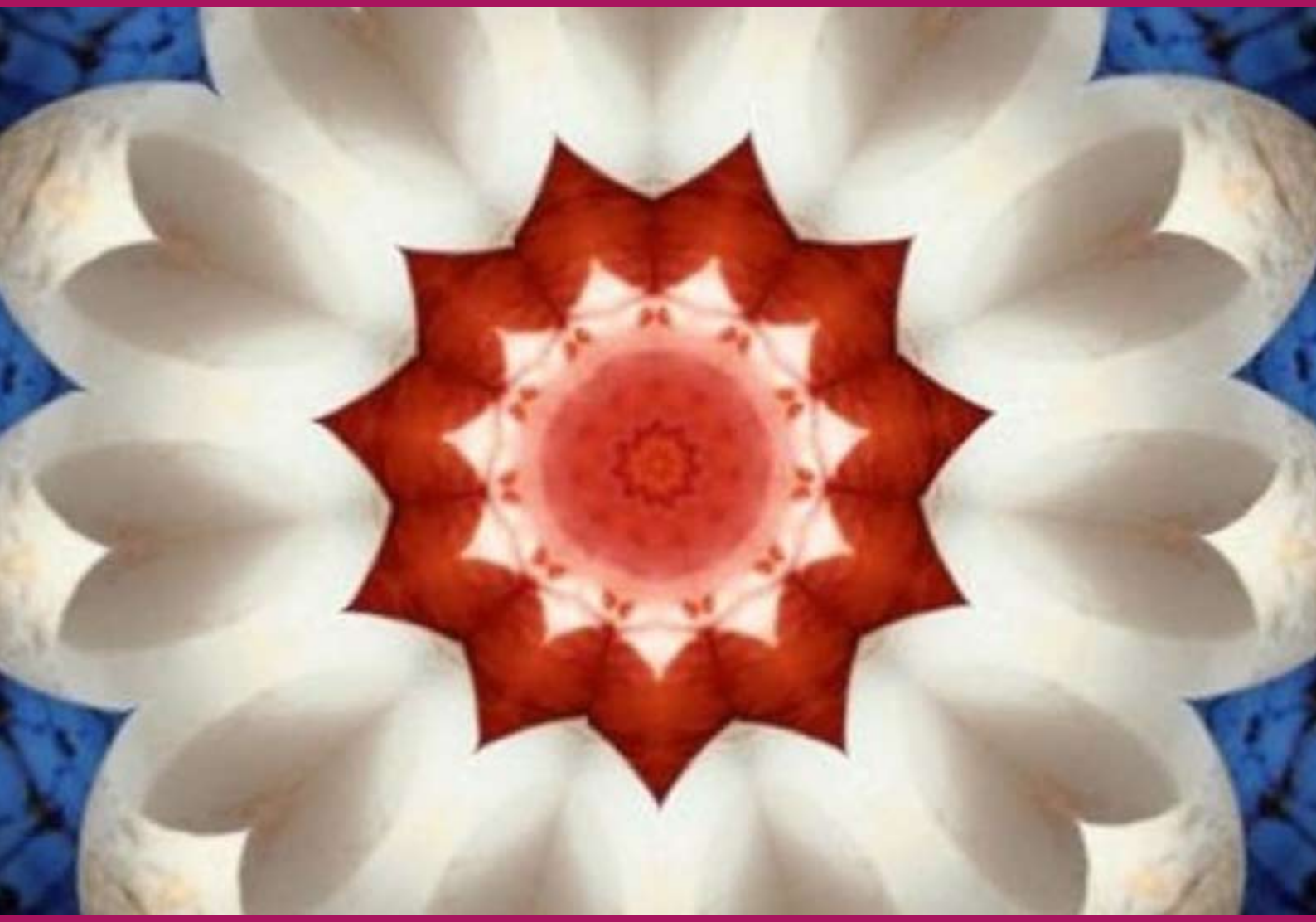


chapter seven

The ICT Opportunity Index (ICT-OI)*

** Chapter 7 is based on an extract from ITU's publication "Measuring the Information Society 2007", which was published in February 2007. Please note that the ICT Opportunity Index is an ITU index that was developed concurrently with the Digital Opportunity Platform.*

The world is increasingly being characterized as a global Information Society, where the importance of extending access to Information and Communication Technologies (ICT) is considered vital for social development and economic growth. Attainment of internationally agreed developmental goals, including those of the Millennium Development Goals (MDGs), through access to ICT has been well documented. Several studies have been able to show the positive micro- and macro-economic impact that investment in ICT has, particularly through externalities generated by the productivity effects that the appropriate use of Information and Communication Technology has on the economy.

ICT policy and strategy play a key role in creating the right environment to foster the spread and use of ICT. Information and data on ICT developments and progress are an important pillar to evidence-based policy making and to decision makers for appropriate policy choices. They help to identify targets, and to track and benchmark progress.

Reliable, available and comparable data help decision makers to steer the path for achieving goals and targets from a global perspective. ITU has established itself as the main source of global telecommunication and ICT statistics. Based on its extensive experience in data collection - carried out through close cooperation with member states – ITU developed the ICT Opportunity Index (ICT-OI). The ICT-OI represents an important contribution to the measurement of the Information Society.

The ICT-OI, which was acknowledged by the World Summit on the Information Society (WSIS), is a useful statistical tool to compare ICT developments in different countries and regions over time. Ten widely available and reliable indicators and a sound methodology allow the ICT-OI to combine multiple factors into a single overall value. A composite index such as the ICT-OI is particularly useful for comparisons over a set period of time and between countries of similar income levels, or with similar social, regional or geographic characteristics; it provides useful insights to policy makers and analysts. Since the ICT-OI is composed of a number of indicators that are grouped into four sub-indices, it is further possible to recognize weaknesses and strengths in different areas and to tackle these accordingly.

Reducing multiple effects and developments into one single number makes indices a very simple and user-friendly tool, and consequently very popular, at least in terms of acknowledgement and media-attention. It also puts the spotlight not only on the importance of ICT – and the digital divide – but also on the importance of indicators – and the statistical divide. The only criterion not to include a country in the ICT-OI is the lack of country data for several of the indicators used to calculate the ICT-OI. Consequently, the index will help to highlight the need to collect more basic ICT data for those countries that would like to be included.

While the advantages of a single index are undeniable, there are limitations of presenting a large amount of information narrowed into a composite, single index value. Estimated values and a limited number of indicators are further shortcomings. Thus, while indices provide a useful tool for comparisons, they should be used judiciously, in terms of drawing overly simplistic conclusions. It should also be noted that the main objective of the ICT-OI is to track the digital divide and to help particularly developing countries measure their progress (or shortcomings). To be able to include a large number of economies, the index is limited in terms of the indicators that it is composed of. For this reason, the exact position and ranking of high-income/highly developed economies, should not be overrated. Rather, their inclusion in the index is to benchmark the rest of the world and to help identify targets. More precise and qualitative indicators, that are currently not available for most developing countries, would be needed to produce analytically useful tools for high-income/highly developed economies.

7.1 BACKGROUND OF THE ICT OPPORTUNITY INDEX[1]

The ICT Opportunity Index is the result of the merger of two well-known projects, ITU's Digital Access Index (DAI)[2] and Orbicom's Digital Divide Index. Both, the ITU's Digital Access Index and Orbicom's Digital Divide Index were published in 2003. Merging the two indices was a direct response to the increasing need for international cooperation and the World Summit on the Information Society's call for multi-stakeholder partnerships to create digital opportunities. Although the two indices rely on different methodologies, they also share a number of important characteristics. These similarities not only allowed for the merger, but also – in the interest of cooperation and to avoid duplication – made the existence of two separate indices and projects difficult to justify: Both, the ITU and the Orbicom Index are global in nature or "digitally inclusive" by maximizing the number of countries covered. They measure access to and use of ICT for the large majority of the world's economies. Both indices are quantitative in nature and share a large number of

indicators. The main source of data is ITU's World Telecommunication/ICT Indicators Database.

The ICT Opportunity Index was first published in November 2005, in time for the second phase of the World Summit on the Information Society.[3] It covered a total of 139 economies and tracked developments from 1995 to 2003. As the earlier Digital Divide Index, it was based on the infostate conceptual framework that allows linkages of ICT to economic development through the country's productive capacity and use of ICT.

Today's ICT Opportunity Index, which is produced by ITU, is largely based on ITU data and Orbicom's conceptual framework to measure the digital divide.[4] Although the index no longer refers to the *infostate* (instead, this is referred to now simply as *ICT Opportunity*), the conceptual framework remains the same. (See the following section for more details on the index methodology).

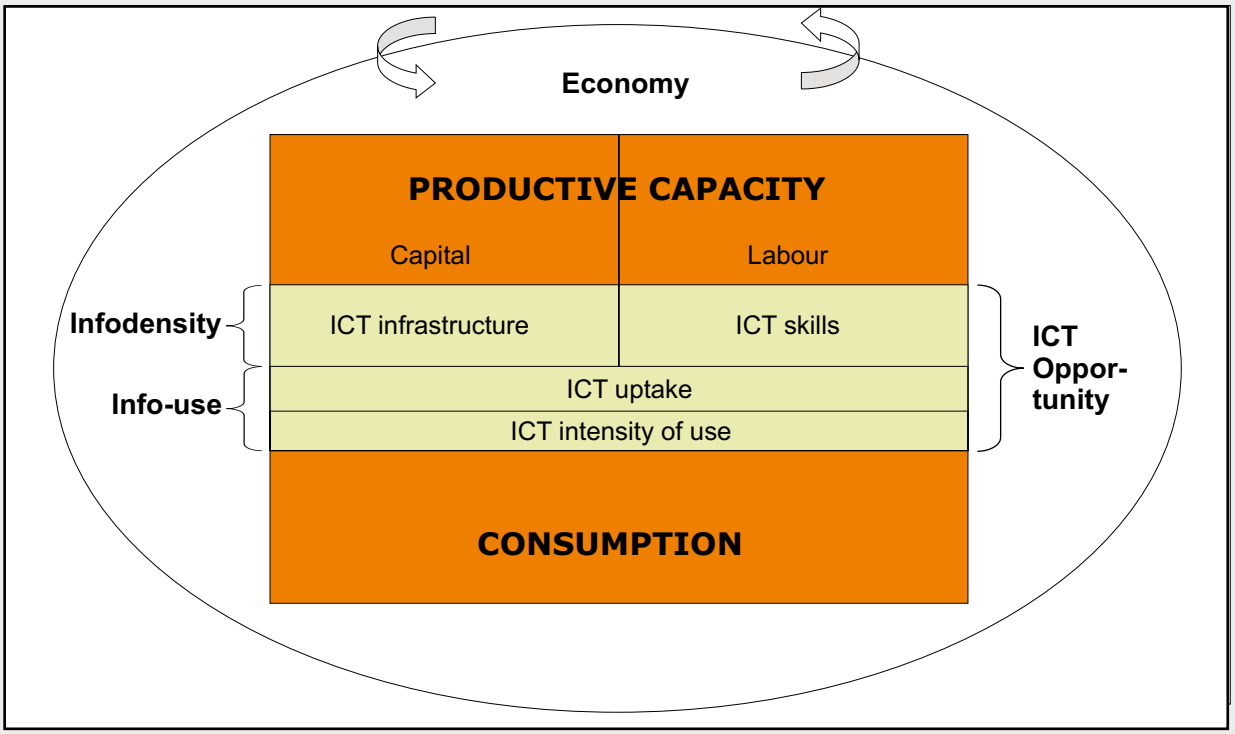
ITU has developed the ICT Opportunity Index so as to measure access to and usage of ICT by individuals and households in its inclusive sense. The fundamental principle has been to interpret the notion of ICT access and usage within the context of a global Information Society, thus recognizing ICT opportunities as an important part of social development.

7.2. ICT OPPORTUNITY INDEX

7.2.1 Conceptual framework of the ICT Opportunity Index

The conceptual framework of the ICT Opportunity Index has been adopted from Orbicom's Digital Divide Index presented in the "*From the Digital Divide to Digital Opportunities: Measuring Infostates for Development"* publication. The framework, which is closely linked to economic theory, is based on a dual nature of ICT: ICT are a productive asset, as well as a consumable. "*In that setting the conceptual framework developed the notions of a country's infodensity and info-use. Infodensity refers to the slice of a country's overall capital and labour stocks, which are ICT capital and ICT labour stocks and indicative of productive capacity. Info-use refers to the consumption flows of ICT. Technically, it is possible to aggregate the two and arrive at the degree of a country's ICT-ization, or infostate.*"[5]

Figure 7.1: The ICT-OI conceptual framework, which is set within the socio-economic, geopolitical and cultural environment of every economy



Source: ITU adapted from Orbicom.

This conceptual framework is particularly useful by including the underlying variables that specify the notion of ICT Opportunity. ICT Opportunities depend on the degree of **infodensity** and **info-use** (See Figure 7.1).

Infodensity symbolizes the productive capabilities and capacity of the economy in terms of **ICT labour** stocks and **ICT capital**. The quality and the quantity of these two inputs are fundamental factors for growth and for economic development. ICT capital is made up of Information and Communication Technology network infrastructure, as well as ICT networks machinery and equipment. ICT labour is the total stock of ICT skills of an economy's labour force. As for all other (non-ICT) forms of labour and capital, the total output will be an increasing function of these ICT stocks.

Info-use refers to an economy's ICT consumption (or use) within a given period. Since ICT goods are a necessary prerequisite for the use of ICT services, a distinction is made between **ICT uptake** and **ICT intensity** of use.

It should be noted that both, infodensity and info-use can keep growing and expanding since there is no upper limit for ICT capital or labour, and with new ICT being introduced over time. This also implies that there is no upper limit in terms of ICT Opportunities.

7.2.2 Applying the conceptual model: the indicators

To be able to carry out measurements, the most suitable indicators have to be identified to fill the conceptual framework and its building blocks. The choice of indicators is mainly driven by the availability and quality of data as well as an indicator's ability to reflect the purpose behind the conceptual framework. The inclusion of too many variables raises issues of definitions, overlapping coverage and the statistical notion of auto correlation where the variables themselves may be inter-dependent. There are a number of limitations so that the empirical application of the model will always be imperfect. The choice of indicators will depend not only on data availability and quality but also closely take into consideration knowledge of telecommunication sector dynamics.

