Community Access Indicators

Extract adapted from chapter 2 of the
2003 World Telecommunication Development Report:
Access Indicators for the Information Society
on "Measuring Acess to ICTs".

2. MEASURING ACCESS TO ICTS

2.1 Introduction

Ensuring universal service and access to information and communication technologies (ICTs) is in many countries a top national objective, often enshrined in laws that govern the sector.[1] Despite this, few governments presently track accessibility on a regular basis. Those governments that do measure and monitor access, do not always use the most appropriate indicators. Furthermore, given the different approaches taken by different countries, the different indicators used worldwide are not always compatible. These factors have made it difficult to measure ICT development accurately and to elaborate targeted plans for enhancing access. With these obstacles in mind, this chapter examines ways of measuring access to ICTs in three major areas: individual, household and community access.

2.2 Measurement in practice

Access to ICTs can be quantified in various ways, with indicators based on different categories:

- *Individual*. Indicators that measure accessibility in terms of *people*. This includes indicators such as main telephone lines per 100 inhabitants or the percentage of the population that uses the Internet. This also includes spatial indicators that measure accessibility in terms of coverage or distance from ICT facilities. Some indicators in this category are useful for tracking *universal access*, or the percentage of the population that could theoretically use an ICT device or service.

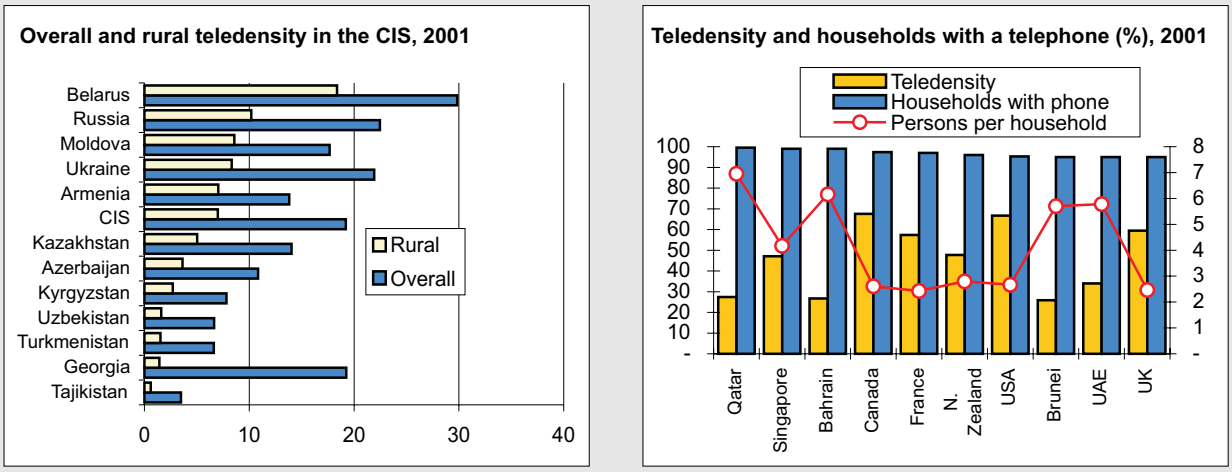
- *Household*. Indicators that measure the availability of ICTs in the *home* such as the percentage of households with a telephone. Household measurements determine the level of *universal service*.

- *Community*. Indicators that revolve around the availability of services in *population centres* such as the number of villages with telephone service. This can also include access to shared facilities such as Internet cafés.

Per capita measurement is the traditional method of illustrating individual access to ICTs. One reason for this is that virtually all ICT service providers compile administrative records for operational and billing purposes. It then is a simple mathematical exercise to divide an ICT device or service by the population to derive a per capita indicator. While such per capita measures are convenient and useful for comparing general statistics across countries, they can be misleading. This is because a *per capita* indicator does not reflect the differing socio-demographic composition of nations. If there are 100 telephone lines in a country all owned by the same person, for example, then is that country better off than a country with 50 telephone lines owned by 50 different people? In a similar vein, a concern in many countries is equitable distribution of ICT services between urban and rural areas. For example, data from the Commonwealth of Independent States on main telephone lines per 100 inhabitants would place Moldova sixth. However in terms of main telephone lines per 100 inhabitants in rural areas, Moldova ranks third, suggesting it has a more equitable distribution of telephone lines than countries that have a higher

Figure 2.1: Per capita distortions

Main telephone lines per 100 inhabitants, overall and rural, Commonwealth of Independent States (CIS), 2001 (left) and main telephone lines per 100 inhabitants and percentage of households with a telephone, selected high income economies, 2001 (right)



Source: ITU World Telecommunication Indicators database and RCC.

overall penetration (Figure 2.1, left). Per capita measures can also be distorted because of demographic differences. For example, some countries with large family sizes may be as well off in terms of household telephone penetration as countries that, on a per capita basis, have more telephone lines (Figure 2.1, right).

The penetration rate of ICTs per 100 households is thus a more precise measurement of access than per capita indicators. While the number of telephone lines per 100 subscribers gives only a general idea of access, the number of homes with a telephone is quite specific. With a per capita measure, it is difficult to determine what kind of targets should be set whereas for households, the ideal is that 100 per cent should have ICTs. The level of ICTs in households is also the way *universal service*—a fundamental policy objective of many nations— is measured.

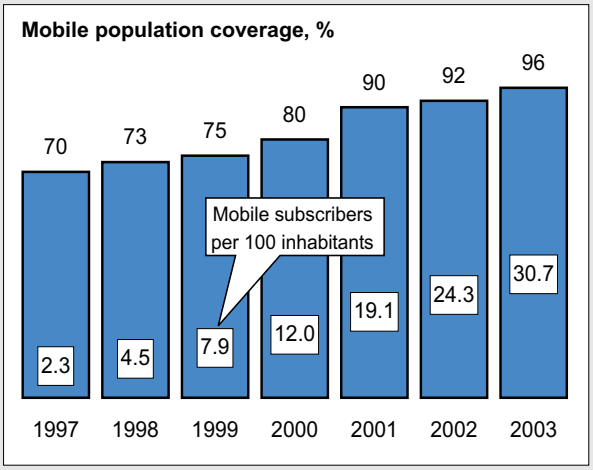
Universal service in telephones and newer ICTs such as personal computers or Internet access will not be achievable for many developing nations in the short-run. Their concern should be to promote widespread accessibility of facilities outside the home, such as public payphones and Internet cafés. This is known as *universal access* — that is, the prevalent availability of services. How can this be measured? Per capita measurements, such as public payphones per 100 inhabitants, are not so useful because they do not give a clear indication of how many people have access. One possibility is to ask heads of households, through a survey, what options they have for using ICTs. In the 2001 South African census for example, householders were asked whether they had access to a telephone at their neighbours' home or other locations outside their home. The census found that six per cent of households did not have convenient access to a telephone of any type. This result indicates that South Africa's rate of universal access is 94 per cent (Figure 2.2, left).

Another useful way of measuring universal access is mobile cellular coverage. Practically every country in the world now has at least one mobile cellular operator.[2] There is an ideal indicator for measuring universal access based on mobile technologies: the *percentage of the population that is covered by a mobile cellular signal*, regardless of whether they currently subscribe to the service. A number of mobile operators compile this statistic, though they do not always report it on a systematic basis. In addition, coverage rollout can be a licence obligation in some countries and is therefore a measurable indicator.[3] Furthermore, it is not a difficult statistic to compile, so it is surprising that more countries do not provide it, particularly in view of its usefulness in measuring universal access. In the case of South Africa, only four per cent of the population is not covered by a mobile cellular signal so the level of universal access

Figure 2.2: Two ways of measuring universal access

Household telephone access, per cent, 2001(left) and mobile population coverage, per cent 1997-2003 (right), South Africa

Telephone facilities available to households, per cent			
Telephone in dwelling and cell-phone	14.2	Universal Service = 42.4	Universal Access = 94.0
Telephone in dwelling only	10.2		
Cell-phone only	18.0		
At a neighbour nearby	6.6		
At a public telephone nearby	38.5		
At another location nearby	3.2		
At another location, not nearby	3.4		
No access to a telephone	**6.0**		
Total	**100.0**		



Note: Mobile population coverage refers to the percentage of population that are within range of a cellular signal regardless of whether they are subscribers or not.

Source: ITU adapted from Statistics South Africa and MTN.

is 96 per cent (Figure 2.2, right). The two figures reached, 94 and 96 per cent respectively, are remarkably close. The former figure is a more precise indicator of universal access since it is based on results that ask about the availability of telephone service. The latter figure is theoretical, based on the assumption that if a person had a mobile phone, they could use it to make a call. Nonetheless, they are both useful figures and the latter is particularly important in the absence of surveys.

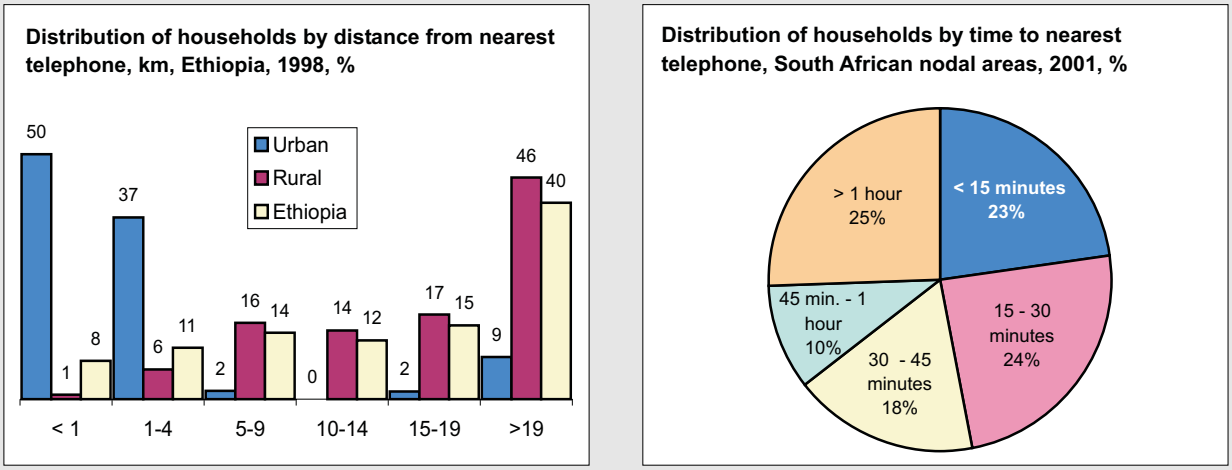
Some countries have used other ways of measuring universal access. Spatial indicators measure distance or time from ICT facilities. In 1998, Ethiopia collected data about distances between households and the nearest telephone broken down by rural and urban locations (Figure 2.3, left).[4] Respondents were asked whether they *used* a telephone and if not why. Surprisingly, even though 40 per cent of households are more than 19 kilometres from a phone, only half cited distance as being a barrier and only one per cent mentioned price. Over three-quarters mentioned there were other reasons for not using a telephone but did not specifically state them. And even though there were only 0.3 main lines per 100 inhabitants in Ethiopia, almost twenty per cent of households reported that they used telephones. South Africa has compiled data on the time to the nearest telephone for selected rural households.[5] The data show that one quarter of poor rural households are more than one hour away from a telephone (Figure 2.3, right).

While spatial indicators can be useful, they suffer from the relativity of the measurement. For example, ten kilometres may not seem like a great distance on a motorcycle, while two kilometres could be far to walk for an elderly person. The time taken to reach a telephone also depends on what transport is available. To avoid ambiguity, it would be preferable to use the *availability of a telephone service outside the home* and *percentage of population covered by mobile* as the preferred indicators for measuring universal access to telephones. While these measures are typically used in relation to telephone service, they could equally be applied to other ICTs.

Another concept of accessibility revolves around community measurements. In this case, indicators such as the number of localities with a certain ICT could be measured. This can be a valuable indicator, since one desirable goal in expanding ICT access would be to provide all localities with ICTs. Most countries have statistics about the number of localities (e.g. cities, towns and villages) within their territory. It would be logical to measure the availability of services in these administrative units. However, it has to be noted that population dispersion is not the same across localities. An indicator such as the *percentage*

Figure 2.3: Spatial dimensions of ICT access

Percentage distribution of households by distance from telephone service, kilometres, 1998, Ethiopia (left) and percentage distribution of nodal households by time to nearest telephone, South Africa, 2001(right)



Note: Right chart: Nodal areas are 13 specific areas for accelerated rural development. These are rural areas in South Africa of extreme poverty, with a serious lack of facilities and services.

Source: ITU adapted from Central Statistical Authority (Ethiopia), Ethiopian Telecommunication Corporation and Statistics South Africa.

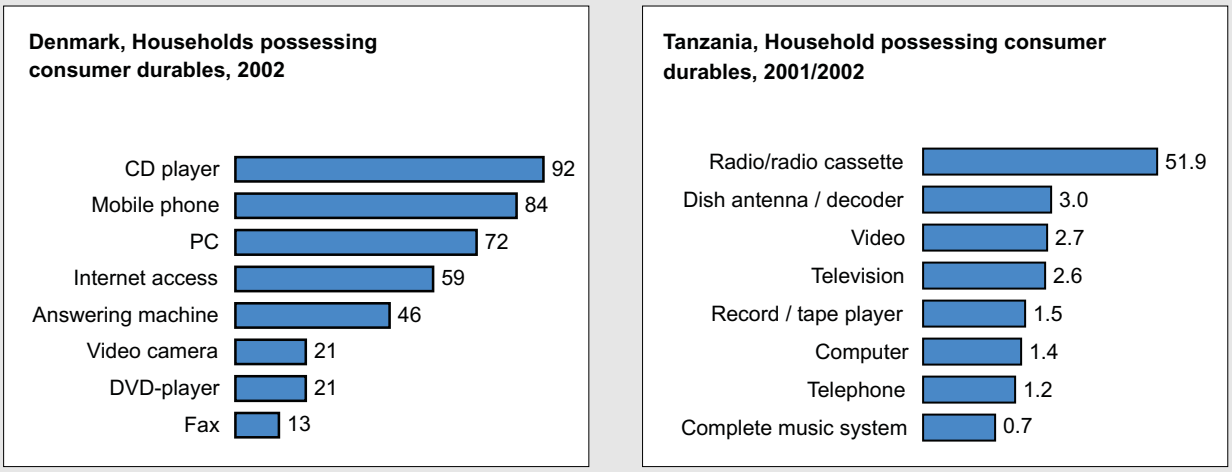
of villages with a telephone is not the same as the *village population with access to a telephone*. It would be logical to assume that more populated villages would be covered first.

