INTERNATIONAL TELECOMMUNICATION UNION

WSIS Thematic Meeting on Multi-Stakeholder Partnerships for Bridging the Digital Divide

Seoul, Republic of Korea, 23 - 24 June 2005

Document: BDB-WSIS/06

22 July 2005

MEASURING DIGITAL OPPORTUNITY

July 2005

This report has been drafted by Michael Minges, Senior Market Analyst at TMG, Inc. under the direction of Lilia Pérez Chavolla and Tim Kelly of the Strategy and Policy Unit of ITU, with inputs from Dr. C. M. Cho of the Korea Agency for Digital Opportunity and Promotion (KADO). It has been prepared for presentation and discussion at the WSIS Thematic Meeting on "Multi-stakeholder partnerships for bridging the digital divide", in Seoul, Republic of Korea, 23-24 June 2005 and reflects the comments made at that meeting. It marks a first step in responding to the request, in the Geneva Plan of Action of the World Summit on the Information Society, to develop a composite Digital Opportunity Index. The material presented has benefited from discussions at two earlier meetings: "Workshop on Building Digital Bridges", held on 10-11 September 2004 in Busan, Republic of Korea and "WSIS Thematic Meeting on Measuring ICT for Development", held 7-9 February 2005, in Geneva, Switzerland.

This paper, together with the others that have been prepared for the WSIS Thematic Meeting, can be found on the website at www.itu.int/wsisbridges. The views expressed in this paper are those of the authors, and do not necessarily reflect those of the ITU or its membership.

TABLE OF CONTENTS

TABLES

FIGURES

1 OVERVIEW

The first phase of the World Summit on the Information Society (WSIS), held in Geneva, Switzerland, 10-12 December 2003, identified the need for international evaluation and benchmarking through comparable statistical indicators in order to follow up the implementation of the objectives, goals and targets of its Plan of Action.[1] To carry this out, WSIS called for:

- the creation of a composite *Digital Opportunity Index* (DOI);
- all countries to provide statistical information on the Information Society; and
- the establishment of internationally comparable indicator systems.

In regard to the last point, a "Partnership for the Measurement of ICTs for Development", comprising international organizations and national statistical agencies, has commenced work on elaborating a set of comparable indicators for measuring the information society. As a first step, they have identified a list of *core* Information and Communication Technology (ICT) indicators in the areas of infrastructure, household and individual access, business use and the ICT sector (see Annex).[2]

This paper outlines how the core set of indicators can be mapped to create a DOI. In that respect, the DOI proposed here uses a novel approach. Most ICT indices (*e-indices*) are based on a set of indicators identified by the index creator while the DOI is created from a set of internationally-agreed indicators. The DOI initially uses a subset of the core infrastructure and household and individual access indicators, which are the most widely available among countries. This keeps the research manageable and enables the inclusion of a diverse set of countries since the other core indicator sets generally have more limited country coverage at this point in time.

2 DOI METHODOLOGY

Indices use a set of indicators to create a single value that can be compared to other countries. This section examines the choice of indicators and the methodology used to convert them to an index value for the DOI.

2.1 Comparison of indicators

It is useful to compare the core infrastructure and household and individual access indicators mentioned above to those used by other e-indices. Although close to two dozen e-indices have been identified,[3] this report looks at popular e-indices such as the IDC *Information Society Index (ISI)*[4], the World Economic Forum *Networked Readiness Index (NRI)*,[5] the Orbicom *Monitoring the Digital Divide*[6] and the ITU *Digital Access Index (DAI)*[7] for comparative purposes (Table 1). Although none of the indicators appears exactly in

[1] See E) Follow-up and evaluation (para 28) in the WSIS Geneva Plan of Action available at: http://www.itu.int/wsis/docs/geneva/official/poa.html

[2] http://measuring-ict.unctad.org/QuickPlace/measuring-ict/Main.nsf/h_Index/215B47A1349CB45AC1256FA400303002/?OpenDocument. The core list was discussed at the WSIS Thematic Meeting on measuring ICT for development, held in Geneva, 7-9 February 2005, and will be discussed further during a statistical side event to be held during the Tunis phase of WSIS, in November 2005.

[3] See, for instance, http://www.bridges.org/ereadiness/ereadiness_tools_bridges_10Mar05.pdf or George Sciadas (2004) "International Benchmarking for the Information Society", at: http://www.itu.int/digitalbridges/docs/background/BDB-intl-indices.pdf.

[4] http://www.idc.com/groups/isi/main.html

[5] http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme%5CGlobal+Information+Technology+Report

[6] http://www.orbicom.uqam.ca/projects/ddi2002/ddi2002.pdf

[7] http://www.itu.int/ITU-D/ict/dai/index.html

the same way in all of the indices, some such as mobile cellular subscribers per 100 inhabitants or proportion of individuals that used the Internet appear in four of the indices. Other core indicators such as mobile population coverage or mobile tariffs do not appear in any of the other indices. Given that only some of the core infrastructure indicators appear in other e-indices, the DOI should produce unique results.

Table 1: Inclusion of the infrastructure and access and use of ICTs by households and individuals core indicators in different e-indices

	DAI	NRI	ISI	Orbicom
A-2 Mobile cellular subscribers per 100 inhabitants	●		●	●
A-4 Internet subscribers per 100 inhabitants				
A-5 Broadband Internet subscribers per 100 inhabitants	●			
A-7 Percentage of population covered by mobile cellular telephony				
A-8 Internet access tariffs (20 hours per month), in US$, and as a percentage of per capita income	●	●		
A-9 Mobile cellular tariffs (100 minutes of use per month), in US$, and as a percentage of per capita income				
HH-3 Proportion of households with a fixed line telephone				
HH-5 Proportion of households with a computer			●	
HH-7 Proportion of households with Internet access at home		●		
HH-8 Proportion of individuals that used the Internet	●		●	●

Note: DAI = Digital Access Index (ITU), NRI = Network Readiness Index (World Economic Forum), ISI = Information Society Index (IDC).

Source: Adapted from information on the indices shown above.

2.2 Constructing the DOI

An index needs a framework for converting indicators to a unitary value. Most indices also group related indicators into categories that can be useful for analyzing countries relative strengths and weaknesses. This section reviews methodologies used for various e-indices and describes the structure of the DOI. The indicators are then described with goalposts and weighting within the DOI explained.

2.3 Index methodology

Methodologies and classifications used by e-indices include:

- In the free information available on its website, IDC does not go into detail about how the Information Society Index is constructed.[8] The index features 15 indicators and covers 53 countries. There appears to be a maximum score of 1'000 and the indicators are grouped into four categories (social, Internet, computers and telecom). Beyond that, the free information does not describe how indicators are normalized or the aggregation technique.
- WEF's NRI consists of three component indexes (Environment, Readiness and Usage) each of which has a further three sub indexes. The index uses 48 indicators covering 104 countries. Data are transformed on a scale of 1 to 7; there are no weightings within sub indexes with values averaged to create the value. The NRI is then computed as the average of the component indexes.
- Orbicom follows an innovative approach. The 12 indicators are indexed to a reference country and year. There are two categories: Info density and Info Use. The individual indicators within each category are summed to get an index value. The index covers 139 countries.

[8] The methodology is available in the report that is sold for US$ 3,500.
http://www.idc.com/getdoc.jsp?containerId=32161

- The ITU's Digital Access Index groups 8 indicators into five categories (Infrastructure, Affordability, Knowledge, Quality and Usage). The indicators are normalized relative to desirable values or goalposts. For example, a goalpost of 100 was established for mobile cellular subscribers per 100 inhabitants. Assuming a country had 60 mobile cellular subscribers per 100 inhabitants, then the index value would be 0.6 (60/100). Indicators are weighted within their groups and then the groups are averaged to arrive at the DAI value. This is the same methodology used by the United Nations Development Program's Human Development Index (HDI), which is arguably the benchmark for composite indices, as it is one of the longest-standing and most referenced of all.[9] The DAI covered 178 countries.

The DOI follows the same methodology as the DAI and HDI. Grouping the indicators and using goalposts to normalize the values offers a number of benefits. First, it is a straightforward and transparent methodology since the goalposts are identifiable and the calculations clear. Second, the use of goalposts establishes targets that countries can aspire to and establishes a parameter for achievement. Establishing the goalposts sharpens thinking about the indicators themselves and their relevance to the information society. Third, grouping the indicators allows countries to see where they are relatively strong and weak, which can be useful for policy-making. Fourth, the index can be tracked over time without the index values changing meaning. This is particularly useful for policy evaluation.

There are certain drawbacks with the DOI methodology. The determination of the goalposts is difficult for an ever evolving sector like ICT where technologies decline and grow in importance. Although the goalposts are often determined by best practice or logical limits, they can be exceeded (for instance, several economies now appear to have more mobile phones than inhabitants). National definitions of the indicators can result in exaggerated values; if these are used as best practice, they can establish goalposts that will be impossible for other countries to reach. Best practice, as reflected in an indicator value, is not always possible with ICTs since the indicators can vary for social reasons. The categorization of indicators into sub indexes and the weights assigned involves a degree of subjectivity and can impact the index values. The impact can be minimized through statistical techniques that determine appropriate weights and classifications while retaining the analytical power of categories.

Not all of the core infrastructure and access and use of ICTs by households and individuals indicators are utilized for the DOI. Either they were not suitable for the proposed framework or sufficient data does not yet exist. The remaining indicators lend themselves to a logical classification:

- The first is **Opportunity**. In order to participate in the information society, consumers must have accessibility to ICT service and must be able to afford it. The *percentage of the population covered by mobile cellular telephony* represents coverage (basic accessibility) while the two tariff indicators, *Internet access tariffs as a percentage of per capita income* and *Mobile cellular tariffs as a percentage of per capita income* reflect affordability.

- The next category is **Infrastructure**, which includes network indicators such as the proportion of households with a fixed *line telephone, mobile cellular subscribers per 100 inhabitants, proportion of households with Internet access at home and mobile Internet subscribers per 100 inhabitants*. It also includes the devices that provide the interface between the user and the network; here it is represented by proportion of households with a *computer*.

- **Utilization** shows the extent of ICT usage and includes proportion of individuals that used the Internet**.** Quality reflects a level of access that enables higher degrees of functionality. This provides support for services such as video streaming that can enhance desirable information society applications such as telemedicine, e-government and e-learning. The indicator selected for this category is the ratio of *broadband subscribers among Internet subscribers (separated by both fixed and mobile)*.