The building blocks of the model are infodensity and info-use, and their components ICT capital (network infrastructure), ICT skills, ICT uptake and ICT intensity of use .

While the conceptual framework of the ICT Opportunity Index has not changed, the list of indicators has been modified. The new list of indicators chosen to construct the 2007 ICT-OI is reflected in Table 7.1.

It should be noted that the indicators chosen to measure ICT Opportunity include all four ICT-related indicators identified to track the Millennium Development Goals.[6] Additionally, six out of the eight ICT-related ICT Opportunity Index indicators are part of the core list of indicators identified by the *Partnership on Measuring ICT for Development.*[7] Eight out of the ten indicators are part of the ITU's World Telecommunication Indicators Database. ITU has many years of experience in the area of ICT statistics and a long history of close cooperation with national official data providers, including (particularly in earlier years) telecommunication operators, Ministries and regulatory authorities. Continuous work in this area, including in the area of benchmarking, confirms ITU's role as the main source of internationally comparable ICT statistics.

Infodensity

ICT capital is made up not only of telecommunication and Information and Communication Technology (ICT) network infrastructure, but also of ICT machinery and equipment (cables, routers etc). Only very limited internationally comparable data are available for ICT machinery and equipment so that the measurement of ICT capital will be limited to measuring network infrastructure, for which reliable data are widely available. The extent of **network** and infrastructure development was captured through penetration rates of fixed telephone lines, mobile cellular subscribers and international internet bandwidth. Both, fixed telephone lines and mobile subscribers, are widely recognized as key indicators to measure the basis of a country's telecommunication/ICT infrastructure. While penetration rates reflect the state of ICT access, increasingly availability of international internet bandwidth spurred by falling prices in fibre has enabled subscribers the opportunity to use communications more effectively in a globalized world. The bandwidth indicator also involves investment in infrastructure and facilities that enable rapid and efficient transmission of voice and data across the globe. Compared to the 2005 ICT Opportunity Index, a number of indicators were dropped from the networks list. These include "internet hosts per 100 inhabitants" and "digital telephone lines/main telephone lines". Information for the first indicator has shown to be less than reliable in terms of country-level data.[8] Regarding the percentage of digital telephone lines, ITU data show that by 2005,

the large majority of countries reported more than 90 percent of digitalized telephone lines, making this indicator somewhat obsolete. The indicator for "cable TV subscriptions" was dropped since cable TV is more popular in some regions than in others and limited to only some countries.

As ICT diffusion and uptake are clearly impacted by social and educational factors, enrolment rates in the primary, secondary, and tertiary sectors were taken as an inclusive reflection of wider productive and social opportunities to penetration. Together, educational enrolment and literacy figures represent the best available indicators to reflect the extent to which knowledge-based inputs enhance awareness to ICT goods and services which in turn, impact on access and usage. The information, sourced from UNESCO, provides enrolment in primary, secondary and tertiary segments of the educational system. Although ICT skills would be a good indicator to use in this model, measurement work in this area is still at a very nascent state and limited to a few countries. For this reason, skills are approximated with generic education indicators. It can also be assumed that ICT skills are closely linked to overall skills, although differences certainly exist between countries. Since higher educational levels are associated with more advanced skills and at the same time may be a better proxy for ICT skills, secondary education is weighed more than primary education and tertiary education is weighed more than secondary education. No modification have been made to the skills indicators since the 2005 ICT-OI.

Info-use

In order to capture ICT uptake (usage and consumption related parameters of ICT goods and services), three widely available and popular ITU indicators were used: internet users and computers per 100 inhabitants, and the proportion of households with a TV. While the latter indicator is not very significant for developed countries, where penetration rates have achieved close to one hundred percent in most cases, it remains an important indicator for developing countries. Ideally, other indicators on the use of ICT by households could have been included. However, since only a limited number of countries collect ICT household data, these limitations had to be taken into consideration.

With the recognition that the index has to be reflective in its developmental focus, the bias towards focusing variables on access to the internet was avoided by including indicators such as the percentage of households with a TV as these, too, form an important component of ICT goods. On the other hand, the ICT-OI includes the number of broadband subscribers (per 100 population) as one of the indicators, despite the fact that not all countries in the world have commercialized broadband services. The uptake of broadband is relevant since it is closely associated with intensity of use. The choice also reflects the importance that is attributed to the spread of broadband technologies, particularly since many applications (e-education, e-health, e-government) deemed useful in the area of ICT for development, have been linked to the uptake of broadband.[9]

While two indicators were included to measure ICT intensity (total broadband internet subscribers per 100 inhabitants, and international outgoing telephone traffic (minutes) per capita), these indicators are limited and can only provide a partial picture of the intensity of ICT use mainly due to data limitations.

7.2.3 Quality of data

A major criterion for the choice of the indicators that the ICT Opportunity Index is based on, is the availability and quality of data. The ICT Opportunity Index is based on a total of 10'980 data points: five years (2001-2005), 183 countries, and ten indicators. While the majority of data is made available directly by countries, there are some data quality and availability issues. Some data, for example the number of computers or the amount of international bandwidth, are not officially collected by all countries; in other cases, the latest (2005) data are not available. Finally, data for some economies are not available from the official country source. These difficulties have generally been overcome by using reliable secondary source data, by estimating the latest data based on past years' values, trends and growth rates, and by using national data when internationally comparable data are not available. Since the availability of data was one of the criteria in the choice of indicators, estimation of missing cells was kept to a minimum.

It should also be noted that all national country contacts were requested to verify and confirm, correct and/or provide their country-specific data used to compute the ICT Opportunity Index. Close to 50 percent of countries responded to this questionnaire.[10]

Some basic rules were applied to estimate missing data values within the different indicator categories (networks, skills, uptake, and intensity). Within the network category, only a fraction of data points for main telephone lines and mobile cellular subscribers were missing. Almost all countries track these indicators and provide data to ITU. Countries with

Table 7.1: ICT Opportunity Index: a total of 10 indicators

	Indicator used
Info Density	
Networks	a) Main telephone lines per 100 inhabitants b) Mobile cellular subscribers per 100 inhabitants c) International internet bandwidth (kbps per inhabitant)
Skills	a) Adult literacy rates b) Gross enrolment rates - primary - secondary - tertiary (*Source:* UNESCO)
Info use	
Uptake	a) Internet users per 100 inhabitants b) Proportion of households with a TV c) Computers per 100 inhabitants
Intensity	a) Total broadband internet subscribers per 100 inhabitants b) International outgoing telephone traffic (minutes) per capita

Source: ITU.

three or more missing data points (out of the five) in any of these two indicators (main telephone lines and mobile cellular subscribers) were not included in the 2007 ICT-OI. Bandwidth data were available for almost all countries for at least some years. If only 2005 data were missing, the 2004 values were used. Bandwidth data lacked completely only for a minority of countries. In this case, internet user data were compared to other countries and estimates made based on countries with the same level of internet use penetration rates.

Within the skills category, which is based on UNESCO's figures, missing data were estimated using growth rates of the latest two available years. In-between year data were estimated based on a simple average of the first and latest available year data.

The uptake category of the ICT Opportunity Index is composed of three indicators: internet users per 100 inhabitants, computers per 100 inhabitants, and proportion of households with a TV. The first two indicators are part of the group of indicators that are being tracked to measure the progress made towards the Millennium Development Goals (MDGs). Since there are data gaps for these indicators at the country level, ITU estimates a substantive number of these data, particularly the number of computers. ITU estimates the number of computers using industry sales data, shipment data and based on the number of internet users. Data for the number of internet users are provided by approximately 60 percent of countries. For most developed and larger developing nations, internet user data are based on methodologically sound user surveys conducted by national statistical agencies or industry associations. These data are either directly provided to the ITU by the country concerned or the ITU does the necessary research to obtain the data. For countries where internet user surveys are not available, the ITU calculates estimates based on average multipliers for the number of users per subscriber. These multipliers depend on the development status of a country, since a developing country, where more people use public internet access than home internet access, will have more internet users for each internet subscribers than a highly developed country.

While data on the percentage of households with a TV are provided by only a limited number of country contacts, an effort was made to find alternative national and regional sources so as to find data for at least one year (for 2001 to 2005) per country. It should be noted that, as opposed to some other indicators, such as the number of mobile cellular or broadband subscribers,

the change in the percentage of households with a TV is much more gradual. In other words, data from countries that track this indicator on a yearly basis show that penetration rates vary only slightly over years, and that the trend is towards a growing number of households with televisions. This also implies that "older" (for example year 2000) data are still relatively useful to make 2001-2005 estimates. When no data were available at all, estimates were made based on comparable economies, taking into consideration a number of factors: the reference economy would have a similar population base, a similar income level (GDP per capita), as well as similar internet user, mobile cellular subscriber, and fixed line penetration levels.

Two indicators, the number of broadband internet subscribers per 100 inhabitants, and international outgoing telephone traffic per capita, were used for the intensity category. Since broadband is a relatively new technology and has received a large amount of attention (largely because of its ability to deliver quality internet access and deliver innovative applications), ITU has made substantial efforts to collect this data. Even if countries do not provide the broadband data through the ITU questionnaire, there are relatively reliable ways to find out whether or not a country has commercialized broadband services. For example, ITU checks the main telecommunication operators' web sites to see if broadband services are advertised. If this is not the case, (and unless the ITU country contact has provided the data), it may be assumed that broadband services are not commercially available. Online research is carried out to confirm this assumption. By the end of 2005, ITU estimates that still about one quarter of all economies do not have commercial broadband services. If broadband services are available, but some years are missing, these are estimated, based on previous years' growth rates, as well as simple averages, for estimations of in-between year data.

Some data are available for most countries in terms of international outgoing telephone traffic. Forecast methods were used to estimate missing values based on average growth rates. For economies with no data at all, estimates were made based on comparable economies, taking into consideration the population size, income level, as well as the total number of telephone subscribers (fixed and mobile).

7.2.4 Reference year and reference country

To effectively monitor the digital divide, a reference year and a reference country must be identified. As the reference country, the average of all countries is used in each component of the ICT Opportunity Index. The reference year for the 2007 ICT Opportunity Index is the year 2001, for which the largest number of data cells are filled/available. This allows for optimal measurements. The reference year provides an important benchmark to quantify and monitor trends in ICT Opportunity across countries and over time in a systematic manner. It is also important to monitor the digital divide.

The reference country (average) has a value of 100 for the reference year throughout the exercise – for each indicator, component and the overall ICT Opportunity level. The sub-indices for all other countries assume their corresponding values. However, the reference country's score is not static but moving over time. Consistent with the framework's terms of reference, two-fold comparisons can be made: cross-country comparisons at any given point in time, and within each country over time. In a way, for specific indicators, aggregate components of interest and sub-indices or for the overall ICT Opportunity level, the values of different economies will effectively reflect each other's timeline. For instance, if country A had 20 percent internet penetration in 2004 while country B achieved that level already in 2002, it could be said that country A is two years behind.

7.2.5 Methodological details

The discussion on the conceptual framework pointed to the need to identify the notions of infodensity and info-use and their subcategories to arrive at economies' overall ICT Opportunity level. The move from the theoretical framework to the actual empirical application, primarily through the choice of indicators, will be characterized by adjustment and an approximation of the framework.

The first step towards the construction of the ICT Opportunity Index is the complete collection (or filling of data cells) for the ten indicators, five years, and 183 economies to be part of the index. As mentioned before, the only criterion to exclude an economy was the lack of data and difficulty to estimate missing values. To make values comparable, per capita and per household adjustments were made for all ten indicators.[11]

Outliers, smoothing techniques and scalars

In some cases, for example for international internet bandwidth per capita, series are characterized by an extreme range or outliers. While in theory the conceptual framework does not foresee an upper limit (ICT Opportunities can grow indefinitely), smooth-

ing adjustments for outliers were made necessary for comparability and to limit the impact of one single indicator on the overall ICT Opportunity value. Smoothing adjustments were applied to international internet bandwidth, computers, broadband subscribers and international outgoing telephone traffic. They were based on the mean, the standard deviation (variance) and their ratio (the co-efficient of variation), and applied in a systematic way on the basis of the following rule:

For CV<1.5, max = x + 4std
For 1.5<CV<3, max = x + 3std
For CV>3, max = x + 2std

where:

CV: The series' Coefficient of Variation (difference)
x: The series' mean/average
std: Standard deviation

This procedure resulted in only a few, but useful, maximum values and not in all series. It does not pose an upward boundary to measurements over time. Smoothing techniques to minimize the effect of outliers were applied through application of scalars based on the level of coefficient of variation in the indicator series.

The indicators international bandwidth per capita, broadband subscribers and international outgoing telephone traffic were subject to monotonic transformations by adding the scalars to the numerator and denominator. Scalars were arrived at through a simple and systematically applied rule based on statistical analysis of each individual series, specifically:

For CV<1.5, scalar = 4x
For 1.5<CV<3, scalar = 3x
For CV>3, scalar = 2x

Finally, an adjustment was made to the 'gross enrolment' indicator (part of the skills indicators), which was combined to form a composite indicator. To give adequate recognition to higher education levels, the 'gross enrolment indicator' is adjusted as follows:

$$I^{gross\ enrolment} = (\text{primary} + 2 \times \text{secondary} + 3 \times \text{tertiary})/6$$

Sub-indices

Once a complete and comparable set of indicators has been developed from the raw data, every single indicator is computed into an (sub-) index, regardless of its original unit of measurement. Within each index, an average value and a reference year (2001) are specified. This is important since the ICT Opportunity Index will help compare countries to one another, as well as over time. Thus, for the reference country (average) the formula will be:

$$I_t^{i,c} = (V_t^{i,c} / V_{to}^{i,c}) \times 100$$

where I stands for the value of the index, i refers to individual indicators, V to raw values of indicators, t_o refers to the reference year and t to any other year.

Using the notation j for all other countries we have:

$$I_t^{i,j} = (V_t^{i,j} / V_{to}^{i,c}) \times 100$$

This normalization allows immediate comparisons between other countries and the reference country (the average), and for any country over time.

