CHAPTER FOUR

From measurement to policy-making

4.1 Overview

In the *Tunis Agenda for the Information Society*, world leaders call for governments and other stakeholders to move from principles to action (para. 1).[1] Achieving the challenging agenda set out in the *Geneva Plan of Action* and the *Tunis Agenda*, as well as reaching the Millennium Development Goals (MDGs), will require governments to design and implement sustainable development policies or 'national e-strategies', including those that promote digital opportunity. In this context, the Digital Opportunity Index (DOI) provides a practical tool to assess and design policy. As a gauge to monitor changes in the level of access and use of Information and Communication Technologies worldwide, the DOI provides both a snapshot of the status of the digital divide and of its evolution over time. This information is crucial for the evaluation and development of ICT policies at the national, regional and international levels.

This chapter discusses some of the challenges faced by policy-makers in developing sustainable policies for building an 'inclusive development-oriented Information Society' (*Tunis Agenda*, para. 83) in an increasingly complex ICT environment. It examines the ways in which the DOI can support the policy-making process by identifying trends and gaps in the promotion of access to ICTs, infrastructure and utilization. Finally, the chapter explores potential complementarities between the DOI and other indices of social development that could improve our understanding of the interactions between digital opportunity and education, gender and other socio-economic and political factors.

4.2 Informing ICT policies in a complex environment

The evolution of the telecommunication sector around the world from a relatively closed environment, based on state-owned monopolies, to an open one, characterized by increasing competition, has heightened the complexity of the sector. This complexity is also affected by an increased interdependence between the telecommunication sector, the broader ICT sector, and the economy as a whole.

The increased complexity of the telecommunications environment is an international phenomenon that affects developed and developing countries alike. Prompted by internal and external pressures for change and the need to participate in the global economy, many developing countries have initiated institutional reform in their telecommunication sector.[2] These reforms usually include changes in the regulatory environment, revisions to trade and investment laws, restructuring of the incumbent fixed-line operator, and the introduction of market competition (see Table 4.1).

Universal access is a case in point. Facilitating the deployment of telecommunications infrastructure and making services available to all at fair and reasonable rates is a traditional policy objective for the sector and a major goal of policies aimed at bridging the digital divide. In a monopolistic environment, cross-subsidies between different types of subscribers (e.g. from urban to rural, and from business to residential subscribers) and between services (e.g. from long distance and international calls to line rental and local calls) were used to make telephone services more affordable, and to permit the geographic averaging of prices. Once the sector is opened to competition, these implicit subsidies have been substituted in many cases by explicit mechanisms for universal access, such as targeted universal service funds. In addition, pre-paid access has also become an important way of increasing the number of mobile users.

Complex regulatory systems also need to be adaptable. Sustainable regulatory policies need to provide stability to promote investment, including from abroad. Yet, they should also be flexible enough to adapt to changes inside and outside the telecommunication sector, including technological advances. Adaptive regulation requires policy-makers to experiment with different combinations of policy instruments, develop new research tools and even modify the policy-making process itself. Policy-making becomes more of a trial and error exercise based on constant feedback, and learning from the experiences of neighbouring countries. This is where policy tools such as the DOI play an important role in informing telecommunication policy and in gaining a better grasp on its complexity.

Table 4.1: Examples of policy objectives and instruments in an open market environment

Policy Objectives	Examples of policy Instruments	Potential DOI Impact
Information Economy Level		
Economic growth	**Expansive fiscal policy**, monetary policy, competition in ICT	Infrastructure (3, 4, 5) Utilization (9)
Innovation rate	**Targeted subsidies**, Innovation policy, competition in ICT	
ICT Sector Level		
ICT investment level	**Direct public investment, targeted subsidies,** tax incentives, competition in ICT	Opportunity (1) Infrastructure (3, 5)
Universality of service	Targeted subsidies, competition in ICT	Opportunity (1, 2, 3) Infrastructure (4, 5, 6, 7, 8) Utilization (9)
Broadband access	**Targeted subsidies**, competition in ICT	Infrastructure (8) Utilization (10, 11)
Affordability	Retail price caps, price benchmarking, competition in ICT	Opportunity (2, 3)
Quality of service	**Mandated service quality**, competition in ICT	Utilization (10, 11)
Protocols and standards	**Mandated standards**, voluntary agreements, international agencies	Opportunity (1) Infrastructure (4, 5, 6)
Consumer protection	**Conditional regulation**, consumer protection laws	Opportunity (2, 3) Utilization (9)
Inter-operator Level		
Competitive behaviour	Open market entry, antitrust oversight	Opportunity (1, 2, 3) Infrastructure (7, 8) Utilization (10, 11)
Access to incumbent network	Open access, interconnection, unbundling obligations	
Wholesale prices	Price cap for wholesale price, monitoring of interconnection agreements	

Note: Items in blue font refer to policy instruments that are sometimes considered incompatible with competitive policies. The third column indicates where these policy measures could impact a country's DOI sub-index scores. The numbers in parentheses in this column refer to the individual indicators of the DOI, as numbered in Figure 2.3 in Chapter Two.