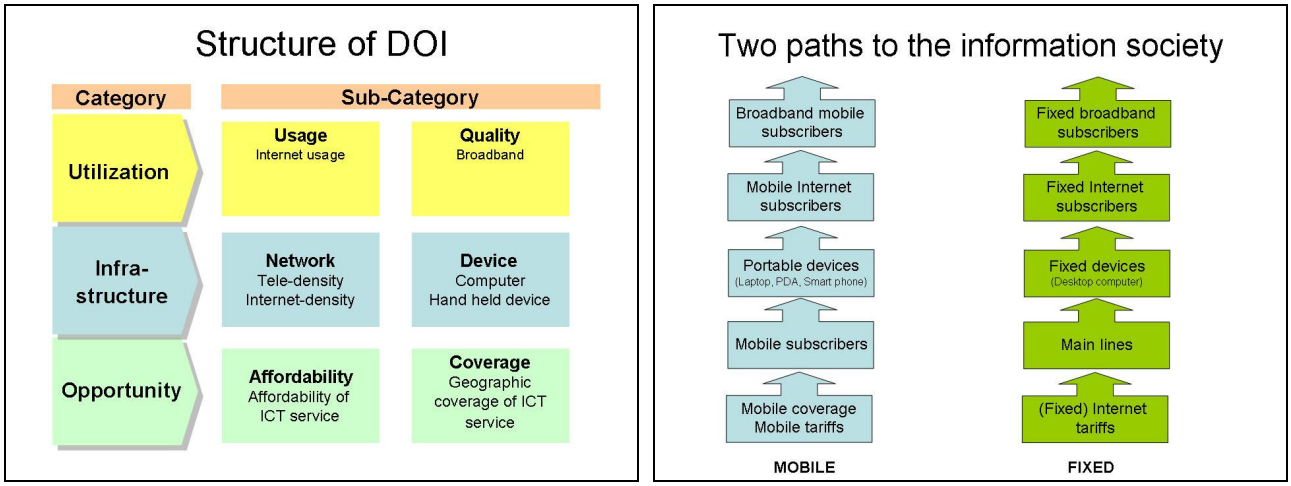
The classification is sequential, in that each category is dependent on the previous (Figure 1, left). The classification also reflects higher levels of access, from basic voice communications to broadband connectivity. In order to have access to infrastructure, users must have the opportunity to be covered by the

[9] The UNDP uses a similar methodology for its Technological Achievement Index. See http://hdr.undp.org/statistics/indices/#5

service and able to afford it. Utilization depends on having infrastructure and a device. Finally, given all the prerequisites for connectivity, users will then want to aspire to higher levels of quality through broadband access.

The popularity of mobile communications and introduction of high-speed 2.5 and 3G (third generation) services make wireless technology a key component of the information society. Almost all of the indicators selected for the DOI have a mobile component. Some are explicit, such as mobile coverage or mobile subscribers, while others are embedded in indicators such as computers (e.g., smart phones, PDAs) or Internet subscription (which can include mobile Internet subscriptions). This lends the DOI to an alternate classification of fixed versus mobile (Figure 1, right). This allows analysis of the relative importance of each in a country's progression to the information society. The trend toward ubiquity[10] suggests that countries should not sacrifice one path at the expense of the other but that both should be pursued simultaneously.

Figure 1: Classifying the DOI



Source: Left chart: Adapted from C. M. Cho; right chart: ITU/KADO Digital Bridges Project.

3 ANALYZING THE CORE INDICATORS

The core ICT indicators represent international agreement about the main statistics to be used for analyzing the information society. This section analyzes the choice of indicators, pointing out their utility as well as their limitations with possible repercussions for index results. [11] It also review trends in the indicators, and suggests goalposts that can be used to normalize them for the DOI.

3.1 Opportunity

3.1.1 Percentage of population covered by mobile cellular telephony

This is an ideal indicator for measuring *potential* access to communications. In order to enable access, users have to have access to infrastructure. This indicator measures that since if users had a mobile phone and a subscription, they would be able to use the service. It is also a widely available indicator, disseminated by many mobile operators. The goalpost is set at 100, a point at which mobile cellular is available to all inhabitants of an economy. A number of economies have achieved this. This indicator is included in the Coverage and Affordability category and assigned a weight of 33%.

[10] See, for instance, the research conducted for the ITU New Initiatives workshop, on Ubiquitous network Societies, held 6-8 April 2005, Geneva, at http://www.itu.int/osg/spu/ni/ubiquitous/ and the presentations made at the WSIS Thematic Meeting on Ubiquitous Network Societies, held 16-17 May 2005, in Tokyo, at www.wsis-japan.jp.

[11] Definitions for most of the indicators are available from the ITU: http://www.itu.int/ITU-D/ict/material/Top50_e-Oct2004.doc

3.1.2 Internet access tariffs (20 hours per month), in US$, and as a percentage of per capita income

Affordability is a vital component of demand and use of ICT services but often difficult to determine. There are different types of Internet access (e.g., dial-up, broadband, wireless) and comparing prices between countries does not always reflect this quality aspect. In addition, flat rate pricing is a typical option for broadband and some dial-up packages; the cost advantage is typically dependent on intensity of use. There is also the issue of whether the telephone line rental charge should be included (or, in the case of cable modem access, the monthly subscription charge).

The selection of 20 hours of use per month for this indicator is a popular yardstick. For example, the European Union includes 20 hours in its Indicator access cost *e*Europe indicator[12], the OECD used 20 hours of use in its analysis[13] and the ITU featured the same amount of use for the Digital Access Index. According to market research, the average time spent at home accessing the Internet was 24 hours in December 2003 (Figure 2, left).

Because affordability is of concern, the cheapest package available that provides *at least* twenty hours of use (spread over peak and off-peak times) is used to derive this indicator. The calculation does not include the telephone line rental but does include telephone usage charges if applicable. The Internet tariff is divided by monthly Gross National Income to obtain the percentage of per capita income.

Hong Kong, China has both the lowest Internet access tariff (US$3.85) and the most affordable (0.19 percent of per capita income). Therefore the goalpost, Internet access tariff as a percentage of per capita income, was established at 0.20. This indicator is part of the Affordability and Coverage category where it is assigned a weight of 33%.

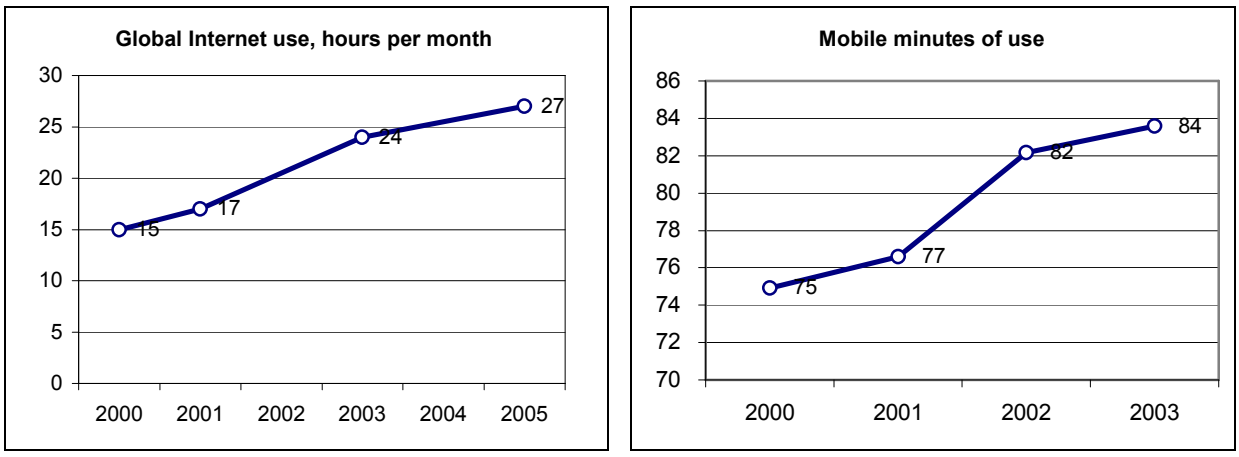
3.1.3 Mobile cellular tariffs (100 minutes of use per month), in US$, and as a percentage of per capita income

Given that mobile is now the predominant form of voice communications, mobile tariffs are a key measure of affordability for individual consumers (fixed lines remain more important for businesses). One complication is the wide variety of tariffs available, which makes comparisons difficult. Although the "core indicator" is shown as including 100 minutes of use per month, in reality, levels of use tend to be lower (84 minutes per month for a sample of 40 countries, Figure 2, right).[14] Furthermore, mobile tariffs tend to differ for on-net (calls within the mobile network of the same operator) and off-net (calls outside an operator's mobile network). The indicator itself does not provide a guideline of how the 100 minutes of use per month should be computed. The indicator included for the DOI is based on pre-paid tariffs, the predominant form of access in most developing nations, and uses the OECD low user basket methodology which is applicable to prepaid tariffs.[15] The OECD basket for low usage results in 37 minutes of use per month—significantly less than what the core indicator specifies—but does include 30 text messages per month. Because of the difficulty of determining registration (i.e., initial connection or installation) charges, which are, in any case, often waived or bundled with other services for pre-paid customers, these are excluded from the basket.[16] The resulting basket values were then divided by monthly Gross National Income per capita to create an affordability indicator. As with Internet tariffs, pre-paid mobile is most

[12] http://europa.eu.int/information_society/eeurope/2002/news_library/documents/benchmarking05_en.pdf
[13] http://www.oecd.org/dataoecd/43/5/2767166.xls
[14] A simpler and possibly more realistic measure of mobile affordability might be the cost of a monthly prepaid card. In many countries, mobile usage is related to the amount available on the recharge voucher with users often economically limited to one voucher per month.
[15] The OECD mobile basket methodology was originally developed as part of a series of tariff comparison baskets developed in the late 1980s, in a methodology described in OECD (1990) "Performance Indicators for Public Telecommunication Operators". The methodology has been revised over time and a dull explanation can be found in Commission of the European Communities. December 2004. *Commission Staff Working Paper Volume II. Annex to the European Electronic Communications Regulation and Markets 2004 (10th Report)*. http://europa.eu.int/information_society/topics/ecomm/all_about/implementation_enforcement/annualreports/10threport/index_en.htm
[16] Many operators feature a free number of minutes or offer a subsidized phone for new subscribers. There is often insufficient information about the breakdown among these items in order to determine the actual connection cost.

affordable in Hong Kong, China at 0.16 percent of per capita income. This is used as the goalpost. The indicator is part of the Affordability and Coverage category where it is assigned a weight of 33%.

Figure 2: Talking and surfing



Note: Data in the left chart refer to home and work access for 2000-2001 and home access for 2003-2005. Data in the right chart is the average of 40 countries and refers to outgoing traffic.

Source: Adapted from Nielsen//NetRatings and ITU/KADO Digital Bridges Project.