Once every indicator has been expressed in index form, we proceed to aggregate across each component. After indicators have been treated as explained, the result is an unweighted average. The choice of a geometric rather than an arithmetic mean represents a value judgment that favors symmetrical rather than uneven development across indicators of interest.

Indices are obtained as:

$$\hat{I}_t^{i,j(c)} = \sqrt[n]{\prod_{i=1}^{n} I_{n,t}^{i,j(c)}}$$

with denoting product and n the number of each component's individual index. For networks n=3 (fixed, mobile and bandwidth), for skills n=2 (literacy and gross enrolment), for uptake n=3 (TV, computers and internet users) and for intensity n=2 (broadband subscribers and international outgoing traffic). We continue likewise for the subsequent level of aggregation. Networks and skills are combined into the Infodensity index as:

$$\text{Infodensity} = \sqrt[k]{\prod_{i=1}^{k} I_{n,t}^{i,j(c)}}$$

with k=2. Uptake and intensity are combined into the Info-use index as:

$$\text{Info-use} = \sqrt[z]{\prod_{i=1}^{z} I_{n,t}^{i,j(c)}}$$

where z=2.

Finally, when we have both infodensity and info-use, we arrive at the highest level of aggregation, a country's ICT Opportunity value, simply as:

$$\text{ICT Opportunity Index} = \sqrt[2]{(\text{infodensity x info-use})}$$

The results of the 2007 ICT-OI are presented in Table 7.2.

7.3 RESULTS OF THE 2007 ICT OPPORTUNITY INDEX

The results of the ICT Opportunity Index allow for a number of interesting analytical exercises. The framework of the analysis allows for the identification of progress towards ICT opportunities and the digital divide which here is understood as the relative difference in ICT Opportunity levels among economies (or regions/groups). In addition, analysis can be carried out for each economy, or on the basis of ICT-OI groups that are made up of countries with similar ICT-OI results.

7.3.1 2007 ICT-OI groupings

For analytical purposes, the 183 economies covered by the empirical application are divided into four categories. The division into these categories is based on the results of the latest available data (2005). The basis of the division is the reference country (overall average value) of the index, which lies at ICT-OI value 148 (2007 ICT-OI values range from as low as 12, to as high as 378). The 57 economies which lie above the average were divided into two categories: *high* and *upper*, with 29 economies in the *high* and 28 economies in the *upper* category.[12] The same was done for all economies that lie below the average: the 126 economies below average were divided into two categories, by an equal number of countries: *medium* and *low*. This division into four categories also allows for another perspective for the analysis of the digital divide over time.

High (ICT-OI levels of 249 and above): The 29 economies in this category have achieved a high level of access to and use of Information and Communication Technologies.

They include 17 European countries, six Asian economies – Hong Kong (China), Singapore, Taiwan (China), Macao (China), the Republic of Korea and Japan – as well as Canada, the United States, Australia, Israel, Barbados and New Zealand. It should be noted that this category includes many smaller developed economies (and some city states) in terms of population and/or land area, such as Luxembourg, Switzerland, Denmark, the Netherlands, Singapore, Iceland, and Hong Kong (China), Taiwan (China) and Macau (China), suggesting that it is easier to connect smaller economies. All economies in this category share a high income level.

Upper (ICT-OI levels from 150 to 248): The 28 economies in this category have achieved an elevated level of access to, and use of, for a majority of their inhabitants. What often sets this group apart from the *high* category is imbalance in a specific category. For example some countries in this group may have a high level of infrastructure availability but a lower score in uptake. Analysing the separate category values can be useful for policy-makers seeking to find out where their countries are weak in access to the Information Society. The category includes the Baltic States (apart from Estonia, which is ranked in the *high* category), a number of Central Eastern European countries (Czech Republic, Hungary, Croatia, Slovak Republic, Poland), as well as a number of Arab States (UAE, Bahrain, Qatar and Kuwait). It also includes eight Small Island Developing States, namely Antigua & Barbuda, Aruba, Bahamas, Jamaica, Virgin Islands, Grenada, French Polynesia and Mauritius. The only South American country in the *upper* category is Chile.

Medium (ICT-OI levels from 68 to 149): The 63 economies in this category are generally characterized by competitive markets and major advances in the mobile sector. It includes a number of large countries in terms of populations, including Russia, Brazil, China, and Mexico. It also includes the majority of Latin American and Caribbean countries, such as Uruguay, Argentina, Costa Rica, Trinidad & Tobago, Venezuela, Colombia, Peru, Dominican Republic, and others. While almost all of the economies in this category have commercialized broadband services, penetration rates remain very low (below one percent) for almost all of them. A few countries in the top half of this category, including China, Turkey, Lebanon, Brazil and Argentina, have achieved broadband penetration levels between two-four percent.

Low (ICT-OI levels from 12 to 68): The 63 economies in this category include the majority of Least Developed Countries and African countries. Differences in the ICT levels vary in this category but those in the bottom half have minimal levels of access to the

Table 7.2: ICT Opportunity Index 2001-2005 values and 2005 Ranking

ECONOMY	2001	2002	2003	2004	2005	2005 Rank
Sweden	263.16	299.38	323.92	350.12	377.69	1
Luxembourg	209.43	233.83	259.08	300.19	371.10	2
Hong Kong, China	232.69	272.36	310.53	344.08	365.54	3
Netherlands	237.07	266.23	301.65	328.46	362.82	4
Denmark	253.95	287.83	317.34	332.95	360.79	5
Switzerland	246.82	288.57	326.07	343.08	353.60	6
Singapore	231.45	268.95	309.38	338.14	346.68	7
United Kingdom	208.74	247.23	282.64	315.39	346.37	8
Iceland	226.11	245.90	287.69	316.29	340.57	9
Norway	223.07	250.78	282.77	308.69	338.53	10
Canada	252.19	265.54	297.63	325.75	337.16	11
Belgium	228.68	253.02	287.00	304.16	324.21	12
United States	224.63	250.80	276.47	305.67	323.85	13
Australia	183.80	207.32	227.53	259.88	322.73	14
Austria	230.02	254.45	271.32	290.39	305.60	15
Germany	211.61	230.73	254.10	282.36	303.42	16
Taiwan, China	190.87	228.63	263.14	279.35	302.71	17
Israel	158.92	184.26	208.53	270.71	296.71	18
Finland	204.36	251.27	265.30	286.51	293.51	19
Ireland	180.71	204.70	222.84	260.03	286.32	20
Macao, China	171.23	195.72	227.06	250.39	280.45	21
Korea (Rep.)	202.13	231.28	252.10	265.31	280.08	22
France	190.44	212.67	238.77	260.13	278.34	23
Estonia	151.51	178.78	221.34	254.97	269.81	24
Barbados	126.77	138.26	221.50	249.92	264.85	25
New Zealand	180.16	193.35	210.32	238.05	257.73	26
Japan	180.01	204.74	225.43	246.99	256.90	27
Italy	163.60	188.12	218.37	239.40	255.68	28
Spain	161.65	183.61	207.00	232.89	249.28	29
HIGH AVERAGE	**204.34**	**231.67**	**261.96**	**288.97**	**312.17**	
Slovenia	154.69	191.69	204.03	229.73	246.13	30
Antigua & Barbuda	127.06	132.07	158.22	190.37	244.92	31
Aruba	141.13	143.62	170.75	210.66	238.36	32
Cyprus	155.43	175.02	197.33	202.14	221.95	33
Latvia	109.98	125.34	140.48	172.67	218.77	34
Malta	160.31	170.78	180.87	203.51	212.27	35
Portugal	147.39	164.88	185.32	198.50	209.57	36
Czech Republic	135.19	154.77	162.98	184.38	202.72	37
Lithuania	103.29	123.50	143.21	166.52	201.63	38
Qatar	109.77	123.79	147.97	166.43	196.92	39
Hungary	120.89	137.65	166.85	180.00	192.41	40
United Arab Emirates	133.57	143.00	153.77	167.77	190.99	41
Slovak Republic	123.14	132.01	146.02	165.91	188.92	42
Bahamas	140.45	152.01	163.62	175.05	184.13	43
Bahrain	130.72	144.90	162.07	174.14	182.40	44
Croatia	118.20	132.56	140.76	151.50	176.41	45
Poland	105.16	123.84	132.58	157.87	166.36	46
Jamaica	82.82	112.05	117.89	128.61	165.16	47
Greece	122.29	131.92	136.19	149.62	162.34	48

ECONOMY	2001	2002	2003	2004	2005	2005 Rank
Virgin Islands (US)	115.35	121.44	126.84	147.24	160.13	49
Chile	115.78	128.58	141.73	154.14	157.65	50
Grenada	102.89	124.66	149.25	152.15	156.79	51
Brunei Darussalam	114.70	120.03	131.62	147.89	156.09	52
French Polynesia	100.06	101.68	113.91	134.68	154.21	53
Kuwait	106.27	113.49	128.42	144.00	153.88	54
Romania	80.74	97.89	116.91	131.03	150.45	55
Mauritius	95.74	102.94	110.03	118.88	150.27	56
Malaysia	107.61	115.39	125.05	136.87	150.19	57
UPPER AVERAGE	**120.02**	**133.63**	**148.38**	**165.79**	**185.43**	
Ref. country (average)	**100.00**	**110.52**	**122.51**	**134.62**	**147.56**	
New Caledonia	91.18	100.20	110.86	131.92	146.61	58
Uruguay	104.10	105.06	108.21	123.52	143.31	59
Argentina	101.84	103.57	111.17	126.98	140.40	60
Seychelles	115.43	125.29	128.09	136.98	139.67	61
Lebanon	93.01	108.90	119.04	124.60	139.15	62
Russia	80.14	90.47	105.34	121.85	137.27	63
Brazil	87.22	97.14	104.41	122.56	136.44	64
St. Vincent	88.08	98.43	114.11	116.73	132.19	65
Costa Rica	93.30	105.83	117.23	123.92	130.58	66
Turkey	86.35	89.76	97.97	112.77	128.53	67
Trinidad & Tobago	93.72	95.68	101.36	114.46	127.22	68
Belize	88.75	94.13	102.64	115.70	127.06	69
Mexico	88.04	96.67	103.38	113.21	124.68	70
Bulgaria	94.89	100.00	106.71	114.38	123.46	71
Puerto Rico	87.04	97.44	105.15	113.81	122.83	72
TFYR Macedonia	79.05	87.21	95.80	100.72	120.36	73
Belarus	68.30	82.85	96.49	108.48	120.09	74
Saudi Arabia	80.03	91.88	100.38	109.84	116.20	75
Venezuela	83.44	87.31	93.87	101.91	114.03	76
Bosnia	71.92	81.91	89.87	97.39	113.44	77
Serbia and Montenegro	81.46	95.52	101.81	112.36	111.23	78
China	65.43	77.54	89.03	100.47	109.41	79
Colombia	70.47	76.97	83.12	89.75	105.32	80
Peru	71.58	75.71	82.36	92.69	104.50	81
Ukraine	64.82	70.41	82.43	94.14	102.26	82
Moldova	59.59	68.12	75.71	84.70	102.19	83
Jordan	78.67	84.25	89.23	95.87	102.17	84
Guyana	79.20	82.03	88.32	91.55	100.69	85
Oman	71.23	76.79	82.95	89.06	100.44	86
Thailand	75.17	81.24	90.37	95.21	99.20	87
Maldives	66.71	76.55	85.72	90.46	99.06	88
Suriname	79.13	83.63	89.65	94.37	97.30	89
South Africa	79.58	82.20	85.16	88.26	96.78	90
Panama	79.70	84.15	87.16	94.65	96.69	91
Ecuador	63.86	73.75	80.29	91.34	96.42	92
El Salvador	64.37	69.31	79.86	88.98	95.27	93
Tunisia	63.38	69.05	79.78	87.82	95.12	94
Dominican Rep.	71.91	74.19	79.47	84.67	94.50	95

Table 7.2: ICT Opportunity Index 2001-2005 values and 2005 Ranking (cont'd)