2.2.1 The problems of comparability

One difficulty often confronted when comparing ICT statistics is that different terms are used for measuring access. This makes country comparisons imperfect. For example, a clear distinction exists between use, access and ownership/subscription, but the terms are sometimes used interchangeably. *Access* means that an individual could *utilize* an ICT because it is available but may not necessarily be doing so. *Use* means that a person is actually utilizing an ICT. *Ownership/subscription* means that the individual possesses an ICT device or subscribes to an ICT service. Another point of confusion is that some surveys ask households whether they have access to an ICT service, rather than asking whether the service is available from the home. For example, a household would be counted as having Internet access even if access was not available from the home, but the head of household had access from work. Countries should therefore try to be specific about what they mean or use the most appropriate term. Ideally, they should compile statistics on all three: access, use and possession/subscription. Comparing access, use and ownership helps identify barriers and has important policy implications. For example, if the level of usage does not match the level of accessibility, this suggests that there are other barriers besides infrastructure that are affecting the take-up of ICTs. The level of ownership, measured through purchase or subscription to an ICT good or service, can reflect how convenient it is to use ICTs.

Another important consideration is that the relevance of specific ICTs differs between developed and developing countries. Developed countries may be interested in newer ICTs and may no longer collect data for older ones (e.g. radio, television and fixed telephones) on the assumption that almost all households already possess them. Conversely, developing nations may assume that so few households have new technologies such as Internet access that they are not worth tracking. Denmark, for instance, does not track statistics on how many households have radios, televisions or fixed telephone lines and has chosen to focus on consumer electronics (e.g. DVD players, etc.), computers and the Internet (Figure 2.4, left). Tanzania on the other hand, tracks radios, television and fixed telephones but not access to the Internet (Figure 2.4, right). The drawback with these different focuses is that they result in a "statistical divide", where comparable data are not

Figure 2.4: Gaps in possession collecting and in possessions collected
Percentage of households with various ICTs, 2002, Denmark (left) and Tanzania (right)



Source: ITU adapted from Statistics Denmark and National Bureau of Statistics (Tanzania).

available for all countries. Another disadvantage relates to the fact that some ICTs, considered to be "old", are not tracked, whereas the decline of certain technologies can be an extremely useful factor to measure for analytical purposes. In the case of Denmark, the lack of data about household possession of fixed telephones means that this cannot be tracked in relation to mobile. This is important because a fixed telephone typically offers more and cheaper solutions for Internet access than a mobile.

2.3 Indicators

There are numerous ICTs from the mundane (radio) to the futuristic (global positioning systems) as well as many sub classifications (e.g. desktop computer, laptop computer, personal digital assistant). Collecting official data for all of them is beyond the capacity of most nations. This section highlights the most relevant ICTs for measuring household and individual access to the information society.

2.3.1 Broadcasting

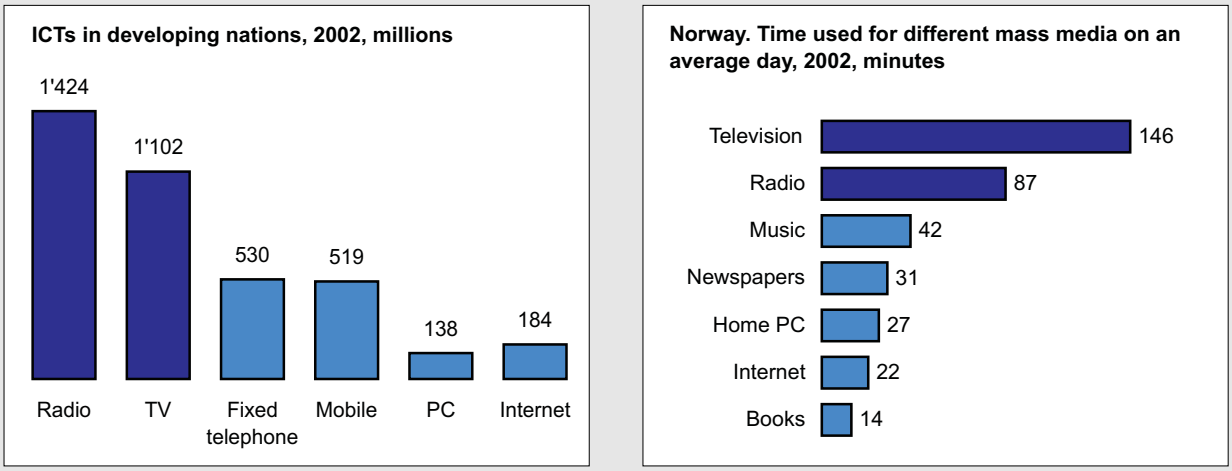
Radio and television broadcasting is the predominant means of electronic information and entertainment in all countries. Time use surveys for most developed nations show that watching television is the activity people devote the most time to after work and sleep. The average Norwegian spends over two hours a day watching television and over one hour listening to the radio (Figure 2.5, right). In developing nations, access to broadcasting is far higher than access to other ICTs such as telephones or personal computers (Figure 2.5, left). This makes compiling indicators on access to information delivered over broadcast networks very relevant.

Broadcasting is also important to monitor because of its fusion with other ICTs.[6] For example, it is possible to make telephone calls and access the Internet over cable television networks. Broadcast technologies also have a role to play as a development tool particularly in developing countries. Radio is being combined with Internet technologies to overcome literacy and language barriers. In this situation, radio stations download information from the Internet and re-disseminate it orally to the surrounding community, in local languages.[7]

Most countries in the world have radio and television stations. One common indicator, c*overage*, varies with limitations due to difficult terrain and a lack of electricity.[8] The latter appears to be a significant barrier, perhaps even more than affordability. Data from Africa show a strong relationship between the availability of electricity and home television set ownership (Figure 2.6, left). Anecdotal evidence suggests that one of the main reasons consumers opt for electricity in developing nations is to power television sets. Unlike radios, batteries cannot easily power a television set.[9] Data from developing countries suggest that while radio ownership is

Figure 2.5: The most popular ICTs

ICTs in developing nations, millions, 2002 (left) and time used for different mass media, per day in minutes, 2002, Norway (right)



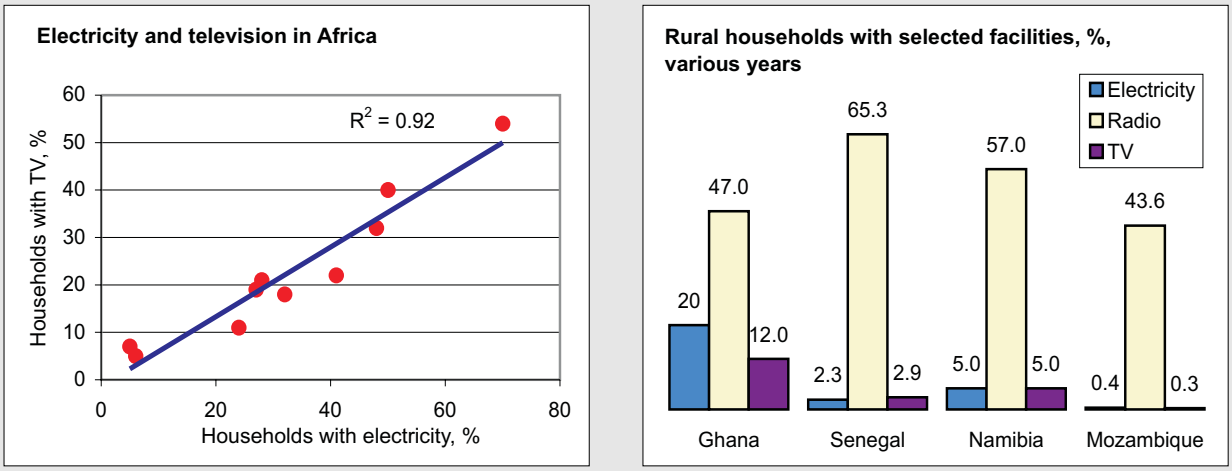
Note: Left chart: Radio and TV refers to sets, mobile refers to mobile cellular subscribers, Fixed telephone refers to main telephone lines, PC refers to personal computers and Internet refers to users. Right chart: Music refers to listening to DVDs, cassettes or records and not over radio.
Source: ITU World Telecommunication Indicators database and Statistics Norway.

roughly equally distributed between rural and urban areas, there is a significant gap for television, mainly attributable to the more limited availability of electricity in rural areas (Figure 2.6, right).[10] One implication is that statistics on the *number of homes with electricity* should be collected since the lack of a suitable energy source impacts the ability to use other ICTs.

The conventional indicators for measuring broadcast penetration are the *number of radio and television sets* and the *percentage of households with a radio or*

Figure 2.6: Electricity and ICTs

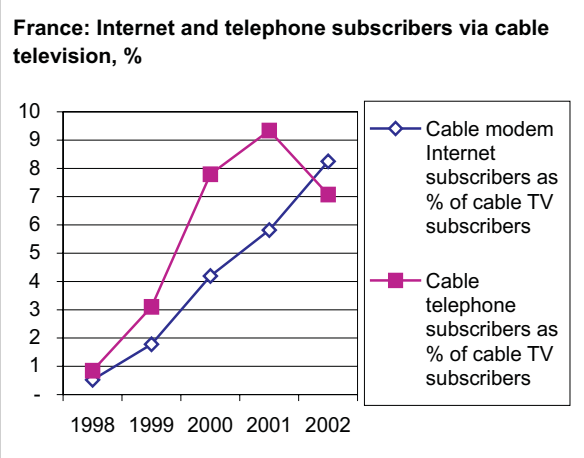
Relation between households with electricity and television (left) and rural households with selected facilities (right), selected African countries, various years



Source: ITU adapted from national statistical offices.

Figure 2.7: Cable television indicators
France, 2002

	31 Dec. 2002	Per cent of households
Households	24'651'000	100.0
Households passed by cable TV	8'810'270	35.7
Households passed by cable Internet	6'122'067	24.8
Cable TV subscribers	3'430'194	13.9
Cable modem Internet subscribers	282'992	1.1
Cable telephone subscribers	56'185	0.2



Source: ITU adapted from *Association française des opérateurs de réseaux multiservices* (AFORM, France).

television.[11] Few countries collect the number of broadcast sets and thus most data are estimates.[12] These are derived from sales of sets or surveys asking households whether they have a television. Some countries with licensing regimes collect data on the number of licences. This statistic is often used as a proxy for household availability. However not all people pay the licence fee so the true figure is underrepresented. This is apparent when licence data is contrasted with census or household surveys on the number of homes with a broadcast reception set. Few developed countries compile data on households with a radio and some do not ask about the availability of a television set.[13] This makes broadcast data another source of the statistical divide with radio ownership often of more relevance to the least developed nations.

Cable television networks can be built to provide telephone service and Internet access. Therefore the availability of cable television statistics is important for understanding a country's ICT potential. In this regard a number of useful indicators exist (Figure 2.7).

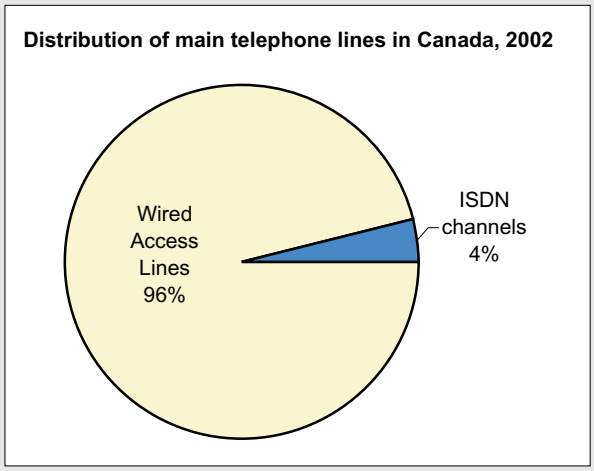
2.3.2 Fixed telephones

ITU has been publishing data on telephones since 1972 in its annual *Yearbook of Statistics*. The indicator has evolved with market trends and technological development. Initially, the number of telephone sets was compiled. This proved less useful as an indicator over time given the increasing number of telephone sets in the home, or attached to private branch exchanges (PBXs) in companies. Also, liberalization of equipment markets in many countries allowed consumers to choose their own sets, which meant that incumbent operators no longer knew how many there were. This led to a preference for *lines in operation*—also referred to as *main* or *direct exchange lines* (DELs) —as the primary indicator for measuring telephone access.

A main line has traditionally referred to the connection—typically a copper wire—from a subscriber to the telephone company's switching exchange. Technological changes have since blurred this definition. For example, in some countries, telephone service is provided via coaxial cable over pay television networks. In others, wireless local loop (WLL) technology severs the traditional concept of the main line represented by a copper line. The emergence of integrated services digital networks (ISDN) has also dramatically impacted the concept of the main line. ISDN converts a single physical line into virtual channels. Basic rate ISDN provides two channels while primary rate provides many more (e.g. 30 in Europe and 23 in North America and Japan).[14] This led to the practice, particularly in Europe and Japan of including ISDN channels in main line statistics. In order to enhance comparability, all countries should provide a breakdown of how their main telephone line figure is computed (Figure 2.8).

