capita

further for a senior citizen. Time is also relative. The length of time it takes a person to reach a telephone depends on their transport. Someone walking to a telephone will take much longer than someone riding a motorcycle.

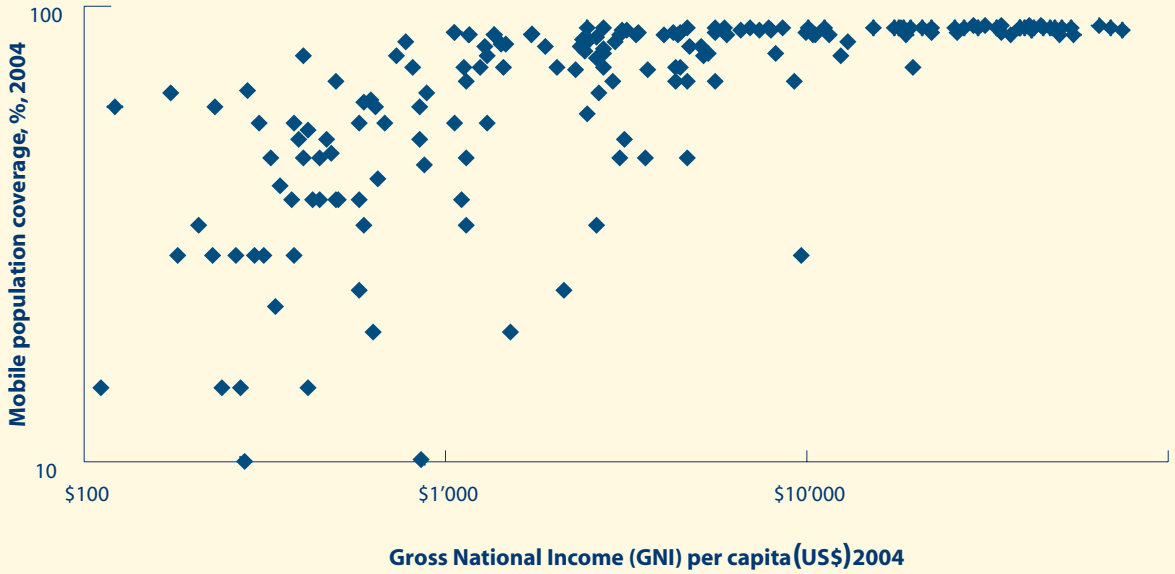
The percentage of population covered by mobile cellular telephony is an ideal indicator for measuring potential access to communications. The radio-based technology of mobile networks dispenses with the need to go to physically go to a certain location to use a telephone. Radio waves permeate through space, so people can use mobile phones anywhere, as long as there is coverage. For those who do not have a subscription, entrepreneurs are willing to provide a mobile public phone service. Examples range from Village Phones in Bangladesh (also Uganda and more recently, Rwanda),[3] to 'umbrella people' in Nigeria.[4]

Mobile phone coverage also offers much more than simple access to voice telephony. Today's mobile networks offer text messaging and Internet access, while new cell phones are capable of supporting a multitude of ICTs—handheld phones or Personal Digital Assistants are becoming the equivalent of mini-PCs and can also be used as radios or TVs.

Mobile coverage is reported by many operators, sometimes through maps showing service availability on roads and future expansion plans. Coverage often has important regulatory implications, since many mobile licenses are contingent upon fulfilling coverage obligations. All developed nations have achieved high levels of digital mobile coverage (see Figure 2.5), as have a number of middle-income developing nations. In this group of countries, the focus is on intensifying indoor coverage in locations such as offices, apartment buildings and subway stations. Coverage is also spreading rapidly in lower income nations. For example, growing competition in Bangladesh has increased mobile population coverage from 35 per cent of the population in 2003 to a projected 85 per cent at the end of 2005 (see Box 3.1 in Chapter three). One especially promising development for developing nations, particularly those with large rural populations, is the commercialization of low frequency mobile technologies. These enable wider coverage with fewer base stations and hence reduce the cost of mobile infrastructure significantly (see Figure 2.6).

However, countries cannot afford to be complacent about mobile coverage, due to constant innovation and the continual improvement of cellular technology. As one mobile technology is superseded by the next, this affects, and can reduce, coverage. While today's second generation mobile technology has wide coverage, the focus is now on third generation (3G) systems. Many governments have included coverage requirements in the license obligations of 3G mobile operators. In Sweden, the regulator notes that the country's

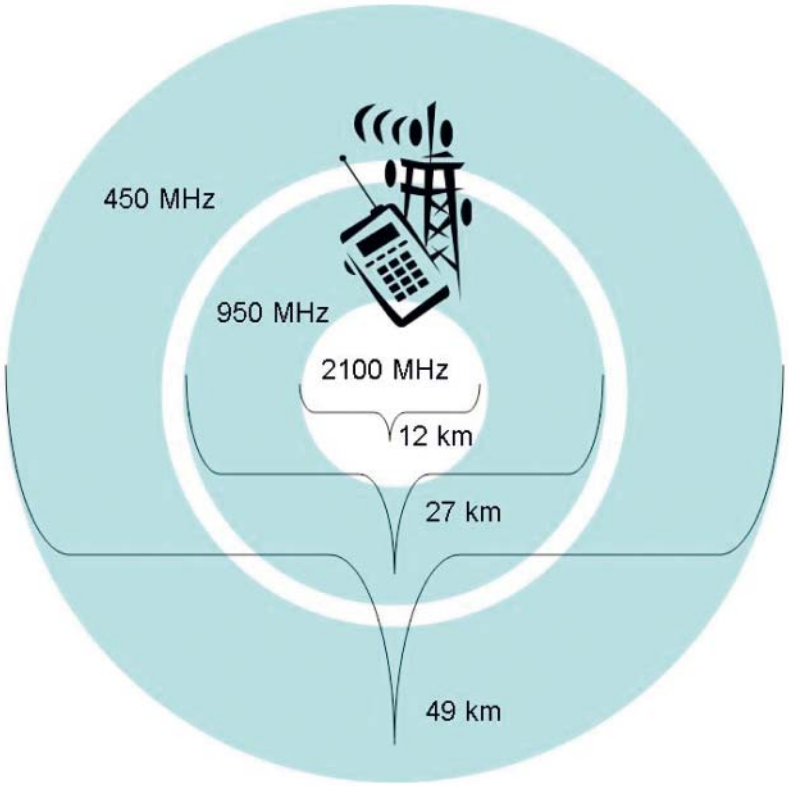
Figure 2.5: Mobile coverage and income



Note: Logarithmic scale used in both axes

Source: ITU/Korea Digital Opportunity Platform.