Source: Adapted from Johannes Bauer, 2004 [3].

4.2.1 The increasing need for information

In this complex environment, indicators traditionally collected from operators on telephone penetration are useful, but insufficient, for policy analysis. Monitoring of the availability, affordability and utilization of ICTs is also vital, as are disaggregated data, to better assess the impact of the digital divide on particular groups, such as women, the elderly or the rural population. The structure adopted for the DOI, with its sequence of sub-indices measuring Opportunity, Infrastructure and Utilization, mirrors the policy cycle of planning, implementation and outcomes. Closing the policy loop relies on feedback obtained through the collection, analysis and benchmarking of ICT statistics.

The cases of Hong Kong (China)[4] and Australia[5] illustrate the positive impact of coordination among the stakeholders involved in the provision and collection of ICT data, such as National Statistical Offices (NSOs), Telecommunication Regulatory Agencies (TRAs), telecommunication ministries, industry and even academia. Considered among the economies with the best practices in data collection, Hong Kong (China) and Australia have succeeded in establishing mechanisms for different stakeholders to participate and provide inputs in the selection of ICT indicators, the formulation of surveys, as well as the analysis of results. The strong connection between their policy-making processes and statistical data collection is reflected in their regular revision of ICT indicators based on policy needs.[6]

The call of the *Geneva Plan of Action* for all countries and regions to set up 'coherent and internationally comparable indicator systems' (para. 28f), as well as the activities of the *Partnership on Measuring ICT for Development* to develop a common set of core ICT indicators, have encouraged coordination among governments and NSOs on data collection worldwide. In 2004, for example, Latin American and Caribbean countries, through the UN Economic Commission for Latin American and the Caribbean (ECLAC) and the European Commission, carried out

an inventory of ICT statistics collected in the region as a first step towards standardization and technical cooperation in building statistical capabilities. Their collaborative efforts are now focusing on the monitoring and evaluation of universal access indicators.[7] Moreover, in early 2006, representatives from TRAs, NSOs and fixed and mobile operators in South Asia came together to develop an ICT indicators manual that seeks to promote uniformity in the indicators, definitions and methodologies used to collect ICT data and facilitate regional comparisons.[8]

4.3 The DOI as a policy tool

As discussed in Chapter one, the DOI provides a comprehensive statistical framework for monitoring the digital divide and evaluating progress towards a more equitable Information Society. The ICT indicators included in the DOI provide policy-makers with a frame of reference for comparisons across time, between regions and between interest groups, such as the low-income and rural populations targeted in universal service policies. For instance, changes over time in the three DOI sub-indices can be used by policy-makers as benchmarks for evaluating the impact of national ICT policies, either by looking at changes in rankings with respect to other countries or at the scores for their nation.