ECONOMY	2001	2002	2003	2004	2005	2005 Rank
Fiji	66.48	75.14	77.76	80.34	92.97	96
Georgia	62.43	70.16	76.55	81.68	90.28	97
Iran (I.R.)	62.25	71.24	79.62	83.58	89.74	98
Palestine	65.85	69.48	74.36	81.83	89.33	99
Mongolia	56.09	60.46	75.42	81.93	87.68	100
Armenia	51.57	60.00	70.35	80.33	87.30	101
Kazakhstan	55.86	63.50	68.56	77.75	85.32	102
Azerbaijan	49.90	64.03	68.95	76.93	83.90	103
Tonga	42.96	55.85	64.72	72.73	80.54	104
Morocco	50.34	53.44	58.91	69.43	79.50	105
Albania	50.32	55.81	63.17	70.28	79.25	106
Egypt	51.89	60.03	67.19	71.91	78.82	107
Philippines	62.11	67.92	72.74	77.48	78.81	108
Cape Verde	60.06	64.64	68.63	73.07	77.70	109
Paraguay	60.44	66.68	69.37	74.78	77.59	110
Viet Nam	43.51	48.14	54.02	65.55	76.66	111
Syria	41.91	53.25	65.00	72.19	76.53	112
Algeria	36.35	45.37	52.87	63.78	75.55	113
Namibia	58.69	61.84	67.10	69.21	73.74	114
Micronesia	26.44	40.80	62.36	70.73	73.67	115
Bolivia	58.87	63.71	66.30	70.23	73.24	116
Guatemala	50.30	56.82	60.64	68.28	72.34	117
Samoa	47.70	49.26	57.00	63.36	68.48	118
Gabon	49.45	54.07	57.68	63.57	68.43	119
Kyrgyzstan	47.83	50.64	57.17	63.48	67.72	120
MEDIUM AVERAGE	**69.39**	**76.56**	**84.14**	**92.42**	**101.22**	
Indonesia	46.72	50.11	55.90	61.42	67.68	121
Libya	45.54	56.17	60.69	65.13	66.71	122
Botswana	59.59	60.62	61.42	62.74	66.16	123
Nicaragua	47.26	50.85	55.11	59.69	64.18	124
Honduras	46.68	51.20	53.47	58.20	63.35	125
S. Tomé & Principe	22.96	46.23	53.36	58.79	61.01	126
Zimbabwe	38.47	49.77	53.24	55.10	60.02	127
Sri Lanka	41.03	46.30	51.74	57.88	58.82	128
Uzbekistan	38.27	42.69	47.86	54.23	58.54	129
Swaziland	42.82	46.60	50.71	54.18	56.31	130
Bhutan	19.45	21.43	47.25	52.08	55.88	131
Cuba	37.67	42.22	43.77	50.07	55.30	132
India	31.52	36.77	40.41	46.43	53.55	133
Turkmenistan	33.85	35.66	37.39	46.11	53.29	134
Sudan	24.94	30.04	39.05	42.49	49.83	135
Senegal	34.12	36.38	40.61	46.07	47.11	136
Yemen	23.51	33.69	37.29	41.73	46.47	137
Togo	39.40	44.00	46.33	47.39	45.81	138
Pakistan	25.34	29.13	36.49	41.29	45.50	139
Tajikistan	23.54	29.39	36.03	42.39	45.20	140
Nigeria	21.49	27.23	31.01	36.67	44.23	141
Gambia	34.38	37.61	40.45	41.87	43.99	142
Vanuatu	31.22	40.05	41.68	42.45	43.50	143
Mauritania	27.85	31.35	33.82	37.19	43.38	144
Kenya	29.81	33.98	39.60	41.18	42.26	145
Djibouti	26.49	32.27	35.86	39.63	41.13	146
Haiti	25.47	30.45	35.54	39.95	40.92	147
Ghana	25.02	30.00	33.85	38.69	40.23	148
Cameroon	26.81	29.57	32.63	36.64	39.62	149
Equatorial Guinea	27.53	32.15	34.41	37.51	39.30	150
Lao P.D.R.	23.57	26.35	29.03	31.29	39.29	151
Côte d'Ivoire	31.56	34.37	36.21	38.10	39.15	152
Zambia	25.57	27.97	31.94	36.05	38.52	153
Benin	22.63	26.01	28.35	30.29	35.20	154
Papua New Guinea	27.51	29.41	30.73	33.02	34.38	155
Solomon Islands	26.78	26.91	26.62	30.41	34.05	156
Bangladesh	18.48	20.80	23.67	26.95	31.56	157
Somalia	16.46	19.06	25.50	30.33	31.51	158
Lesotho	24.86	30.24	30.56	29.68	31.45	159
Tanzania	20.01	22.85	27.48	27.37	31.24	160
Congo	21.37	24.88	25.37	28.90	30.54	161
Uganda	18.91	20.48	22.49	24.51	29.66	162
Angola	16.27	18.87	22.12	27.59	28.82	163
Cambodia	20.25	24.20	25.29	27.29	28.75	164
Comoros	10.49	10.84	21.76	25.93	28.55	165
Nepal	18.97	20.17	23.41	25.01	27.91	166
Eritrea	8.22	8.87	10.02	24.36	27.36	167
Guinea-Bissau	9.67	11.01	20.46	26.79	27.34	168
Madagascar	19.48	21.35	23.32	24.58	26.03	169
Mozambique	17.76	19.89	22.16	24.55	25.70	170
Mali	15.88	17.08	20.44	22.22	22.92	171
Malawi	16.78	18.75	20.81	21.88	22.79	172
Guinea	18.32	21.14	21.89	22.25	21.46	173
Burundi	13.16	14.04	16.66	19.74	21.26	174
Rwanda	16.19	17.11	18.03	18.56	20.27	175
Burkina Faso	14.52	15.56	18.19	18.79	19.69	176
Myanmar	9.03	10.45	15.26	16.06	19.11	177
Ethiopia	10.10	11.96	14.01	16.27	17.68	178
Central African Rep.	12.49	13.02	14.85	16.28	16.97	179
Afghanistan	3.19	8.04	11.30	13.11	14.91	180
Niger	7.90	10.31	11.20	13.56	14.75	181
Chad	11.30	13.43	14.93	14.46	13.82	182
D.R. Congo	7.14	9.72	11.01	11.95	12.33	183
LOW AVERAGE	**24.66**	**28.40**	**32.10**	**35.45**	**38.16**	

Information Society. The majority of countries in this category have not yet launched broadband services and fixed line penetration remains very low.

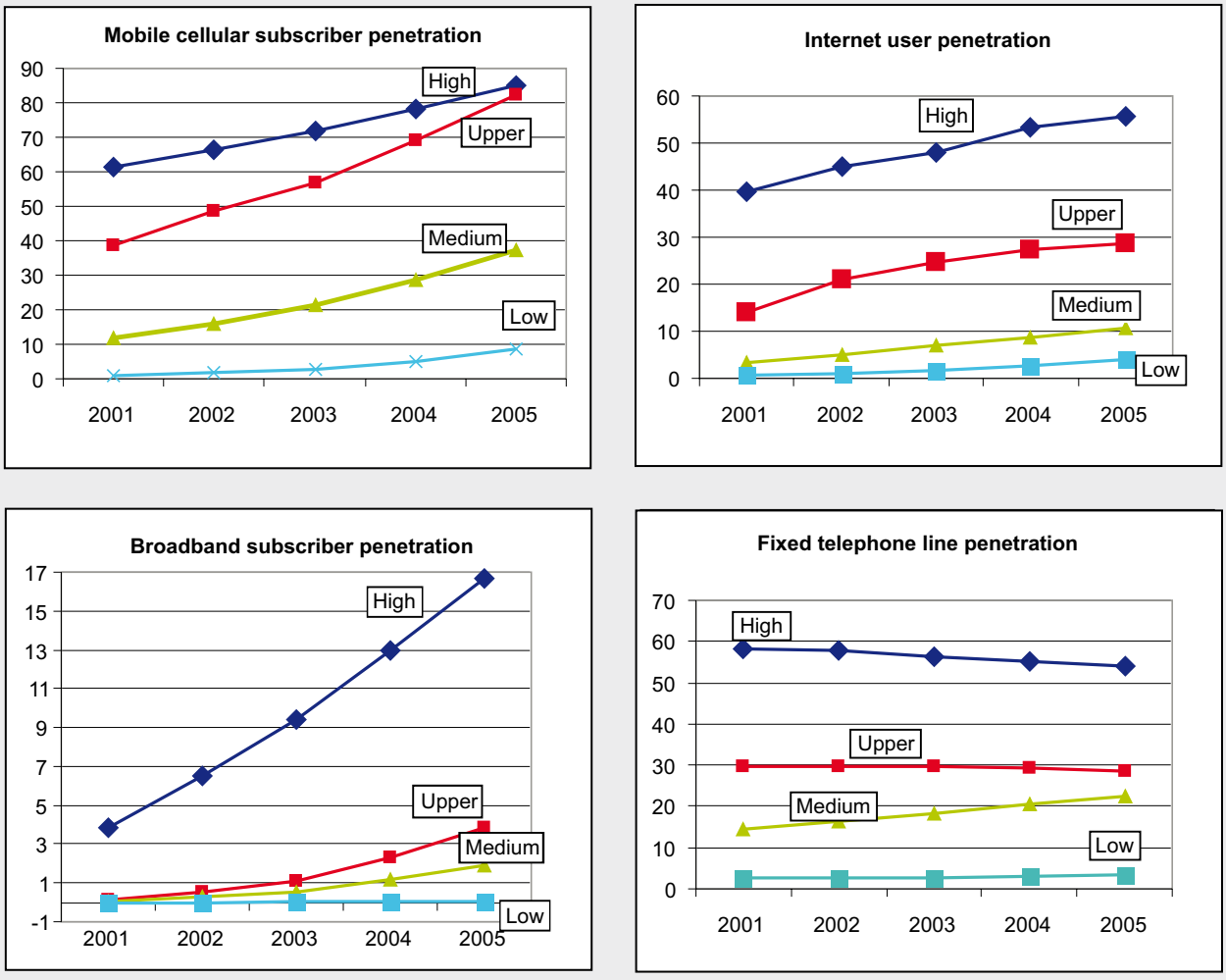
7.3.2 ICT Opportunity progress and discrepancies

The absolute values of the index results, which are further discussed in the section 7.3.3 on "ICT Opportunity Index growth rates: evolution over time", clearly show that almost all economies in the world have made substantial progress since 2001. Figure 7.2 provides a breakdown of penetration rates for four separate ICT-OI indicators, from 2001-2005, for each of the ICT-OI categories (*high*, *upper*, *medium* and *low*). This breakdown highlights that while there is growth in almost all areas and across all categories, penetration rates particularly in terms of internet users and broadband subscribers remain very low for countries with *low* and *medium* ICT-OI levels. The highest penetration levels and highest growth rates across categories have been achieved in the area of mobile cellular subscribers. However, penetration levels range from ten percent (for countries with *low* ICT-OI levels) to over 85 percent in the *high* category.

Similarly, internet user penetration rates remain relatively low (at an average of four percent in 2005) for countries with *low* ICT-OI levels, compared to close to 30 and over 55 percent for the *upper* and *high* categories. Despite the differences, penetration rates are increasing across all categories.

The difference between the categories is most striking in terms of broadband subscribers, where the high

Figure 7.2: 2001-2005 penetration rates for mobile cellular subscribers, fixed telephone lines, internet users and broadband subscribers, by ICT-OI category



Source: ITU.

category is far ahead, at an average of almost 17 percent. Countries from the other ICT-OI categories are lagging behind, with penetration levels of 4, 2, and 0.1 percent.

The only area that is not showing growth across all categories is fixed telephony. Fixed telephone line penetration has slightly decreased for countries in the *high* (from 58 percent in 2001, to 54 percent in 2005) and *upper* (from 30 to 29 percent between 2001-2005) ICT-OI categories, but is increasing in countries with *low* and *medium* ICT-OI levels.

The major differences between categories is confirmed by country level ICT-OI data. While some economies have been able to catch up in terms of their position vis-à-vis the developed countries, others have made less progress. The specific country values help to visualize the degree of the digital divide and provide the basis for more detailed analysis (Table 7.2: ICT Opportunity Index 2001-2005 values and 2005 Ranking). It should be noted that the exact position/ranking of economies is not considered analytically very useful. The prime objective of the ICT Opportunity Index is to identify the digital divide and to help understand how it has evolved since the beginning of this century. To adequately measure differences among economies with highly developed ICT levels, more precise and qualitative indicators would be needed.

The 2007 ICT-OI results were also used to highlight the status and progress of certain country groupings, particularly those that were identified and mentioned during the World Summit on the Information Society (WSIS, see section 3.5 "WSIS groupings").

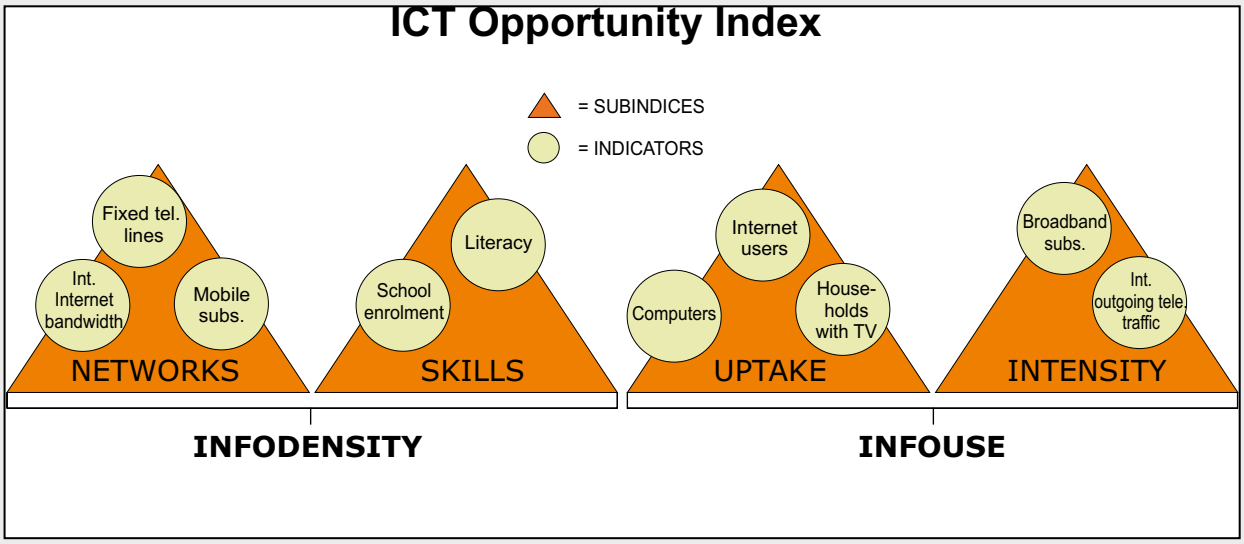
The 2007 ICT-OI is derived from ten indicators, grouped into four sub-indices: the networks index, the skills index, uptake index and the intensity index. These sub indices and the indicators that they are composed of are illustrated in Figure 7.3. Annex 1 provides an overview of the values for each economy and within each index and is useful for the identification of relative strengths and weaknesses.

Apart from cross-country comparisons, the ICT Opportunity Index's methodology is able to highlight relative movements of different ICT-OI groups over the five year period 2001-2005. It shows how fast the four ICT-OI groups are making progress compared to each other. These normalized values are particularly useful to analyze the evolution of the digital divide (see section 7.3.4 on "Tracking the digital divide").

7.3.3 ICT Opportunity Index growth rates: evolution over time

One of the more important uses of the ICT Opportunity Index is to measure progress over time (2001-2005). Seven out the ten countries with the highest growth rates (between 2001 and 2005) are Least Developed Countries (LDCs) (Figure 7.4, left chart). While this is a positive development, growth rates need to be seen in perspective since high growth rates are not

Figure 7.3: ICT-OI: sub-indices and indicators



Source: ITU.

sufficient to overcome the digital divide, particularly in countries that start at very low ICT levels. It is also true that not all developing countries have high growth rates and the list of the ten countries with the lowest growth rates between 2001 and 2005 includes three LDCs (Figure 7.4, right chart).