Figure 2.6: Radio-frequency and coverage

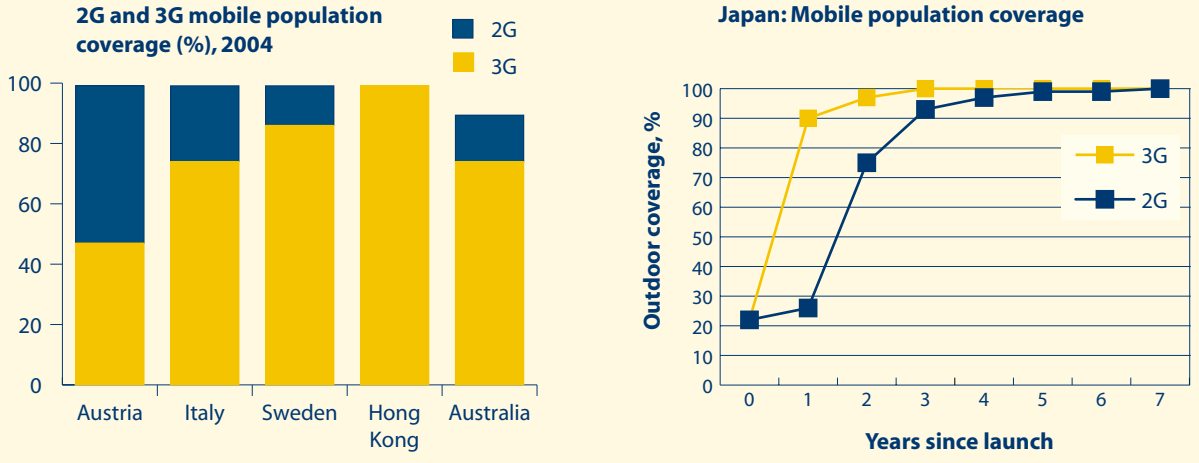


Note: The Figure shows the relative cell areas of different radio frequencies.

Source: Adapted from International 450 Association.

high 3G population coverage (85 per cent at end 2004) is due to regulatory obligations, with roll-out faster than purely commercial conditions would have dictated (see Figure 2.7, left).[5] Nevertheless, the regulator remained concerned that the 3G mobile operators had not met levels of coverage by the date stipulated in their license conditions. There are signs that 3G networks can be rolled out more rapidly since they can leverage on existing infrastructure. Japan took eight years to achieve 100 per cent coverage with second generation mobile networks, but this was accomplished in just four years for 3G (see Figure 2.7, right).

Figure 2.7: 2G and 3G mobile coverage, 2004



Source: Adapted from Hutchison Whampoa and DoCoMo.

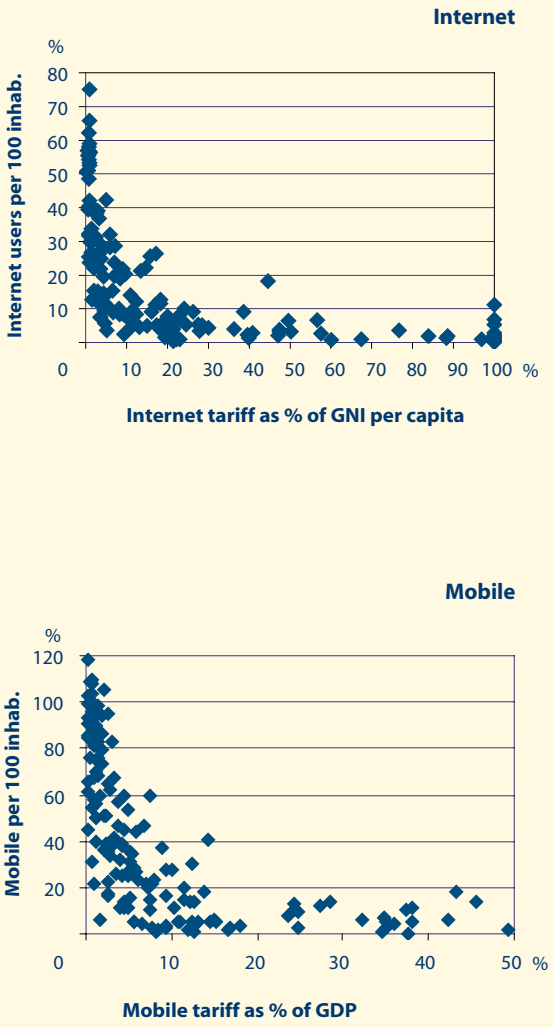
2.3.2 Affordability

Two indicators in the DOI measure affordability: Internet access tariffs as a percentage of income and mobile cellular tariffs as a percentage of per capita income. Affordability is a vital determinant of access to ICT services. As a general rule, high penetrations of mobile and Internet services are only achieved when tariffs are less than 10 per cent of per capita income (see Figure 2.8). Service affordability alone is not the only factor determining ICT use. As Figure 2.8 shows, there are a number of countries with affordable tariffs, but where usage is relatively low. Take the Islamic Republic of Iran, for instance, where Internet and mobile service charges are relatively low (less than two per cent of per capita income), but where Internet and mobile penetration rates are relatively low. In the case of Internet, the high cost of PCs is a barrier to greater usage in Iran. In contrast, for mobile, existing capacity is insufficient to meet demand.

Although affordability is a key component of opportunity, it is surprising how few governments monitor Internet and mobile tariffs, partly because the variety of tariffs in many markets makes comparisons difficult. Tariff baskets standardize a common set of usage criteria, such as number of hours of Internet use or number of mobile calls, to allow prices to be compared. For Internet tariffs, 20 hours of Internet access per month is a popular yardstick. The European Union monitors 20 hours in its Internet access cost eEurope indicator[6], the OECD used 20 hours of use in its analysis[7] and the ITU featured the same amount of use in the Digital Access Index. Since affordability is the main concern, the cheapest package providing at least twenty hours of use (spread over peak and off-peak times) is used to derive this indicator. For dial-up packages, telephone usage charges need to be included.

Given that mobile is now the main form of voice communications, mobile tariffs are a key measure of affordability for consumers. The DOI is based on pre-paid tariffs, the main form of payment in most developing nations, and uses the OECD low user basket methodology with prepaid tariffs.[8] The OECD basket is based on 37 minutes of use and 30 text messages per month (see Table 2.1). Basket values are divided by monthly Gross National Income per capita to assess affordability.

Figure 2.8: Tariffs and affordability, 2005



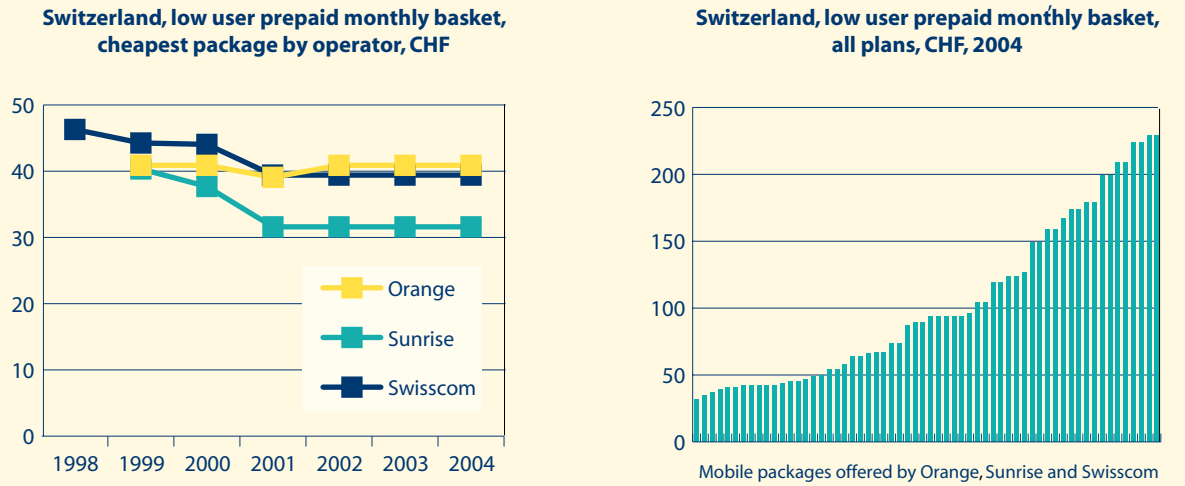
Source: ITU/Korea Digital Opportunity Platform.