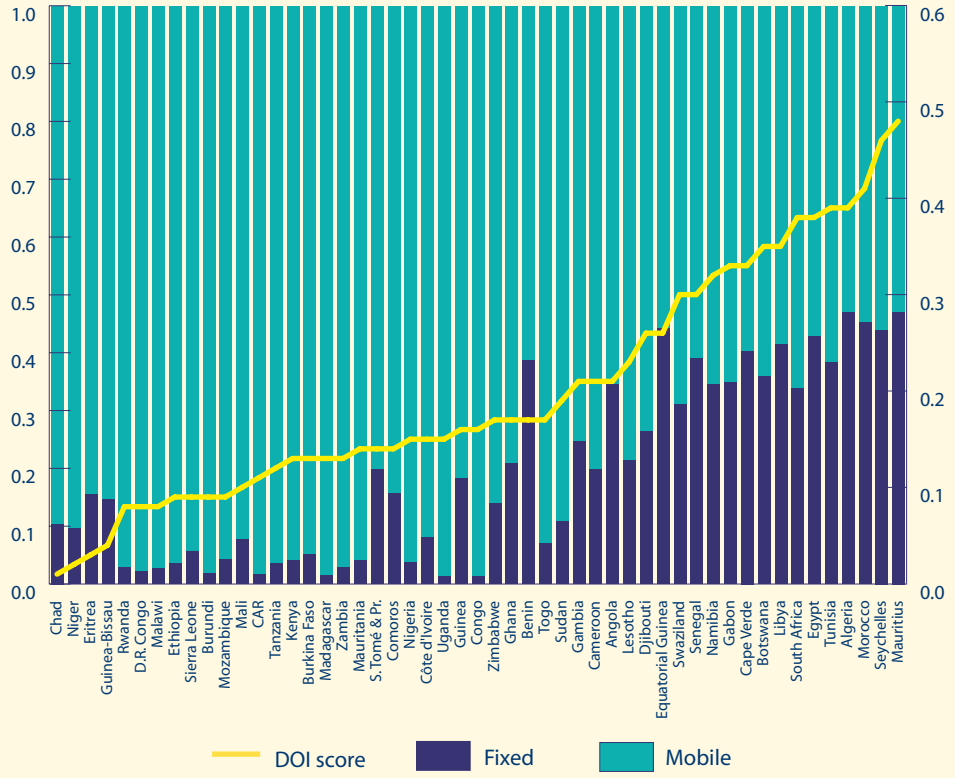
The DOI can also be used to inform the policy process at different levels, from comparisons across countries to analyses of gaps within a particular country, looking at differences across regions in a country or at disparities in access by specific groups, such as women, youth and the disabled. This section illustrates the flexibility of the DOI methodology as a policy tool by applying the DOI for international comparisons, for the evaluation of national policies and gaps, as well as for the assessment of disparities in digital opportunity, based on gender or other variables.

4.3.1 Regional comparisons: a closer look at Africa

The DOI results analyzed in Chapter three indicate that the extent of the divide between high- and low-income countries is large, with high-income countries averaging DOI scores nearly four times higher than those of low-income countries. Not surprisingly, Africa, the region with some of the poorest countries in the world, is greatly impacted by the divide. When compared to other regions, Africa ranks last with an average regional DOI score of 0.20, barely one-third that of Europe (0.55: see Figure 3.2). As illustrated in the DOI world map in the Statistical Annex, 32 of the 41 economies worldwide with DOI scores below 0.2 are in Africa.

Figure 4.1: Mobile and fixed contribution to DOI scores in Africa, 2005

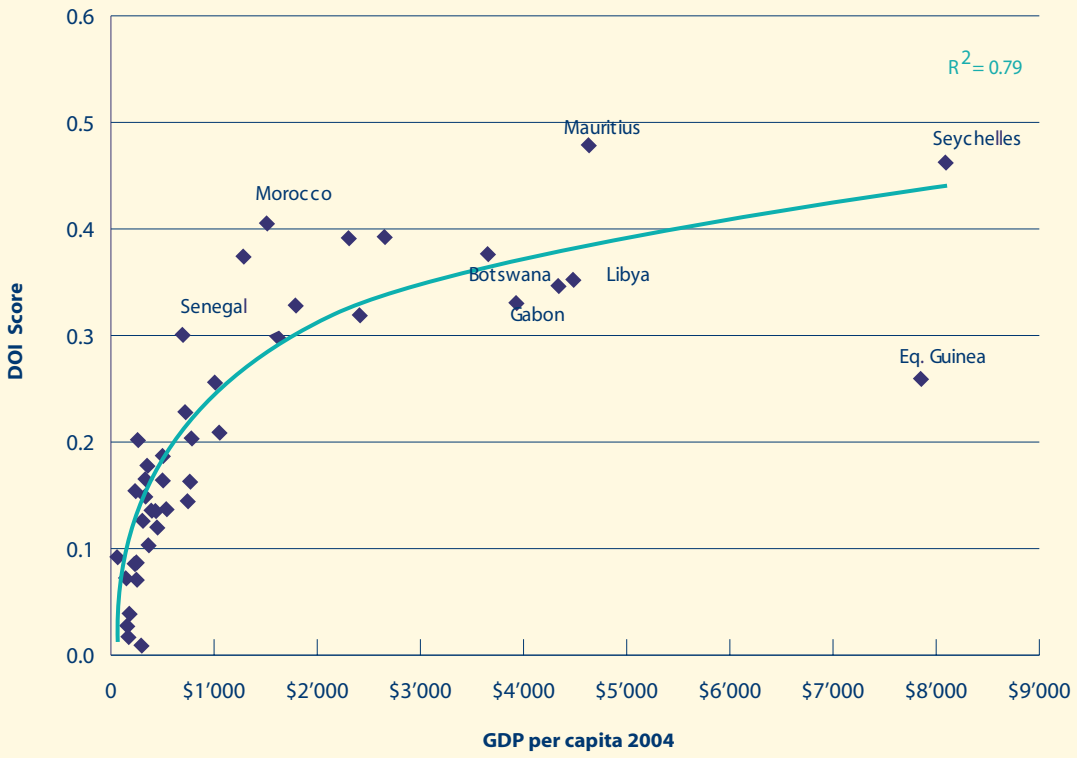
Mobile indicators are strong drivers of the DOI scores for Africa