Figure 2.8: Breaking down main lines
Main telephone lines in Canada, 2002

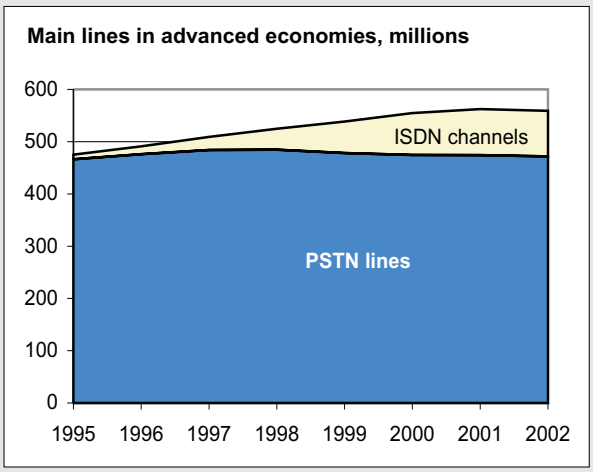
A. PSTN access lines	19'160'211	A. PSTN access lines	19'160'211
B. ISDN subscribers	95'853	C. ISDN channels	801'861
-Basic Rate	66'798	-Basic Rate a)	133'596
-Primary Rate	29'055	-Primary Rate b)	668'265
Total wired access lines (A+B) (telephone subscribers)	19'256'064	Total voice grade equivalents (A+C) (main lines)	19'962'072

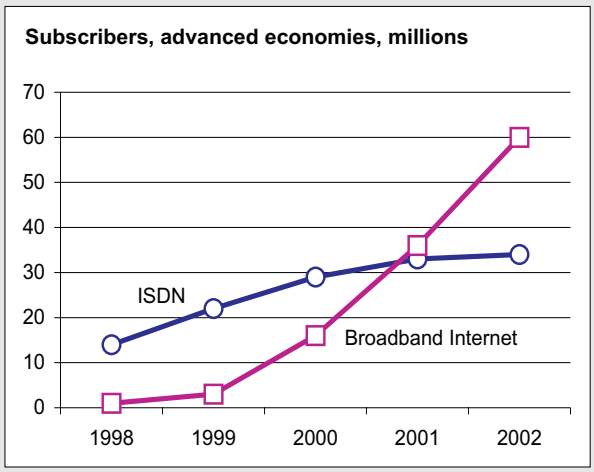


Note: a) Each basic rate ISDN subscriber is equivalent to two channels. b) Each primary rate ISDN subscriber is equivalent to 23 channels.
Source: ITU World Telecommunication Indicators database.

ISDN channels have provided an artificial boost to main line statistics. While main lines — including ISDN channels — have grown, fixed telephone lines in service peaked at 502 million in advanced economies in 1998 and have been declining since then (Figure 2.9, left). One reason for this is ISDN itself, which negates the need for a second physical line for a facsimile machine or dial-up Internet access. Another reason is the growing substitution of mobile phones for fixed ones. Furthermore, asynchronous digital subscriber line (ADSL), like ISDN, allows users to access the

Figure 2.9: The death of ISDN?
Main telephone line in advanced economies, millions (left) and ISDN and Broadband Internet subscribers (right), advanced economies, millions





Source: ITU World Telecommunication Indicators database.

Internet while keeping their telephone line free for voice communications. Broadband consumer technologies such as ADSL and cable modem access have now eclipsed ISDN as the main method for consumers moving beyond dial-up access. There were 60 million broadband subscribers in advanced economies compared to 34 million ISDN subscribers in 2002 (Figure 2.9, right). The few nations where ISDN continues to grow are those where there are bottlenecks to broadband access and ISDN is the only option for faster than dial-up access. It may only be a matter of time before ISDN disappears altogether, a victim of cheaper and faster broadband alternatives.

Another predicament with the traditional *teledensity* indicator (*main telephone lines per 100 inhabitants*) is that it is no longer the sole gauge of telephone access. Mobile telephone subscriptions have surpassed fixed lines in many countries.[15] This makes it difficult to find an ideal solution for measuring telephone density. One alternative is to combine all telephone subscribers, both fixed and mobile, to compute a *total telephone density* indicator. This results in double counting since the indicator includes subscribers that have both fixed and mobile phones, limiting its analytical usefulness. A way around double counting is to use *effective telephone density* whereby either fixed or mobile teledensity, whichever is higher, is used.

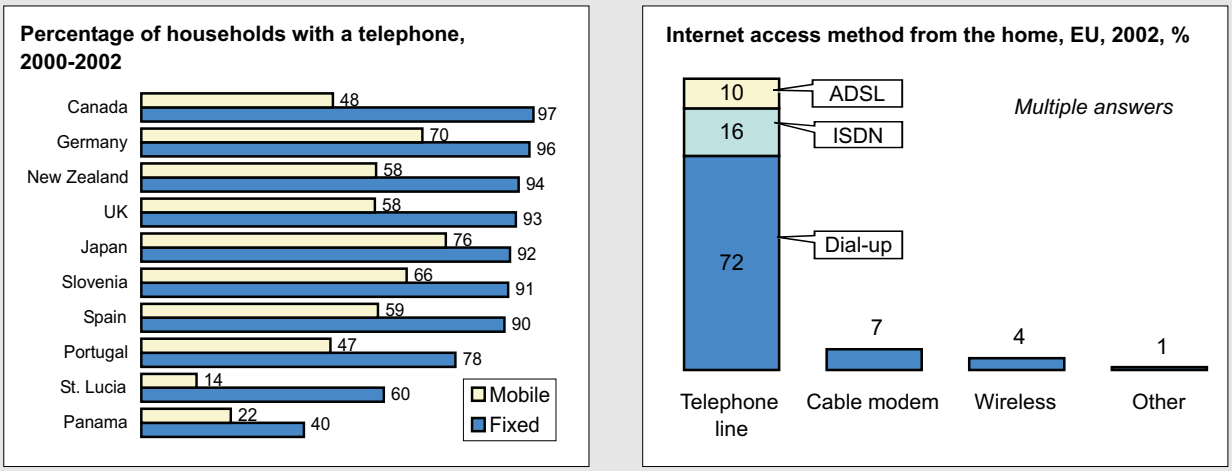
Despite the definitional issues and challenge posed by the rise of mobile phones, the number of main telephone lines and the associated penetration figure remains an important indicator. In most developed nations and many developing ones, the fixed line is still the predominant household telephone service (Figure 2.10, left). Main telephone lines are also the predominant method for Internet access since they provide the physical connection for dial-up, ISDN or ADSL (Figure 2.10, right).

A key statistic is the *number of homes with a fixed telephone*, the traditional indicator for measuring universal telephone service. The United States has been at the forefront of tracking home phone ownership, producing bi-annual reports with details by state, income and other socio-economic variables (Figure 2.11).[16] A number of developed nations do not compile this statistic on the questionable assumption that they believe all households already have a fixed telephone. . The highest rates of fixed telephones in households are to be found in Taiwan, China (97.8) and Canada (97.4). Furthermore, the rise of mobile shows that fixed telephones in homes are declining in developed economies that compile the two statistics (Figure 2.13, left).

One problem with national surveys is that it is often unclear whether a home telephone refers to only fixed

Figure 2.10: Still the most popular for homes and Internet

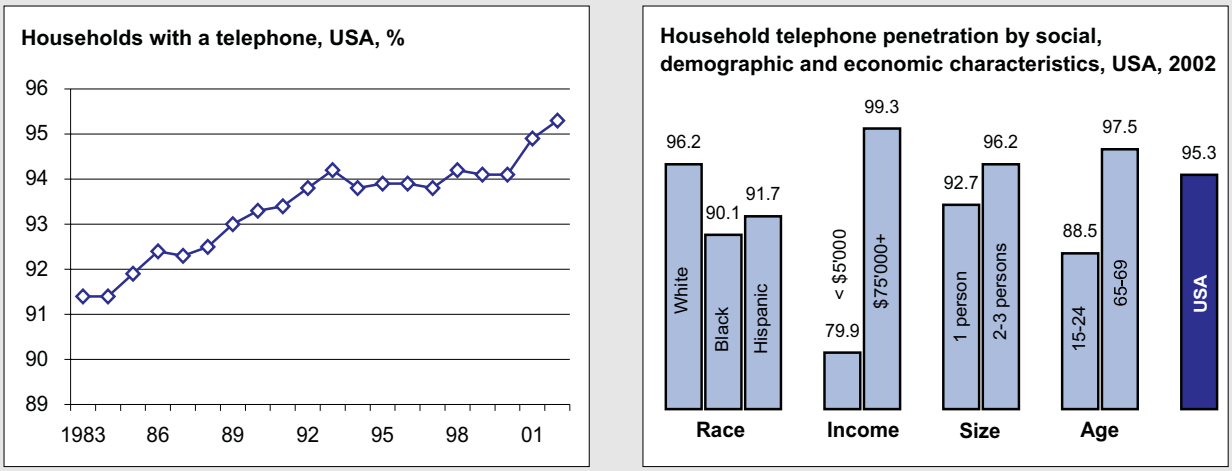
Percentage of households with fixed and mobile telephones, 2000-2002, selected countries (left) and Internet access from the home, distribution by method, 2002, European Union (right)



Source: ITU World Telecommunication Indicators database and ITU adapted from Gallup Europe.

Figure 2.11: Telephones in homes

In the United States, 1983-2002 (left) and breakdown by socio-economic characteristics, 2002 (right)

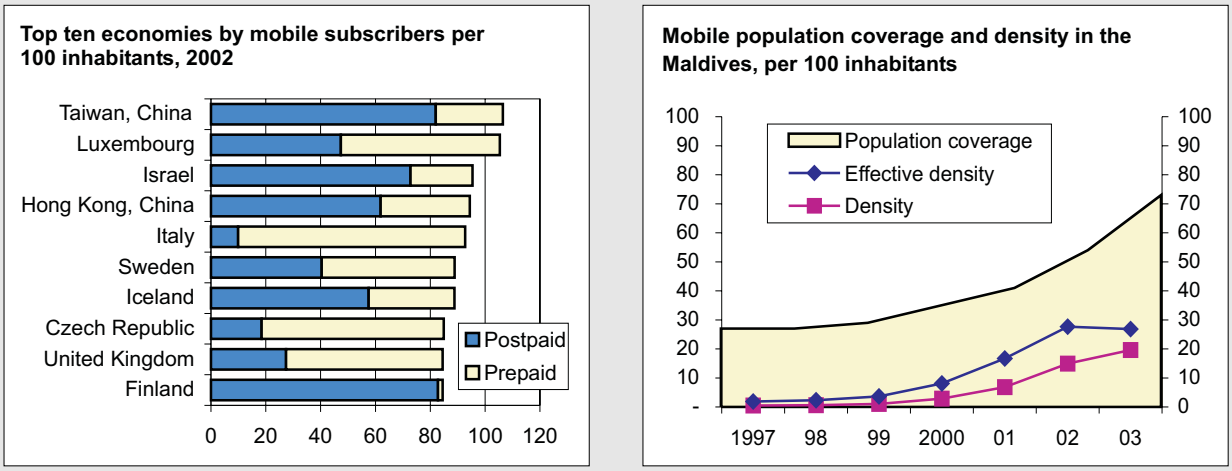


Source: ITU adapted from Federal Communications Commission (USA).

lines or also includes mobile. Ideally the following three questions should be asked in household surveys: whether the household has a fixed line only, both a fixed and mobile phone or only a mobile phone (Figure 2.13,right). For countries in which surveys on home telephone penetration is not available, a proxy can sometimes be used. The percentage of homes with a fixed telephone can be derived from administrative records if the share of residential lines is available. The *number of residential telephone lines per 100 households* is calculated by dividing the number of residential telephone lines by the number of

Figure 2.12: Mobile indicators

Top ten economies by mobile subscribers per 100 inhabitants, 2002 (left) and mobile population coverage, actual and effective mobile subscribers per 100 inhabitants, Maldives (right)



Note: Right chart: Effective density refers to mobile subscribers divided by the population with mobile coverage multiplied by 100.
Source: ITU World Telecommunication Indicators database.

households and multiplying by 100. This derivation has limitations since business lines can be reported as residential particularly where residential subscription is cheaper. Other distortions in the results of this derivation are caused by the inclusion of second lines and ISDN channels.

2.3.3 Mobile telephones

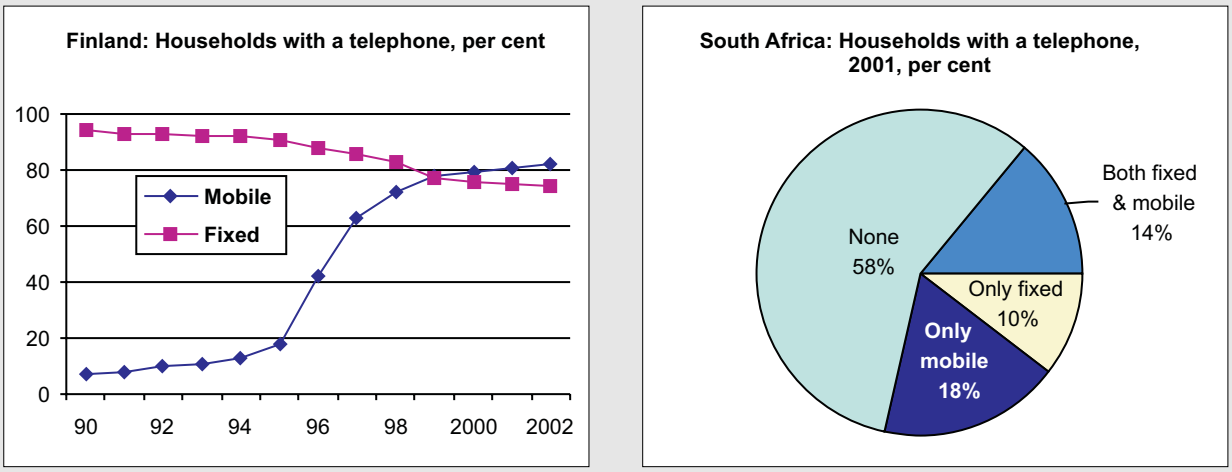
Mobile indicators are critical for analysing access to telephone service given that in most countries there are now more mobile than fixed telephone subscribers. *Mobile density*, or the *number of mobile subscribers per 100 inhabitants*, has surpassed 100 in some nations. It is difficult to determine whether this is caused by inactive prepaid accounts or growing ownership of more than one mobile telephone. Statistics regarding mobile subscriptions should include the split between subscription-based and prepaid accounts (Figure 2.12, left).

One of the most useful indicators of universal access is the *percentage of the population covered by a mobile cellular network* (see discussion in section 2.2). Inhabitants who are covered by a mobile cellular signal have the potential to subscribe to the network whether or not they actually do so. Where there is a large gap between population coverage and penetration, it suggests that bottlenecks in access are more due to affordability than to infrastructure shortcomings. One indicator that can be derived from the level of coverage is the *effective mobile subscribers per 100 inhabitants*, sometimes expressed as the level of take-up of a particular service. This indicator is calculated by adjusting the population to those with coverage (Figure 2.12, right).

The *percentage of homes with a mobile telephone* is another useful indicator for tracking universal service. Many developed nations now survey the percentage of households with a mobile telephone even when they do not ask for the number of fixed lines. This is unfortunate, as it is particularly useful to track these two indicators together. In Finland, one country where both are tracked, home ownership of fixed telephones has been declining since 1990 as a result of mobile phones (Figure 2.13, left). By 1998 the number of homes with mobile phones had exceeded those with a fixed one. By 2003, the percentage of Finnish homes with a mobile phone stood at 92 compared to just 64 for a fixed line. Data from developing nations also confirm that trend. According to the 2001 South African census, 18 per cent of homes have only a mobile phone compared to ten per cent that have only a fixed (Figure 2.13, right).