Table 2.1: OECD Basket Methodology

Minutes	Fixed	On-net	Off-net	TOTAL
Peak	6.4	5.3	2.4	14.1
Off-peak	5.9	4.9	2.2	13.0
Weekend	4.5	3.8	1.7	10.0
Calls	25	per month		
SMS	30	per month		

Source: Adapted from OECD.

Figure 2.9: Mobile baskets in Switzerland

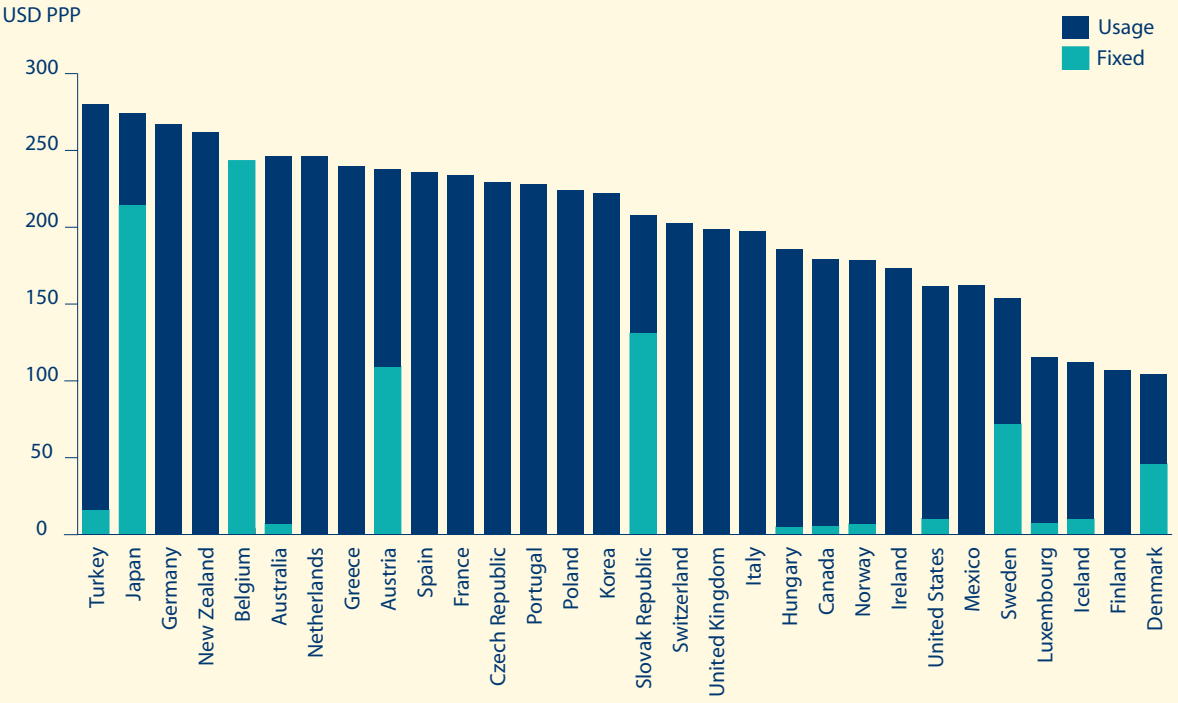


Source: The Swiss telecom regulatory agency OFCOM.

The regulatory authority in Switzerland tracks the data necessary for compiling both Internet and mobile baskets. It has monitored the decline in the cost of mobile baskets since the introduction of competition in 1998 (see Figure 2.9, left). In 2004, there were 60 plans on the Swiss market for which the regulator computed tariff baskets (see Figure 2.9, right).[9] International and regional organizations such as the OECD and the EU also track prices using baskets for their members (see Figure 2.10).

Most developing countries do not track pricing. One reason is that mobile and Internet services are often outside the scope of tariff regulation. However, given the major impact of affordability on countries' progress towards an Information Society and how the growth of mobile telephony promises to reduce the digital divide, this should be revisited. Price movements can be very useful in illustrating the impact of policy changes. For example, the regulator in India illustrates

Figure 2.10: OECD basket of low user mobile telephone charges, August 2004



Source: OECD.

StatLink: http://dx.doi.org/10.1787/621056451217

the impact of several policy changes on mobile prices, which have declined significantly and today, cost about the same as a fixed line call (see Figure 2.11).

2.4 Infrastructure

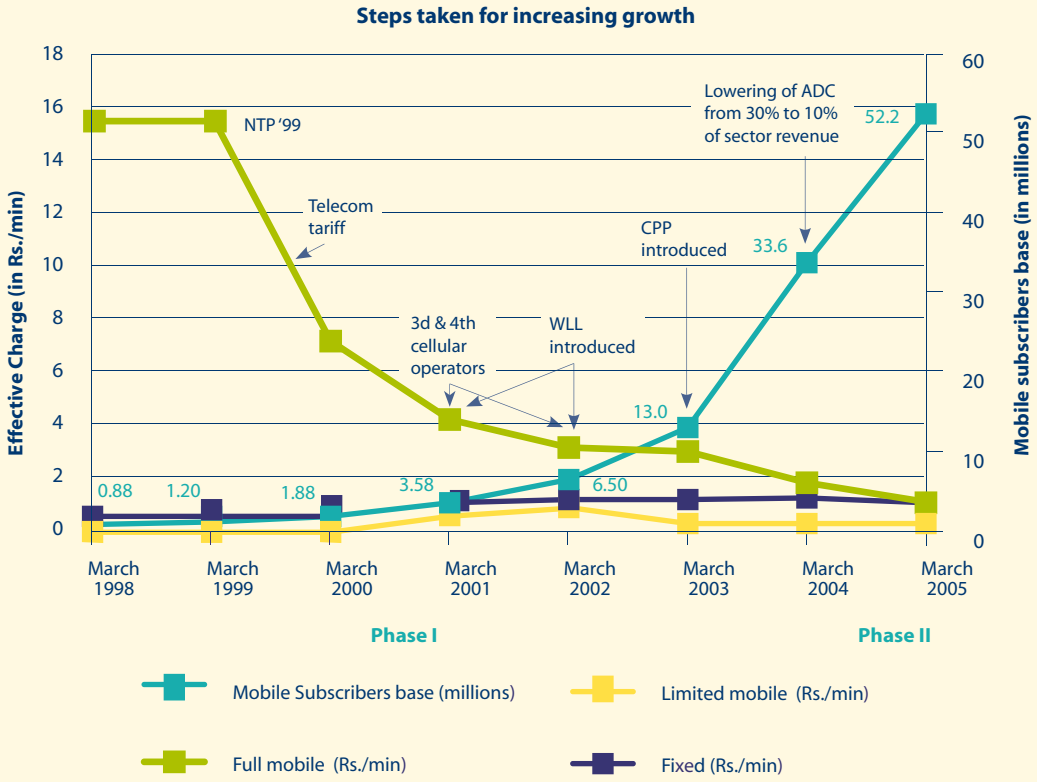
The availability of access to fixed and mobile telecommunications networks and terminal devices is fundamental for accessing electronic information and for participating in the Information Society.

Therefore, the percentage of homes with a fixed line is also an indicator of possible limits to Internet access.