Source: ITU/KADO Digital Opportunity Platform.

Figure 4.2: Link between income and DOI scores

In Africa, lower levels of income are reflected in generally low DOI scores



Source: ITU/KADO Digital Opportunity Platform.

Nevertheless, despite this situation, many African countries are making progress in reducing their internal gaps. As a region, Africa has the highest growth rate in mobile cellular subscribers of any region, with a 66 per cent growth rate in 2005.[9] In fact, the contribution of mobile indicators to the total DOI scores of the African countries is significant, especially in countries with overall DOI scores below 0.20 (see Figure 4.1), with the mobile contribution to the overall DOI being as high as 99 per cent in the extremes cases of Congo and Uganda (see Figure 3.4). In contrast, those African countries with DOI scores above 0.20 tend to have a greater fixed contribution to their scores.

Interestingly, when relating their performance in the DOI to national economic performance (as measured by gross national income per capita: see Figure 4.2), a few of the higher ranking African countries, such as Botswana, Equatorial Guinea, Gabon and Libya, tend to underperform, compared to countries with similar income. This is because the wealth of these countries is overstated due to natural resources such as diamonds or oil. By contrast, in the Seychelles and Mauritius, their DOI rankings are much higher than would be predicted on the basis of income, partly due to heightened use of ICTs in their large service (tourism) and financial sectors. Evidently, the performance of the telecommunication sectors in these countries cannot be explained exclusively in terms of income and other variables (such as policy initiatives, the existence of a telecommunication regulator and the level of openness of a market) play an important role. The strength of the relationship between the DOI and national economic performance is lower for Africa (R2 = 0.79) than for the world as a whole (R^2 = 0.85), which again suggests the importance of other, non-economic factors.

The DOI map of Africa in the Statistical Annex shows a pattern of high scores among the North African economies (Algeria, Egypt, Libya, Morocco and Tunisia); the western economies (Cape Verde and Senegal); the Southern economies (Botswana, Namibia and South Africa); and the island economies of Mauritius and Seychelles. By contrast, low-ranking economies are mostly inland, in the Sub-Saharan region, and also include economies such as Chad, Eritrea, Ethiopia, Niger and Sierra Leone.

This distribution seems to provide evidence for the impact of institutional arrangements on the development of ICT networks. While most of the African economies won their independence in the 1960s and 1970s, they have followed different paths, due to economic and political factors. Low-ranking states are largely agrarian economies, with highly unequal distributions of income. Niger, for instance, is among the poorest countries in the world, ranking last in the UNDP Human Development Index. At the opposite extreme, high-ranking countries tend to have more diversified and dynamic economies. Mauritius, for example, has focused on developing its financial institutions and building its domestic

and information infrastructure, which has attracted foreign direct investment and helped establish strong trade links with India and South Africa. These factors, combined with a stable political system since the 1960s, and a small geographic area and population, help explain Mauritius' number one DOI ranking within Africa (Data Table 2a) for Opportunity and Infrastructure and number five for Utilization. Similar circumstances apply to Seychelles, a tourist resort of only 81'000 inhabitants, ranking second in the overall DOI for the region.