In addition to grouping countries according to their 2005 ICT-OI level into *low*, *medium*, *upper* and *high*, countries have been categorized into different growth rate bands. These show which countries have had *low*, *medium*, *upper* or *high* growth rates during the period 2001-2005, a useful tool for countries to track their progress. (Annex 2 to this chapter: ICT-OI average annual growth rates, 2001-2005 and growth rate bands).

Table 7.3 on "The Digital Divide over time" provides a very useful overview of the evolution of digital opportunities in terms of the different ICT-OI categories (*high*, *upper*, *medium*, *low*). The first table (A) shows the average values for each category and for each year, along with their respective absolute changes and growth rates for the 2001-2005 period. This simple exercise allows for some key findings.

All categories are making progress, every year. The 2001-2005 data show that growth rates in this period were (on average) highest amongst the *upper* ICT-OI countries (54.5%). Countries in the *low* ICT-OI group had a growth rate of 54.8 percent. The lowest growth rate (45.9 %) occurred in the *medium* category.

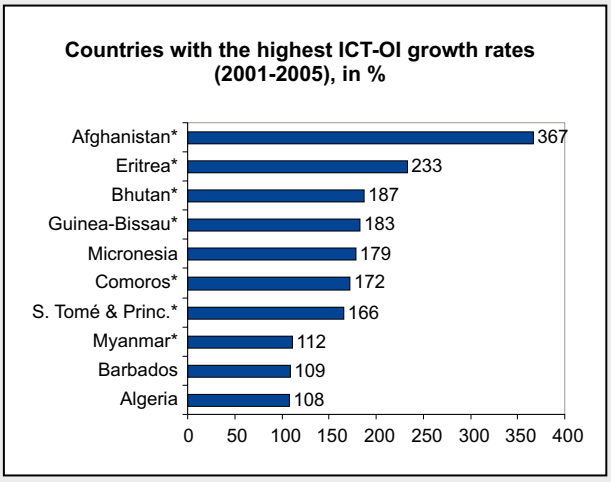
7.3.4 Tracking the digital divide

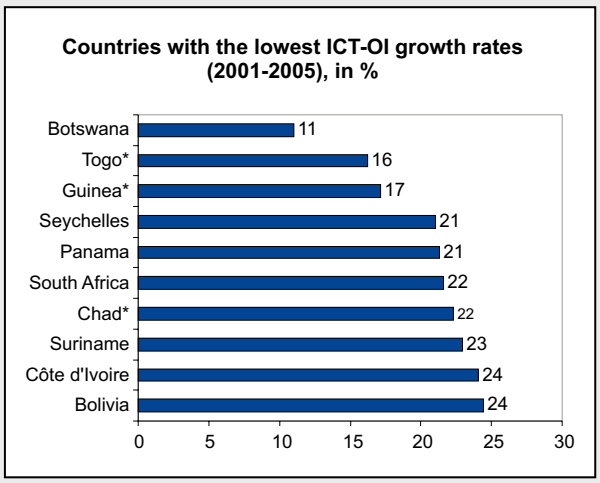
Besides analysing the trend of digital opportunities over time in terms of absolute values (see section A of Table 7.3), it is useful to highlight the relative movement of the digital divide. The normalized values (see section B of Table 7.3) allow for meaningful interpretations of the digital divide between any two groups within the index. Through 'normalization', the difference between the groups is analyzed from the 2005 perspective. It shows differences between groups in terms of their position as of 2005. The direction of this measure over time points to the evolution of the digital divide: a downward movement indicates a closing divide between the two groups, and an upward movement indicates a widening divide (Section C). This analysis shows that the divides between the *high* and any other group has increased over the five-year period 2001-2005.

Between 2001-2005 the divide also grew between the *upper* group and the lower and the *medium* group. A drop during this five year period took place only between the *medium* and the *low* group (from 66.0 in 2001, to 63.1 in 2005).

These findings suggest that between 2001-2005, the digital divide actually increased between those economies that already have very high ICT levels and the rest of the world. It decreased between the *medium* group and the *low* group, indicating that countries with low levels of ICT have somewhat been able to catch up and reduce the divide compared to countries in the *medium* level.

Figure 7.4: 2007 ICT-OI growth rates 2001-2005: top and bottom ten





Note: Countries marked with * are LDCs.
Source: ITU.

However, a look at developments only over the last year (2004/2005) shows a slightly different picture. The divide between the *high* group and every other group was actually decreased during this year, by between four-eight value points, depending on the group (See section D of Table 7.3). This might be due partially to saturation in the mobile sector in many of the developed countries, which allows developing countries with high mobile growth rates, to further catch up.

The same year (2004/2005) showed an increase in the divide between the *upper* and *medium* group and the *upper* and the *low* group. This might be partially due to the fact that economies in the *medium* and *upper* group started to launch broadband services and increase penetration. This was not the case in most economies in the *low* category, where broadband services are almost non-existent.

While the categorization of countries in the ICT-OI provides a very useful insight into the evolution and complexity of the digital divide, more country-specific analysis are needed to understand why some countries are doing better than others. For this, the 2007 ICT-OI and its sub-indices, provide a useful framework.

Table 7.3: The Digital Divide over time

Evolution of the Digital Divide, by group							
Group	***(A) ICT-OI***						
	2001	**2002**	**2003**	**2004**	**2005**	**Change**	**Growth**
High	204.3	231.7	262.0	289.0	312.2	107.8	52.8
Upper	120.0	133.6	148.4	165.8	185.4	65.4	54.5
Medium	69.4	76.6	84.1	92.4	101.2	31.8	45.9
Low	24.7	28.4	32.1	35.5	38.2	13.5	54.8
Reference country (average)	**100.00**	**110.52**	**122.51**	**134.62**	**147.56**	**47.6**	**47.6**
	(B) Normalized ICT Opportunities						
	2001	**2002**	**2003**	**2004**	**2005**		
High	301.5	309.3	315.5	316.7	312.2		
Upper	177.1	178.4	178.7	181.7	185.4		
Medium	102.4	102.2	101.3	101.3	101.2		
Low	36.4	37.9	38.7	38.9	38.2		
Reference country (average)	**147.56**	**147.56**	**147.56**	**147.56**	**147.56**		
	(C) Digital divides						
	2001	**2002**	**2003**	**2004**	**2005**		
High-Low	265.1	271.4	276.8	277.9	274.0		
High-medium	199.1	207.1	214.2	215.4	210.9		
High-upper	124.4	130.9	136.8	135.0	126.7		
Upper-low	140.7	140.5	140.1	142.9	147.3		
Upper-medium	74.7	76.2	77.4	80.4	84.2		
Medium-Low	66.0	64.3	62.7	62.4	63.1		
	(D) Changes in digital divides						
		2001/02	**2002/03**	**2003/04**	**2004/05**		
High-Low		6.2	5.5	1.0	-3.9		
High-medium		8.0	7.1	1.3	-4.5		
High-upper		6.5	5.9	-1.8	-8.3		
Upper-low		-0.2	-0.4	2.8	4.4		
Upper-medium		1.5	1.2	3.1	3.8		
Medium-Low		-1.7	-1.6	-0.2	0.6		

Source: ITU.

7.3.5 WSIS groupings

The World Summit on the Information Society (WSIS) highlighted the need to "*pay special attention to the particular needs of people of developing countries, countries with economies in transitions, Least Developed Countries, Small Island Developing States, Landlocked Developing Counties, Highly Indebted Poor Countries, countries and territories under occupation, countries recovering from conflict and countries and regions with special needs as well as to conditions that pose severe threats to development, such as natural disasters*".[13]

The main objective of the ICT-OI is to track the progress of developing countries and highlight their opportunity to become Information Societies. While there is no official definition of "developed" economies in the UN system, it is usually agreed that this list includes some 30 economies, including countries of Western Europe, Australia, New Zealand, Japan, Singapore, South Korea and Hong Kong (China), Macau (China) and Taiwan (China) in Asia-Pacific as well as the USA, Canada, Bermuda and Israel. Almost all of these countries rank at the top of the ICT-OI although Portugal and Greece are exceptions as they rank somewhat lower.

Since the group of 'developed countries' is very large, it might be more useful for analytical purposes to use some other groupings that were mentioned during the WSIS. Those countries that were especially highlighted in the WSIS Declaration of Principles (paragraph 16) can be grouped into the following categories: Least Developed Countries,[14] Small Island Developing States,[15] Landlocked Developing States,[16] countries with special needs,[17] Heavily Indebted Poor Countries (HIPC),[18] countries affected by natural disasters,[19] and countries with economies in transitions.[20]

A group that has been receiving a lot of attention and is the focus of the development community is that of the LDCs.[21] The close link between development status and digital opportunities is highlighted through the fact that almost all LDCs rank very low in the ICT-OI (Table 7.4).

Table 7.5 provides an overview of all (63) countries ranked in the *low* ICT-OI category[22] and their status in terms of the WSIS classification, based on paragraph 16. It highlights how many countries within each classification (LDC, SIDS, transition economies etc) have low ICT-OI levels.

Table 7.4: LDCs in the ICT-OI

Country	Region	LDC	ICT-OI category
Afghanistan	Asia	LDC	LOW
Angola	Africa	LDC	LOW
Bangladesh	Asia	LDC	LOW
Benin	Africa	LDC	LOW
Bhutan	Asia	LDC	LOW
Burkina Faso	Africa	LDC	LOW
Burundi	Africa	LDC	LOW
Cambodia	Asia	LDC	LOW
Cape Verde	Africa	LDC	MEDIUM
Central African Rep.	Africa	LDC	LOW
Chad	Africa	LDC	LOW
Comoros	Africa	LDC	LOW
D.R. Congo	Africa	LDC	LOW
Djibouti	Africa	LDC	LOW
Equatorial Guinea	Africa	LDC	LOW
Eritrea	Africa	LDC	LOW
Ethiopia	Africa	LDC	LOW
Gambia	Africa	LDC	LOW
Guinea	Africa	LDC	LOW
Guinea-Bissau	Africa	LDC	LOW
Haiti	Americas	LDC	LOW
Lao P.D.R.	Asia	LDC	LOW
Lesotho	Africa	LDC	LOW
Madagascar	Africa	LDC	LOW
Malawi	Africa	LDC	LOW
Maldives	Asia	LDC	MEDIUM
Mali	Africa	LDC	LOW
Mauritania	Africa	LDC	LOW
Mozambique	Africa	LDC	LOW
Myanmar	Asia	LDC	LOW
Nepal	Asia	LDC	LOW
Niger	Africa	LDC	LOW
Rwanda	Africa	LDC	LOW
S. Tomé & Principe	Africa	LDC	LOW
Samoa	Oceania	LDC	MEDIUM
Senegal	Africa	LDC	LOW
Solomon Islands	Oceania	LDC	LOW
Somalia	Africa	LDC	LOW
Sudan	Africa	LDC	LOW
Tanzania	Africa	LDC	LOW
Togo	Africa	LDC	LOW
Uganda	Africa	LDC	LOW
Vanuatu	Oceania	LDC	LOW
Yemen	Asia	LDC	LOW

Source: ITU.

One hundred percent of the "countries with special needs" and "countries emerging from war and armed conflicts" and over 90 percent of all LDCs are within the *low* ICT-OI category. Similarly, 90 percent of the "Heavily Indebted Poor Countries" (HIPC) rank *low*. The three LDCs and four HIPCs that have *medium* ICT-OI levels are Cape Verde, Maldives and Samoa

(Samoa is both, an LDC and a HIPC) and Guyana, Bolivia, and Kyrgyzstan.[23] This indicates that they are doing better in terms of ICT opportunities than their income level and development status would suggest. Although SIDS share an economic vulnerability because of a number of shared characteristics (including small size, dependence on exports and often imported energy, as well as a fragile ecosystem) they are much more diverse in terms of income levels and development status. The group of Small Island Developing States includes a number of high and higher income economies, such as Singapore, Barbados, Jamaica, and others. In 2005, only 24 percent of all SIDS are ranked as *low* ICT-OI economies. Transition economies are doing even better, with only 16 percent situated in the *low* category by 2005. The 26 countries particularly hit by natural disaster during 2005 are represented in all four ICT-OI categories (*low*, *medium*, *upper* and *high*), with 54 percent in the *low* category, including all nine LDCs that were also hit by natural disaster in 2005. One problem with using the 2005 natural disaster statistics to identify this group is that a certain time lag exists between the moment a country suffers a disaster and the moment the impacts on the telecommunication/ICT sector are felt.

As pointed out in Figure 7.4 (2007 ICT-OI growth rates), the best performances in terms of ICT-OI improvement (2001-2005) have been achieved by some economies with very limited ICT Opportunity levels. Out of the top ten growth rate countries (with annual growth rates over 100 percent) seven are ranked in the *low* ICT-OI category. These seven are also LDCs.

Among the 63 economies ranked in the ICT-OI's *low* category, 22 economies show a high growth rate band, meaning their ICT-OI ranking has improved exceptionally well over the period of 2001-2005. Seventy-seven percent of these countries are LDCs, 45 percent are HIPCs. However, not all LDCs, HIPCs or African countries show high growth rate bands over this five-year period and 12 LDCs and 12 HIPCs have low growth rates over the same period, suggesting that some low income countries are finding it difficult to take advantage of and expand their digital opportunities.

An interesting comparison that can be used for all countries and groupings is that of 'income levels' to 'ICT-OI rankings'. While there is an obvious link between a country's income level and its ICT-OI status, it is helpful to see which countries are doing comparatively better (or worse) in terms of ICT opportunities than their GDP per capital (income) level would suggest. To calculate this difference, a country's ICT-OI rank is subtracted from its GDP rank[24] (Table 7.6, GDP rank minus ICT-OI rank). A positive number indicates that the country has achieved higher ICT Opportunity levels than its income level would expect. A negative number, on the other hand, shows that based on the country's income level, its ICT-OI level is comparatively low. This simple comparison helps countries to evaluate their efforts to spread the Information Society in relative terms (or relative to their possibilities and resources). More detailed national analysis and case studies – that go beyond the scope of this publication – can help identify other factors (regulatory framework, pricing strategies, public access projects) to explain a country's relative ranking

A comparison between the SIDS' income levels and their ICT-OI ranks shows that over 60 percent of SIDS are ranked higher in the ICT-OI than their income level (GDP per capita) would suggest. Jamaica, Guyana and S. Tomé & Principe rank as much as 30 positions above their GDP rank. The fact that these economies occupy relatively small land areas is certainly an advantage for spreading access to ICT. Another helpful characteristic is a high population density since it is more difficult to bring ICT infrastructure and access to a highly dispersed population. Four SIDS (Singapore, Maldives, Mauritius and Barbados) rank in the top-ten economies in terms of high population density and all four of these have high ICT-OI rankings, compared to their income levels.