3.2 Infrastructure

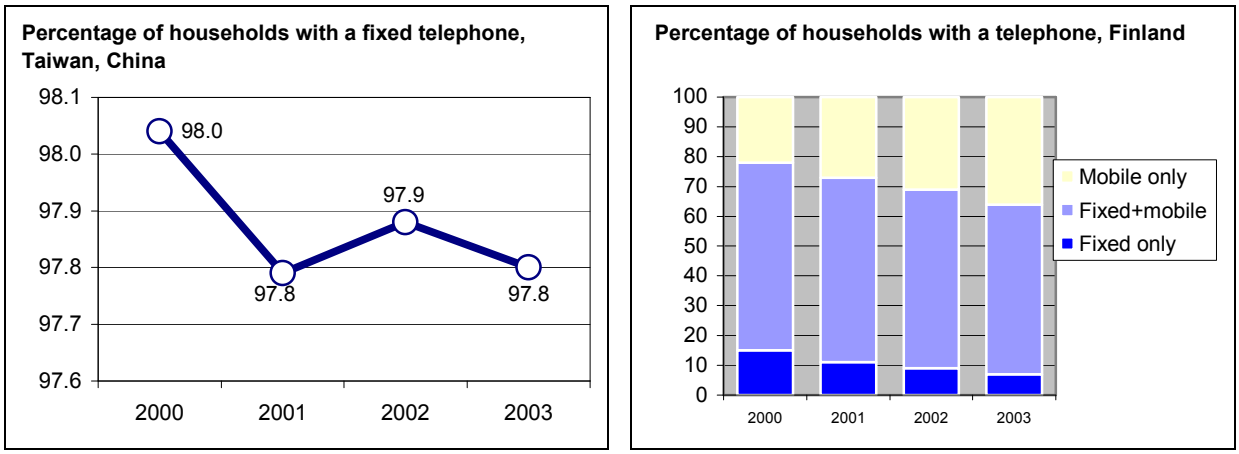
3.2.1 Proportion of households with a fixed line telephone

Fixed telephone lines is one of the oldest statistics used to analyze the telecommunication sector. Although they have been eclipsed by mobile, fixed telephone lines nonetheless are a major form of voice communications. Service charges for fixed tend to be cheaper than mobile communications making fixed more attractive. Fixed telephone lines also provide a basis for Internet access in most economies, whether through dial-up, ISDN (Integrated Services Digital Network) or higher speed DSL (Digital Subscriber Line) services.

The proportion of households with a fixed line telephone is used as the indicator on the grounds that fixed lines are generally stationary and, unlike mobile phones, tend to be associated with a household rather than an individual. There are some measurement issues with the indicator, which is survey-based. A number of high-income countries do not compile this indicator possibly in the belief that universal telephone service is widespread. Another issue is that some countries report the number of households with a telephone without specifying whether it refers to fixed or mobile phones (or both). A substitute for this indicator would be to use administrative records on the number of residential telephone lines and derive the number per 100 households. One shortcoming with this approach is that it does not account for second lines although this is declining as households replace them with ISDN or DSL which does not tie up the telephone line when engaged for Internet access.

Taiwan, China leads the world in the percentage of households with fixed telephone lines with a figure of 97.8 for 2003 (Figure 3, left). Although there has been a slight fall in households with a fixed telephone in Taiwan, China, it has been less than other countries such as Finland which have witnessed a rapid decline in household fixed telephone penetration due to mobile substitution (Figure 3, right). The goalpost established for this indicator is the ideal that all households (100%) have a fixed telephone line. The indicator is assigned a 20 percent weight within the Infrastructure category.

Figure 3: Fixed line trends

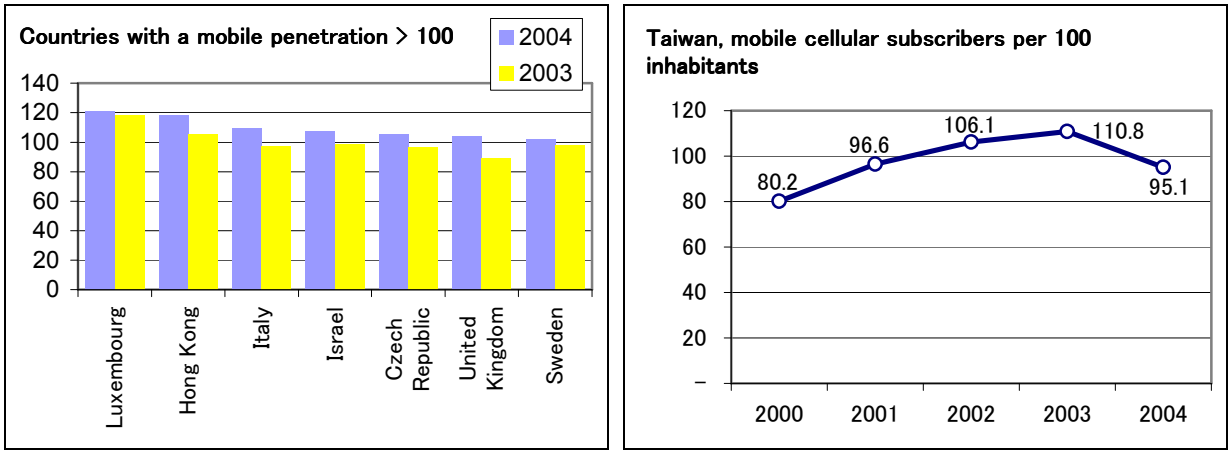


Source: Adapted from the Directorate General of Budget, Accounting and Statistics and Statistics Finland.

3.2.2 Mobile cellular subscribers per 100 inhabitants

This is the universal indicator for measuring mobile penetration. Mobile is becoming the predominant method of communications in most economies and is thus a fundamental indicator of information society development. Like fixed, mobile also suffers from comparability problems. These arise primarily from issues to do with prepaid. On the one hand, the number of mobile subscribers can include inactive prepaid users; operators vary in the length of time they consider a prepaid subscriber inactive. On the other hand, some subscribers maintain two or more typically prepaid subscriptions because of cheaper on-net calls as well as other reasons (e.g., work number versus personal number, enhanced roaming capability, car phones etc.). As a result, mobile cellular subscribers per 100 inhabitants can exceed 100 (reached by three countries in 2003 and seven in 2004, Figure 4, left). This implies that there are already more mobile phones than inhabitants, which is likely to be the case as we approach ubiquitous network societies in which computer and communication capabilities are embedded into the environment and objects around is. But is creates a problem when trying to establish a goalpost for this indicator. Indeed, the difficulty of establishing goalposts is illustrated by the case of Taiwan, China (Figure 4, right), which had exceeded a mobile cellular penetration of more than 100 in 2003, only to see it decline to below 100 in 2004 when subscriber rolls were cleaned up (e.g., inactive subscribers deleted from reported operator figures). A theoretical maximum of 100 is established as the goalpost for this indicator. Note that countries such as Finland, Japan and the US, which have a relatively low percentage of prepaid subscribers, tend to be penalized with this indicator. The indicator is assigned a 20 percent weight within the Infrastructure category.

Figure 4: Mobile cellular subscription trends



Source: ITU/KADO Digital Bridges Project and Directorate General of Budget, Accounting and Statistics.

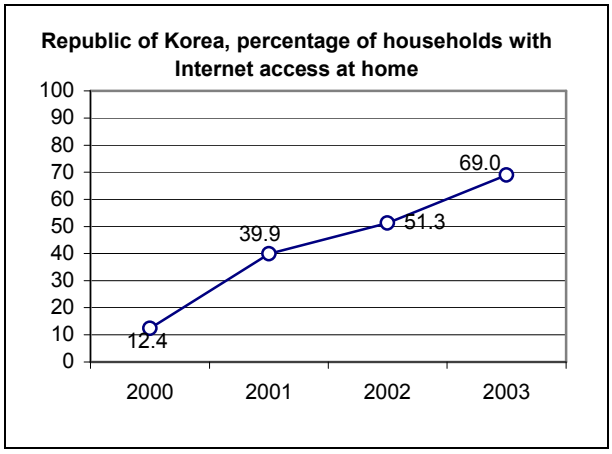
3.2.3 Proportion of households with Internet access at home

Internet subscriptions give an indication of the extent of households accessing the Internet through paid services. As such, it can be a useful indicator of the information society in terms of demand as well as a proxy for the overall Internet infrastructure in place.

A growing number of countries are collecting data on households with Internet access at home through censuses and household or specialized ICT surveys. For countries that do not currently collect this data, a proxy can be used based on the number of residential Internet subscribers. If that is not available, then the percentage of homes with Internet access can be estimated based on global averages for the share of residential Internet subscribers among total Internet subscribers.

The Republic of Korea leads the world with 69 percent of its households having Internet access at home in 2003 (Figure 5). The goalpost for this indicator is set at 100 percent and it is assigned a weight of 20 percent within the infrastructure category.

Figure 5: Households with Internet access at home



Source: Adapted from National Internet Development Agency of Korea.

3.2.4 Mobile Internet subscribers per 100 inhabitants

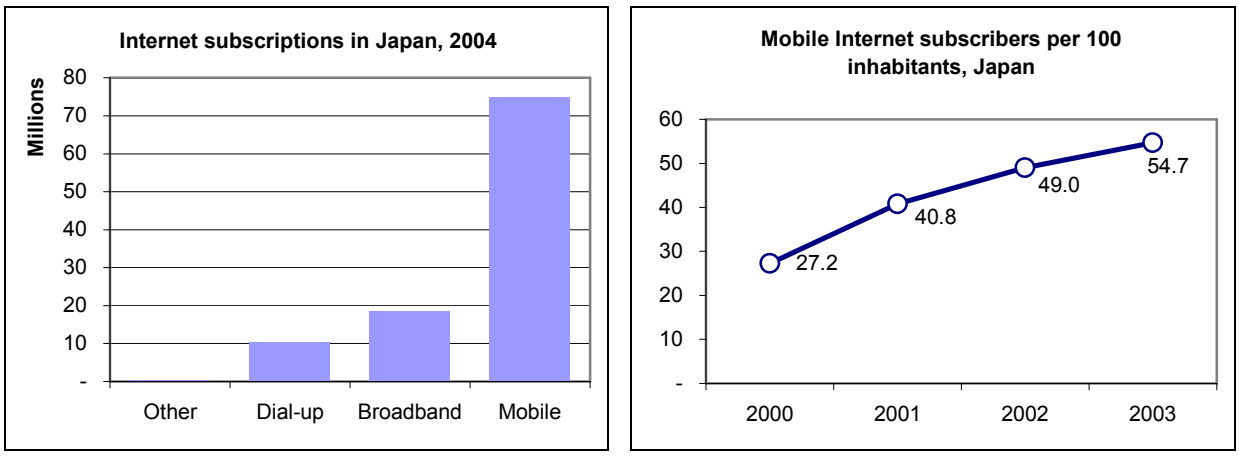
There are data and methodological issues with mobile Internet subscribers. Because mobile Internet access is relatively recent, most countries do not report data on the number of subscribers.[17] Some operators report the number of high-speed subscriptions (e.g., GPRS, 3G) as an equivalent for mobile Internet subscribers regardless of whether the user actually accesses the Internet. Other operators report the number of subscriptions to their mobile portal services (e.g., i-mode, Vodafone Live, etc.), again, regardless of whether users actually use the service. Some users utilize mobile cellular networks to access the Internet using laptop computers. Indeed, access to some 3G networks is often initially only possible through data cards connected to computers while other 3G networks only offer high-speed data and not voice. There is little consensus as to whether these types of users should be considered fixed Internet subscribers or mobile Internet subscribers. Finally, the concept of Internet access is seriously challenged when including mobile, since the users' experience is entirely different and many so-called mobile Internet users are not actually surfing websites *per se* but downloading logos and ring tones or sending picture messages.