The growing use of mobile phones for data and text applications makes tracking that area important.[17] Although the *number of short message services* (SMS)—a precursor to more intensive mobile data use—is a popular indicator (Figure 2.14, left), a more

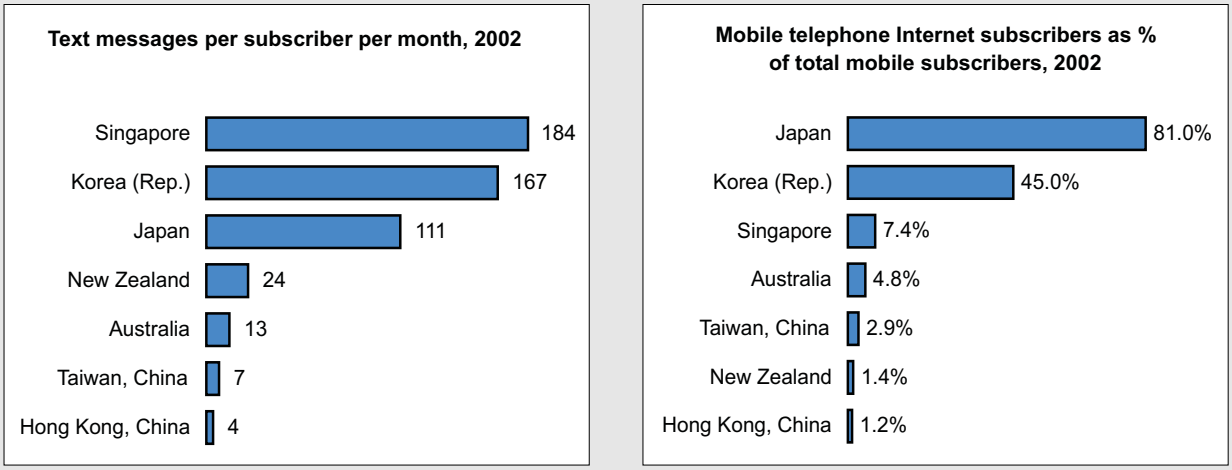
Figure 2.13: Households with more mobile phones than fixed
In Finland, 1990-2002 (left) and South Africa, 2001(right)



Source: ITU adapted from national sources.

Figure 2.14: Mobile Internet

Number of text messages per mobile subscriber per month (left) and mobile phone Internet subscribers as percentage of total mobile subscribers, 2002, advanced Asia-Pacific economies (right)



Source: ITU World Telecommunication Indicators database.

relevant one may be the *percentage of mobile subscribers that use SMS*. Mobile indicators that measure Internet access and high-speed data availability are also useful. This would include the *number of mobile customers that subscribe to a mobile Internet service* (Figure 2.14, right). In some countries, Internet access is occasionally bundled into the price of mobile subscription, so a better indicator might be the *number of mobile customers that use a mobile Internet service*. The availability of high-speed Internet access should be a policy indicator in countries that have licensed third generation networks. The licence conditions often compel operators to achieve a specific level of population coverage by certain dates. This would be captured by the *percentage of the population covered by high-speed mobile Internet access*. Related to this indicator, is the *number of mobile customers that use high-speed Internet services*.

2.3.4 Personal computers

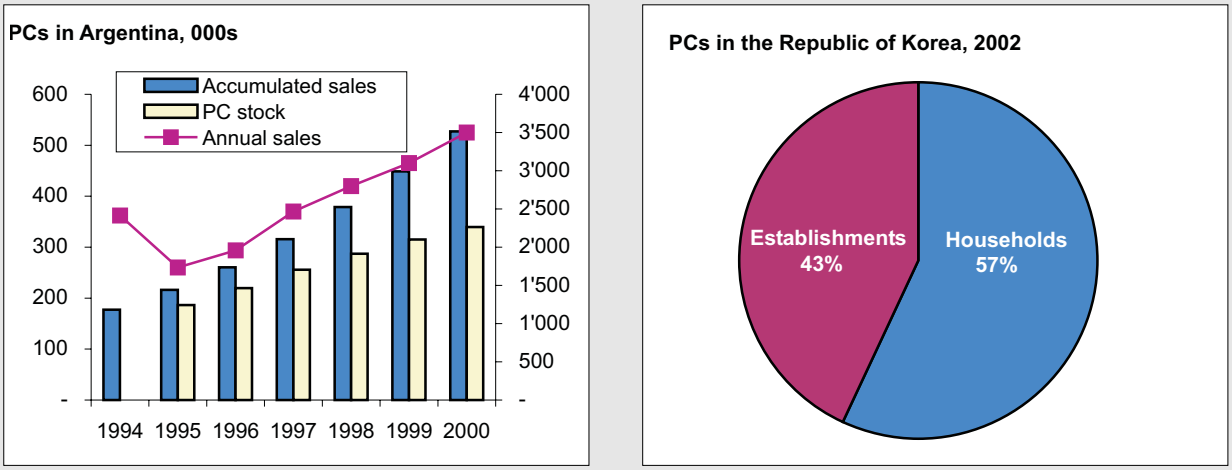
Access to a personal computer (PC) is important not only because is it an information device in own right, but also because it is the leading gateway to Internet access. Plus, PCs are useful for developing basic computer skills prior to navigating the Internet.

Despite their importance, only a few countries publish data on the number of PCs. Unlike television sets, that are basically found in homes or hotel rooms, collecting data would involve surveying all the places where there might be a PC: schools, homes, offices, libraries, Internet cafés, etc. Therefore most estimates regarding the stock of PCs are based on shipments (e.g. the number of PCs sold) in a given country and year. Annual shipment data can be multiplied by an estimated replacement rate to obtain an approximation of PCs for the country. The life of a PC will vary depending on various factors such as wear and tear and obsolescence, and replacement rates differ between developing and developed nations with the former hanging on to PCs for longer.[18] Though there is no precise methodology for determining PC replacement rates, a general rule of thumb is that they are changed every three to five years.

Apart from wear and tear, computers also become obsolete, as software updates require faster machines. In light of all these factors, an overall country figure for the number of PCs could be estimated by adding up the last five years sales (Figure 2.15, left).[19] It is a major drawback that, as with so many other statistics, reliable data on the number of PCs sold is not available for many developing nations.

A surrogate for sales is PC import figures, data that is sometimes available from customs departments of national governments. However, use of import data

Figure 2.15: PCs
Estimated number of PCs in Argentina (left) and the Republic of Korea, 2002 (right)



Note: Left chart: PC stock is derived from adding up sales for the last five years.
Source: ITU adapted from Prince and Cooke (Argentina) and National Statistical Office (Korea (Rep.)).

has limitations. Often only value rather than volume data is available. Also, if PCs were assembled in the country from imported parts, they would not be counted. Customs data would also not include undeclared imports. Additionally, some of the imported PCs may be later exported.

Despite the data difficulties, some national statistical offices as well as industry associations and consulting companies publish data on the number of PCs. ITU compiles statistics for countries in which shipment or import data is available based on the methodology described above. Data could also be aggregated from surveys of ICT usage in business, education, government and households (Figure 2.15, right).

Given the limitations with determining the number of PCs in a country, alternative measures should be considered. PC-related statistics collected by some statistical agencies and industry associations include the *number of people that use a computer*. For example, the Association of Spanish Internet Users has been collecting data since 1996 on the number of adults in Spain that use a computer (Figure 2.16, left).[20] In Malta, the National Statistics Office carried out a 2002 survey that not only determines the number of people using computers, but also provides information about their socio-economic characteristics (Figure 2.16, right).[21]

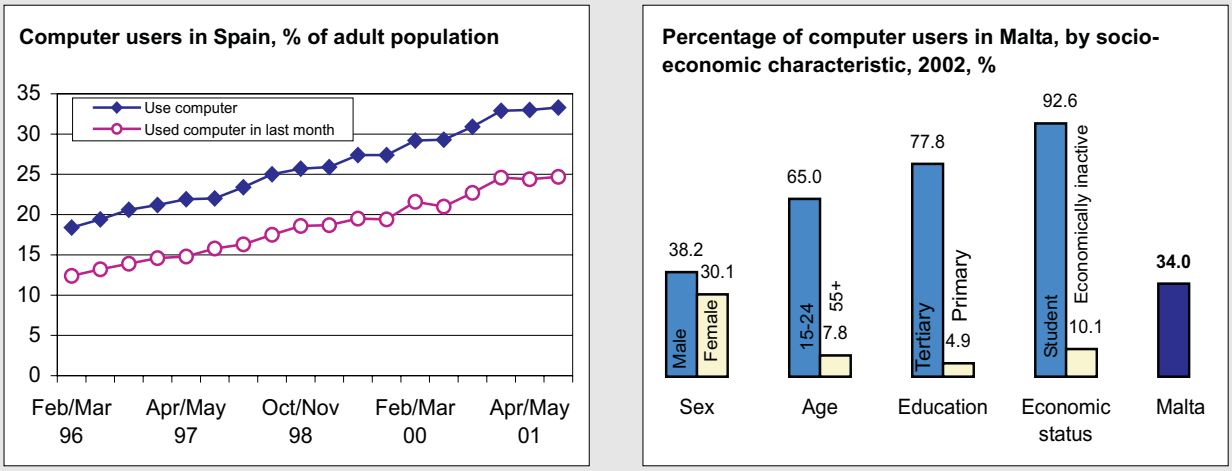
A growing number of national statistical agencies compile data on the *percentage of households with a computer* through censuses or on a more regular basis through household surveys. The advantage of official household statistics is that the methodology is usually sound and the data on ICT use are normally publicly available. Additionally, this data can be cross-correlated with other data, for instance on income, gender, location, education and other characteristics of the head of household. This can enhance the analysis of national digital divides. Sufficient data is now available for many developed economies to analyze developments over time.[22] Virtually all developed countries report this statistic allowing rankings of the top countries by PC household penetration (Figure 2.17, left). More developing nations have begun asking households about the availability of PCs particularly as a result of the 2000/01 round of censuses (Figure 2.17, right).

2.3.5 Internet

Most references to the digital divide and information society revolve around access to the Internet. Yet it is remarkable how little we know about the Internet's true extent—particularly in developing nations. While most developed nations now have regular Internet user surveys—either conducted by the National Statistical Office (NSO)

Figure 2.16: Computer use

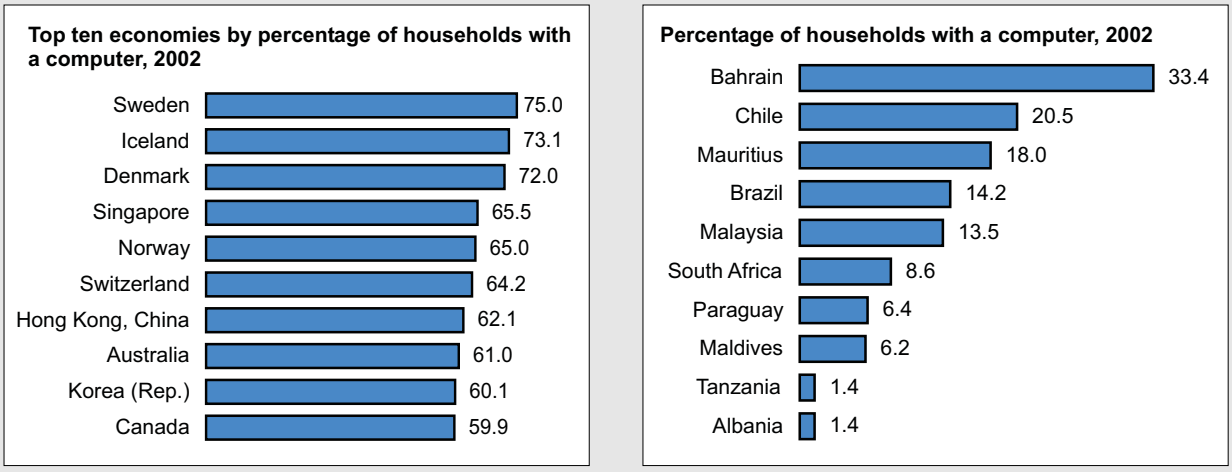
Computer users in Spain as percentage of adult population (left) and socio-economic characteristics of computer users in Malta, 2002 (right)



Note: The right chart shows the percentage of computer users within each category. For age, 65 per cent of all 15-24 year olds in Malta use a computer.
Source: ITU adapted from AUI (Spain) and National Statistics Office, Malta.

Figure 2.17: PC homes

Top ten economies by percentage of households with a computer (left) and percentage of households with a computer, selected developing economies (right), 2002



Note: Data for Norway and Sweden refer to household members with access to computer in the home. Data for Albania, Bahrain, Canada, Iceland, South Africa, Switzerland and Tanzania refer to 2001. Data for Malaysia and Maldives refer to 2000.
Source: ITU World Telecommunication Indicators database.

or private polling organizations—there have been few such surveys in developing nations and none in the lowest income countries (Table 2.1, Box 2.1).

Although Internet user surveys are available for developed regions, comparability is still a problem. This is because the surveys do not follow a standard methodology. Comparability revolves around three areas: age, frequency of use and access device.[23]

- The *age* from which Internet use is measured varies. For example, in the United States, government

surveys measure access from the age of three; in the Republic of Korea, surveys measure access from the age of six, while in Europe many national surveys start from the age of 16 (Figure 2.18, left). These differences could be reconciled by showing Internet use from a common starting age, and with uniform age cohorts.[24] The problem with just using adult penetration is that a large segment of the Internet market, youth, is being excluded. This also has relevance in benchmarking to determine why some countries have a higher rate of youth access than others. By the same token, Internet surveys often have an upper boundary for age that affects comparability. ITU data on Internet users reflects the number reported in a survey and divides that by the entire population to obtain a penetration figure (Figure 2.18, right).