The influence that the degree of population density has can be further analyzed. Take the top twenty most populated countries in the word (Table 7.6). This group of '20 densely populated economies' includes 7 SIDS and 4 LDCs, with some countries represented in both categories. What is remarkable is the number of countries that do comparatively well in terms of digital opportunities, compared to their income level. Fifteen out of these 20 economies are doing better in terms of ICT Opportunities than their income level (as measured by their GDP per capita) would suggest.

Table 7.5: Countries ranked *low* in the ICT-OI and their status with regards to special needs

Country	Region	LDC	SIDS	LLDC	Special need	HIPC	2005 Disaster	Transition Economies	ICT-OI rank	ICT-OI category
Afghanistan	Asia	LDC		LLDC	CEFWAC		Disaster		180	LOW
Angola	Africa	LDC							166	LOW
Bangladesh	Asia	LDC					Disaster		157	LOW
Benin	Africa	LDC				HIPC			154	LOW
Bhutan	Asia	LDC		LLDC					131	LOW
Burkina Faso	Africa	LDC		LLDC		HIPC			176	LOW
Burundi	Africa	LDC		LLDC	CEFWAC	HIPC			174	LOW
Cambodia	Asia	LDC						Transition	163	LOW
Central African Rep.	Africa	LDC		LLDC		HIPC			179	LOW
Chad	Africa	LDC		LLDC		HIPC			182	LOW
Comoros	Africa	LDC	SIDS			HIPC	Disaster		164	LOW
D.R. Congo	Africa	LDC			CEFWAC	HIPC			183	LOW
Djibouti	Africa	LDC					Disaster		146	LOW
Equatorial Guinea	Africa	LDC							150	LOW
Eritrea	Africa	LDC			CEFWAC	HIPC			167	LOW
Ethiopia	Africa	LDC		LLDC	CEFWAC	HIPC			178	LOW
Gambia	Africa	LDC				HIPC			142	LOW
Guinea	Africa	LDC			CEFWAC	HIPC			173	LOW
Guinea-Bissau	Africa	LDC	SIDS		CEFWAC	HIPC			168	LOW
Haiti	Americas	LDC	SIDS			HIPC	Disaster		147	LOW
Lao P.D.R.	Asia	LDC		LLDC				Transition	151	LOW
Lesotho	Africa	LDC		LLDC					159	LOW
Madagascar	Africa	LDC				HIPC			169	LOW
Malawi	Africa	LDC		LLDC		HIPC	Disaster		172	LOW
Mali	Africa	LDC		LLDC		HIPC			171	LOW
Mauritania	Africa	LDC				HIPC			144	LOW
Mozambique	Africa	LDC				HIPC	Disaster		170	LOW
Myanmar	Asia	LDC							177	LOW
Nepal	Asia	LDC		LLDC		HIPC			165	LOW
Niger	Africa	LDC		LLDC		HIPC	Disaster		181	LOW
Rwanda	Africa	LDC		LLDC	CEFWAC	HIPC			175	LOW
S. Tomé & Principe	Africa	LDC	SIDS						126	LOW
Senegal	Africa	LDC				HIPC			136	LOW
Solomon Islands	Oceania	LDC	SIDS						156	LOW
Somalia	Africa	LDC			CEFWAC	HIPC			158	LOW
Sudan	Africa	LDC				HIPC			135	LOW
Tanzania	Africa	LDC				HIPC			160	LOW
Togo	Africa	LDC				HIPC			138	LOW
Uganda	Africa	LDC		LLDC		HIPC			162	LOW
Vanuatu	Oceania	LDC	SIDS						143	LOW
Yemen	Asia	LDC							137	LOW
Zambia	Africa	LDC		LLDC		HIPC	Disaster		153	LOW
Botswana	Africa			LLDC					123	LOW
Cameroon	Africa					HIPC			149	LOW
Congo	Africa					HIPC			161	LOW
Côte d'Ivoire	Africa					HIPC			152	LOW
Cuba	Americas		SIDS				Disaster		132	LOW
Ghana	Africa					HIPC			148	LOW
Honduras	Americas					HIPC			125	LOW
India	Asia						Disaster		133	LOW
Indonesia	Asia						Disaster		121	LOW
Kenya	Africa						Disaster		145	LOW
Libya	Africa								122	LOW
Nicaragua	Americas					HIPC			124	LOW
Nigeria	Africa								141	LOW
Pakistan	Asia						Disaster		139	LOW
Papua New Guinea	Oceania		SIDS						155	LOW
Sri Lanka	Asia								128	LOW
Swaziland	Africa			LLDC					130	LOW
Tajikistan	Asia			LLDC				Transition	140	LOW
Turkmenistan	Asia			LLDC				Transition	134	LOW
Uzbekistan	Asia			LLDC				Transition	129	LOW
Zimbabwe	Africa			LLDC					127	LOW
Countries per category		**45**	**33**	**31**	**9**	**38**	**26**	**31**		
Low' ICT-OI ranking per category		**42**	**8**	**22**	**9**	**34**	**14**	**5**		
Low-ranked countries a % of total		**93.3**	**24.2**	**71.0**	**100.0**	**89.5**	**53.8**	**16.1**		

Note: LDC – Least Developed countries; SIDS – Small Island Developing States; LLDC – Landlocked Developing Countries; CEFWAC – Countries Emerging from War and Armed Conflicts; HIPC – Heavily Indebted Poor Countries; 2005 Disaster – countries particularly affected by natural disasters in 2005.

Source: ITU. Categories and definitions were adapted from UN and IMF.

Table 7.6: ICT Opportunities, income levels and population density

Economy	Region	LDC	SIDS	ICT-OI rank	GDP Rank	Difference (GDP rank minus ICT-OI rank)	Population density (persons per square km)
Macao, China	Asia			21	26	5	19'327.73
Hong Kong, China	Asia			3	21	18	6'629.94
Singapore	Asia		SIDS	7	20	13	6'373.81
Malta	Europe			35	43	8	1'268.99
Maldives	Asia	LDC	SIDS	88	92	4	1'100.67
Bahrain	Asia			44	38	-6	1'024.85
Bangladesh	Asia	LDC		157	159	2	984.89
Mauritius	Africa		SIDS	56	63	7	667.56
Taiwan, China	Asia			17	40	23	632.71
Barbados	Americas		SIDS	25	50	25	625.58
Palestine	Asia			99	128	29	614.95
Aruba	Americas		SIDS	32	28	-4	515.38
Korea (Rep.)	Asia			22	41	19	490.56
Puerto Rico	Americas		SIDS	72	36	-36	441.46
Comoros	Africa	LDC	SIDS	165	152	-13	428.57
Netherlands	Europe			4	8	4	395.99
India	Asia			133	139	6	348.42
Lebanon	Asia			62	64	2	343.94
Belgium	Europe			12	13	1	343.88
Rwanda	Africa	LDC		175	174	-1	343.22

Note: The difference (GDP rank minus ICT-OI rank) is calculated by subtracting a country's ICT-OI rank from its GDP rank. A positive number indicates that the country has achieved higher ICT Opportunity levels than its income level would expect. A negative number, on the other hand, shows that based on the country's income level, its ICT-OI level is comparatively low.

Source: ITU.

7.4 CONCLUSIONS

The 2007 World Telecommunication Indicators and ICT Opportunity Index (ICT-OI) provide the latest available data on the telecommunication/ICT sector, as well as ITU's most recent product in the area of international benchmarking.

The ICT-OI, which has benefited from the expertise of several international and research organizations, is based on a carefully selected list of indicators and methodology. It is an important tool to track the digital divide by measuring the relative difference in ICT Opportunity levels among economies, and over time. It further presents an important step in achieving the objectives identified by the World Summit on the Information Society (WSIS) by helping countries and regions to realistically evaluate their performance. The 2007 ICT-OI, which is an inclusive index and provides measurement across 183 economies, relies on ten indicators that help measure ICT networks, education and skills, uptake and intensity of the use of ICT. For analytical purposes, economies are grouped into four categories, ranging from *high* to *low* ICT Opportunities. Apart from cross-country comparisons, the index's methodology highlights relative movements between 2001-2005, and shows which countries are making progress and how fast.

A summary of the 2007 ICT-OI results showed that significant progress has been made across almost all economies and all areas of the telecommunication/ICT sector since the beginning of this century. At the same time, major differences remain. The findings highlight that the digital divide, which is understood as the relative difference in ICT Opportunity levels among economies and groups, needs to be seen in perspective and will show different results, depending on which economies or groups are being compared. The ICT-OI highlights that between 2001-2005 the divide increased between those economies that already have very high ICT levels and the rest of the world. It decreased between the *medium* group and the *low* group, indicating that countries with low levels of

somewhat been able to catch up and reduce the divide compared to countries in the *medium* level.

An indicator-centric analysis suggests that the majority of countries are lagging behind in terms of broadband uptake and the difference in broadband penetration between economies with *high* ICT-OI levels and the rest of the world is significant and greater than for any other indicator. For policy makers, this finding suggests that more efforts need to be undertaken to integrate and strengthen broadband policies and strategies.

The development of the ICT Opportunity Index has been based on the notion that the tracking of a composite measure is relevant for policy implications, particularly in a developmental context. Further, social and economic policies of countries also impact indirectly on the extent of usage and thus the uptake and intensity of ICT goods and services. It is therefore important not to limit measurements to the ICT sector, only, but instead to monitor broader social and economic trends. It is only then that meaningful inferences can be drawn regarding the impact of ICT on social and economic development.

Finally, it should be noted that more detailed and country specific (case) studies need to be carried out to understand the reasons for the progress that countries are making in the area of telecommunication/ICT. Here, the ICT-OI can be a guiding tool to highlight and select countries that are doing particularly well, over time and compared to other countries. Based on its year-to-year analysis and itemization of indicators, it may also be used to assess the impact of new policies and regulatory changes.

Notes

[1] Only minor changes have been made to the conceptual framework of the ICT-OI published in 2005 and parts of this introduction have been adapted from the previous ICT Opportunity Index publication. See: George Sciadas (Editor). From the Digital Divide to Digital Opportunities. Measuring Infostates for Development. Orbicom and ITU, 2005.

[2] In 2003, ITU developed the Digital Access Index to measure the overall ability of individuals in a country to access and use ICT. The index captured availability of infrastructure, affordability ,educational level and quality. The indicators covered fixed and mobile subscribers, internet access price, literacy and school enrolment, as well as quality parameters such as broadband subscribers and international internet bandwidth. Only those factors that affected the availability of ICT were taken into account.

[3] See http://www.itu.int/ITU-D/ict/publications/dd/summary.html.

[4] This framework was first presented by Orbicom in its publication "Monitoring the Digital Divide – Observatoire de la fracture numérique" in 2002. At this stage, the conceptual framework was presented and articulated with only a pilot application to demonstrate the empirical feasibility of the theory in nine countries. This was mostly used for wide consultations and led to the 2003 publication, after which the joint index with ITU was initiated.

[5] George Sciadas (Editor). From the Digital Divide to Digital Opportunities. Measuring Infostates for Development. Orbicom and ITU, 2005.

[6] See: http://www.itu.int/ITU-D/ict/mdg/.

[7] See Partnership on Measuring ICT for Development, at: http://www.itu.int/ITU-D/ict/partnership/index.html.

[8] A major drawback with the indicator "internet hosts per 100 population" is that although internet hosts are assumed to be located in the country shown by their two-letter ISO country code Top Level Domain (ccTLD) (e.g., .ch for Switzerland), this is not necessarily the case. A host with the .ch domain name might actually be located anywhere in the world. Also, the very popular .com domain name, which is used all over the world, cannot be assigned to one single country.

[9] The importance of broadband technologies was highlighted in the ITU's 2006 World Telecommunication Development Report, see: http://www.itu.int/ITU-D/ict/publications/wtdr_06/index.html.

[10] Each country contact received the available data for the eight ITU indicators for 2001 to 2005: main telephone lines in operation, international outgoing telephone traffic (in minutes), cellular mobile telephone subscribers, internet users, total broadband internet subscribers, international internet bandwidth, number of computers and percentage of households with a TV.

[11] The UNESCO indicators on school enrollment and literacy rate are provided in terms of penetration rates by UNESCO.

[12] Since 57 cannot be divided into two equal groups of countries, 29 countries were classified as *high* and 28 countries were classified as *upper*.

[13] WSIS Declaration of Principles, Para 16.

[14] For the complete list of LDCs, see: http://www.un.org/special-rep/ohrlls/ldc/list.htm.

[15] For the complete list of SIDS see, http://www.itu.int/ITU-D/ldc/sids/sids_region1.html.

[16] For the complete list of LLDS, see: http://www.un.org/special-rep/ohrlls/lldc/list.htm.

[17] For a list of countries with special needs (Countries Emerging from War and Armed Conflicts), see: http://web/ITU-D/ldc/special-needs.html.

[18] For the list of HIPC, see: http://www.imf.org/external/np/pp/eng/2006/082106.pdf (page 5).

[19] While there is no clear definition for this group of countries, a number of organisations (including the United Nations International Strategy for Disaster Reduction, the Centre for Research on the Epidemiology of Disasters (CRED)) have published some information called "2005 disasters in numbers", which lists a total of 25 countries that were particularly affected by natural disasters in 2005. See: http://www.unisdr.org/disaster-statistics/pdf/2005-disaster-in-numbers.pdf.

[20] While the term 'economies in transition' is not clearly defined, the IMF has identified some key ingredients of a transition process, which includes liberalization, macroeconomic stabilization, restructuring and privatization, and legal and institutional reforms. For a list of the 25 IMF defined economies in transition, see: http://www.imf.org/external/np/res/seminars/2004/calvo/pdf/fische.pdf (page 14). Also see:

http://www.ebrd.com/pubs/econo/wp0060.pdf (page 26) and
http://www.un.org/esa/policy/reports/e_i_t/n0647258.pdf (page 24).