Japan leads the world in mobile Internet with a subscription rate of over half the population in 2003 (Figure 6, right). Several surveys on Internet use suggest these subscriptions are not all active. However, in order to establish a goalpost, there could be symmetry with mobile subscriptions per 100 inhabitants where the goalpost was set at 100. Given that mobile is a prevalent and personal form of communications where per capita indicators are likely to be more relevant, then it would be desirable for all mobile subscribers to have

[17] Note that a high-speed mobile network is not essential for mobile Internet access. There are numerous instances of mobile subscribers using GSM networks at speeds of 9.6 kbps to access the Internet. In addition, Japan's popular i-mode service operates at this speed.

access to the Internet. Therefore a goalpost of 100 is established for this indicator; it is given a weight of 20% within the Infrastructure category.

Figure 6: Mobile Internet subscription trends



Source: Adapted from National Post and Telecom Agency, Sweden and Ministry of Internal Affairs and Communications, Japan.

3.2.5 Proportion of households with a computer

Computers are critical components of the information society. They can be used by themselves to enrich personal productivity through word processing, spreadsheets, presentation and dozens of other applications. They are also important for providing the interface between users and the Internet. This indicator uses the generic *computer* rather than Personal Computer (PC). In addition to mini and mainframe computers, this indicator should also include other devices that have a processor and computer-like components such as screens and keyboards. This would thus incorporate devices such as laptops computers, Personal Digital Assistants (PDAs) and smart phones.[18]

Virtually all of the statistics on the stock of computers for countries is based on PCs (generally, but not always including laptops). Although it may not include larger computers, this is usually not an issue since they comprise only a small proportion. However, the stock of computers would not include devices such as Internet-enabled phones, which essentially perform a similar service as that of a PC but for mobile networks. Therefore if one reason for measuring computers is to examine its relationship to Internet access, then the mobile market would be left out (except for those who use mobile networks for high-speed data access from laptops with suitably equipped data cards).

Sweden ranks first in the world with a household computer penetration of 80 in 2003 (Figure 7 below, left). A goalpost of 100 is established. This indicator is part of the Infrastructure category where it is assigned a weight of 20%. In the future, it would be preferable to include Internet-enabled mobile devices to widen the scope (Figure 7 below, right).

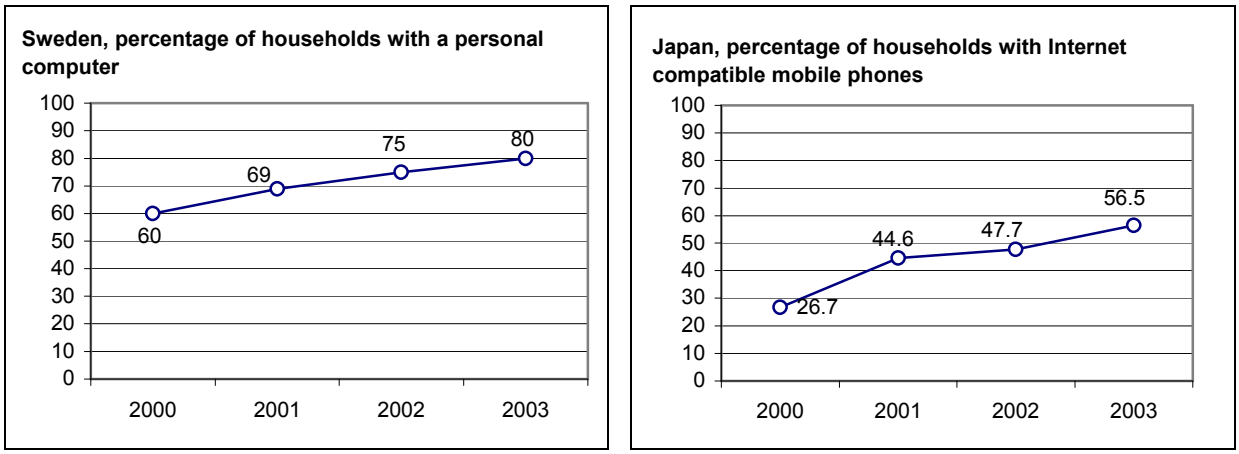
3.3 Utilization

3.3.1 Proportion of individuals that used the Internet

The utilization sub-index includes the proportion of individuals that used the Internet (in the last 12 months). There are several comparability issues with this indicator in that not all countries use the same time span to measure Internet use. Also, where surveys are carried out, the age ranges can vary across countries. More problematic is that many countries still do not carry out surveys on the number of Internet users and the data must be estimated from subscriber counts. The highest value for this indicator is the Republic of Korea with 61.2 in 2003. The indicator is assigned a weight of 33% within the Utilization category.

[18] Some estimate that sales of devices using Windows for PDAs and Smart Phones will surpass those for conventional computers by 2008. http://www.c-i-a.com/pr0403.htm

Figure 7: Computer trends



Source: Adapted from Statistics Sweden and Ministry of Internal Affairs and Communications.

3.3.2 Ratio of Broadband Internet subscribers per 100 inhabitants among Internet subscribers per 100 inhabitants

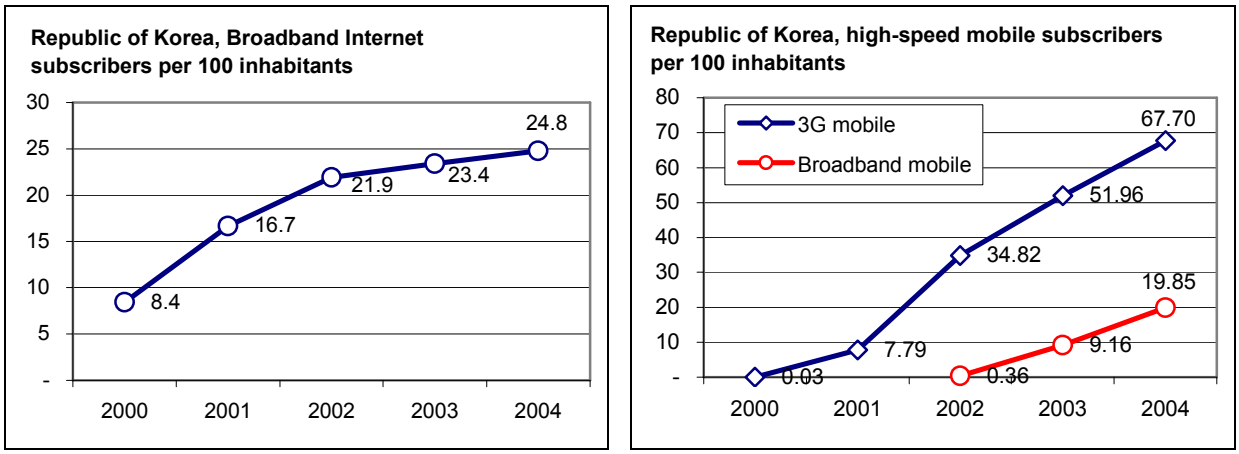
Many socially desirable applications envisioned for the information society are only possible with broadband access. The definition of broadband hinges on speed and mode. There is a growing consensus that a service should be considered broadband only if it offers speeds of at least 256 kbit/s in at least one direction. In some instances, the service (e.g., DSL, cable modem) is considered broadband even when they offer speeds less than 256 kbit/s and they are included in the country statistics because the service provider sells them as "broadband". But this practice is not to be encouraged.

"Mode" refers to the network over which broadband is utilized. Most data only cover "fixed" broadband access (e.g., DSL, cable modem, fixed wireless, fibre optic, Ethernet LAN, etc.) and therefore do not include broadband mobile cellular network subscribers. Given that high speed Internet access over mobile networks is growing, this should be included in the indicator where the service is available.

For the purposes of the DOI, this indicator is divided into two, each with equal weight. The first is conventional fixed broadband and the second mobile broadband. The Republic of Korea leads the world in the ratio of fixed broadband subscriptions to total Internet subscriptions with a rate of 100 (Figure 8, left). This indicator is given a weight of 33% within the Utilization category.

For definitional consistency, mobile broadband should also refer to the number of subscribers to mobile cellular networks offering speeds of at least 256 kbit/s in one direction. So far, only two 3G technologies (CDMA EV-DO and W-CDMA) fulfil this requirement. Like fixed broadband, Korea also ranks first in the world in this category with a mobile broadband ratio of 100 in 2003 (broadband mobile subscribers to mobile Internet subscribers) (Figure 8, right). One caveat is that mobile broadband is unlike fixed broadband where users subscribe because they want the higher speed. With mobile, users often subscribe to a network because of reasons other than broadband access *per se*. Broadband mobile does offer considerable advantages in terms of quality making the indicator consistent with its categorization. A goalpost of 100 is thus established for mobile broadband. This makes it consistent with the goalpost for mobile cellular subscribers per 100 inhabitants implying that ideally all mobile subscriptions should eventually have access to broadband speeds to meet the highest level of quality. It is given a weight of 33% within the Utilization category.

Figure 8: Broadband subscription trends



Note: In the right chart, 3G refers to CDMA2000 1X (153 kbit/s) and EV-DO (2 Mbit/s) whereas broadband mobile refers to EV-DO only. CDMA EV-DV and W-CDMA services are soon to be launched in Korea, as well as WiBro, which is considered by some to be a 4G mobile service. Note that, in the right chart, "subscribers" refers to the service as a whole (voice and data) and does not imply that all users with suitably-equipped mobile phones make use of the high-speed data services.

Source: Adapted from National Internet Development Agency of Korea (NIDA) and Korean mobile operators (SKT, KTF and LGT).

3.4 Summary

The exact indicators selected for the DOI and their goalposts and weights are identified in Table 2 below, while Table 3 provides an example of how the DOI is computed (as well as serving as a good example of data availability). Each of the three categories is assigned is a weight of 33% to derive the final DOI value. A statistical analysis suggests that the weighting has little impact on the overall results.[19] Therefore, while not duly impacting the results, the categories make it easier for analysts to see which areas a country is relatively strong or weak.

[19] The results generated by weighting indicators within categories and then averaging the categories to obtain the DOI are almost the same as if the indicators were not categorized and simply averaged across the board.