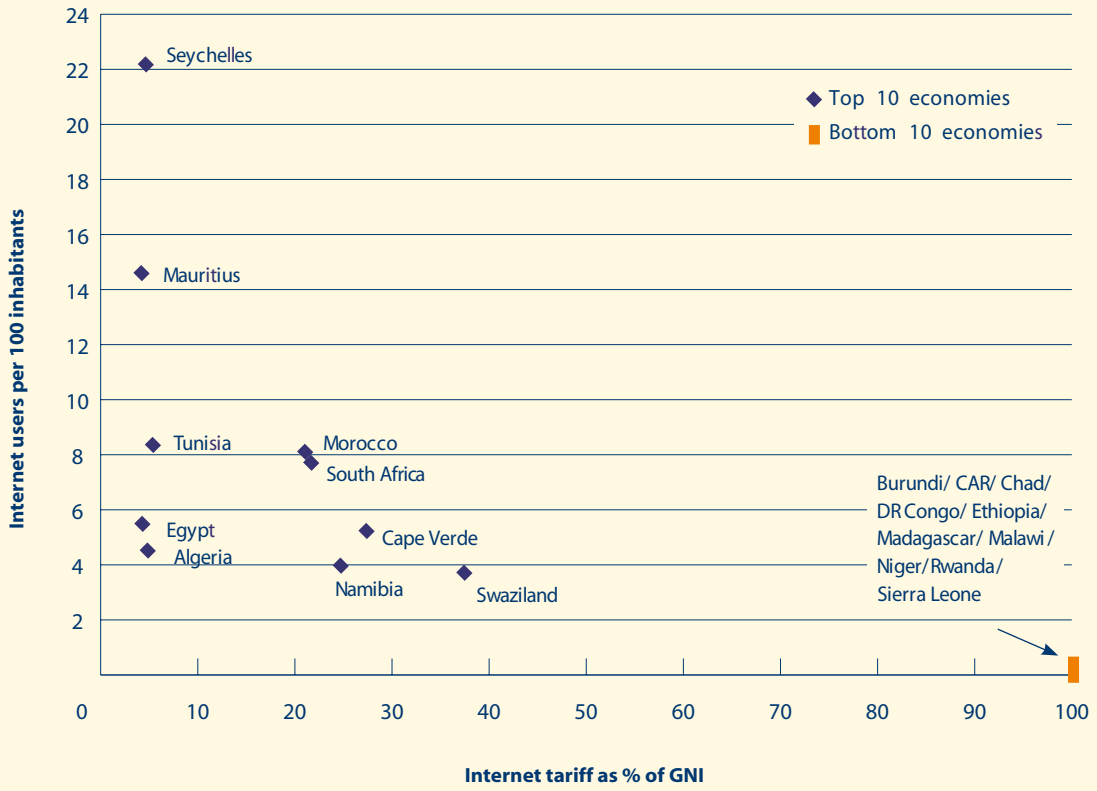
The differences among high- and low-ranking countries are also affected by the stability of their political systems. While high-ranking countries are characterized for having fairly stable democratic systems, with a sound legal framework and political institutions, low-ranking economies have often been plagued by political instability and an uncertain legal framework. Chad, for instance, which is the lowest DOI ranking country overall, suffered civil warfare until 1990 and has ongoing border disputes with its neighbours. Over recent years, the circumstances of some of these countries have improved, supported by debt relief and economic adjustment programmes that have reduced perceptions about the risk of investing in these countries. But warfare is the enemy of human development, and the stain of history lasts long after peace is restored.

From a telecommunication policy perspective, high-ranking countries illustrate the influence of liberalisation and competition in promoting opportunity and infrastructure deployment. Most of the North African countries, as well as Senegal and South Africa, have opened their fixed and mobile markets to competition and are rapidly increasing high-speed network deployment. Competition is helping to reduce tariffs and introduce service packages that respond better to the needs of the population. In Algeria, for instance, the entry of a third wireless cellular provider triggered new strategies for prepaid services that had not previously been offered by the incumbents.

As stated above, Africa has exhibited the highest recent growth rate in the mobile market of any region, with Algeria, Egypt, Nigeria and South Africa accounting for 60 per cent of the new mobile subscribers added in the region. In 2005, Nigeria alone added 9.7 million subscribers, which represents about 7 per cent of its total population.[10] Mobile phones provide more than three-quarters of all the phone connections in 19 countries in Africa.[11] As Africa shows, the tendency of developing countries to promote mobile coverage and utilization over fixed services makes the DOI's mobile components particularly useful for monitoring advances in regional markets.

Figure 4.3: Impact of internet tariffs on utilization

Top and bottom ten ranking African economies by Internet users per 100 inhabitants, 2005



Source: ITU/KADO Digital Opportunity Platform.

In utilization, only 2.5 per cent of Africa's 900 million inhabitants are online, compared to a world average of 16 per cent.[12] Yet, the African market is growing fast in the number of internet users, with a four-fold increase since 2000.[13] The highest densities of internet users per 100 inhabitants are located in Mauritius (22.2 internet users 100 inhabitants), Seychelles (14.6), S. Tomé & Principe (11.1), Tunisia (8.4) and Morocco (8.2). Kenya is a rising star, with the fastest-growing internet population in Sub-Saharan Africa, increasing three-fold in 2005.[14] The vast majority of internet users in Africa are located in urban areas, due to greater wealth and an urban bias in network deployment in the region's cities, as well as tariff structures that can result in higher long-distance rates for rural areas to connect to the internet.