[21] The United Nations General Assembly decides which countries are included in (or graduate from) the list of LDCs under the recommendation of ECOSOC, see: http://www.itu.int/ITU-D/ldc/who.html.

[22] As was mentioned earlier in the text, the category 'developing countries' was not included for analytical purposes since this group is very large and includes over 85 percent of the countries included in the ICT-OI.

[23] It should be noted that both, Cape Verde and Samoa, are expected to graduate from the LDC list, soon.

[24] The GDP rank is based on all countries' GDP per capita levels.

Annex 1: 2007 ICT-OI sub-indices: Infodensity (networks and skills) and Infouse (uptake and intensity)

Economy	NET-WORKS SKILLS Index	index	INFO-DENSITY Index	UP-TAKE index	INTENSITY Index	INFOUse Index	ICT-OI value
Sweden	605.1	153.8	**305.1**	464.5	470.59	**467.56**	**377.69**
Luxembourg	675.5	112.0	**275.1**	412.6	607.37	**500.61**	**371.10**
Hong Kong, China	553.7	117.0	**254.5**	366.7	751.74	**525.01**	**365.54**
Netherlands	555.6	141.6	**280.5**	472.6	466.09	**469.35**	**362.82**
Denmark	616.5	145.8	**299.8**	390.2	483.22	**434.22**	**360.79**
Switzerland	548.7	110.3	**246.0**	417.8	618.51	**508.32**	**353.60**
Singapore	437.6	136.3	**244.2**	395.9	611.56	**492.08**	**346.68**
United Kingdom	590.4	156.9	**304.4**	391.1	397.26	**394.17**	**346.37**
Iceland	486.2	141.4	**262.2**	411.5	475.50	**442.36**	**340.57**
Norway	492.8	147.4	**269.5**	387.7	466.27	**425.20**	**338.53**
Canada	398.5	136.0	**232.8**	422.1	565.06	**488.36**	**337.16**
Belgium	498.0	153.3	**276.3**	304.5	475.09	**380.37**	**324.21**
United States	346.7	143.3	**222.8**	443.6	499.37	**470.64**	**323.85**
Australia	426.0	155.9	**257.7**	447.5	365.16	**404.22**	**322.73**
Austria	449.1	131.8	**243.3**	365.1	403.75	**383.94**	**305.60**
Germany	496.0	131.2	**255.0**	355.9	366.09	**360.97**	**303.42**
Taiwan, China	432.0	110.1	**218.1**	381.3	462.92	**420.12**	**302.71**
Israel	335.4	133.7	**211.7**	358.2	482.61	**415.77**	**296.71**
Finland	371.3	154.0	**239.1**	347.9	373.18	**360.33**	**293.51**
Ireland	440.4	137.5	**246.1**	308.8	359.46	**333.15**	**286.32**
Macao, China	358.4	131.0	**216.7**	272.7	483.08	**362.94**	**280.45**
Korea (Rep.)	254.1	144.9	**191.9**	392.3	425.85	**408.74**	**280.08**
France	354.4	137.3	**220.6**	341.4	361.42	**351.26**	**278.34**
Estonia	339.6	137.2	**215.9**	346.2	328.50	**337.24**	**269.81**
Barbados	303.7	130.4	**199.0**	239.7	518.63	**352.57**	**264.85**
New Zealand	256.2	146.9	**194.0**	387.0	302.89	**342.35**	**257.73**
Japan	243.3	132.7	**179.7**	386.5	348.96	**367.25**	**256.90**
Italy	332.4	135.0	**211.8**	305.7	311.60	**308.63**	**255.68**
Spain	331.9	142.3	**217.3**	255.2	320.37	**285.92**	**249.28**
Slovenia	261.8	146.0	**195.5**	332.2	289.02	**309.86**	**246.13**
Antigua & Barbuda	444.0	123.8	**234.4**	236.1	277.26	**255.86**	**244.92**
Aruba	316.9	123.8	**198.1**	155.7	528.52	**286.85**	**238.36**
Cyprus	233.6	121.3	**168.3**	279.1	307.04	**292.72**	**221.95**
Latvia	228.7	138.5	**178.0**	262.1	275.85	**268.90**	**218.77**
Malta	298.3	111.1	**182.0**	202.0	303.39	**247.55**	**212.27**
Portugal	253.4	134.8	**184.9**	184.3	306.29	**237.57**	**209.57**
Czech Republic	295.8	125.0	**192.3**	231.5	197.35	**213.74**	**202.72**
Lithuania	245.9	140.3	**185.7**	219.2	218.66	**218.90**	**201.63**
Qatar	215.6	113.9	**156.7**	199.4	306.99	**247.40**	**196.92**
Hungary	232.6	133.7	**176.3**	192.4	229.06	**209.96**	**192.41**
United Arab Emirates	222.1	93.1	**143.8**	218.7	294.05	**253.60**	**190.99**
Slovak Republic	249.2	122.4	**174.7**	274.6	152.06	**204.36**	**188.92**
Bahamas	195.4	116.4	**150.8**	183.2	275.83	**224.77**	**184.13**
Bahrain	203.1	114.7	**152.6**	182.2	260.73	**217.98**	**182.40**
Croatia	241.5	121.3	**171.2**	217.8	151.75	**181.79**	**176.41**
Poland	190.7	137.5	**162.0**	211.6	137.94	**170.86**	**166.36**
Jamaica	363.9	94.1	**185.0**	154.5	140.65	**147.41**	**165.16**
Greece	252.2	139.2	**187.4**	140.2	141.11	**140.65**	**162.34**
Virgin Islands (US)	228.3	130.4	**172.5**	84.4	261.72	**148.65**	**160.13**
Chile	176.0	122.4	**146.8**	157.0	182.68	**169.33**	**157.65**
Grenada	164.3	130.4	**146.3**	168.1	167.94	**168.00**	**156.79**
Brunei Darussalam	195.7	110.5	**147.0**	173.8	157.95	**165.70**	**156.09**
French Polynesia	126.9	137.3	**132.0**	153.7	211.23	**180.17**	**154.21**
Kuwait	159.3	111.3	**133.1**	210.4	150.38	**177.88**	**153.88**
Romania	158.3	120.8	**138.2**	165.1	162.38	**163.72**	**150.45**
Mauritius	141.6	100.7	**119.4**	185.0	193.28	**189.08**	**150.27**
Malaysia	133.3	104.7	**118.1**	244.3	149.28	**190.96**	**150.19**
Reference country	**164.4**	**102.6**	**129.9**	**147.5**	**190.60**	**167.66**	**147.56**
New Caledonia	158.1	137.1	**147.2**	102.0	208.96	**146.01**	**146.61**
Uruguay	145.9	128.2	**136.8**	164.0	137.49	**150.15**	**143.31**
Argentina	149.4	137.1	**143.1**	135.3	140.23	**137.72**	**140.40**
Seychelles	151.3	102.1	**124.3**	197.5	124.83	**157.00**	**139.67**
Lebanon	110.6	120.9	**115.6**	153.9	182.19	**167.45**	**139.15**
Russia	161.9	139.2	**150.1**	144.7	108.89	**125.53**	**137.27**
Brazil	124.2	121.0	**122.6**	168.6	136.78	**151.86**	**136.44**
St. Vincent	122.2	120.2	**121.2**	115.6	179.83	**144.18**	**132.19**
Costa Rica	121.2	105.0	**112.8**	197.2	115.79	**151.12**	**130.58**
Turkey	158.6	116.0	**135.6**	109.6	135.32	**121.80**	**128.53**
Trinidad & Tobago	156.4	108.1	**130.0**	122.0	127.02	**124.50**	**127.22**
Belize	117.0	105.0	**110.8**	149.3	142.13	**145.66**	**127.06**
Mexico	113.7	108.8	**111.2**	150.9	129.47	**139.80**	**124.68**
Bulgaria	185.5	127.8	**154.0**	128.7	76.15	**99.01**	**123.46**
Puerto Rico	185.3	117.3	**147.4**	68.0	154.02	**102.34**	**122.83**
TFYR Macedonia	137.6	115.3	**126.0**	140.6	94.10	**115.01**	**120.36**
Belarus	133.5	134.4	**134.0**	148.9	77.82	**107.65**	**120.09**
Saudi Arabia	111.1	94.0	**102.2**	174.6	99.93	**132.10**	**116.20**
Venezuela	102.0	114.6	**108.1**	120.0	120.47	**120.24**	**114.03**
Bosnia	118.3	121.3	**119.8**	117.9	97.96	**107.46**	**113.44**
Serbia and Montenegro	165.1	121.3	**141.5**	95.9	79.75	**87.43**	**111.23**
China	113.3	106.1	**109.6**	81.6	146.17	**109.21**	**109.41**
Colombia	131.4	110.9	**120.7**	87.3	96.71	**91.89**	**105.32**
Peru	73.6	113.3	**91.3**	125.2	114.31	**119.62**	**104.50**
Ukraine	118.0	135.3	**126.4**	85.4	80.14	**82.75**	**102.26**
Moldova	101.2	111.2	**106.1**	114.2	84.82	**98.44**	**102.19**
Jordan	87.0	114.1	**99.6**	116.7	94.12	**104.80**	**102.17**
Guyana	97.4	112.1	**104.5**	108.6	86.71	**97.03**	**100.69**
Oman	103.4	100.4	**101.9**	90.7	108.06	**99.01**	**100.44**
Thailand	102.3	114.1	**108.0**	105.3	78.87	**91.13**	**99.20**
Maldives	96.2	94.3	**95.3**	99.7	106.37	**102.99**	**99.06**
Suriname	119.3	107.9	**113.4**	70.5	98.76	**83.46**	**97.30**
South Africa	104.7	101.0	**102.8**	96.3	86.15	**91.08**	**96.78**
Panama	109.4	117.3	**113.3**	72.8	93.44	**82.50**	**96.69**

Annex 1: 2007 ICT-OI sub-indices: Infodensity (networks and skills) and Infouse (uptake and intensity)

Economy	NET-WORKS Index	SKILLS index	INFO-DENSITY Index	UP-TAKE index	INTENSITY Index	INFOUse Index	ICT-OI value
Ecuador	105.3	114.2	**109.7**	89.4	80.40	**84.77**	**96.42**
El Salvador	92.8	94.8	**93.8**	87.4	107.06	**96.73**	**95.27**
Tunisia	107.1	99.2	**103.1**	93.6	82.35	**87.78**	**95.12**
Dominican Rep.	86.4	109.6	**97.3**	79.2	106.39	**91.77**	**94.50**
Fiji	82.9	107.9	**94.6**	78.8	105.95	**91.39**	**92.97**
Georgia	93.3	121.3	**106.4**	75.4	77.84	**76.63**	**90.28**
Iran (I.R.)	76.8	98.4	**86.9**	117.4	73.11	**92.65**	**89.74**
Palestine	78.4	122.7	**98.0**	81.5	81.27	**81.40**	**89.33**
Mongolia	58.3	123.4	**84.8**	111.2	73.82	**90.61**	**87.68**
Armenia	69.6	118.0	**90.7**	92.8	76.17	**84.07**	**87.30**
Kazakhstan	98.9	131.5	**114.1**	55.1	73.90	**63.81**	**85.32**
Azerbaijan	83.0	108.5	**94.9**	74.9	73.42	**74.16**	**83.90**
Tonga	87.1	110.6	**98.1**	43.0	101.69	**66.10**	**80.54**
Morocco	73.1	68.8	**71.0**	78.5	101.15	**89.09**	**79.50**
Albania	91.8	108.9	**100.0**	53.9	73.29	**62.83**	**79.25**
Egypt	75.9	91.2	**83.2**	71.5	77.97	**74.68**	**78.82**
Philippines	64.9	114.2	**86.1**	67.8	76.73	**72.12**	**78.81**
Cape Verde	75.0	65.7	**70.2**	89.7	82.53	**86.02**	**77.70**
Paraguay	64.7	107.7	**83.5**	68.5	75.82	**72.09**	**77.59**
Viet Nam	71.0	96.6	**82.8**	62.7	80.37	**70.97**	**76.66**
Syria	71.7	94.0	**82.1**	68.8	73.90	**71.32**	**76.53**
Algeria	79.9	94.6	**87.0**	45.4	94.83	**65.63**	**75.55**
Namibia	64.0	87.9	**75.0**	68.4	76.91	**72.52**	**73.74**
Micronesia	62.3	110.6	**83.0**	55.7	76.73	**65.39**	**73.67**
Bolivia	67.7	117.3	**89.1**	47.2	76.80	**60.20**	**73.24**
Guatemala	84.5	79.1	**81.8**	48.2	84.96	**63.98**	**72.34**
Samoa	61.3	103.9	**79.8**	46.6	74.20	**58.77**	**68.48**
Gabon	63.6	80.6	**71.6**	52.2	81.96	**65.41**	**68.43**
Kyrgyzstan	51.6	122.5	**79.5**	43.9	75.72	**57.68**	**67.72**
Indonesia	57.5	102.6	**76.8**	48.8	72.84	**59.62**	**67.68**
Libya	48.5	126.3	**78.3**	42.0	77.07	**56.86**	**66.71**
Botswana	82.4	93.1	**87.6**	30.1	83.02	**49.98**	**66.16**
Nicaragua	48.3	99.4	**69.3**	44.7	78.98	**59.42**	**64.18**
Honduras	57.7	99.6	**75.8**	38.7	72.33	**52.93**	**63.35**
S. Tomé & Principe	38.6	69.9	**52.0**	69.7	73.54	**71.60**	**61.01**
Zimbabwe	29.0	78.2	**47.6**	74.3	76.89	**75.61**	**60.02**
Sri Lanka	54.0	98.3	**72.9**	29.4	76.72	**47.48**	**58.82**
Uzbekistan	30.4	113.6	**58.8**	46.8	72.56	**58.27**	**58.54**
Swaziland	46.8	76.9	**60.0**	36.9	75.64	**52.83**	**56.31**
Bhutan	30.6	123.4	**61.5**	35.8	72.12	**50.81**	**55.88**
Cuba	24.4	133.1	**56.9**	40.5	71.26	**53.70**	**55.30**
India	38.9	78.6	**55.3**	35.6	75.48	**51.81**	**53.55**
Turkmenistan	25.0	113.6	**53.3**	39.2	72.35	**53.28**	**53.29**
Sudan	25.1	58.6	**38.4**	58.6	71.54	**64.73**	**49.83**
Senegal	38.9	43.8	**41.3**	36.2	79.78	**53.76**	**47.11**
Yemen	41.0	65.9	**51.9**	24.3	71.17	**41.58**	**46.47**