With the emergence of the Information Society, the concept of universal service has evolved to include the proportion of households with a computer and the proportion of households with Internet access from their home. Europe tracks citizens' access to the Internet using the key policy indicator of the percentage of households with access to the Internet at home (see Figure 2.12). European officials are concerned about the European digital divide, noting: 'There are wide disparities in connectivity between Member States, and these have not reduced since 2001. The central aim of eEurope is 'the Information Society for all', but this latest benchmarking evidence shows there has been little convergence between Member States.'[10]

Figure 2.11: Mobile prices in India

Mobile growth and effective charge per minute (in Rupees)



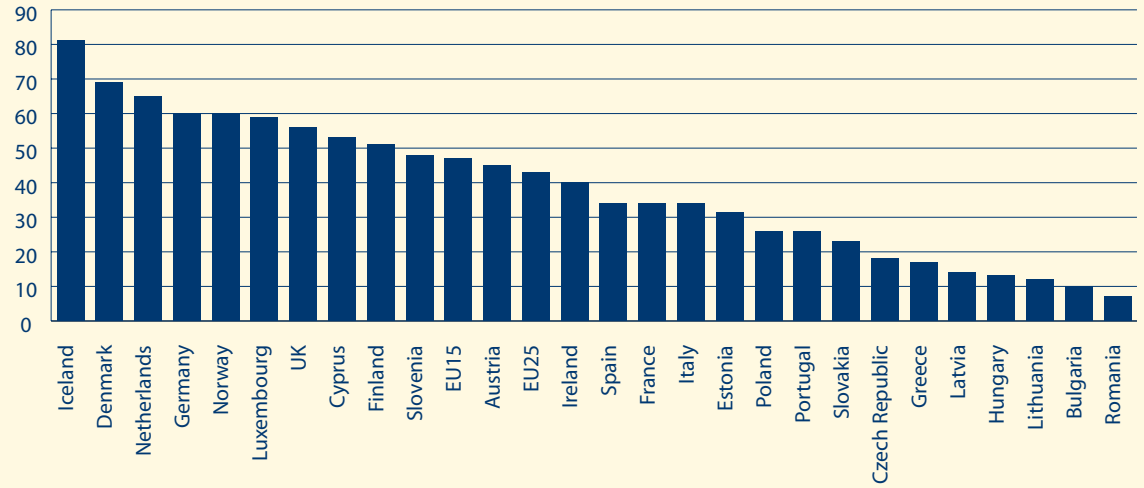
Note: NTP '99 = India's New Telecom Policy 1999.
WLL = Wireless Local Loop
CPP = Calling Party Pays
ADC = Access Deficit Charge

Source: Telecommunications Regulatory Authority of India.

2.4.1 Universal service

The percentage of households with a fixed telephone has been the traditional definition of universal service in the telecommunication sector. In many developed countries, this indicator has been tracked for policy purposes to monitor progress towards universal service goals. A fixed telephone line is also a fundamental building block of the Information Society, as dial-up and broadband via Digital Subscriber Lines (DSL) remain the most prevalent forms of Internet access.

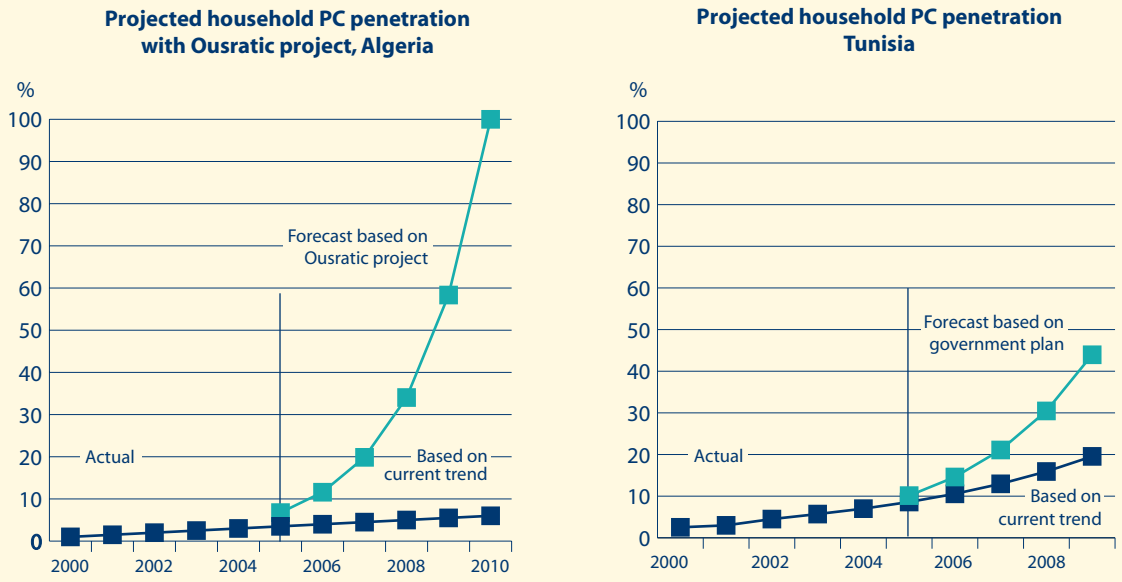
Figure 2.12: Households with Internet access, Europe, 2004



Source: EUROSTAT.

Universal service in ICTs is not only a policy prerogative of developed nations. In July 2005, Algeria announced its OUSRATIC programme (literally 'family ICT' programme) of 'one PC per household', to be reached by 2010 (see Figure 2.13, left).[11] This target aims to increase the number of computers by some five million. Tunisia has a similar programme for family computers. Less ambitious than Algeria, it calls for favorable financing of PCs for families in order to reach one million household PCs by 2009, or a penetration rate twice that of what would be reached under current trends (see Figure 2.13, right).[12] Egypt has a similar programme. All of these projects will need close monitoring to ensure they stay on track to meet their goals. The DOI is useful for this monitoring that these countries are undertaking, as it tracks household PC penetration.

Figure 2.13: Household PC projections for North Africa, 2000-2010



Source: ITU estimate (left chart); ITU estimate from Tunisian Ministry of Communications Technology data (right chart).

2.4.2 Individual access

Mobile phones are personal in nature. The sheer variety of cell phones emphasizes individuality. There are now cell phones targeted exclusively for children[13] and fashion phones by popular designers (see Figure 2.14).[14] These developments have revolutionized universality concepts. Universal access refers to access at public facilities, while universal service refers to having ICTs in the home. The mobile phone does not fit either of these categories. It is thus appropriate to measure individual access to mobile telephony. The infrastructure category of the DOI includes two indicators that do so: mobile cellular subscribers per 100 inhabitants and mobile Internet subscribers per 100 inhabitants.

The status of mobile phones as the preferred form of communications was confirmed when they surpassed fixed lines in number in 2002. By the end of 2005, there were only a handful of countries where there were still fewer mobile subscribers than fixed telephone lines. The percentage of mobile cellular subscribers in the population can exceed 100 (achieved by two countries in 2002, three in 2003, nine in 2004 and 26 in 2005; see Table 2.2) due to double-counting of lapsed subscriptions, as well as some users having more than one subscription. This implies that there are already more mobile phones than inhabitants in some countries, which is likely to be the case as we approach ubiquitous network societies in which computer and communication capabilities will become embedded in the environment and objects around us. Nevertheless, survey-based data confirm the trend towards ubiquity of mobile phones. In Finland, 99 per cent of the population between the age of 15 and 40 has a mobile phone; in the population as a whole, 94 per cent own a mobile phone (See Table 2.3).[15]

Figure 2.14: A mobile for every taste

Source: Firefly, Samsung.