Table 2: DOI structure

Category / indicator	Goalpost	Weight within category (%)	Note
Opportunity			
Percentage of population covered by mobile cellular telephony	100	33	2003 data used. A number of countries have already reached the goalpost.
Mobile cellular tariffs as a percentage of per capita income	.16	33	2005 data used (divided by 2004 annual average exchange rates). The most affordable service was in Hong Kong at 0.16 of per capita income. The indicator is adjusted by the goalpost and subtracted from 100 to be consistent (since for other indicators, high values are the most desirable).
Internet access tariffs as a percentage of per capita income	.20	33	2005 data used (divided by 2004 annual average exchange rates). The most affordable service was in Hong Kong at 0.18 of per capita income. The indicator is adjusted by the goalpost and subtracted from 100 to be consistent (since for other indicators, high values are the most desirable).
Infrastructure			
Proportion of households with a fixed line telephone	100	20	2003 data used. The highest value for this indicator was in Taiwan, China with 97.8.
Mobile cellular subscribers per 100 inhabitants	100	20	2003 data used. A few economies have already exceeded the goalpost.
Proportion of households with Internet access at home	100	20	2003 data used. The highest value for this indicator was in the Republic of Korea with 69.
(Mobile) Internet subscribers per 100 inhabitants	100	20	2003 data used. The highest value for this indicator was in Japan with 54.7.
Proportion of households with a computers	100	20	2003 data used. The highest value for this indicator was in Sweden with 80.
Utilization			
Internet users per 100 inhabitants	100	33	2003 data used. The highest value for this indicator was in the Republic of Korea with 61.2.
Ratio of (Fixed) Broadband Internet subscribers to total Internet subscribers	100	33	2003 data used. The highest value for this indicator was in the Republic of Korea with 100.
Ratio of (Mobile) Broadband Internet subscribers to mobile Internet subscribers	100	33	2003 data used. The highest value for this indicator was in the Republic of Korea with 22.4.

Note: Base data refers to the statistic used to compute the indicator (by dividing by population or Gross National Income per capita in the case of tariffs). The indicator is divided by the goalpost shown in Table 2 to obtain the sub index value. The weighted value is obtained by multiplying the sub index by the weight shown in Table 2. The Digital Opportunity Index is calculated by averaging the three category scores.

Source: Adapted from Office of the Telecommunications Authority (OFTA, http://www.ofta.gov.hk/en/datastat/main.html), Census & Statistics Department, World Bank.

Table 3: Calculating the DOI for Hong Kong

2003	Base data	Indicator	Sub index	Weighted	Note on data sources used for benchmark
Opportunity				**0.99**	
Percentage of population covered by mobile cellular telephony	100.00	100.00	1.00	0.33	3 mobile coverage
Mobile cellular tariffs as a percentage of per capita income	3.35	0.16	0.99	0.33	Pre-paid call charges for CSL (http://prepaid.hkcsl.com/english/es_charges.html) based on the OECD low user tariff basket.
Internet access tariffs as a percentage of per capita income	3.85	0.18	0.99	0.33	i-Cable dial-up tariff; includes 20 hours per month including telephone usage charges for HK$30. http://www.i-cable.com/ourservices/dialup/e-home.html
Infrastructure				**0.67**	
Proportion of households with a fixed line telephone		97.7	0.98	0.20	Derived from residential exchange lines (OFTA)
Mobile cellular subscribers per 100 inhabitants	7,194,335	105.8	1.00	0.20	Public Mobile Radiotelephone Subscriber Units (OFTA)
Proportion of households with Internet access at home		60.0	0.60	0.12	Households with personal computers at home connected to the Internet (C&SD)
Number of mobile telephone Internet subscribers	729,554	10.65	0.1	0.02	2.5G subscribers (OFTA).
Proportion of households with a computer		67.5	0.68	0.14	Households with personal computers at home (C&SD)
Utilization				**0.37**	
Proportion of individuals that used the Internet		47.2	0.47	0.18	Derived from persons aged 10 and over who had used Internet service during the last year (C&SD)
Ratio of Broadband Internet subscribers to Internet subscribers		52.6	0.53	0.17	Estimated no. of registered broadband Internet access customer accounts (OFTA)
Ratio of Broadband mobile subscribers to mobile Internet subscribers	0	-	-	-	3G launched only in Jan-04 (OFTA).
DIGITAL OPPORTUNITY INDEX				**0.68**	
Reference					
Population	6,803,100				Mid-year (Census & Statistics Department)
Gross National Income per capita (US$)	25,760				World Bank.
Annual average exchange rate	7.79				2004, HK$ per one US$ (World Bank)

Note: Base data refers to the statistic used to compute the indicator (by dividing by population or Gross National Income per capita in the case of tariffs). The indicator is divided by the goalpost shown in Table 2 to obtain the sub index value. The weighted value is obtained by multiplying the sub index by the weight shown in Table 2. The Digital Opportunity Index is calculated by averaging the three category scores.

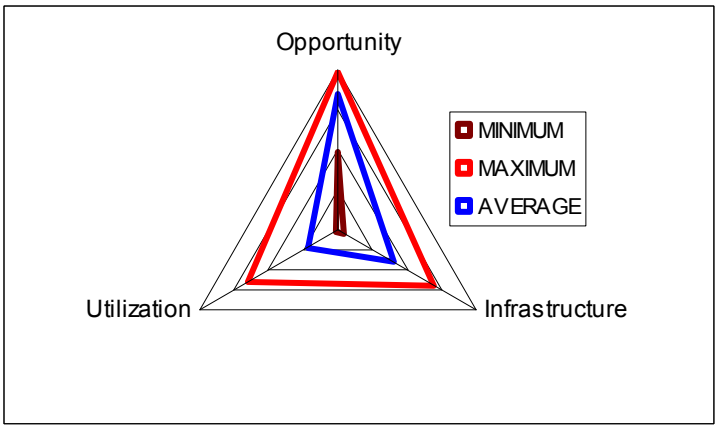
Source: Adapted from Office of the Telecommunications Authority (OFTA, http://www.ofta.gov.hk/en/datastat/main.html), Census & Statistics Department, World Bank.

4 ANALYZING THE RESULTS

The DOI was applied to a group of 40 leading economies that are geographically and economically diverse (Table 4, below). A number of observations can be made. The top ten economies are all developed (though three are not OECD members) but geographically diverse: four from Europe, five from Asia and one from North America. The bottom ten are all developing but also geographically diverse with four from Asia, four from South America and two from Africa. The DOI shows a huge digital divide with the Republic of Korea, the highest ranked, having a score over three times greater than the lowest ranked, India. While the Republic of Korea scored 77% of the maximum, India only had a DOI of 25% of the maximum. There is also some geographic clustering: the Asian Tigers all ranked in the top ten as did the Nordics included in the sample, a number of Western European countries ranked in the teens, Central and Eastern European nations ranked in the low twenties and some Latin American economies in the high twenties.

Looking at the categories, the one with the highest average value was *Opportunity* (Figure 9). This category measures basic access (reflected by mobile coverage) and affordability of networks. Many countries have widespread coverage of mobile networks (though not necessarily corresponding high levels of penetration). In the group of sample countries, affordability was not a major bottleneck for most. Mobile pricing exceeded 10% of income in only one country. However, Internet pricing was less affordable. The data suggest that for most countries, policy should now emphasize *Infrastructure* and *Utilization*. In terms of the *Infrastructure* category, the average value is 0.40. Most developed economies scored over 0.5 but well below one. One reason is that even in developed nations there are still "ICT-resistant" segments of the population. Developing nations scored far lower in this category, given the relatively high cost of advanced ICT equipment such as computers and Internet access and the fact that public access, which is not captured in the index, often plays a significant role. The lowest scores were recorded in the *Utilization* category. Less than a quarter of the economies in the sample have half of their population online. While some developed nations have high levels of fixed broadband, few countries have corresponding high levels of mobile broadband. This is likely to change with the recent uptake of 3G deployments. The average category scores reflect a natural progression of ICT evolution, from coverage and affordability, to infrastructure and finally quality. While the world has passed the first level, one might say it is less than "half-way" there in terms of the second and still has far to go to achieve the third.

Figure 9: DOI category values



Source: ITU/KADO Digital Bridges Project.

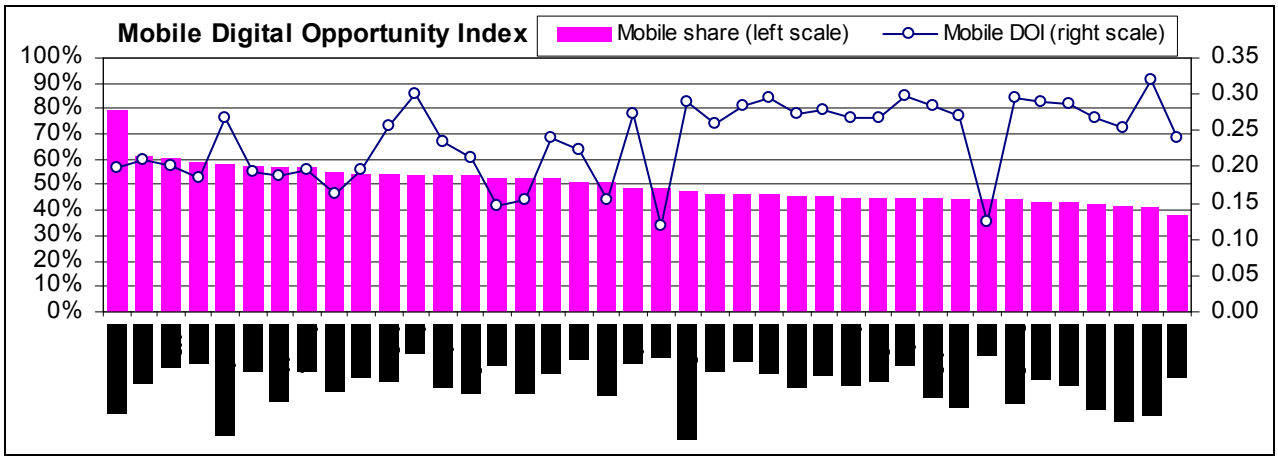
As mentioned earlier, the DOI can also be disaggregated by fixed and mobile networks/services. The Republic of Korea and Japan, ahead in 3G mobile, lead in the mobile DOI (Figure 10). However, the share of mobile in their overall DOI is still less than their fixed share. Mobile has a much bigger impact on the DOI for developing nations; in South Africa, for instance, mobile accounts for 79% of its overall DOI score.