Affordability is the greatest barrier to internet usage in the region (see Figure 4.3). This is partly due to Africa's limited infrastructure and the high cost of bandwidth, as several African countries, particularly landlocked ones, depend on high-cost satellite links, and do not have ready access to undersea fibre optic cables. Furthermore, regional voice and data traffic is often routed through Europe and North America due to the lack of Internet Exchange Points within the region.[15] The average cost of a dial-up Internet account for 20 hours a month in Africa is US$47.09, above the average monthly salary and around 44 per cent higher than the global average in 2005 (see Data Table 7).[16] The introduction of flat rates for Internet calls in some African countries should promote utilization in remote areas. Moreover, some economies (e.g. Seychelles) are offering internet connection rates that are up to 50 per cent lower than local call rates.[17]

Increasing demand, the introduction of cheaper wireless technologies such as WiMAX, and the opening of new traffic interconnection hubs in the region should help reduce the cost of bandwidth in the region. Hopefully, these savings can be passed onto consumers in lower internet access prices.[18]

4.3.2 National comparisons: the case of India

One of the most useful features of the DOI for policy analysis purposes is that it allows for comparisons of countries' rankings, in overall DOI scores, clusters (Opportunity, Infrastructure and Utilization) and individual indicators. This enables policy-makers to compare a country's performance with its peers and to understand in which areas it is doing well and areas where its performance is not so competitive.

Figure 4.4 highlights the results obtained for India when a country-level analysis is used. Overall, India scores 0.29 on the DOI, which gives it a ranking of 119th in the index, ahead of neighbours Pakistan (128th) and Bangladesh (139th), but behind China (74th) and Sri Lanka (106th). India is one of the fastest gainers in the DOI, having increased its score from 0.17 in 2001 (see Figure 3.5). India's main gains originate in mobile penetration, where India is adding new mobile subscribers at the rate of more than two million per month, thanks in part to the 'One India, one rupee' tariff structure and 'lifetime' prepaid plans, which have helped reduce the cost of mobile ownership (see Box 4.1).