Table 2.2: Countries with mobile penetration greater than 100, 2002-2005

2002	2003	2004	2005	Rank 2005
Luxembourg	Hong Kong, China	Czech Republic	Austria	11
Taiwan, China	Luxembourg	Hong Kong, China	Bahrain	12
	Taiwan, China	Iceland	Cyprus	21
		Israel	Czech Republic	7
		Italy	Denmark	18
		Luxembourg	Estonia	10
		Norway	Finland	17
		Sweden	Greece	13
		United Kingdom	Iceland	20
			Ireland	15
			Israel	5
			Italy	3
			Hong Kong, China	4
			Jamaica	16
			Lithuania	2
			Luxembourg	1
			Macao, China	6
			Netherlands	22
			Norway	25
			Portugal	9
			Singapore	19
			Spain	23
			Sweden	24
			Taiwan, China	26
			United Arab Emirates	14
			United Kingdom	8

Source: ITU/Korea Digital Opportunity Platform.

Table 2.3: Percentage of persons with a mobile phone, Finland, 2005

	Age group, %				
	<40	40 - 49	50 - 59	60 - 74	All
Men	99	97	94	89	96
Women	99	95	92	74	91
Total	99	96	93	81	94

Source: Statistics Finland.

While one mobile phone per person is the norm in developed nations, developing countries are also moving in this direction. There are signs that the rapid growth of mobile telephony means that these countries are reaching the milestone of one mobile per person more quickly than in the past. In Algeria, for example, mobile penetration has jumped from less than 1 to over 40 in just five years. The dream of an individual mobile phone for all may even be realizable in the Least Developed Countries (LDCs), where cellular phone subscriptions are skyrocketing. After all, mobiles first exceeded fixed telephones in an LDC (Cambodia in 1993). Today, 96 per cent of all of telephone subscribers in Cambodia use a mobile phone, the second-highest ratio in the world. The highest ratio of mobile phone users in the world is the Democratic Republic of the Congo, where the fixed line network is virtually non-existent.

Achieving a telephone penetration of one was often used as a lofty target for LDCs: by 2005, there were only three LDCs that did not have a mobile penetration above one. In Bangladesh, where mobile penetration was less than one in 2000, it had risen to 5.7 by 2005 and is forecast to reach 20 by 2010. For one fifth of the population of a country - where the average citizen lives on just over a dollar a day - to subscribe to mobile phones in less than a decade is both amazing and inspiring. This may still be a far cry from the universal rate of over 100 experienced in some developed nations, but nevertheless, it is an astounding feat in a country where it took over one hundred years to reach a fixed line penetration of one.

Given the transition from fixed to mobile as the most popular method of communications, it follows that Internet access over mobile networks is an important means of bridging the digital divide and enhancing digital opportunity. Many applications available in a 'fixed-line' Internet access mode are also available in a miniaturized mobile mode. Examples of mobile data applications that are improving public administration, enhancing livelihoods, facilitating financial transactions, as well as providing entertainment, include:

- In Senegal, Manobi has created a mobile-based agricultural pricing system. The system has received much praise and recognition, and won the World Summit Award for the best e-content and the African ICT Achievers' Award for the most innovative company. Over 3'000 Senegalese farmers and traders receive product prices on their mobile phones (see Figure 2.15, left). One farmer reported making 30 per cent more from selling cabbages by using the system.[16]

- In the Philippines, the Civil Service Commission receives between 1'000-1'500 queries and complaints each month by text messages sent from mobile phones by citizens.[17]

- Celpay in Africa provides a mobile payment service using mobile phones. Celpay received a Wall Street Journal Europe Innovation Award for the service, which is operational in Zambia and the Democratic Republic of the Congo. Given that traditional consumer banking is virtually non-existent in Africa, Celpay has great potential. For example, the

Figure 2.15: Mobile phones at work and play

Source: Manobi, T-Mobile.

Democratic Republic of the Congo only has around 20,000 active bank accounts, but over two million mobile subscribers.[18]

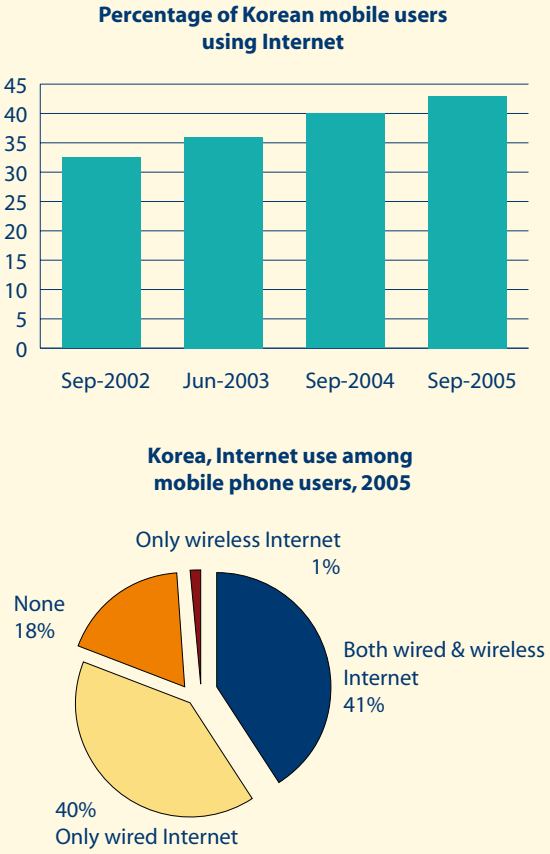
- The German mobile operator T-Mobile broadcasts 2006 World Cup matches to customers' cell phones in Austria, Croatia, Czech Republic, Germany, Hungary, Slovakia and the UK (see Figure 2.15, right).[19]

The number of mobile Internet subscribers can also be used to track the usage of 'm-applications'. Data availability is not as robust as it might be and the statistics that are available carry different definitions and concepts. Such teething problems are not surprising, given the novelty of the service. However, mobile Internet subscribers are a crucial indicator to monitor, given the growing impact that the mobile Internet will have in the future.

Some economies analyze information about mobile Internet use, especially the leaders in Internet access from mobile phones. For example, the Republic of Korea publishes a detailed report on mobile Internet use based on a multitude of indicators: the percentage of mobile phone users using the wireless Internet stood at 43 per cent in 2005 (see Figure 2.16, upper chart).[20] In the Republic of Korea, the vast majority of mobile users who use the wireless Internet also use the wired Internet, with only 1 per cent using the wireless Internet exclusively (see Figure 2.16, lower chart).