Table 4: DOI ranking

		Opportunity	Infrastructure	Utilization	DOI
1	Korea (Rep.)	0.97	0.70	0.65	0.77
2	Hong Kong	0.99	0.67	0.37	0.68
3	Japan	0.96	0.66	0.38	0.67
4	Denmark	0.97	0.67	0.35	0.66
5	Sweden	0.97	0.69	0.33	0.66
6	Canada	0.96	0.53	0.43	0.64
7	Singapore	0.98	0.65	0.28	0.64
8	Taiwan	0.98	0.65	0.28	0.64
9	Netherlands	0.95	0.60	0.33	0.63
10	Switzerland	0.96	0.62	0.27	0.61
11	United States	0.97	0.54	0.33	0.61
12	Austria	0.94	0.54	0.36	0.61
13	United Kingdom	0.96	0.58	0.30	0.61
14	Israel	0.93	0.55	0.35	0.61
15	Australia	0.95	0.60	0.25	0.60
16	Germany	0.95	0.57	0.25	0.59
17	Belgium	0.95	0.48	0.34	0.59
18	Spain	0.94	0.49	0.25	0.56
19	Italy	0.97	0.48	0.22	0.56
20	France	0.95	0.45	0.26	0.55
21	Hungary	0.88	0.36	0.19	0.47
22	Czech Republic	0.87	0.40	0.11	0.46
23	Poland	0.90	0.35	0.12	0.46
24	Malaysia	0.90	0.26	0.15	0.44
25	Chile	0.79	0.26	0.24	0.43
26	Argentina	0.85	0.23	0.11	0.40
27	Mexico	0.78	0.20	0.09	0.36
28	Turkey	0.68	0.32	0.04	0.34
29	Thailand	0.82	0.16	0.04	0.34
30	Russia	0.78	0.18	0.05	0.34
31	Egypt	0.83	0.14	0.02	0.33
32	Philippines	0.84	0.12	0.03	0.33
33	China	0.64	0.20	0.09	0.31
34	Venezuela	0.62	0.15	0.14	0.30
35	Indonesia	0.81	0.05	0.03	0.30
36	Colombia	0.54	0.28	0.05	0.29
37	Peru	0.69	0.07	0.10	0.28
38	Brazil	0.49	0.21	0.13	0.28
39	South Africa	0.59	0.12	0.04	0.25
40	India	0.69	0.03	0.02	0.25
	MEDIAN	**0.92**	**0.43**	**0.23**	**0.51**

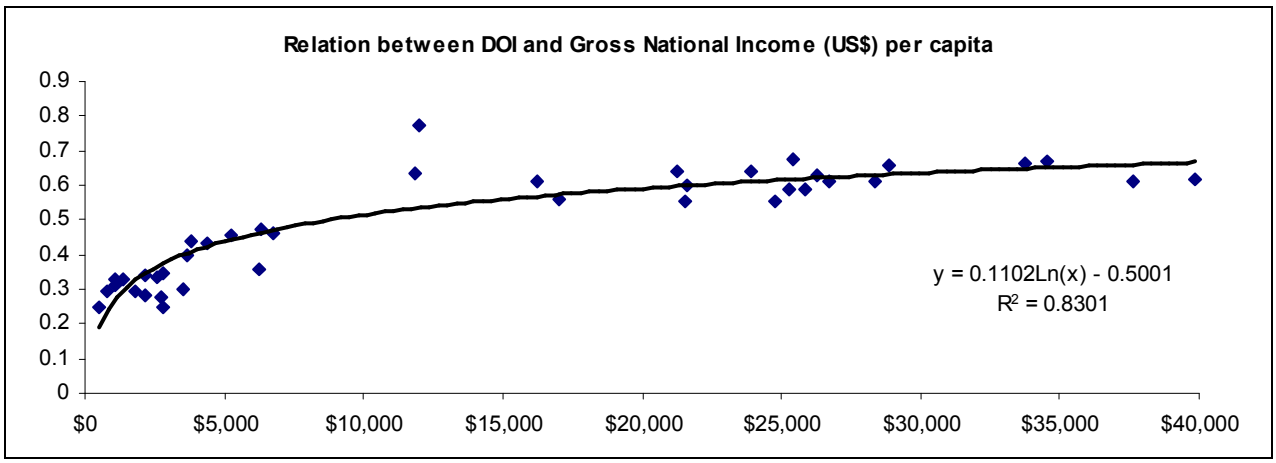
Note: On a scale of 0 to 1 where 1 = highest value. Economies with the same DOI value are ranked by thousands of a decimal point.
Source: ITU/KADO Digital Bridges Project.

Figure 10: Mobile impact on DOI



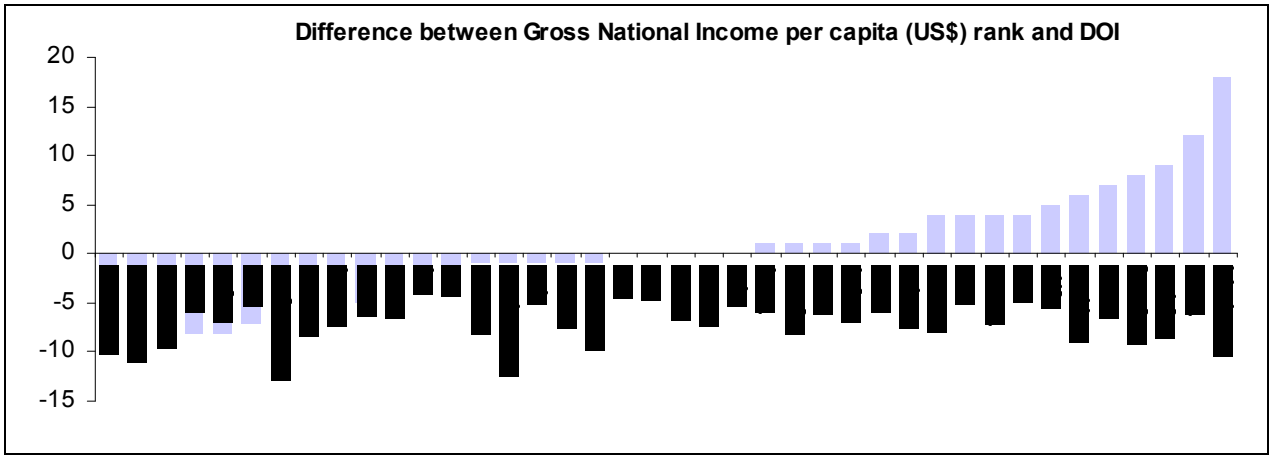
Source: ITU/KADO Digital Bridges Project.

Figure 11: The DOI and Gross National Income per capita



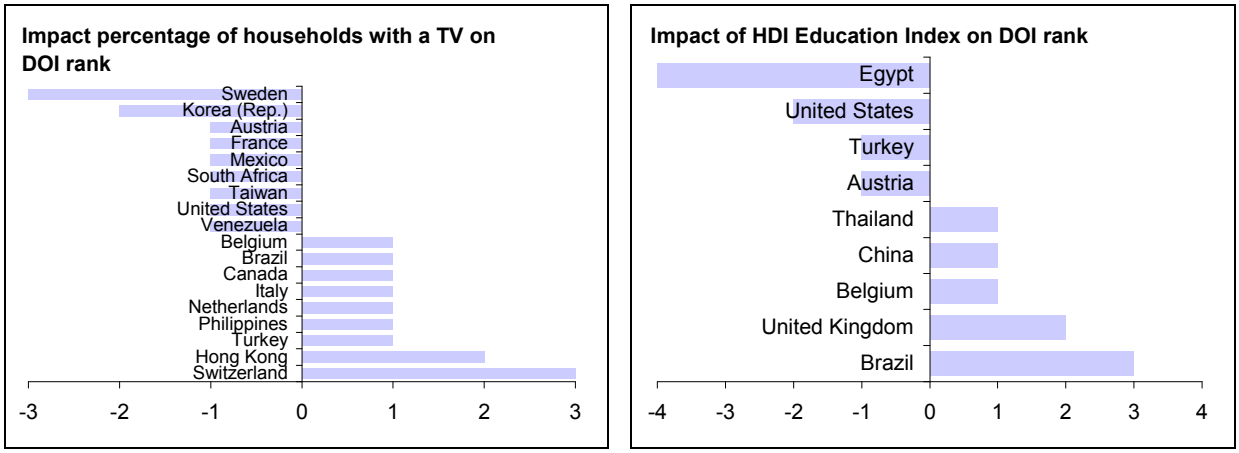
Source: Adapted from ITU/KADO Digital Bridges Project and World Bank data.

Figure 12: Difference between Gross National Income per capita and DOI ranks



Source: Adapted from ITU/KADO Digital Bridges Project and World Bank data.

Figure 13: Extending the DOI



Source: Adapted from ITU/KADO Digital Bridges Project and UNDP data.

As would be expected, there is a close relationship between the DOI and income (Figure 11, above). Nonetheless, there are some outliers with economies such as the Republic of Korea and Taiwan, China doing much better in ICTs than their incomes would suggest. On the other hand, countries such as South Africa and the United States are not doing as well in ICTs as they should be, considering their level of income (Figure 12, above). This can be interpreted as showing how important are factors other than income (e.g., policy, company performance), and is thus, in some ways, even more meaningful for policy-makers than the DOI itself.

The DOI has a modular design so that it can be linked to other data sets. For instance, the DOI might be enhanced by eventually including indicators from the other core sets that have been adopted, but where data is not yet widely available. As an example, assume that the *proportion of households with a television* from the core indicators on access and use of ICTs by households and individuals is to be included in the DOI. This can be done by re-weighting each of the existing sub-indices from 0.33 to 0.25 and adding a new category, "broadcasting" with the indicator proportion of households with a television. A goalpost is easy to establish: the ideal is that all households have a television. As discussed earlier, broadcasting penetration should not have a significant impact on the DOI since it tends to be correlated to other variables. Indeed, there is no impact on the rankings for more than half the countries (22). For the others, the impact is small with rankings changing at the most three positions (Figure 13 above, left). This example is for illustrative purposes only since it is unlikely so much significance ($1/4^{th}$ weight) would be attached to one indicator.

The DOI could also be linked to other indices outside the ICT sector for instance, to investigate the impact of "soft" variables such as income and education on digital opportunities. In this case, the sub-indices of the Human Development Index, such as the Education Index could be used.[20] The technique is the same as described above for adding household broadcast penetration. The three sub-indices of the DOI are rescaled from 0.33 to 0.25 and the Education Index is added (also with a weight of 0.25). Surprisingly, adding in a knowledge factor does not have much impact as overall rankings did not change for 31 of the 40 countries. For the countries whose rankings were affected, the change ranged from +3 in Brazil to -4 in Egypt (Figure 13 above, right). This suggests both that the Index, as calculated here, is relatively robust and that factors like income and education are auto-correlated with the DOI. The DOI rankings can also be compared to those of other e-indices (Table 5, below).

[20] The Education Index is calculated from adult literacy and primary, secondary and tertiary school enrolment.