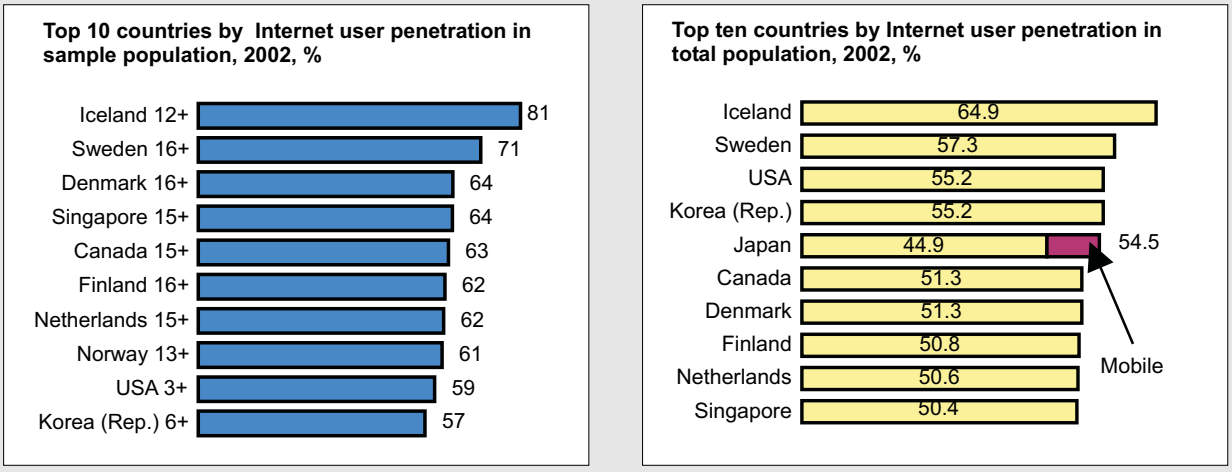
- *Frequency of use*. Another area where surveys are inconsistent is the definition of how often a person should use the Internet before being considered a user. The frequency of use in surveys ranges from within the last year, within the last three months, monthly, weekly and daily. It would be preferable for surveys to ask for a range of periods rather than just one in the hope of making the data more internationally comparable. A minimum commitment to the Internet would be using it at least once a month; this figure should be proposed as a common limit.

- *Access device*. Until recently, virtually all users utilized the Internet through a personal computer. However with the development of Internet access through mobile phones, this is starting to change. In the case of Japan, Internet access through mobile phones has become popular. According to administrative records, 81 per cent of all Japanese mobile customers also subscribe to a mobile Internet provider. Some 10 per cent of Japanese Internet users only access the Internet from their mobile phones.

In most developing nations however, estimating the number of Internet users is guesswork. In the early years of the Internet, before commercial services became available, Internet users were estimated by applying a multiplier to the number of Internet host computers.[25] One problem with this technique was that the multiplier was not very scientific. Another was that countries could have a low number of hosts—either because they were not picked up when the host

Figure 2.18: Who is number one?

Top ten countries ranked by Internet users per 100 inhabitants in the survey age population (left) and in the total population (right), 2002



Note: The left chart shows the number of Internet users divided by the surveyed population (shown to the right of the country name). For example, data for Singapore refer to those aged 15 and over using the Internet divided by the total 15 and over population. The right chart shows the reported number of Internet users divided by the total population for country. For example, data for the Republic of Korea refer to those six years old and over using the Internet divided by the total population of the country. Data for Japan also includes users only accessing the Internet from mobile phones. Data for Canada, Netherlands and the United States are estimated.

Source: ITU adapted from national Internet user surveys and ITU estimates.

Table 2.1: Internet user surveys around the world

Economy	Year	Population using Internet: Per cent	Population using Internet: Age	Source	Note
Argentina	2002	15.0	18+	TNS	Usage in last month.
Australia	2002	58.0	18+	AusStats	Usage in last year.
Austria	2002	36.6	16+	Eurostat	Usage in last 3 months.
Belgium	2002	44.0	15+	TNS	Usage in last month.
Brazil	2002	4.3	2+	Nielsen//NetRatings	Home users only.
Bulgaria	2002	9.6	18+	Vitosha	Ever used Internet.
Canada	2000	52.8	15+	Statistics Canada	Usage in last year.
Chile	2001	17.7	6+	SUBTEL	
China	2002	4.6	6+	CNNIC	% calculated on entire population.
Cyprus	2002	23.9	15+	CYSTAT	
Czech Republic	2002	21.7	16+	Eurostat	Usage in last 3 months.
Denmark	2002	64.3	16+	Eurostat	Usage in last 3 months.
Estonia	2002	43.0	15+	Emor	Usage in last 6 months.
Finland	2002	62.4	16+	Eurostat	Usage in last 3 months.
France	2002	36.8	11+	Mediametrie	Usage in last month.
Germany	2002	46.0	10+	Federal Statistical Office	Usage in last 3 months.
Greece	2002	14.7	16+	Eurostat	Usage in last 3 months.
Hong Kong, China	2002	48.2	10+	C&SD	Usage in last year.
Hungary	2002	18.0	15+	SIBIS	Usage in last month.
Iceland	2002	81.1	12+	Statistics Iceland	
India	2002	16.0	18+	TNS	Delhi, Mumbai, Calcutta and Chennai only.
Indonesia	2002	6.0	15+	TNS	2 largest cities only.
Ireland	2002	38.0	15+	Amárach	
Israel	2002	42.0	18+	TNS	Usage in last month. Jewish population.
Italy	2002	28.0	16+	Eurostat	Usage in last three months.
Jamaica	2003	36.0	15+	JAMPRO	
Japan	2002	57.1	6+	MPHPT	Including access from mobile phones.
Korea (Rep.)	2002	59.4	6+	KRNIC	Usage in last month.
Latvia	2002	28.0	15+	SIBIS	Last month.
Lithuania	2002	18.0	16+	Baltic	Usage in last 3 months.
Luxembourg	2002	39.8	16+	Eurostat	Usage in last 3 months.
Malaysia	2002	21.0	18+	TNS	Urban Peninsular only. Usage in last month.
Malta	2002	26.8	15+	National Statistics Office	
Mauritius	2002	12.8	12+	Central Statistics Office	
Mexico	2002	10.0	All	COFETEL	
Netherlands	2001	57.0	12+	Statistics Netherlands	Usage in last month.
New Zealand	2002	57.0	10+	ACNielsen	Usage in last month.
Norway	2002	52.0	13+	Gallup	Usage in last month.
Peru	2002	23.0	12+	Apoyo	“Habitual users.” Only metropolitan Lima.
Poland	2002	20.0	15+	SIBIS	Last month.
Portugal	2002	17.4	16+	Eurostat	Usage in last 3 months.
Romania	2002	13.0	15+	SIBIS	Last month.
Serbia	2002	16.0	18+	TNS	Past month.
Singapore	2002	63.9	15+	IDA	Last year.
Slovak Republic	2002	24.0	15+	SIBIS	Last month.
Slovenia	2002	37.0	15+	SIBIS	Last month.
Spain	2002	18.7	16+	INE	Last 3 months.
Sweden	2002	71.0	16+	Statistics Sweden	Last 3 months.
Switzerland	2002	45.1	14+	WEMF	Once a week.
Taiwan, China	2002	38.0	All	FIND	
Thailand	2001	5.6	All	National Statistical Office	
Turkey	2000	9.1	18+	OECD	Urban areas.
Ukraine	2002	4.0	18+	TNS	Past month.
United Kingdom	2002	55.0	16+	National Statistics	Last 3 months.
United States	2001	53.9	3+	NTIA	
Venezuela	2002	10.0	18+	CAVECOM	Regular.

Source: ITU adapted from sources shown in table.

Box 2.1: Over surveyed

While many developing nations have yet to carry out Internet user surveys, some developed nations already have a number of surveys. Take Spain for example where at least six Internet user surveys have been conducted. In theory, assuming the surveys follow appropriate methodological practice, they should all produce similar results. In reality, they do not, with estimates of the percentage of persons using the Internet ranging from over half to less than a fifth of the population (Box Figure 2.1, left). What can explain such large variations?

- *Age*. The surveys do not all use the same age. Sample ages range from those older than 14 to those older than 16. However at those ages, each year only accounts for around one per cent of the population. Therefore, age is not a significant factor in explaining the large differences in the survey results.

- *Sample size*. The population questioned for the surveys ranged from around one thousand to over 50'000. In general, the larger the population sample, the smaller the estimate of the number of people online. Therefore, the size of the sample seems to have a bearing on the results.

- *Method*. The smaller samples used only telephone interviewing techniques whereas the larger ones used personal interviews or a combination of the two. The use of interviews only by telephone would have an impact since ten per cent of Spanish households do not have fixed telephones. It is far more likely for family members to be using the Internet if they have a fixed telephone line. Therefore, surveys that only carry out telephone interviews would tend to overestimate the number of Internet users.

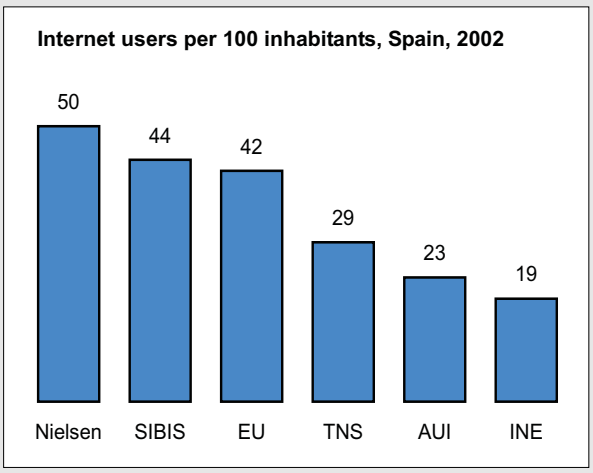
- *Frequency of use*. The period over which a person is considered an Internet user was not always specified. One would assume that the more lenient the definition, the higher the percentage of Internet users. Yet the survey that had the most generous definition, usage in the last three months, showed the smallest number of users online. Therefore, it is not clear that the frequency of use had much bearing in the different results.

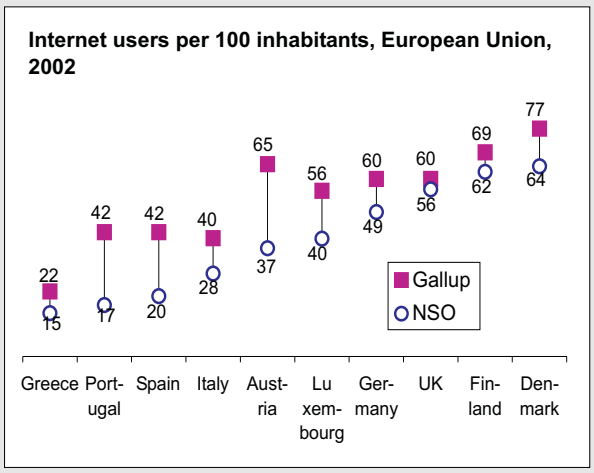
- *Date*. The surveys were all conducted throughout 2002. The first was in March and the last in the fourth quarter. According to one of the surveys, the percentage of Internet users increased between one to two per cent in 2002. Therefore, it does not seem that the nine-month range in survey dates could have had a significant impact.

The two surveys that used the largest samples sizes and personal interviews were conducted by national organizations. One has carried out Internet user surveys in Spain since 1996 whereas the other is the national statistical agency which carried out its first Internet user survey . The other surveys were conducted by organizations where Spain was just one of several countries surveyed. It is interesting to contrast the results of surveys carried out by Gallup for European Union nations with those conducted by national statistical agencies. In almost every country, Gallup reports a higher Internet penetration than the national statistical agencies (Box Figure 2.1, right). This is significant because the European Union has been using the Gallup data to analyze Internet diffusion in the region.

Box Figure 2.1: So how many are online?

Internet users per 100 inhabitants, selected European Union members, 2002





Source: ITU adapted from Gallup-Europe and Eurostat.

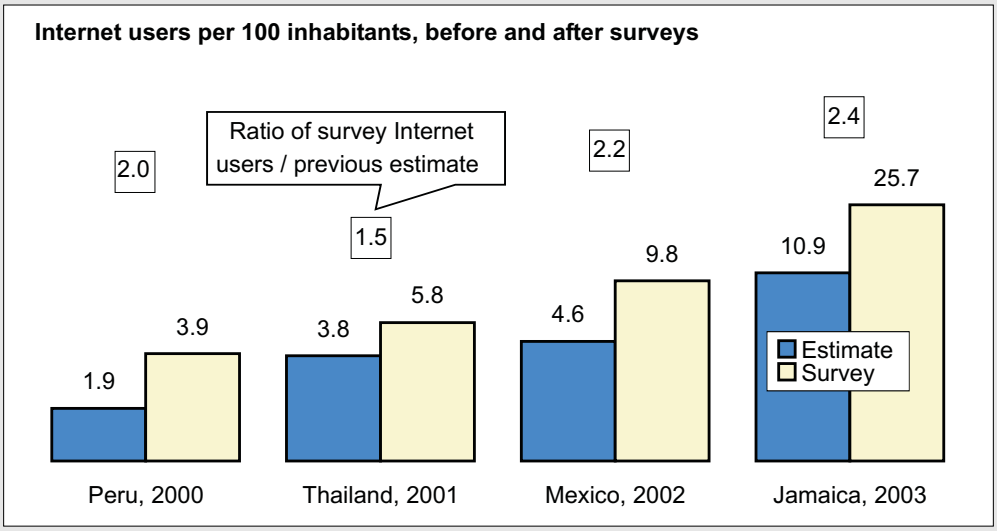
count was done or national organizations used generic top-level domain names (e.g. .com, .edu).[26] As time went on and Internet subscriber data became available, a multiplier of subscribers was used to estimate the number of users.[27] While the number of subscribers *may* set a minimum threshold, again the question of what multiplier to use is problematic. A widely used assumption is that most dial-up subscriptions are in households with an average of three users (e.g. husband, wife and child).

This method has become less reliable due to "free subscriptions" and prepaid cards.[28] There is also growing evidence that the use of Internet cafés in developing nations is increasing rapidly, seriously challenging the notion that the number of users can be estimated based on a multiple of the number of subscribers. In Togo, the incumbent telecommunication operator has estimated the number of Internet users by interviewing Internet cafés about the number of clients they receive. The Internet user to subscriber ratio in Togo works out to 17, or more than five times the multiplier commonly used. The resulting figure gives Togo the highest penetration rate among West African nations even though its per capita income is among the lowest. Either Togo is overestimating the number of users or its neighbours are underestimating.