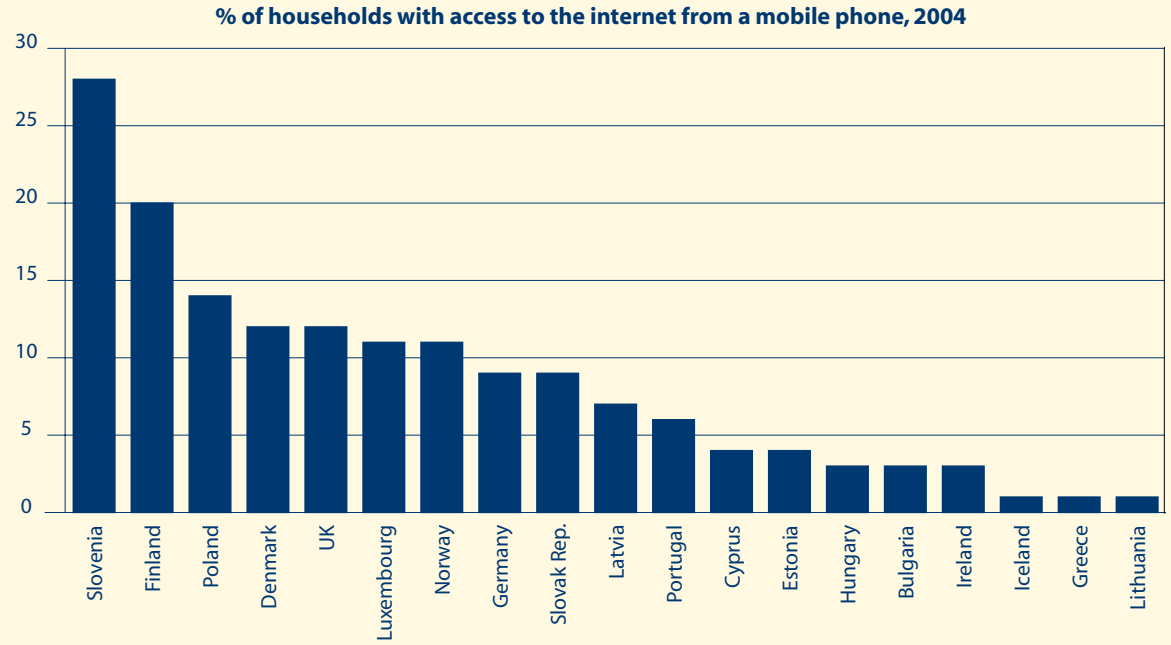
One interesting aspect of mobile Internet usage is the wide variation in access among countries of similar economic or geographic circumstances. In Europe, almost a third of Slovenian households and one fifth of Finnish households use mobile phones to access the Internet, while in other countries, less than five per cent of households use mobile phones to access the Internet (see Figure 2.17).

Figure 2.16: Mobile Internet in the Republic of Korea, 2002-2005



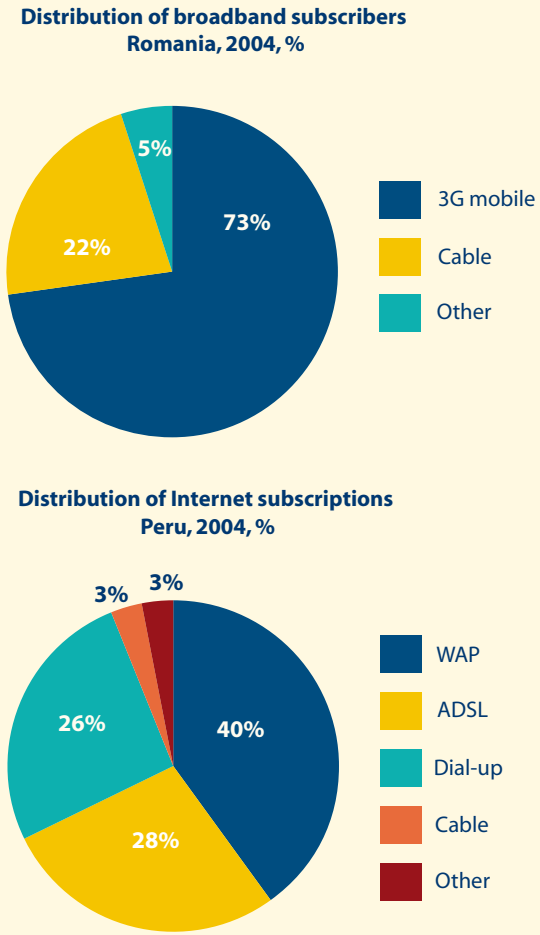
Source: NIDA.

Figure 2.17: Mobile Internet in Europe



Source: EUROSTAT.

Figure 2.18: Mobile Internet in Romania and Peru



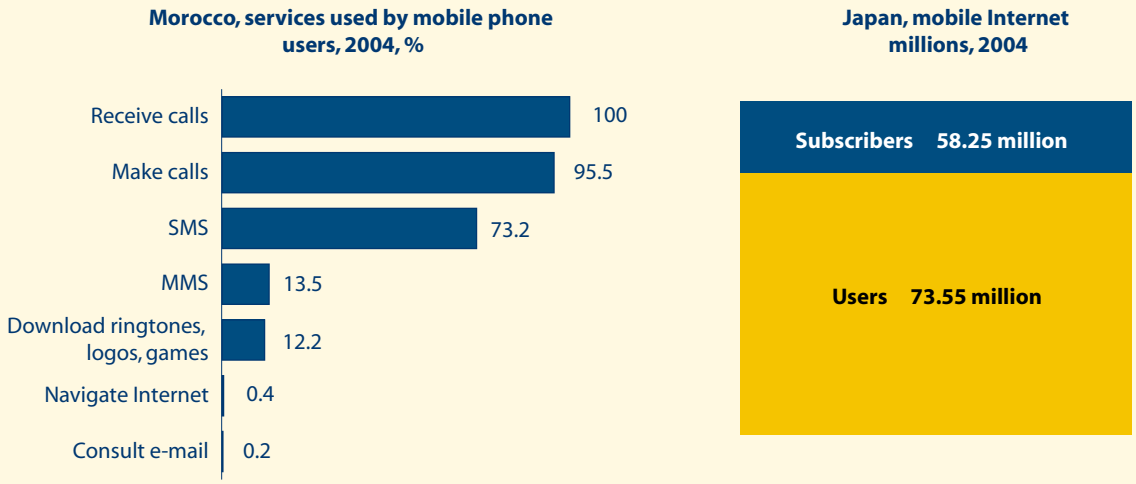
Source: Adapted from ANRC and OSIPTEL.

There is a growing number of developing nations where mobile Internet statistics are being compiled. In Romania, the majority of broadband connections are from mobile (see Figure 2.18, upper chart). In Peru, the telecommunication regulator includes Wireless Access Protocol (WAP) subscribers with its Internet subscription statistics. In that country, WAP is the main method of Internet subscription, ahead of dial-up and broadband (see Figure 2.18, lower chart).

Surveys offer interesting insights into mobile Internet use. In Morocco, an ICT survey asked mobile users about how they used their phones. While all Moroccan mobile users used their cell phones to receive calls, only 0.4 per cent used them to access the Internet (see Figure 2.19, left). Surveys also contrast with the often exuberant and confusing figures published by operators for mobile Internet use. For example, although Japan has the world's highest ratio of mobile Internet subscribers per 100 inhabitants, a survey by the Ministry of Internal Affairs and Communications indicates that not all subscribers are actually using their mobiles to access the Internet (see Figure 2.19, right).