Table 5: Comparison of DOI ranks with other e-indices

	DOI	NRI		ISI		DAI		Orbicom	
		*	**	*	**	*	**	*	**
Korea (Rep.)	1	24	17	16	13	4	3	19	14
Hong Kong	2	7	5	18	15	7	5	8	7
Japan	3	8	6	17	14	15	12	20	15
Denmark	4	4	2	2	2	2	2	2	2
Sweden	5	6	4	1	1	1	1	1	1
Canada	6	10	8	10	7	10	7	3	3
Singapore	7	1	1	12	9	14	11	13	9
Taiwan	8	15	12	24	19	9	6		
Netherlands	9	16	13	3	3	6	4	4	4
Switzerland	10	9	7	7	4	13	10	6	6
United States	11	5	3	8	5	11	8	5	5
Austria	12	19	15	9	6	17	13	18	13
United Kingdom	13	12	10	11	8	12	9	15	11
Israel	14	18	14	20	16	25	19	23	17
Australia	15	11	9	14	11	19	15	16	12
Germany	16	14	11	13	10	18	14	14	10
Belgium	17	26	18	15	12	20	16	8	7
Spain	18	29	20	26	20	29	20	27	19
Italy	19	45	28	23	18	22	17	26	18
France	20	20	16	21	17	23	18	22	16
Hungary	21	38	24	29	22	36	22	32	21
Czech Republic	22	40	26	27	21	31	21	30	20
Poland	23	72	37	33	25	40	23	42	24
Malaysia	24	27	19	37	27	46	25	45	25
Chile	25	35	22	31	23	43	24	39	22
Argentina	26	76	38	36	26	54	26	41	23
Mexico	27	60	33	39	29	64	28	56	27
Turkey	28	52	31	49	36	70	31	57	28
Thailand	29	36	23	47	34	68	30	68	33
Russia	30	62	34	42	31	63	27	61	30
Egypt	31	57	32	45	33	98	38	91	37
Philippines	32	67	36	48	35	90	37	80	36
China	33	41	27	50	37	84	36	79	35
Venezuela	34	84	39	43	32	73	32	63	31
Indonesia	35	51	30	52	39	116	39	94	38
Colombia	36	66	35	41	30	79	34	66	32
Peru	37	90	40			83	35	70	34
Brazil	38	46	29	38	28	65	29	48	26
South Africa	39	34	21	32	24	78	33	59	29
India	40	39	25	51	38	119	40	106	39

Note: DOI = Digital Opportunity Index. NRI = Network Readiness Index. ISI = Information Society Index. DAI = Digital Access Index. * Overall rank including countries not shown here. ** Rank among countries shown here.

Source: ITU/KADO Digital Bridges Project adapted from WEF, IDC, ITU and Orbicom.

5 CONCLUSIONS

The Digital Opportunity Index (DOI) is the first e-index based on internationally agreed ICT indicators. This makes it a valuable tool for benchmarking those indicators considered to be the most important for measuring the information society. Because the indicators used for the DOI have been endorsed by the international community, they will increasingly be collected over time by countries, adding to the coverage of the index enhancing its inclusiveness.

The core infrastructure and use of ICTs by households and individuals indicators selected for constructing the DOI lend themselves to various analytical possibilities. On one hand, the index can be deconstructed along categories such as opportunity, infrastructure and utilization. This assists analysts to determine where countries are relatively strong and weak in order to focus attention on the appropriate area. On the other hand, the DOI lends itself to a fixed/mobile de-aggregation, useful for analyzing the degree to which each is impacting the path countries are taking towards becoming an information society.

The DOI is modular so that core indicators for different sectors can be easily incorporated. For example, indicators from the other core areas such as access and use of ICTs by businesses could be included in future versions of the DOI. The DOI can also incorporate social and economic dimensions that impact ICT take-up for instance by linking to the Human Development Index.

The DOI could also be adapted to different analytical uses. For example, a version tailored to low and middle income countries could be created that incorporates communication access indicators once sufficient data is available and would also include the core broadcasting indicators since radio and television are important development tools. Core indicators that lend themselves to separation by sex can also be utilized to generate a gender-based DOI. Finally, although the research in this report is based on economy level analysis, the DOI could be modified to provide national or regional ICT indices.

One pressing issue is how to deal with indicators that would enhance the DOI but are not yet part of the core indicators. For example, these could include accessibility indicators such as the existence of guidelines for the ICT access by the disabled and quality indicators such as digital literacy per 100 inhabitants. In the same regard, some analysts may find it useful to include ICT sector structure parameters such as the degree of competition to enhance the DOI. These related issues of adding new indicators to the core set as well as to the DOI requires an on-going procedure to be established among the international community and countries concerned.

6 ANNEX: CORE INDICATORS[21]

6.1 Infrastructure and access core indicators

Basic core

A-1 Fixed telephone lines per 100 inhabitants
A-2 Mobile cellular subscribers per 100 inhabitants
A-3 Computers per 100 inhabitants
A-4 Internet subscribers per 100 inhabitants
A-5 Broadband Internet subscribers per 100 inhabitants
A-6 International Internet bandwidth per inhabitant
A-7 Percentage of population covered by mobile cellular telephony
A-8 Internet access tariffs (20 hours per month), in US$, and as a percentage of per capita income
A-9 Mobile cellular tariffs (100 minutes of use per month), in US$, and as a percentage of per capita income
A-10 Percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)

Extended core

A-11 Radio sets per 100 inhabitants
A-12 Television sets per 100 inhabitants

6.2 Core indicators on access and use of ICTs by households and individuals

Basic core

HH-1 Proportion of households with a radio
HH-2 Proportion of households with a TV
HH-3 Proportion of households with a fixed line telephone
HH-4 Proportion of households with a mobile cellular telephone
HH-5 Proportion of households with a computer
HH-6 Proportion of individuals that used a computer (from any location) in the last 12 months
HH-7 Proportion of households with Internet access at home
HH-8 Proportion of individuals that used the Internet (from any location) in the last 12 months
HH-9 Location of individual use of the Internet from all locations in the last 12 months

Response categories:

- At home
- At work
- Place of education
- At another person's home
- Free Public Internet Access Centre (specific denomination depends on national practices)
- Charged Public Internet Access Centre (specific denomination depends on national practices)
- Others

HH-10 Internet activities undertaken by individuals in the last 12 months

Response categories:

- For getting information
    - About goods or services
    - Related to health or health services
    - From government organisations/public authorities via websites or e-mail
    - Other information or general Web browsing
- For communicating
- Purchasing or ordering goods or services
- Internet banking or other financial services
- For education and learning
- For dealing with government organisations/public authorities
- For leisure activities
    - Playing/downloading video or computer games
    - Obtaining movies, music or software

[21] Based on discussions at the WSIS Thematic Meeting on Measuring the Information Society, Geneva, 7-9 February 2005.

    - Reading/downloading electronic books, newspapers or magazines
    - Other leisure activities

Extended core

HH-11 Proportion of individuals with use of a mobile telephone

HH-12 Proportion of households with access to the Internet by type of access from home

- Response categories should allow an aggregation to narrowband and broadband, where broadband will exclude slower speed technologies, such as dial-up modem, ISDN and most 2G mobile phone access, and which will usually result in a speed of at least 256 kbit/s.

HH-13 Frequency of individual access to the Internet in the last 12 months (from any location)

Response categories:

- at least once a day
- at least once a week but not every day
- at least once a month but not every week
- less than once a month

Reference indicator

HH-R1 Proportion of households with electricity[22]

6.3 Core indicators on access and use of ICTs by businesses

Basic core

B-1 Proportion of businesses using computers

B-2 Proportion of employees using computers

B-3 Proportion of businesses using the Internet

B-4 Proportion of employees using the Internet

B-5 Proportion of businesses with a website (or web presence where the business has control over the content)

B-6 Proportion of businesses with an intranet

B-7 Proportion of businesses receiving orders over the Internet

B-8 Proportion of businesses placing orders over the Internet

Extended core

B-9 Proportion of businesses accessing the Internet by modes of access

- Response categories should allow an aggregation to narrowband and broadband, where broadband will exclude slower speed technologies, such as dial-up modem, ISDN and most 2G mobile phone access, and which will usually result in a speed of at least 256 kbit/s.

B-10 Proportion of businesses with a Local Area Network (LAN)

B-11 Proportion of businesses with an extranet

B-12 Proportion of businesses using the Internet by type of activity

Response categories:

- Internet e-mail
- Getting information
    - About goods or services
    - From government organisations/public authorities via websites or e-mail
    - Other information searches or research activities
- Performing Internet banking or accessing other financial services
- Dealing with government organisations/public authorities
- Providing customer services
- Delivering products online

6.4 ICT sector basic core

ICT-1 Proportion of total workforce involved in the ICT sector

ICT-2 Value added in the ICT sector (as a percentage of total value added)

ICT-3 ICT goods imports as percentage of total imports

ICT-4 ICT goods exports as percentage of total exports

[22] Since electricity is not specifically an ICT commodity, but important nevertheless for developing countries prerequisite for using ICT, it is not included in the core list, but included as a reference indicator, just like the number of households, population, GDP etc. will be.

7 ANNEX: DOI INDICATORS

2003	Mobile tariffs % of per capita income 2005	Internet access tariffs % of per capita income	Percentage of population covered by mobile telephony	Proportion of households with a fixed line	Mobile cellular subscribers per 100 inhabitants	Proportion of households with Internet access at home	(Mobile) Internet subscribers per 100 inhabitants	Proportion of households with a computer	Proportion of individuals that used the Internet	Ratio of broadband Internet subscribers to fixed Internet subscribers	Ratio of broadband mobile subscribers to mobile Internet subscribers
Argentina	2.7	4.4	95	*57*	21	*13*	0.5	*25*	15.1	14.8	-
Australia	1.2	1.0	97	*97*	78	53	5.5	66	46.1	13.4	7.91
Austria	1.2	1.5	98	*87*	88	36	10.4	49	46.2	52.3	1.31
Belgium	1.2	1.3	99	*86*	78	*29*	2.4	*45*	30.8	67.3	-
Brazil	8.4	12.4	68	51	26	11	0.7	15.3	11.0	25.5	-
Canada	0.3	0.6	93	96	42	57	1.6	66.8	54.3	66.3	-
Chile	4.7	6.0	99	*52*	48	*10*	1.3	*21*	25.4	42.5	-
China	3.1	11.1	73	*65*	21	*5*	0.2	*10*	6.2	21.0	-
Colombia	6.9	12.3	74	*97*	14	*10*	0.1	*19*	6.2	9.0	-
Czech Republic	2.7	3.7	99	62	96	15	2.8	*25*	26.8	1.6	-
Denmark	0.7	0.6	99	92	88	66	17.3	*72*	51.9	42.8	0.54
Egypt	3.5	4.7	98	*48*	8	*5*	0.1	10.2	3.9	0.5	-
France	1.5	0.7	99	82	67	31	3.7	41	36.6	33.5	-
Germany	1.5	0.7	99	*96*	79	46	6.1	*57*	47.3	20.1	-
Hong Kong	0.2	0.2	99	98	106	60.0	10.7	67.5	47.2	52.6	-
Hungary	2.5	3.4	99	63	77	14	3.3	*22*	23.2	28.5	-
India	5.6	19.8	41	*9*	2	*2*	0.0	*4*	1.7	3.4	-
Indonesia	6.8	33.0	85	*12*	9	*1*	0.1	*2*	3.8	5.8	-
Israel	0.7	2.2	97	*91*	99	*25*	4.4	*54*	36.2	61.9	-
Italy	0.8	0.9	100	80	97	32	6.1	*27*	32.2	14.3	12.94
Japan	1.0	0.7	99	*92*	68	53.6	54.7	63.3	60.6	40.6	2.93
Korea (Rep.)	0.2	1.0	99	*92*	70	69	40.9	77.9	61.2	100.0	22.39
Malaysia	1.8	2.7	95	*65*	44	*7*	2.0	*14*	34.5	3.7	-
Mexico	3.6	4.4	81	46.7	29	8.2	0.0	16.5	11.8	12.7	-
Netherlands	1.1	1.1	99	91	77	60	5.5	68	52.2	38.6	-
Peru	11.0	18.3	75	*20*	11	*1*	0.4	*4*	10.5	16.3	-
Philippines	4.5	18.9	80	*15*	28	*4*	0.4	*12*	4.9	3.0	-
Poland	1.5	3.6	98	74	45	26	0.3	30	23.2	10.1	-
Russia	2.9	4.6	78	*54*	25	*4*	0.3	*8*	8.9	4.5	-
Singapore	0.3	0.6	100	*97.6*	85	64.6	11.9	*68*	54.8	19.1	-
South Africa	6.3	14.4	96	*10*	36	*6*	0.1	*9*	7.1	2.3	-
Spain	1.5	1.5	99	*90*	92	25.23	2.0	*36*	29.6	40.7	-
Sweden	0.7	0.9	99	94.0	98	66.4	5.7	80.0	55.4	30.0	2.33
Switzerland	1.0	0.7	99	*95*	85	*59*	2.0	*67*	38.6	34.9	-
Taiwan	0.2	0.8	99	97.8	111	57	12.3	58.7	39.0	38.4	-
Thailand	3.7	3.8	92	*28*	35	*5*	1.0	9.6	9.6	1.5	-
Turkey	2.7	8.5	68	*97*	41	*7*	0.7	*12*	8.1	1.6	-
United Kingdom	0.8	1.0	99	93	89	45	8.0	55	50.1	22.5	7.54
United States	0.3	0.5	95	*95*	54	54.6	6.2	61.8	57.1	32.2	0.05
Venezuela	8.8	6.7	77	*36*	27	*4*	0.4	*8*	6.1	34.6	-