Thailand used an interesting model for estimating the number of Internet users in the absence of formal surveys.[29] It was based on the assumption that each kbps of domestic and international bandwidth served 4 and 11 Internet users respectively. Beginning in January 2000, the formula was changed to account for the growing volume of excess bandwidth. Under the revised formula, the estimated number of users was 2.3 million in October 2000 compared to 3.9 million with the old methodology. In January 2001, the Thai National Statistical Office launched a survey with the results showing there were some 3.5 million Internet users in Thailand (Figure 2.19).

The results of recent surveys suggest the number of users in other developing nations may be underestimated to an even greater extent than in Thailand. This has profound implications on assumptions about the global digital divide. An Internet survey carried out in Jamaica in January 2003 found that there were almost 675'000 users in the country, five times more than what had been previously estimated (Figure 2.19).[30] Instead of previous estimates of five per cent, the Internet penetration rate in Jamaica was found to be closer to 26 per cent. Another case comes from Peru where a survey was conducted in the metropolitan area of the capital Lima in November 2000.[31] The survey found that 20 per cent of Lima's inhabitants had used the Internet at least once. It is not known how many users there are across the country, but just using the figure for Lima meant that there were at least twice as many Internet users as had been estimated in the past. One

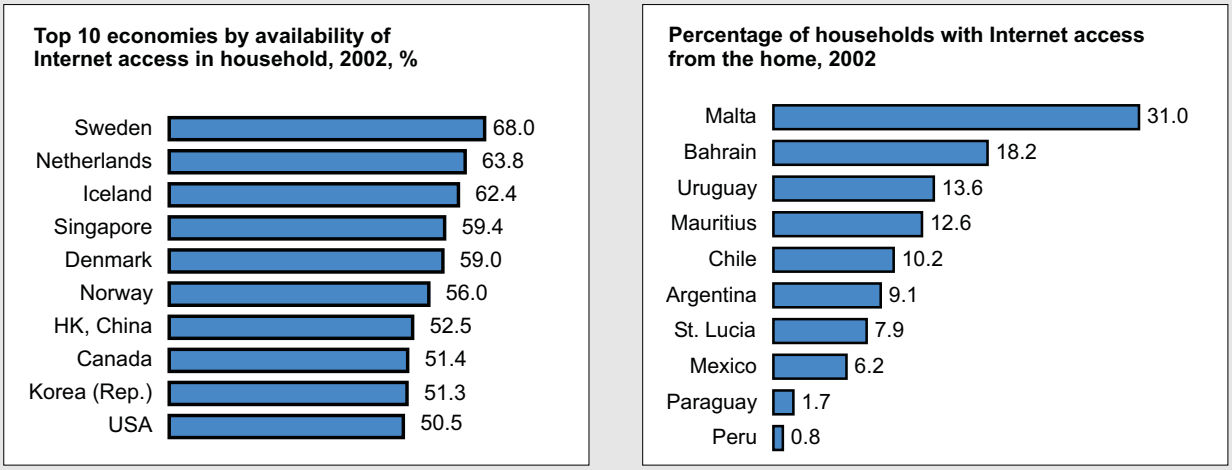
Figure 2.19: The shrinking the digital divide?
Internet users per 100 inhabitants in Peru, Thailand, Mexico and Jamaica



Source: ITU adapted from OSIPTEL, INEI, NECTEC, COFETEL and JAMPRO.

Figure 2.20: Internet in the home

Top ten economies by availability of Internet access in the home (left) and percentage of households with Internet access from the home, selected developing nations (right) 2002



Note: Data for Mexico, St. Lucia, Argentina and Bahrain refer to 2001.
Source: ITU World Telecommunication Indicators database.

of the reasons for the underestimation was widespread use of Internet cafés. In the most recent survey carried out in June 2002, 71 per cent of Lima's Internet users utilized Internet cafés as their main location. This raises the question of how many other countries there may be where the penetration of the Internet is being underestimated.

The evidence suggests that anything short of a proper survey to estimate the number of Internet users is essentially guesswork. The challenge is to increase the number of developing countries that carry out Internet user surveys.

In addition to individual Internet use, another indicator is the *percentage of households with Internet access from home*. Care must be taken in interpreting this statistic. Some countries report the number of households with Internet access, regardless of location. In other words, they would count a household as having Internet access if the home did not have its own access but members of the household used the Internet from work or school. Most developed nations consider this a key indicator of the information society and almost all now compile the percentage of households with Internet access in the home from annual household surveys (Figure 2.20, left). A number of developing countries are also beginning to compile this indicator (Figure 2.20 right).

The growing importance of broadband Internet access means that related indicators should be collected. Broadband may be defined as technologies that provide speeds greater than 128 kbps in at least one direction.[32] This would include ADSL, cable modem and subscribers to other technologies such as fibre Ethernet or wireless. The number of broadband subscribers is divided by the population to obtain the *number of broadband subscribers per 100 inhabitants* (Figure 2.21). It is also useful to know how many homes have broadband Internet access.

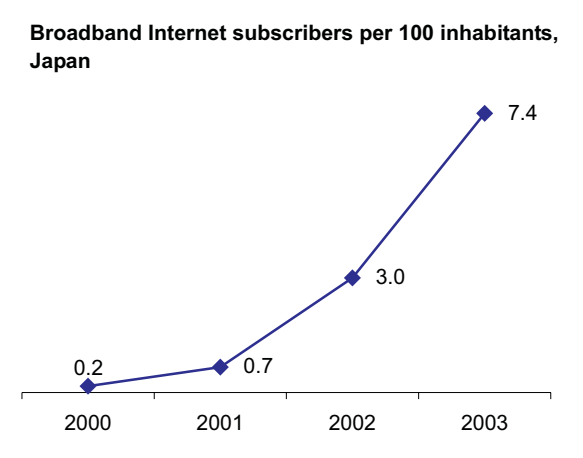
2.4 Community access indicators

The vast majority of households in developing nations do not have modern ICTs such as computers and Internet access. For example, even the most advanced economies in the Latin America region are still far behind their North American neighbours in terms of household ICT availability (Figure 2.22 left). The situation is even worse for other developing countries in the region and around the world. For the immediate future, if citizens in most developing nations are to have access to ICTs, it will have to come from elsewhere such as at the homes of relatives or friends, at work, school or public places such as Internet cafés. This assumption is borne out by surveys in developing countries that show that in many, a primary location of Internet access is an Internet café. In Peru, four out of five Internet users can be found in Internet cafés. In other Latin American countries for which

Figure 2.21: Broadband indicators

Broadband subscribers by technology, March 2003 (left) and per 100 inhabitants, March 2000- March 2003, Japan (right)

Broadband subscribers in Japan	March 2003
DSL Service	7'023'039
Number of Subscribers Using Internet Connection Services that Utilize the CATV Network	2'069'000
FTTH Service	305,387
Total Broadband subscribers	9'397'426
Population (000s)	127'320
Broadband subscribers per 100 inhabitants	7.4



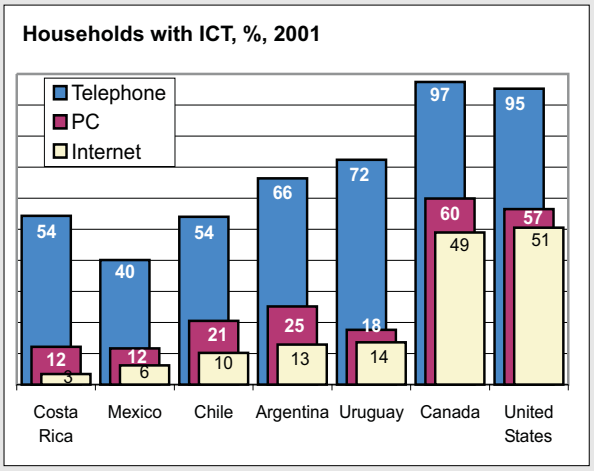
Note: FTTH = Fibre to the home.
Source: ITU adapted from MPHPT (Japan).

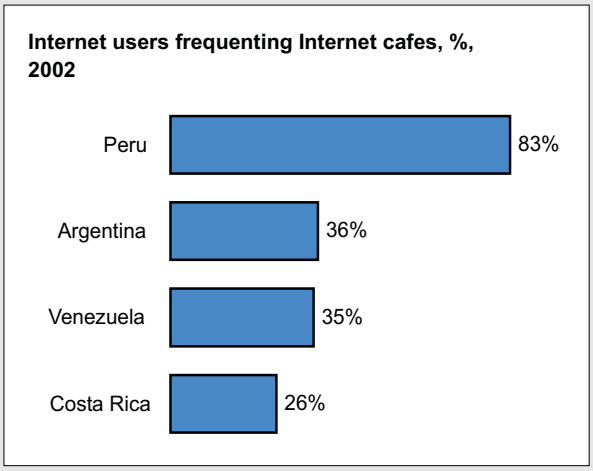
data is available, the corresponding figure is one in three (Figure 2.22 right).

This highlights the importance of measuring access to community ICT facilities. In January 2003, the ITU World Telecommunication/ICT Indicator meeting recommended that statistics on *public Internet access facilities* be collected.[33] This was defined as "*the number of facilities providing Internet access to the public. These can be Internet cafés and public*

Figure 2.22: Not enough ICTs at home

Percentage of households with different ICTs, 2001, selected America region countries (left) and percentage of Internet users that use Internet cafés, selected Latin American countries, 2002(right)





Source: ITU adapted from national surveys.

facilities such as telecentres or libraries. Schools should not be included unless the general public can also use the facilities."[34] The key word is *public,* meaning that the facility is available to all during the hours of operation, whether privately-owned or government-run.

The European Union (EU) included a public access indicator as part of its eEurope benchmarks, the number of *Public Internet Access Points* (PIAPs). This is defined as "*publicly provided centres providing access to the Internet regardless of their public and/or private provider and whether access is free or not though excluding fully private Internet cafés.*"[35] The EU also listed three supplementary indicators that members may want to collect: *number of public access points (excluding private initiatives) per 1'000 inhabitants*; *number of free public access points per 1'000 inhabitants* and *percentage of libraries offering Internet access to the public*. Member States are supposed to collect this data on an annual basis (Figure 2.23).

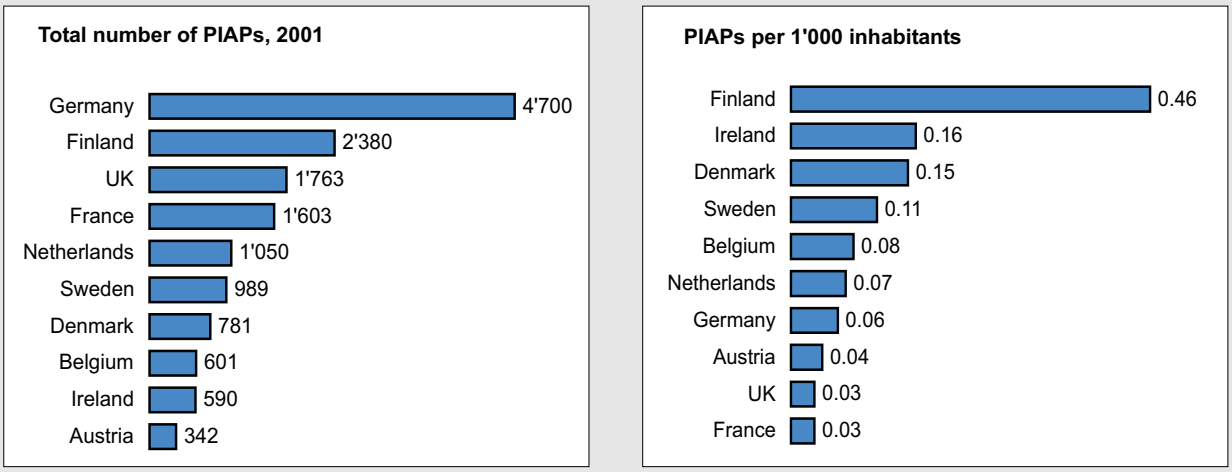
Some developing nations publish similar statistics. The telecommunication regulator in Venezuela has provided data since 2000 on the number of public Internet centres broken down by the type of facility (Figure 2.24, right).[36] In Tunisia, the government Internet agency has statistics on the number of *Publinets* or government sponsored Internet centres (Figure 2.24, left).[37] In July 2003, around ten per cent of all Tunisian users were accessing the Internet from Publinets.

One limitation with using the *number of public Internet facilities per 1'000 inhabitants* is that it does not give an indication of how the facilities are distributed (e.g. urban versus rural). Nor is there a basis for a recommended value since this would be a function of how necessary they are (which in turn depends on the underlying level of ICT ownership). Thus the *number of public Internet facilities* indicator should be analyzed in connection with household Internet availability. Another supplementary indicator would be *how many people frequent Internet cafés and other public Internet access facilities*. The common way of capturing this information is as a specific question in an Internet user survey (Figure 2.25). The typical way this indicator is expressed is the *percentage of users that access the Internet from Internet cafés*. It may be useful to disaggregate the indicator by the percentage that only uses Internet cafés or alternatively, where the Internet café is their main location of access. It may also be useful to distinguish between privately operated and government run facilities, insofar as the level of pricing is different.

Another way of looking at community access is to measure the *number of localities* with public ICT

Figure 2.23: Public Internet Access Points in the EU

Public Internet Access Points (PIAP), total (left) and per 1'000 inhabitants (right), 2001

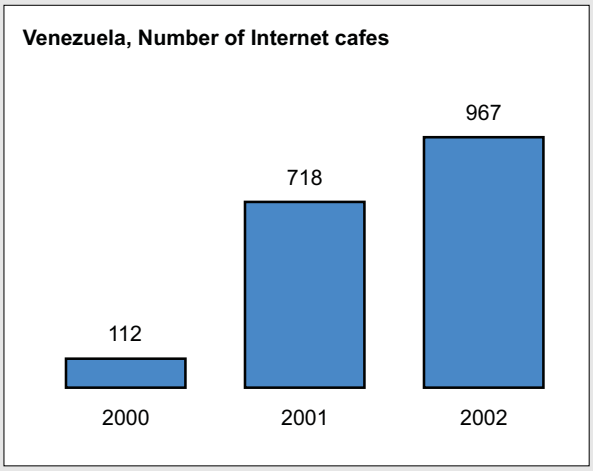


Source: ITU adapted from EU.