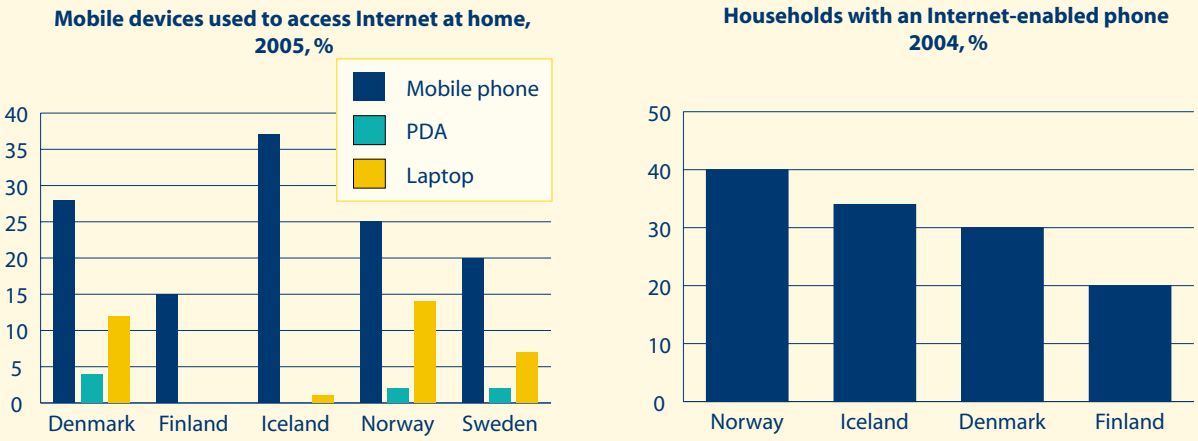
The proportion of households with computers is an 'Infrastructure' indicator in the DOI. It would be useful to have a counterpart indicator for mobile. There are a number of Internet access mobile devices such as mobile phones, laptops, PDAs and smartphones. There is good data from the Nordic countries on the prevalence of each. While 40 per cent of Icelanders access the Internet using a laptop computer at home, they hardly use mobile phones or PDAs to do so. In contrast, over 10 per cent of Danes and Norwegians use mobile phones to access the Internet (see Figure 2.20, left). What is puzzling is why Icelanders do not use the mobile Internet more widely, since they have the second-highest ratio of Internet-enabled phones, after Norwegians (see Figure 2.20, right).

Figure 2.19: Mobile Internet use in Morocco and Japan



Source: ANRT (Morocco), Ministry of Internal Affairs and Communications (Japan).

Figure 2.20: Mobile devices in the Nordic countries



Source: Nordic Information Society Statistics, EUROSTAT.

2.5 Utilization

2.5.1 Internet access

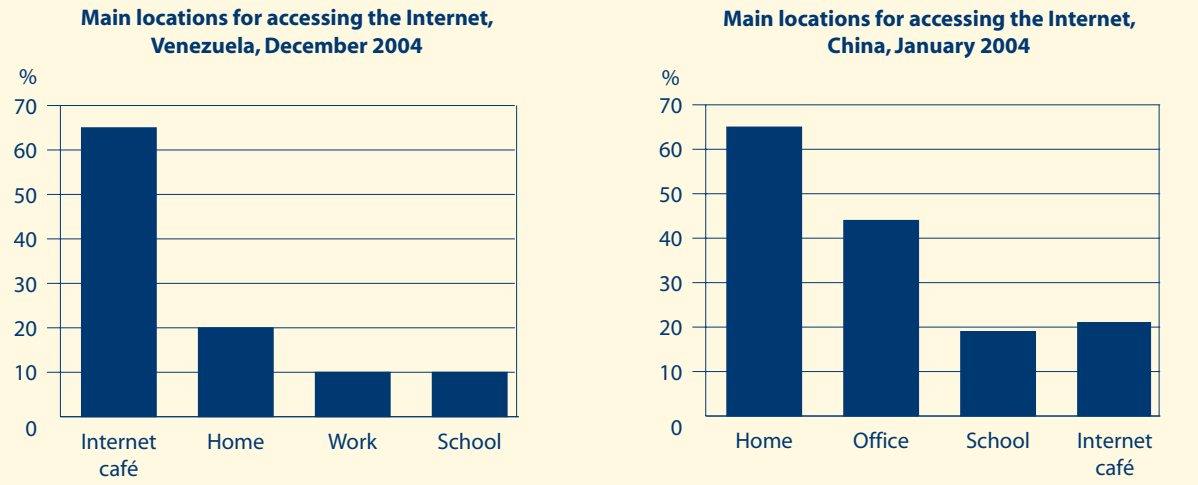
The most popular indicator when discussing the Information Society is the proportion of the population using the Internet. As more and more countries conduct surveys on Internet usage, our understanding about how many people are accessing the Internet is improving. Coordinated efforts in Europe and East Asia have proved especially successful at measuring Internet usage.

The most reliable source of data for this indicator is through a survey. Many developing countries have yet to conduct such surveys, so other methods are used to estimate the number of users. Non-survey estimates are typically based on the number of Internet Service Provider (ISP) subscribers, with assumptions about the number of users per subscriber. However, this method can underestimate the number of users accessing the Internet from Internet cafés. In many developing countries, Internet cafés are the main way of accessing the Internet. A survey from Venezuela found that 66 per cent of Internet users frequent Internet cafés, while in China, only 20 per cent of Internet users visit cafés (see Figure 2.21).

Where accurate, then the percentage of Internet users is a good indicator. Even if people use the Internet from public facilities, they will be included as users. Indeed, the indicator is crucial for measuring the success of government policies in providing public Internet facilities.

In keeping with the DOI's ability to track both fixed and mobile development, it would be ideal to have a breakdown of whether Internet users are fixed or mobile. Few countries

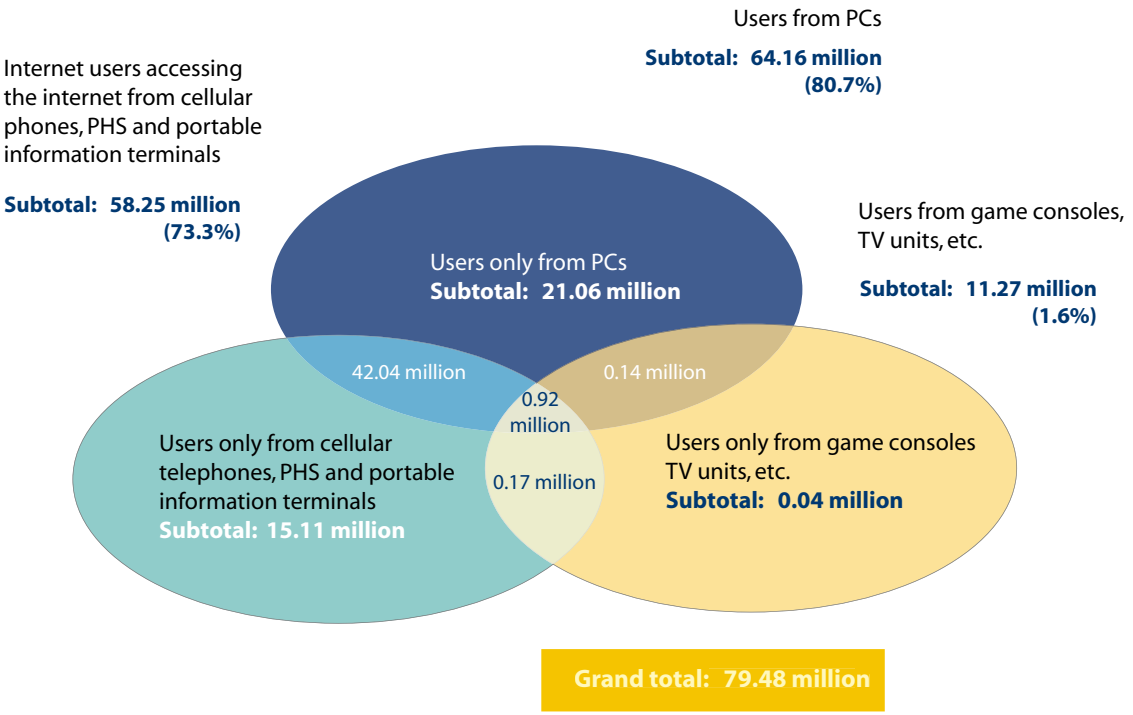
Figure 2.21: Are we being counted?