Note: Figures in italics refer to estimate or earlier year.
Source: ITU/KADO Digital Bridges Project.

8 ANNEX: REFERENCE DATA

Economy	Population 2003	Annual average exchange rate to 1US$ 2004	Gross National Income per capita, US$, 2003
Argentina	37'869'730	2.92	$3'650.00
Australia	19'941'300	1.36	$21'650.00
Austria	8'073'000	0.80	$26'720.00
Belgium	10'372'469	0.80	$25'820.00
Brazil	175'955'500	2.93	$2'710.00
Canada	31'720'400	1.30	$23'930.00
Chile	15'773'500	609.53	$4'390.00
China	1'292'270'000	8.28	$1'100.00
Colombia	43'782'500	2'628.61	$1'810.00
Czech Republic	10'064'600	25.70	$6'740.00
Denmark	5'393'500	5.99	$33'750.00
Egypt	68'648'000	6.20	$1'390.00
France	59'900'268	0.80	$24'770.00
Germany	82'504'000	0.80	$25'250.00
Hong Kong	6'803'100	7.79	$25'430.00
Hungary	10'334'200	202.63	$6'330.00
India	1'056'890'900	45.26	$530.00
Indonesia	215'091'300	8'938.85	$810.00
Israel	6'765'700	4.48	$16'240.00
Italy	57'482'000	0.80	$21'560.00
Japan	127'520'000	108.15	$34'510.00
Korea (Rep.)	47'782'466	1'145.24	$12'020.00
Malaysia	25'170'400	3.80	$3'780.00
Mexico	103'408'700	11.29	$6'230.00
Netherlands	16'285'200	0.80	$26'310.00
Peru	27'148'000	3.41	$2'150.00
Philippines	81'100'000	56.04	$1'080.00
Poland	38'589'000	3.65	$5'270.00
Russia	146'412'200	28.81	$2'610.00
Singapore	4'196'500	1.69	$21'230.00
South Africa	46'365'000	6.44	$2'780.00
Spain	40'939'600	0.80	$16'990.00
Sweden	8'975'670	7.35	$28'840.00
Switzerland	7'317'677	1.24	$39'880.00
Taiwan	22'636'600	33.37	$11'836.00
Thailand	62'531'600	40.27	$2'190.00
Turkey	68'284'000	1'448'898.55	$2'790.00
United Kingdom	59'518'000	0.55	$28'350.00
United States	292'300'000	1.00	$37'610.00
Venezuela	25'697'600	1'886.13	$3'490.00

Source: National statistical offices and World Bank.

9 ANNEX: OECD MOBILE BASKET

	Fixed	On-net	Off-net	TOTAL	Call distribution by time of day
Call distribution	42%	40%	18%	100%	100%
Calls	10.50	10.00	4.50	25	
Number of calls per period	10.50	10.00	4.50	25	
Peak	3.99	3.80	1.71	10	38%
Off-peak	3.68	3.50	1.58	9	35%
Weekend	2.84	2.70	1.22	7	27%
Duration (minutes per call)	1.60	1.40	1.40		
Call length (minutes)	16.80	14.00	6.30	37.10	
peak	6.38	5.32	2.39	14.10	
off-peak	5.88	4.90	2.21	12.99	
weekend	4.54	3.78	1.70	10.02	
Calls	25	per month			
SMS	30	per month			

Source: OECD.

10 ANNEX: NATIONAL DATA SOURCES

Data was primarily obtained from the national sources identified in the table below. Gross National Income per capita data was obtained from the World Bank. In some cases, data were estimated or derived by the ITU/KADO Digital Bridges project.

Country	National Statistical Office	Government agencies / Industry association/ Operator
Argentina	Instituto Nacional de Estadística y Censos www.indec.mecon.gov.ar	Secretaría de Comunicaciones www.secom.gov.ar Comisión Nacional de Comunicaciones (CNC) www.cnc.gov.ar Prince & Cooke www.princecooke.com
Australia	Australian Bureau of Statistics www.abs.gov.au	Australian Communications Authority (ACA) www.aca.gov.au Australian Competition and Consumer Commission www.accc.gov.au
Austria	Statistics Austria www.statistik.at	Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR-GmbH) www.tkc.at
Belgium	Statistics Belgium www.statbel.fgov.be	Institut belge des services postaux et des télécommunications (IBPT) www.ibpt.be
Brazil	Instituto Brasileiro de Geografia e Estatística (IBGE) www.ibge.gov.br	ANATEL www.anatel.gov.br
Canada	Statistics Canada www.statcan.ca	Canadian Radio-television and Telecommunications Commission (CRTC) www.crtc.gc.ca
Chile	Instituto Nacional de Estadísticas www.ine.cl	Subsecretaría de Telecomunicaciones (SUBTEL) www.subtel.cl
China	National Bureau of Statistics www.stats.gov.cn	Ministry of Information Industry www.mii.gov.cn
Colombia	Departamento Administrativo Nacional de Estadística (DANE) www.dane.gov.co	Comisión de Regulación de Telecomunicaciones www.crt.gov.co
Czech Republic	Czech Statistical Office www.czso.cz	Czech Telecommunication Office www.ctu.cz
Denmark	Statistics Denmark www.dst.dk	National IT and Telecom Agency (NITA) www.tst.dk
Egypt	Central Agency for Public Mobilization and Statistics www.capmas.gov.eg	National Telecommunication Regulatory Authority (NTRA) www.tra.gov.eg
France	L'Institut national de la statistique et des études économiques (Insee) http://www.insee.fr	Autorité de Régulation des Télécommunications (ART) www.art-telecom.fr
Germany	Federal Statistical Office www.destatis.de	Regulatory Authority for Telecommunications and Posts (REG TP) www.regtp.de
Hong Kong	Census & Statistics Department www.info.gov.hk/censtatd	Office of the Telecommunications Authority (OFTA) www.ofta.gov.hk
Hungary	Central Statistical Office http://portal.ksh.hu	National Communications Authority www.hif.hu
India	Census of India www.censusindia.net	Telecom Regulatory Authority of India (TRAI) www.trai.gov.in
Indonesia	Central Bureau of Statistics www.bps.go.id	Directorate General of Posts and Telecommunications (POSTEL) www.postel.go.id
Israel	Central Bureau of Statistics www.cbs.gov.il	Ministry of Communications www.moc.gov.il
Italy	Istat - Istituto Nazionale di Statistica (ISTAT) www.istat.it	Italian Communications Authority www.agcom.it/eng
Japan	Statistics Bureau www.stat.go.jp	Ministry of Internal Affairs and Communications www.soumu.go.jp

Country	National Statistical Office	Government agencies / Industry association/ Operator
		Telecommunications Carrier Association (TCA) www.tca.or.jp
Korea (Rep.)	National Statistical Office www.nso.go.kr	Ministry of Information and Communication www.mic.go.kr Internet Statistics Information System (ISIS) http://isis.nida.or.kr
Malaysia	Department of Statistics www.statistics.gov.my	Malaysian Communications and Multimedia Commission (MCMC) www.cmc.gov.my
Mexico	Instituto Nacional de Estadística, Geografía e Informática (INEGI) www.inegi.gob.mx	Comisión Federal de Telecomunicaciones (COFETEL) www.cft.gob.mx >
Netherlands	Statistics Netherlands www.cbs.nl	OPTA www.opta.nl
Peru	Instituto Nacional de Estadística e Informática (INEI) www.inei.gob.pe	OSIPTEL www.osiptel.gob.pe
Philippines	National Statistical Office www.census.gov.ph	National Telecommunications Commission (NTC) www.ntc.gov.ph
Poland	Central Statistical Office www.stat.gov.pl	Office of Telecommunications and Post Regulation (URTiP) www.urtip.gov.pl
Russia	Federal State Statistics Service www.gks.ru	Ministry of Information Technologies and Communications www.minsvyaz.ru
Singapore	Statistics Singapore www.singstat.gov.sg	Infocomm Development Authority (IDA) www.ida.gov.sg
South Africa	Statistics South Africa www.statssa.gov.za	Independent Communications Authority of South Africa (ICASA) www.icasa.org.za
Spain	Instituto Nacional de Estadística (INE) www.ine.es	Comisión del Mercado de las Telecomunicaciones (CMT) www.cmt.es Asociación para la Investigación de Medios de Comunicación (AIMC) www.aimc.es
Sweden	Statistics Sweden www.scb.se	National Post & Telecom Agency www.pts.se Swedish Institute For Transport and Communications Analysis (SIKA) www.sika-institute.se
Switzerland	Federal Statistical Office www.bfs.admin.ch	Federal Office of Communications (OFCOM) www.ofcom.ch
Taiwan	National Statistics www.stat.gov.tw	Directorate General of Telecommunications (DGT) www.dgt.gov.tw
Thailand	National Statistical Office www.nso.go.th	Post and Telegraph Department (PTD) www.ptd.go.th National Telecommunications Commission www.ntc.or.th
Turkey	State Institute of Statistics www.die.gov.tr	Telekomünikasyon Kurumu www.tk.gov.tr
United Kingdom	National Statistics www.statistics.gov.uk	Office of Communications (Ofcom) www.ofcom.org.uk
United States	Bureau of Census www.census.gov	Federal Communications Commission (FCC) www.fcc.gov
Venezuela	Instituto Nacional de Estadística www.ine.gov.ve	Comisión Nacional de Telecomunicaciones (CONATEL) www.conatel.gov.ve

Note: Information valid at 1 July 2005.