Figure 2.24: Public Internet facilities in Tunisia and Venezuela

Publinet statistics, Tunisia, July 2003 (left) and number of Internet cafés, Venezuela, 2000-2002 (right)

Tunisia Publinet (Public Internet access centres) Status at July 2003	
Number	281 (0.029 per 1'000 inhabitants)
Publinet Users	30'000 (10% of Internet users, 0.3% of population)
Price	DT 2 (US$ 1.41) / hour (Max.) Reduction of 25 per cent for students, journalists and handicapped.
Hours	Free to set own hours of service but generally 8h00 – 20h00 every day.
Services	Surfing, e-mail, assistance, training, etc.



Source: ITU adapted from ATI and CONATEL.

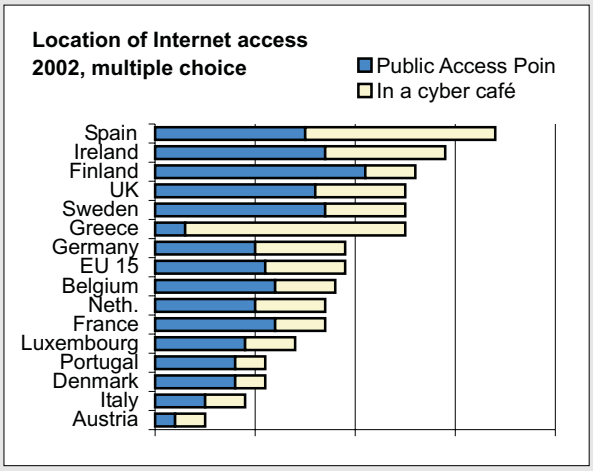
service. Here the availability of at least one facility in a locality is what is important rather than the total number of facilities. This could be broken down by telecentre (providing primarily telephone service) or Internet café (providing primarily Internet access). ITU carried out research for the South Asia region to try to determine how many localities had a telephone.[38] The localities were then mapped back to population to make an estimate of the per cent of the population covered by telephone service. India has regularly tracked the number of villages with a telephone and publishes ongoing statistics on the status

Figure 2.25: Location of access

Excerpt from Eurostat household survey on ICT usage (left) and percentages of Internet users utilizing public access points and Internet cafés, European Union, 2002 (right)

Where have you accessed the Internet in the last 3 months (using a computer or any other means)? (Multiple choice)

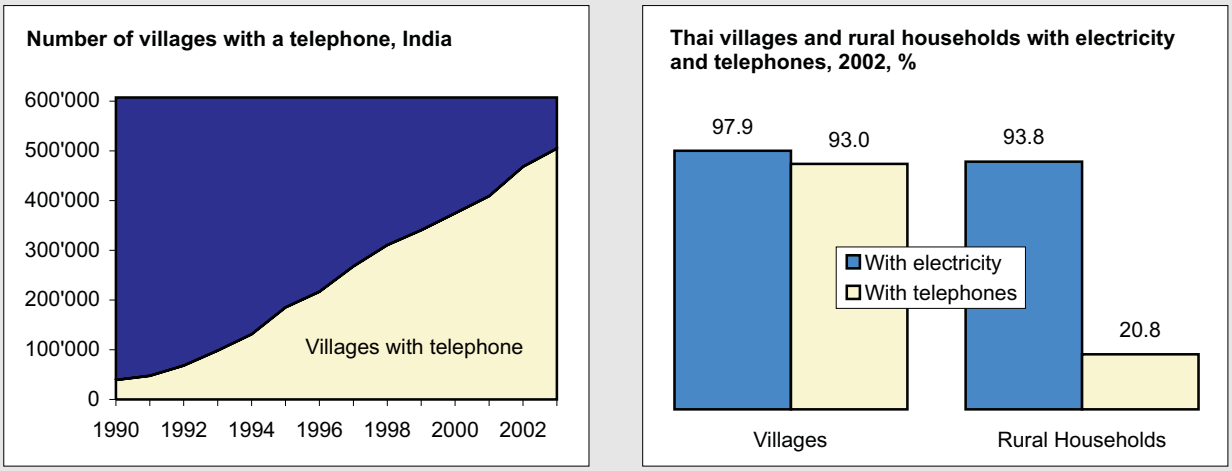
a) At home
b) At place of work (other than home)
c) At place of education
d) At other places
  Of which (optional)
    d1) Public Library
    d2) Postal Office
    d3) Public Office, town hall, government agency
    d4) Community or voluntary organizations
    d5) Internet Café
    d6) Neighbour, friend or relative's house



Source: ITU adapted from "General outline for Eurostat's 2003 household surveys on ICT usage" and Gallup Europe

Figure 2.26: Localities with access

Number of villages with a telephone, India, 1990-2003 (left) and Percentage of villages and rural households with electricity and a telephone, Thailand, 2002 (right)



Note: The number of "revenue" villages in India is 607'491.
Source: ITU adapted from BSNL (India) and National Statistics Office of Thailand.

(Figure 2.26, left).[39] The national statistical office in Thailand also publishes data on the number of villages and rural households with telephone service (Figure 2.26, right).[40]

National authorities may desire to go further in compiling a more detailed set of community access indicators. For example, Mexico has proposed indicators such as the total number of terminals available, minutes of use and population covered by community access centres (Box 2.2).[41] However at least the minimum indicators described above should be maintained for purposes of international comparability.

2.5 Conclusions

- While administrative records are available for some ICTs (e.g. telephone, Internet and cable television subscribers), they are not sufficient for understanding true access and usage of ICTs. *Surveys are therefore imperative*. Few developing countries collect a complete set of ICT data in surveys on a regular basis.

- Electricity is a major barrier to ICT infrastructure development in a number of developing nations. It would be useful to compile the indicator *percentage of homes with electricity* when reporting data on ICTs.

- Countries should strive to collect both universal service and access indicators for policy monitoring. It is important to choose the most appropriate indicators. For universal service, *ICTs in the home* would be the best option. For universal access, the indicators should cover: access options for households, mobile population coverage, community access indicators and other indicators discussed above.

- Good statistical practice is essential for proper analysis and to enhance international comparison. Transparency, clarity, timeliness and relevance are critical. There are many problems with the data available that hinder analysis. Some countries provide regional breakdowns but do not provide an overall country total. Some surveys refer to households having at least "one basic good" without referring to exactly what those goods are. Sometimes dates to which the data pertain are not clear. Another problem is the loose employment of terms: users, subscribers, ownership and access are quite different concepts.

- Surveys should be disaggregated by socio-economic characteristics such as location, gender, income, education and age in order to understand in detail the exact nature of national digital divides.

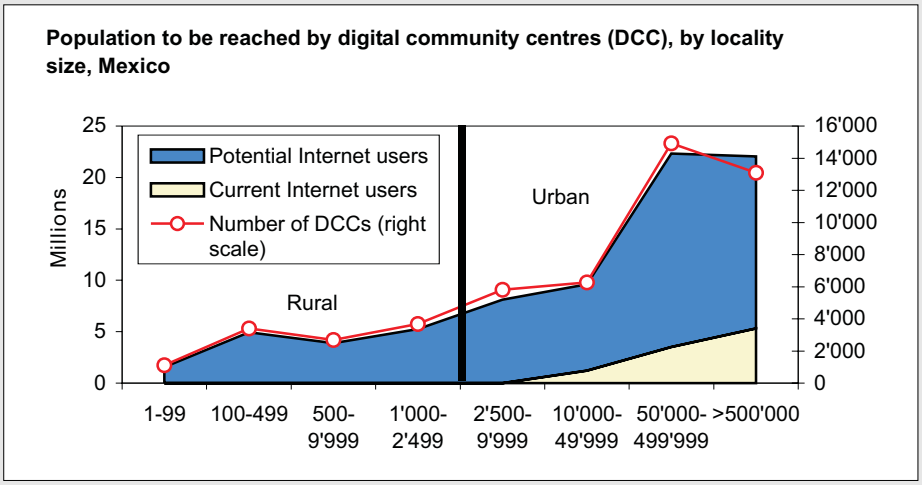
Box 2.2: Community access indicators

The majority of households in developing nations do not have newer information and communication technologies (ICTs) such as computers and the Internet. For the immediate future, the citizens of most developing nations will most likely gain access to ICTs through relatives or friends, work, school or in public places such as Internet cafés. This observation is borne out by surveys in developing countries, which show that, for many of their populations, Internet cafés are a primary location of Internet access.

This makes measuring access to community ICT facilities particularly important. In 2002, the ITU membership passed a Resolution calling on ITU to develop community access indicators. In October 2003, the ITU Workshop on Indicators for Community Access to ICTs proposed several indicators for measuring community access including: *the number of localities with public Internet access centres*, and the *number of users that use public Internet access centres*.

Mexico is keen to enhance nationwide access to ICTs. As a key element of its e-Mexico initiative, the nation plans to install some 50'000 digital community centres to enhance ICT access in underserved areas. It has carried out an analysis of the potential population that will have access; the methodology can serve as a reference for other nations (Box Figure 2.1).

Box Figure 2.2: DCCs in Mexico



Note: The number of DCCs required is calculated by assumptions about the average number of users served based on hours of operation and frequency of use. Potential Internet users are all those aged six and over who can read and write.
Source: ITU adapted from COFETEL (Mexico).

- Government ICT agencies (e.g. telecom regulators, ministries) need to forge links with the national statistical office. In many developing nations, relations between the two are often non-existent. This is unfortunate since the national statistical agency could have data useful for policy analysis and monitoring. Government agencies responsible for ICT should ensure that the necessary data for monitoring universal ICT service and access is being collected by the national statistical agency. As has been shown, administrative records typically collected by government ICT offices are generally insufficient for accurately gauging levels of access.

- Government ICT agencies (e.g. telecom regulators, ministries) need to forge links with the national statistical office. In many developing nations, relations between the two are often non-existent. This is unfortunate since the national statistical agency could have data useful for policy analysis and monitoring. Government agencies responsible for ICTs should ensure that the necessary data for monitoring universal service and access is being collected by the national statistical agency.

- Government agencies should also use the data to produce reports highlighting the level of

universal access and service, measuring progress and identifying digital divides. Very few developing nations do this. One exception is Chile, where the Undersecretary of Communications has produced detailed reports based on data collected by the national statistical agency. The latter should also publish the detailed data and make it available. For example national statistical agencies in Hong Kong, China and the Republic of Korea produce detailed publications on computer and Internet use in their economies.

- There is a continuing requirement for technical assistance in establishing systems for collecting, reporting and analysing ICT indicators.

Annex Table 2.1: The most important indicators for measuring access to ICT

Indicator	*Policy implication*	*Definition*	*Resp.**	*High value Developed***	*High value Developing***
Households with electricity	Universal service	The percentage of households with electricity.	NSO	Most 100	99 Mauritius
Households with a radio	Universal service	The percentage of households with a radio receiver. This should include radios built-in to other devices such as stereo systems or alarm clocks as well as mobile phones and automobiles.	NSO	99 USA	87.9 Brazil
Households with a television	Universal service	The percentage of households with a television receiver. This should include both colour and black and white.	NSO	99.6 Taiwan, China	96.8 Bahrain
Households with a telephone	Universal service	The percentage of households that have a telephone. This should be broken down by households with both a fixed and mobile subscription, only a fixed subscription and only a mobile subscription. For the percentage of households with a mobile phone, it would be useful to know if it is Internet-enabled.	NSO	98.5 (Any, Germany) 97.9 (Fixed, Taiwan- China) 92.0 (Mobile, Finland)	76.3 (Any and fixed, Mauritius) 51.0 (Mobile, Chile)
Households with a personal computer	Universal service	The percentage of households that have a personal computer used in the home.	NSO	73.1 Iceland	33.4 Bahrain
Households with Internet access	Universal service	The percentage of households that Internet access available in the home. A breakdown by the type of access (e.g. dial-up, broadband) would be useful.	NSO	62.4 Iceland	18.2 Bahrain
Percentage of population covered by mobile cellular	Universal access	The percentage of the population that is covered by a mobile cellular signal. This should not be confused with the percentage of the land area covered by a mobile cellular signal or the percentage of the population that subscribers to mobile cellular service. Note that this measures the theoretically ability to use mobile cellular service if one has a handset and subscription.	Regulator	100 many	100 several
Percentage of population with access to a telephone	Universal access	There are various ways of measuring this. One would be to use the percentage of the population covered by a mobile cellular signal. A second would be through a survey that asks people if the have access to a telephone. A third would be by determining the number of localities with telephone service and corresponding populations.	Regulator / NSO	100 many	100 several
Percentage of population that use a personal computer	Universal access	The percentage of population that use a personal computer at any location (e.g. home, school, work).	NSO	Not available	Not available
Percentage of population that use the Internet	Universal access	The percentage of population that use the Internet. The age, frequency of use, gender and access device should be specified.	NSO	81.1 (Age 12+, Iceland)	37.0 (Age 15+, Slovenia)

Annex Table 2.1: The most important indicators for measuring access to ICT (cont'd)

Indicator	*Policy implication*	*Definition*	*Resp.**	*High value Developed***	*High value Developing***
Number of localities with public telephone service	Universal access	The number of localities (e.g. towns, villages) that have telephone service.	Regulator	Not available	100 Maldives
Number of localities with public Internet service	Universal access	The number of localities (e.g. towns, villages) that have public Internet service.	Regulator	Not available	Not available
Percentage of population with access to the Internet	Universal access	The percentage of the population that have theoretical access to the Internet whether they use it or not. Theoretical access would imply that they either have access in the home or at work, school or a public facility. This could either be derived from surveys or through administrative records (i.e. number of localities with Internet service).	NSO / Regulator	Not available	Not available

Note: * Shows who should be responsible for compiling the data. In the case of surveys, it should be the National Statistical Office (NSO). In the case of administrative records, it should be the regulator.
** Among economies that publish this data.
Source: ITU.