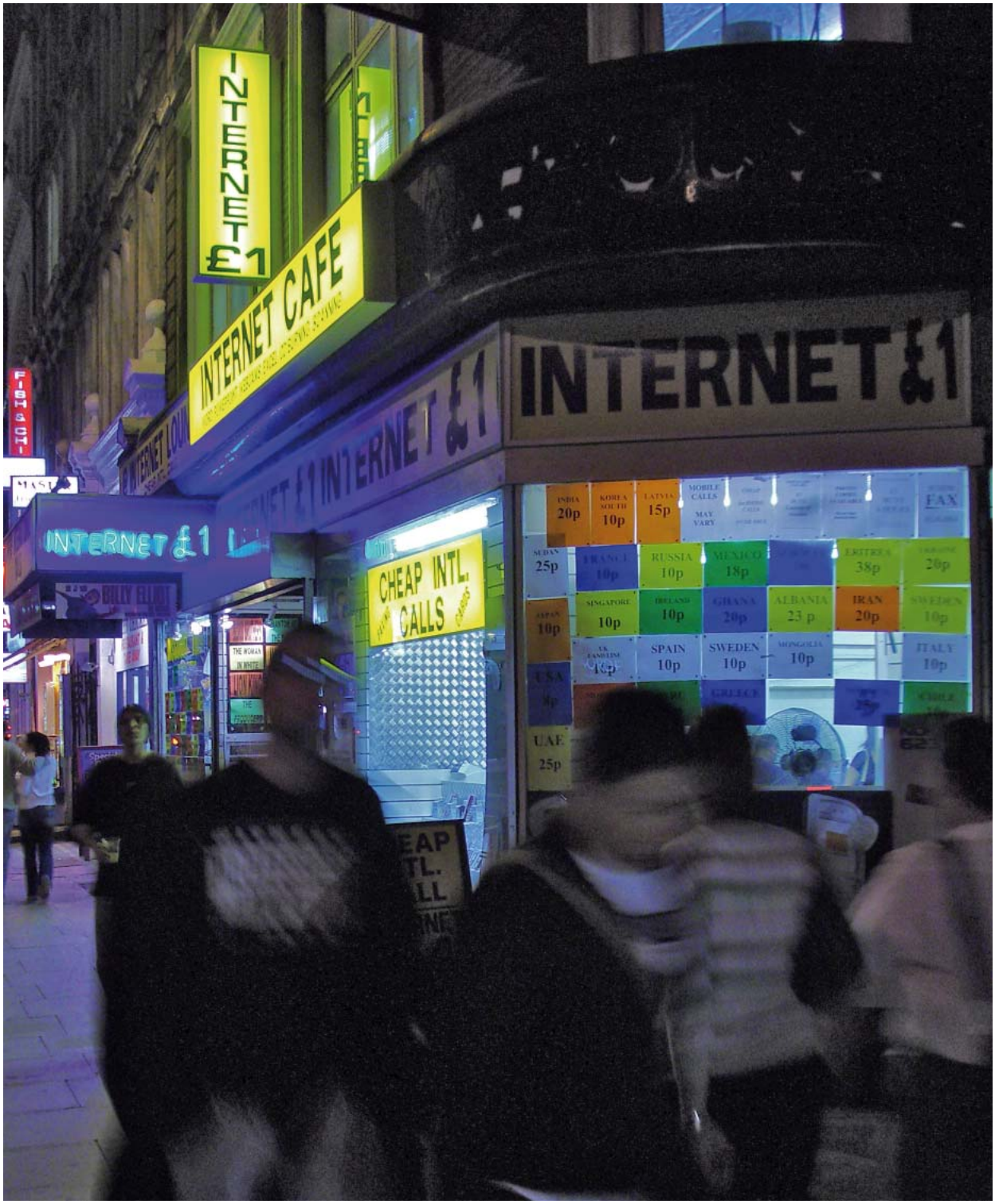
Figure 4.4: DOI scores for India

India's scores for the DOI, its sub-indices and the 11 individual indicators, 2005

	India, 2005	Indicator	DOI
OPPORTUNITY	1 Percentage of population covered by mobile cellular telephony	60.0%	0.80 = 110th
	2 Internet access tariffs as a percentage of per capita income	19.8%	
	3 Mobile cellular tariffs as a percentage of per capita income	4.9%	
INFRASTRUCTURE	4 Proportion of households with a fixed line telephone	10.3%	0.04 = 139th
	5 Proportion of households with a computer	4.5%	
	6 Proportion of households with Internet access at home	2.3%	
	7 Mobile cellular subscribers per 100 inhabitants	4.5%	
	8 Mobile Internet subscribers per 100 inhabitants	0.0%	
UTILIZATION	9 Proportion of individuals that used the Internet	2.3%	0.29 = 93rd
	10 Ratio of fixed broadband subscribers to total Internet subscribers	9.0%	
	11 Ratio of mobile broadband subscribers to total mobile subscribers	0.0%	
	DIGITAL OPPORTUNITY INDEX	**0.29**	**119th**

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

Source: ITU/Korea Digital Opportunity Platform.