Note: Multiple choices were possible, so totals exceed 100 per cent. Ranked in order of preference.

Source: Cavecom-e, CHNIC.

Figure 2.22: Distribution of Internet users by device, Japan, 2004



Note: Figures in parantheses indicate the ratio 'Aged 6 or older' to the total number of Internet users. The total of the figures in parantheses may not be 100, because the number of internet users is rounded, so the total of breakdowns may not necessarily tally with the overall total.

Source: 'Communications Usage Trend Survey in 2004 Compiled', Ministry of Internal Affairs and Communications (Japan).

currently provide this breakdown. Data from Japan show that some 15 million users or almost 20 per cent of users only access the Internet from their mobile phones (see Figure 2.22).

2.5.2 Broadband

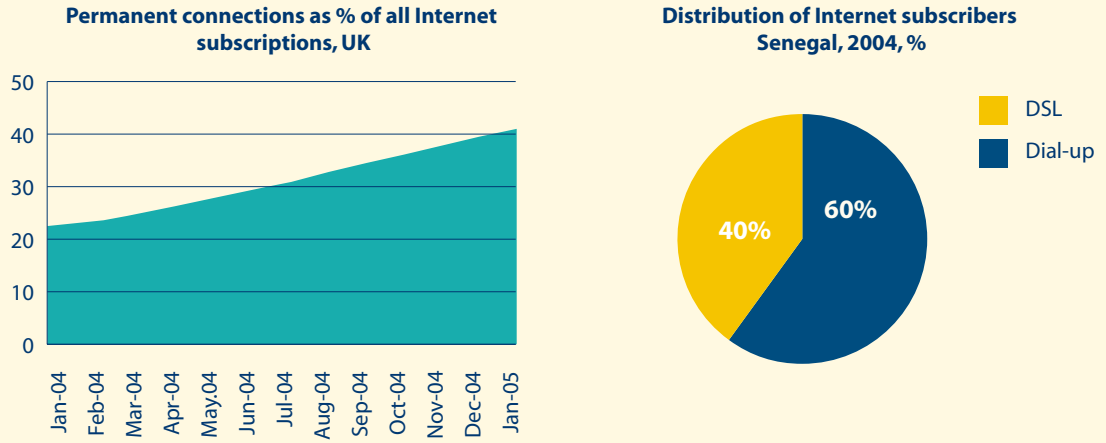
Many of the most desirable applications envisioned for the Information Society are only possible through broadband access. This has made the availability of high-speed Internet service a key policy objective in both developed and developing nations: Colombia promotes the 'massification' or widespread adoption of broadband;[21] India recognizes '… the potential of ubiquitous broadband service in growth of GDP and enhancement in quality of life…';[22] and Nigeria notes that 'broadband is an accelerator of social and economic development in the modern world.'[23]

Two indicators are included in the DOI to measure broadband: the ratio of fixed broadband subscriptions (e.g., Digital Subscriber Lines, access over cable television networks, etc.) to total Internet subscriptions and the ratio of mobile broadband subscriptions to total mobile subscriptions. Since these ratios reflect quality of usage rather than sheer penetration, developing countries are less disadvantaged by these indicators.

The proportion of fixed broadband subscriptions is used in both developed and developing countries as a policy indicator. For example, the UK regularly monitors Internet subscriptions and the distribution between dial-up and, always-on (i.e., broadband) Internet subscriptions (see Figure 2.23, left).[24] In Senegal, the regulator also publishes the share of broadband in total Internet subscriptions (see Figure 2.23, right).[25] Both sets of statistics show a rising trend towards broadband subscriptions. Given the right mix of policy and regulatory encouragement, it is possible that all Internet subscriptions could eventually migrate to broadband.

One barrier to the growth of broadband in developing nations is the lack of the necessary underlying wired infrastructure, such as copper telephone lines and coaxial television cable. Wireless seems the most feasible short-term solution to spreading broadband in developing nations. Wi-Fi has proven popular as a way to connect computers to the Internet, but it is limited by its range. A related technology, WiMAX, is being promoted as a solution for high-speed access, as it can cover large distances. If WiMAX enjoys commercial success, it could prove a broadband solution for many developing countries. Since WiMAX provides another high-speed alternative, it can

Figure 2.23: Broadband ratios in the UK and Senegal



Source: Adapted from National Statistics (UK, left chart); Agence de régulation de télécommunications (Senegal, right chart).

also intensify competition among DSL and cable television providers and lead to lower broadband prices.

Mobile broadband refers to the number of subscribers to mobile cellular networks offering speeds of 256 kbit/s or more. Three 3G technologies (CDMA EV-DO, W-CDMA and TD-SCDMA) meet this definition.[26] However, mobile broadband differs from fixed broadband (where users subscribe mainly for higher speed access) in that users may subscribe for a variety of reasons other than broadband access per se. Broadband mobile offers considerable advantages in capabilities and quality. Ideally, all mobile subscriptions should eventually have access to broadband speeds to meet the highest level of quality and provide the option of high-speed Internet access.

One methodological complication with wireless broadband is whether it should be classified as a fixed or mobile service. Arguably, users carrying a laptop computer or a PDA accessing a Wi-Fi network could be perceived as mobile users. However, users must go to a hot spot to access the Internet, carrying the connotation of being 'fixed'. On the other hand, some users of broadband mobile networks only access them from laptops.

2.6 Conclusions

In line with the WSIS goals, many nations are designing their strategy for the creation of the Information Society and the role of ICTs in their economic and social development, taking into account the specific needs and circumstances of each country. Monitoring implementation is essential to ensure that countries promote a broad-based take-up of ICTs and build an inclusive Information Society. Monitoring and measurement using indices helps identify the full impact of policies, so policy-makers can learn from more successful policies and avoid ineffective measures.

The Digital Opportunity Index is the only e-index based solely on internationally agreed ICT indicators. This makes it a valuable tool for benchmarking the most important indicators for measuring the Information Society. The DOI is a standard tool that governments, operators, development agencies, researchers and others can use to measure the digital divide and compare ICT performance within and across countries.

The core infrastructure and use of ICTs by households and individuals indicators selected for constructing the DOI lend themselves to various analytical possibilities. On one hand, the index can be deconstructed along categories such as opportunity, infrastructure and utilization. This assists analysts in determining where countries are relatively strong and weak and focusing attention on priority areas. On the other hand, the DOI lends itself to a fixed/mobile de-aggregation, useful for analyzing the degree to which each is impacting the path countries are taking towards becoming an Information Society. The next chapter shows how the DOI can be used to track countries' progress and analyze changes in the digital divide.

Annex: Methodological Note

The definitions of the core indicators used to compile the DOI are available from the Partnership.[27] The latest available data (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.

Note: † Derivation of core indicator. *Source:* ITU/KADO.

Endnotes

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