Annex Table 2.2: ICTs in households

Percentage of households with different ICTs

Country	*Year*	*Electricity*	*Radio*	*TV*	*Telephone*	*Fixed line*	*Mobile*	*PC*	*Internet*	*Source*	*Note*
Albania	2001			90.0				1.4		INSTAT	
Argentina	2001				66.5	57.1	27.1	20.5	9.1	INDEC	
Australia	2002							61.0	46.0	AusStats	
Austria	2002						69.4	45.4	30.9	Statistics Austria	
Bahrain	2001			96.8				33.4	18.2	CSO	
Belgium	2001						69.4	44.6	28.0	INS	
Brazil	2002	96.7	87.9	89.9	61.6			14.2		IBGE	
Canada	2001			99.2		97.4	47.6	59.9	49.9	Statistics Canada	
Chile	2002			87.0		51.5	51.0	20.5	10.2	SUBTEL	Colour TV
Costa Rica	2000			84.9	54.3			14.1		INEC	Colour TV
Cyprus	2002							36.0	24.0	Statistical Service	
Denmark	2002						84.0	72.0	59.0	Statistics Denmark	
Estonia	2002		89.3	93.9	85.0	65.1	58.4	21.8	13.9	Statistical Office of Estonia	Colour TV
Finland	2003			96.0		64.0	92.0	58.0	43.0	Statistics Finland	Colour TV (2001/02)
Germany	2001				98.5	96.4	69.8	57.2	36.0	Federal Statistical Office	Total and fixed telephone refers to 2000.
Honduras	2001		74.2	48.0	16.0			3.7		INE	
Hong Kong, China	2002							62.1	52.5	C&SD	
Iceland	2001			96.8				73.1	62.4	Statistics Iceland	
India	2001	55.8	35.1	31.6	9.1					Census of India	
Ireland	2003							42.3	33.6	Central Statistics Office	
Israel	2001			92.6		91.7	73.8	49.8	22.5	Central Bureau of Statistics	Colour TV
Italy	2000						59.6	27.2	15.4	ISTAT	
Japan	2002			99.3			86.1	71.7	48.8	MPHPT	Colour TV (1999)
Korea (Rep.)	2002							60.1	51.3	KNSO	
Luxembourg	2001			93.1	91.0					STATEC	
Malaysia	2000		78.8	84.3		56.7	26.9	13.5	6.9	Department of Statistics	
Maldives	2000			56.7		22.9		6.2		Ministry of Planning and Development	
Malta	2002						74.5	38.0	31.0	National Statistics Office	
Mauritius	2002	99.0		92.8		76.3	28.1	18.0	12.6	Central Statistics Office	TV, radio & telephones from 2001. Electricity from 2000.
Mexico	2002			93.6	45.3			15.2	6.2	INEGI	Internet is from 2001
Morocco	2000	65.9		71.9		24.9				Direction de la Statistique	
Mozambique	2001	5.7	49.5	5.1						INE	
New Zealand	2001			98.1	96.3	93.7	58.3	46.6	37.4	Statistics New Zealand	
Paraguay	2002	89.2		72.3		16.8	32.4	6.4	1.7	DGEEC	
Peru	2002	69.9	80.1	68.7	24.4	21.0	8.3	6.0	0.8	INEI	Data for electricity and radio from 2001

Annex Table 2.2: ICTs in households (cont'd)

Percentage of households with different ICTs

Country	*Year*	*Electricity*	*Radio*	*TV*	*Telephone*	*Fixed line*	*Mobile*	*PC*	*Internet*	*Source*	*Note*
Philippines	2000	68.2	75.2	52.7	14.2					NSO	
Portugal	2001							24.0	13.0	INE	
Serbia and Montenegro	2002			91.8						Statistical Office	Color TV
Singapore	2002			98.6			85.4	65.5	52.0	Statistics Singapore	TV is from 1998
South Africa	2001	69.7	73.0	53.8	42.4	24.4	32.3	8.6		StatSA	
Spain	2002		77.1	99.5		90.2	58.8	36.1	17.4	INE	
St. Lucia	2001	86.6		79.0		60.2	13.7	13.1	7.9	Statistics Department	
Switzerland	2001			93.6			68.6	64.2	36.5	OFS	Internet access for 2000; source: OECD.
Taiwan, China	2002			99.6	97.9	97.9	83.6	56.8	45.9	DGBAS	
Tanzania	2001	9.2	51.9	2.6	1.2			1.4		NBS	Mainland Tanzania
Thailand	2000		77.2	91.5	27.7					NSO	
Tunisia	2001			88.6	31.9					INS	
United Kingdom	2000			99.0	98.0	93.0	58.0	45.0	45.0	National Statistics	Internet for 2002, all others for 2000
United States	2001		99.0	98.2	94.4			56.5	50.5	Census Bureau	Radio, TV and Telephone from 2000
Uruguay	2002			92.9	72.4			17.6	13.6	INE	Localities with > 5'000 inhabitants

Source: ITU adapted from sources shown in table.

[1] There is no shortage of references to universal service/ access being the main goal of telecommunication policy. For further information see ITU. (1998). *World Telecommunication Development Report: Universal Access.* Available from: http://www.itu.int/ITU-D/ict/publications/wtdr_98/index.html; accessed December 1, 2003 and ITU. (2003). *Trends in Telecommunication Reform: Promoting Universal Access to ICTs — Practical Tools for Regulators*. Available from: http://www.itu.int/publications/docs/trends2003.html; accessed December 1, 2003.

[2] Out of 206 countries analyzed, only 12 were found to not have a cellular network at the end of 2002. Thus 97 per cent of all countries had a mobile cellular network.

[3] A related statistic, *percentage of the territory of a country covered by a mobile cellular signal*, can be useful, especially for emergency services within a country. However, it is important that it not be confused with the *percentage of the population covered by a mobile cellular signal* when comparing between countries.

[4] Central Statistical Authority (Ethiopia). (1999, November). *Report on the 1998 Welfare Monitoring Survey*.

[5] Statistics South Africa. (2002). *Measuring rural development: Baseline statistics for the integrated sustainable rural development strategy*. Available from the Statistics South Africa website at: http://www.statssa.gov.za; accessed December 1, 2003.

[6] By the same token, new technologies can substitute for older ones. Radio and television stations provide audio and video streaming over the Internet while some mobile phone models have built-in radios.

[7] Minges, M. (2002, April). *Mixed Media in the LDCs*. Available from: http://www.itu.int/osg/spu/ni/ipdc/index.html; accessed December 1, 2003.

[8] This refers to terrestrial broadcasting since "direct-to-home" satellite broadcast signals are widely available, albeit expensive and some countries have restrictions on use. It is also worth noting the existence of television sets in many countries prior to the introduction of national service. This is due to the reception of signals from neighbouring countries and the use of satellite antennas or Video Cassette Recorders / Digital Video Disks.

[9] Wind-up and solar powered radios also exist, such as those produced by Freeplay (www.freeplay.net). The company also produces a wind-up mobile phone charger.

[10] "Lack of access to electrical energy in rural areas deprives communities ... of … television, which are essential ways of disseminating information on general development concerns." United Nations Development Programme. "Recharging batteries — Zimbabwe". *Sharing Innovative Experiences*, Vol. 8. Available from: http://tcdc.undp.org/experiences/vol8/Zimbabwe.pdf; accessed November 5, 2003.

[11] The broadcast industry uses other metrics such as "universe estimates" (e.g., potential television audience). See "FAQ — About Ratings" at the Nielsen Media Research website: http://www.nielsenmedia.com; accessed December 1, 2003.

[12] The United Nations Educational, Scientific and Cultural Organization (UNESCO) had published the number of radio and television sets in different countries but stopped with its *1999 Statistical Yearbook*.

[13] This lack of data may be a problem in the future, as countries shift towards digital radio and television broadcasting. Important policy-decisions on when to turn-off analogue broadcast channels may be delayed due to lack of reliable data on homes with radios and televisions.

[14] Variations on basic and primary ISDN exist in some countries, sometimes referred to as fractional ISDN. For example in Denmark a variant known as Flex-ISDN provides 12 channels per line.

[15] For more on the statistical implications of mobile telephones surpassing fixed refer to Kelly, T. (2003, January). *Mobile overtakes Fixed*. Available from: http://www.itu.int/ITU-D/ict/WICT02/doc/pdf/doc44_E.pdf; accessed November 5, 2003.

[16] The Federal Communication Commission (FCC), the US industry regulator, requests the national statistical agency, the Bureau of Census, to include questions about telephone availability in its thrice-yearly *Current Population Survey*. Data is available for the last two decades. Considering the variety of information available in the reports, it is surprising that a breakdown by type of home telephone is not shown (e.g. fixed or mobile). This would indicate whether the relatively large increase in US home telephone ownership since 2000 is due to the popularity of mobile phones or specific universal policies. FCC (USA). (2003, April). *Telephone Subscribership in the United States*. Available from: http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/subs1102.pdf; accessed December 1, 2003.

[17] Minges, M. (2003, June). *Is the Internet mobile? Measurements from Asia-Pacific*. Available from: http://www.itu.int/ITU-D/ict/papers/2003/Measuring%20mobile%20Internet.pdf; accessed November 5, 2003.

18 According to some researchers, the PC replacement rate in the US is as high as 70 per cent. On the other hand "In more developing regions, PC replacement rates are much lower". CyberAtlas. (2003). "PC Market headed for geographic shift". Available from: http://cyberatlas.internet.com/big_picture/hardware/article/0,,5921_988841,00.html; accessed November 5, 2003.

[19] Prince and Cooke. (1998, December). *Mercado Informático*. Available from: http://www.spkrsbr.com/biblioteca/htm/resultados.htm; accessed November 5, 2003.

[20] See: http://www.aui.es; accessed December 1, 2003.

[21] National Statistical Office (Malta). (2003). *Survey on ICT Usage in Households*. Available from: http://www.nso.gov.mt; accessed December 1, 2003.

[22] See, for instance, the data for Hong Kong, China, available on the website of the Census and Statistics Department, at http://www.info.gov.hk/censtatd/eng/press/ops/1202/itsurveysummary2002.pdf; accessed December 1, 2003.

23 Another comparability issue for some surveys is the location of use. Surveys conducted by some private organizations only measure Internet access from the home. This would under-report the number of users where access from other locations is widespread.

[24] For example the United States shows data in five age groups (3-8, 9-17, 18-24, 25-49 and 50+); the Republic of Korea shows data broken down by 6-19, 20s, 30s, 40s and 50 and over; European data is broken down into four groupings: 15-24, 25-39, 40-54 and 55+.

[25] Host computers have an Internet Protocol (IP) network address that can be captured by online surveys. Host count surveys are conducted by the Internet Software Consortium (http://www.isc.org/ds; accessed December 1, 2003) and Réseaux IP Européens (RIPE, http://www.ripe.net; accessed December 1, 2003). Multipliers usually range between 3 – 10. See: Hoffman, D. and Novak, T. (1994 , November). "Wanted: Net.Census." *Wired*. Available from: http://www.wired.com/wired/archive/2.11/hoffman.if.html; accessed December 1, 2003.

[26] Through the late 1990s it was not unusual to see statistical tables showing there were no Internet users in Bangladesh despite the fact that the nation connected to the Internet in October 1996. See "First Ping BD — Bangladesh on line (1996.10.11)". Available from: www.nsrc.org/db/lookup/operation=lookup-report/ID=890202369299:497431318/fromPage=BD; accessed November 5, 2003. The Bangladesh country domain name (BD) only started appearing in host counts as from July 1999. See "Distribution by top level domain name". Available from: http://www.isc.org/ds/WWW-9907/dist-byname.html; accessed November 5, 2003.

[27] Another issue is that the term *subscriber* is often used interchangeably with *user,* causing confusion. A subscriber is someone who has registered for Internet service with a provider. A user is someone who uses the Internet regardless of whether they have paid or not.

[28] *Free subscriptions* are where there is no charge levied directly on customers by the Internet access provider for using the Internet. However, there are normally telephone usage charges that the operator shares with the ISP. Some countries therefore report all telephone subscribers who have pre-registered for the service as being Internet subscribers whether they use it or not. Prepaid Internet cards come in various denominations allowing access via telephone numbers indicated on the card until the amount is used up. In some cases, prepaid cards are also sold by Internet cafés. Widespread use of prepaid cards in some countries understates the number of subscribers since there is no conventional contract. One way of dealing with this situation is for telecommunication operators to count the number of telephone numbers accessing prepaid Internet services. Only a few operators currently do this.

[29] National Electronics and Computer Technology Center (Thailand). (2002). *The ASEAN Workshop on the Measurement of Digital Economy*. Available from: http://www.ecommerce.or.th/project/asean-measurement/measurement_report.pdf; accessed November 5, 2003.

[30] Paulwell, P. (2003). "Launch of Jamaica Internet Market Study". Available from: http://www.mct.gov.jm/Minister%20launches%20intnet%20study.pdf; accessed November 5, 2003.

[31] OSIPTEL. (2002, May). *Diagnostico de la Situación de Internet en el Peru*. Available from: http://www.osiptel.gob.pe/OsiptelDocs/GPR/EL_SECTOR/INTERNET/dt_internet.pdf; accessed November 5, 2003.

[32] For more on broadband developments, see ITU. (2003). *Birth of Broadband*. Available from: www.itu.int/birthofbroadband; accessed November 30, 2003.

[33] The meeting noted: "Special emphasis was placed on the development of community access indicators…". World Telecommunication/ICT Indicators Meeting. (2003, January). *Final Report*. Available from: http://www.itu.int/ITU-D/ict/WICT02/conclusions/index.html; accessed November 30, 2003.

[34] ITU. (2003). *Key indicators of the telecommunication/ICT sector*. Draft. Available from: http://www.itu.int/ITU-D/ict/material/Top50_e.doc; accessed November 30, 2003.

[35] EU. (2000, November 20). *List of eEurope Benchmarking indicators*. http://europa.eu.int/information_society/eeurope/benchmarking/indicator_list.pdf; accessed October 1, 2003.

[36] "Centros de acceso de telecomunicaciones, centros de navegación y cibercafé" on the CONATEL website at: http://www.conatel.gov.ve/ns/indicadores/Indicadoresnuevos/CENTROS%20DE%20ACCESO%20DE%20TELECOMUNICACIONES.htm; accessed October 3, 2003.

[37] "Les centres d'accès publics (Publinets)" on the Agence Tunisienne d'Internet (ATI) website at: http://www.ati.nat.tn/publinets/index.htm; accessed October 3, 2003.

[38] Minges, M. and Simkhada, P. (2002, December). "A closer look at South Asia." *ITU News Magazine*. http://www.itu.int/itunews/issue/2002/10/southasia.html; accessed October 3, 2003.

[39] See the "Village Panchayat Telephones(VPT) Monthly Progress Report" on the BSNL website at: http://www.bsnl.co.in/vptstatus(monthly).htm; accessed November 30, 2003.

[40] Available from the National Statistics Office of Thailand website at: http://www.nso.go.th; accessed November 30, 2003.

[41] Undersecretary of Communications (Mexico). (2003, September). *Propuestas sobre indicadores para medir y cuantificar el acceso comunitario a las TIC*. Available from: http://www.itu.int/ITU-D/ict/mexico03/doc/pdf/Doc07_S.pdf; accessed November 30, 2003.