Economy	NET-WORKS Index	SKILLS index	INFO-DENSITY Index	UP-TAKE index	INTENSITY Index	INFOUse Index	ICT-OI value
Togo	22.5	58.4	**36.2**	47.0	71.47	**57.93**	**45.81**
Pakistan	35.5	55.3	**44.3**	30.3	72.11	**46.73**	**45.50**
Tajikistan	29.6	109.7	**57.0**	18.1	71.19	**35.86**	**45.20**
Nigeria	27.4	74.0	**45.0**	26.5	71.24	**43.45**	**44.23**
Gambia	42.1	50.2	**46.0**	23.6	75.27	**42.11**	**43.99**
Vanuatu	31.2	90.7	**53.2**	16.9	74.96	**35.57**	**43.50**
Mauritania	37.3	59.4	**47.1**	22.0	72.74	**39.99**	**43.38**
Kenya	25.9	73.2	**43.5**	23.7	70.97	**41.03**	**42.26**
Djibouti	25.8	48.2	**35.2**	30.1	76.67	**48.01**	**41.13**
Haiti	25.2	86.1	**46.6**	18.0	71.53	**35.92**	**40.92**
Ghana	30.9	71.1	**46.9**	16.6	71.76	**34.52**	**40.23**
Cameroon	23.8	72.0	**41.4**	20.2	71.41	**37.94**	**39.62**
Equatorial Guinea	39.8	36.9	**38.3**	22.1	73.62	**40.31**	**39.30**
Lao P.D.R.	27.8	78.3	**46.7**	15.4	71.28	**33.09**	**39.29**
Côte d'Ivoire	30.7	47.6	**38.2**	22.5	71.62	**40.12**	**39.15**
Zambia	21.8	59.1	**35.9**	24.1	70.98	**41.38**	**38.52**
Benin	25.2	42.6	**32.8**	20.0	71.56	**37.82**	**35.20**
Papua New Guinea	12.9	51.8	**25.9**	29.5	70.85	**45.68**	**34.38**
Solomon Islands	14.6	86.6	**35.6**	13.8	77.05	**32.60**	**34.05**
Bangladesh	19.5	61.3	**34.6**	11.7	70.91	**28.77**	**31.56**
Somalia	22.6	56.9	**35.9**	10.8	71.06	**27.69**	**31.51**
Lesotho	38.8	80.8	**56.0**	4.3	73.16	**17.67**	**31.45**
Tanzania	17.7	58.1	**32.1**	13.1	70.81	**30.40**	**31.24**
Congo	19.7	73.8	**38.1**	8.4	71.12	**24.49**	**30.54**
Uganda	13.0	65.4	**29.1**	12.8	71.11	**30.23**	**29.66**
Angola	21.3	54.2	**34.0**	8.4	71.22	**24.47**	**28.82**
Cambodia	14.0	76.7	**32.8**	8.9	71.24	**25.20**	**28.75**
Comoros	18.8	33.4	**25.1**	14.7	71.74	**32.48**	**28.55**
Nepal	13.3	66.8	**29.8**	9.6	70.97	**26.14**	**27.91**
Eritrea	10.7	54.4	**24.1**	13.6	70.98	**31.01**	**27.36**
Guinea-Bissau	20.4	29.5	**24.5**	13.1	71.00	**30.49**	**27.34**
Madagascar	11.6	77.0	**29.8**	7.3	70.78	**22.72**	**26.03**
Mozambique	15.0	48.4	**27.0**	8.5	70.88	**24.49**	**25.70**
Mali	19.9	24.0	**21.9**	8.0	71.74	**24.02**	**22.92**
Malawi	16.1	68.3	**33.1**	3.4	71.90	**15.68**	**22.79**
Guinea	10.7	33.6	**18.9**	8.2	72.01	**24.35**	**21.46**
Burundi	10.9	27.6	**17.4**	9.6	70.73	**26.04**	**21.26**
Rwanda	10.7	60.1	**25.3**	3.7	71.86	**16.22**	**20.27**
Burkina Faso	17.3	23.7	**20.3**	5.1	71.76	**19.13**	**19.69**
Myanmar	7.8	86.7	**26.1**	2.8	70.76	**14.01**	**19.11**
Ethiopia	8.7	49.5	**20.7**	3.2	70.77	**15.08**	**17.68**
Central African Rep.	9.9	40.7	**20.0**	2.9	71.12	**14.38**	**16.97**
Afghanistan	12.8	49.9	**25.3**	1.1	70.77	**8.79**	**14.91**
Niger	8.3	33.6	**16.7**	2.4	70.81	**13.00**	**14.75**
Chad	7.7	22.8	**13.2**	3.0	70.82	**14.47**	**13.82**
D.R. Congo	5.2	55.8	**17.0**	1.1	71.20	**8.97**	**12.33**

Annex 2: 2007 ICT-OI average annual growth rates, 2001-2005 and growth rate bands

Economy	Average annual growth rate 2001-2005	Growth rate bands	2005 ICT-OI Value
Afghanistan	366.71	HIGH	14.91
Eritrea	232.96	HIGH	27.36
Bhutan	187.25	HIGH	55.88
Guinea-Bissau	182.64	HIGH	27.34
Micronesia	178.63	HIGH	73.67
Comoros	172.29	HIGH	28.55
S. Tomé & Principe	165.69	HIGH	61.01
Myanmar	111.54	HIGH	19.11
Barbados	108.93	HIGH	264.85
Algeria	107.84	HIGH	75.55
Nigeria	105.87	HIGH	44.23
Sudan	99.76	HIGH	49.83
Jamaica	99.43	HIGH	165.16
Latvia	98.92	HIGH	218.77
Yemen	97.67	HIGH	46.47
Lithuania	95.21	HIGH	201.63
Antigua & Barbuda	92.75	HIGH	244.92
Tajikistan	92.03	HIGH	45.20
Somalia	91.40	HIGH	31.51
Tonga	87.46	HIGH	80.54
Niger	86.75	HIGH	14.75
Israel	86.71	HIGH	296.71
Romania	86.33	HIGH	150.45
Syria	82.59	HIGH	76.53
Pakistan	79.51	HIGH	45.50
Qatar	79.39	HIGH	196.92
Estonia	78.08	HIGH	269.81
Luxembourg	77.20	HIGH	371.10
Angola	77.13	HIGH	28.82
Viet Nam	76.19	HIGH	76.66
Belarus	75.83	HIGH	120.09
Australia	75.59	HIGH	322.73
Ethiopia	74.99	HIGH	17.68
D.R. Congo	72.74	HIGH	12.33
Moldova	71.49	HIGH	102.19
Russia	71.29	HIGH	137.27
Bangladesh	70.74	HIGH	31.56
India	69.90	HIGH	53.55
Armenia	69.29	HIGH	87.30
Aruba	68.90	HIGH	238.36
Azerbaijan	68.12	HIGH	83.90
China	67.22	HIGH	109.41
Lao P.D.R.	66.71	HIGH	39.29
United Kingdom	65.94	HIGH	346.37
Macao, China	63.78	HIGH	280.45
Burundi	61.58	HIGH	21.26
Ghana	60.80	HIGH	40.23
New Caledonia	60.79	UPPER	146.61
Haiti	60.65	UPPER	40.92
Hungary	59.16	UPPER	192.41
Slovenia	59.12	UPPER	246.13
Taiwan, China	58.59	UPPER	302.71
Ireland	58.44	UPPER	286.32
Poland	58.20	UPPER	166.36
Morocco	57.95	UPPER	79.50
Ukraine	57.75	UPPER	102.26
Bosnia	57.72	UPPER	113.44
Albania	57.49	UPPER	79.25
Turkmenistan	57.42	UPPER	53.29
Hong Kong, China	57.09	UPPER	365.54
Mauritius	56.96	UPPER	150.27
Uganda	56.84	UPPER	29.66
Brazil	56.43	UPPER	136.44
Mongolia	56.32	UPPER	87.68
Italy	56.28	UPPER	255.68
Tanzania	56.12	UPPER	31.24
Zimbabwe	56.03	UPPER	60.02
Mauritania	55.73	UPPER	43.38
Benin	55.57	UPPER	35.20
Djibouti	55.25	UPPER	41.13
Spain	54.20	UPPER	249.28
French Polynesia	54.12	UPPER	154.21
Slovak Republic	53.42	UPPER	188.92
Netherlands	53.04	UPPER	362.82
Uzbekistan	52.96	UPPER	58.54
Kazakhstan	52.73	UPPER	85.32
Grenada	52.39	UPPER	156.79
TFYR Macedonia	52.27	UPPER	120.36
Egypt	51.89	UPPER	78.82
Norway	51.76	UPPER	338.53
Ecuador	50.97	UPPER	96.42
Zambia	50.66	UPPER	38.52
Iceland	50.62	UPPER	340.57
St. Vincent	50.08	UPPER	132.19
Tunisia	50.07	UPPER	95.12
Czech Republic	49.96	UPPER	202.72
Singapore	49.79	UPPER	346.68
Lebanon	49.61	UPPER	139.15
Colombia	49.45	UPPER	105.32
Croatia	49.25	UPPER	176.41
Turkey	48.84	UPPER	128.53
Maldives	48.50	UPPER	99.06
El Salvador	48.00	UPPER	95.27
Cameroon	47.77	UPPER	39.62
Nepal	47.14	MEDIUM	27.91
Cuba	46.78	MEDIUM	55.30
Libya	46.47	MEDIUM	66.71
France	46.15	MEDIUM	278.34
Peru	45.99	MEDIUM	104.50
Saudi Arabia	45.19	MEDIUM	116.20
Indonesia	44.87	MEDIUM	67.68
Kuwait	44.80	MEDIUM	153.88
Mozambique	44.67	MEDIUM	25.70
Georgia	44.61	MEDIUM	90.28
Mali	44.28	MEDIUM	22.92
United States	44.17	MEDIUM	323.85
Iran (I.R.)	44.16	MEDIUM	89.74
Guatemala	43.81	MEDIUM	72.34
Finland	43.63	MEDIUM	293.51
Samoa	43.56	MEDIUM	68.48
Sweden	43.52	MEDIUM	377.69
Sri Lanka	43.39	MEDIUM	58.82

Annex 2: 2007 ICT-OI average annual growth rates, 2001-2005 and growth rate bands

Economy	Average annual growth rate 2001-2005	Growth rate bands	2005 ICT-OI Value
Germany	43.38	MEDIUM	303.42
Switzerland	43.26	MEDIUM	353.60
Belize	43.18	MEDIUM	127.06
New Zealand	43.06	MEDIUM	257.73
United Arab Emirates	42.99	MEDIUM	190.99
Congo	42.89	MEDIUM	30.54
Cyprus	42.80	MEDIUM	221.95
Equatorial Guinea	42.77	MEDIUM	39.30
Japan	42.71	MEDIUM	256.90
Portugal	42.19	MEDIUM	209.57
Denmark	42.07	MEDIUM	360.79
Cambodia	41.96	MEDIUM	28.75
Kenya	41.78	MEDIUM	42.26
Belgium	41.77	MEDIUM	324.21
Mexico	41.62	MEDIUM	124.68
Kyrgyzstan	41.60	MEDIUM	67.72
Puerto Rico	41.11	MEDIUM	122.83
Oman	41.01	MEDIUM	100.44
Costa Rica	39.96	MEDIUM	130.58
Fiji	39.84	MEDIUM	92.97
Malaysia	39.57	MEDIUM	150.19
Bahrain	39.53	MEDIUM	182.40
Vanuatu	39.35	MEDIUM	43.50
Virgin Islands (US)	38.82	MEDIUM	160.13
Korea (Rep.)	38.57	MEDIUM	280.08
Gabon	38.39	MEDIUM	68.43
Senegal	38.06	MEDIUM	47.11
Argentina	37.86	LOW	140.40
Uruguay	37.66	LOW	143.31
Venezuela	36.67	LOW	114.03
Serbia and Montenegro	36.54	LOW	111.23
Chile	36.16	LOW	157.65
Brunei Darussalam	36.09	LOW	156.09
Central African Rep.	35.87	LOW	16.97
Nicaragua	35.80	LOW	64.18
Malawi	35.80	LOW	22.79
Trinidad & Tobago	35.74	LOW	127.22
Honduras	35.72	LOW	63.35
Palestine	35.66	LOW	89.33
Burkina Faso	35.62	LOW	19.69
Canada	33.69	LOW	337.16
Madagascar	33.61	LOW	26.03
Austria	32.86	LOW	305.60
Greece	32.75	LOW	162.34
Malta	32.41	LOW	212.27
Thailand	31.97	LOW	99.20
Swaziland	31.48	LOW	56.31
Dominican Rep.	31.41	LOW	94.50
Bahamas	31.10	LOW	184.13
Bulgaria	30.11	LOW	123.46
Jordan	29.87	LOW	102.17
Cape Verde	29.37	LOW	77.70
Paraguay	28.39	LOW	77.59
Gambia	27.97	LOW	43.99
Solomon Islands	27.18	LOW	34.05
Guyana	27.13	LOW	100.69
Philippines	26.87	LOW	78.81
Lesotho	26.51	LOW	31.45
Namibia	25.65	LOW	73.74
Rwanda	25.17	LOW	20.27
Papua New Guinea	24.95	LOW	34.38
Bolivia	24.40	LOW	73.24
Côte d'Ivoire	24.06	LOW	39.15
Suriname	22.97	LOW	97.30
Chad	22.33	LOW	13.82
South Africa	21.61	LOW	96.78
Panama	21.31	LOW	96.69
Seychelles	21.00	LOW	139.67
Guinea	17.15	LOW	21.46
Togo	16.25	LOW	45.81
Botswana	11.02	LOW	66.16