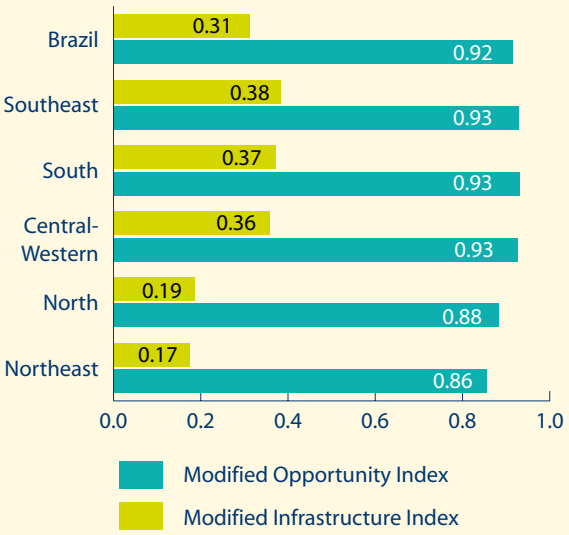


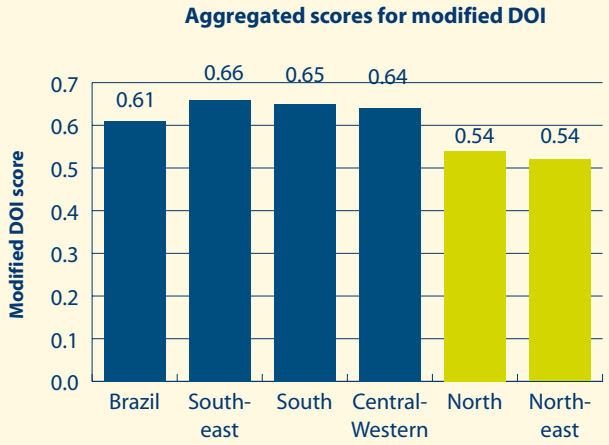
It is instructive, for policy purposes, to look at the different components of India's score. It is doing much better on Utilization (where it ranks 93rd), than on Infrastructure (where it falls to 139th position). India's elevated Utilization score shows that it is succeeding in attracting internet users and persuading these internet users to take up broadband services. Internet and broadband are areas where the private sector is very active. However, in terms of Infrastructure, India is let down by its relatively low proportion of households with fixed-line access and by the fact that, despite recent growth, mobile penetration is still much lower than its neighbours, due to India's relatively late start.

Using the DOI for comparisons between peers can be viewed as a kind of 'national health check', whereby a particular country's performance can be compared with global and regional averages. The country's overall DOI score can then be used to benchmark the performance on individual indicators to produce a specific diagnosis: in the case of India, the diagnosis of 'could do better in infrastructure' would be backed up with further measures to liberalise the fixed-line market. This analysis also suggests that India's current mobile boom still has further to run, as India closes the gap with other developing countries that had introduced nationwide mobile service at an earlier date.

Figure 4.5: Using the DOI to identify digital gaps at the natonal level

Brazilian Digital Opportunity Index Scores (modified) for 2004, per region





Source: ITU/KADO Digital Opportunity Platform.

4.3.3 Monitoring regional disparities within a country: focus on Brazil

After analyzing the usefulness of the DOI as a policy tool for regional comparisons (Africa), and for an individual country (India), the logical next step is to use it for analyzing performance within a country. As expected, connectivity differs widely between urban and rural areas, and between industrial and agricultural regions. Similarly, states with greater administrative and economic importance for the country (e.g., the capital city) tend to have the highest concentrations of subscribers.

The DOI can be used for provincial or state-level comparisons within a country, as shown by the example of Brazil, which ranks fifth in the world in terms of area and population (8.5 million square kilometers and 186.4 million inhabitants). Despite its vast territory, most of Brazil's population is concentrated in the major coastal cities of Rio de Janeiro and Sao Paulo (78 inhabitants/km^2), while its interior is sparsely populated (3 inhabitants/km^2). Brazil is divided into five major regions—North, Northeast, Southeast, South and Central-West—as shown in Figure 4.5. Brazil's overall DOI score in 2005 was 0.42 (up from 0.32 in 2001), which ranks it as 71st in the world.

Although Brazil ranks ninth in the world based on GDP,[19] there are marked imbalances between its regions, with the Southeast having a per capita income three times greater than the Northeast, the region with the highest percentage

of rural population (31 per cent).[20] About 20 per cent of the population (circa 40 million) was living below the poverty line in 2004; in contrast, other countries with similar national GDP levels have less than 10 per cent of citizens below the poverty level.[21] Educational disparities are also apparent, with 30 per cent of the population unable to read or write. Rooted in history, regional disparities persist, despite redistributive policies by the State over recent decades.

In order to apply the DOI within Brazil, it is necessary to modify it to eliminate the indicators for which data are unavailable: in particular, provincial-level data for mobile coverage and the percentage of internet users with access to broadband (for fixed-line and mobile connections). Using the remaining indicators, it is possible to construct an overall DOI score and separate measures for Opportunity and Infrastructure. Brazil's overall average score in the modified DOI is 0.61 but the gap between the highest-ranking region (South-East) and the lowest (Northeast) is 14 percentage points or 23 per cent of the national average. The gap between the two regions is explained by scores that are two- to three-times higher for the Southeast region in terms of mobile subcribership and household access to fixed lines, computers and the internet.[22]

The regional disparities in Opportunity and Infrastructure identified by the DOI can support policy-makers and industry players by pinpointing regions where the adoption of new strategies might be useful and by measuring their impact. To address current gaps, the Brazilian Government has created a Universal Service Fund and licensed competitive wire-line operators to serve sub-areas which larger providers were reluctant to serve.[23] Mobile providers are also offering users innovative rate programmes and discounts on handsets. Meanwhile, fixed operators are exploiting the benefits of convergence to enter the mobile market and attract new subscribers.[24] Clearer rules for unbundling and the promotion of competition in the fixed market are expected to promote network expansion and the continued growth of the Brazilian broadband market.

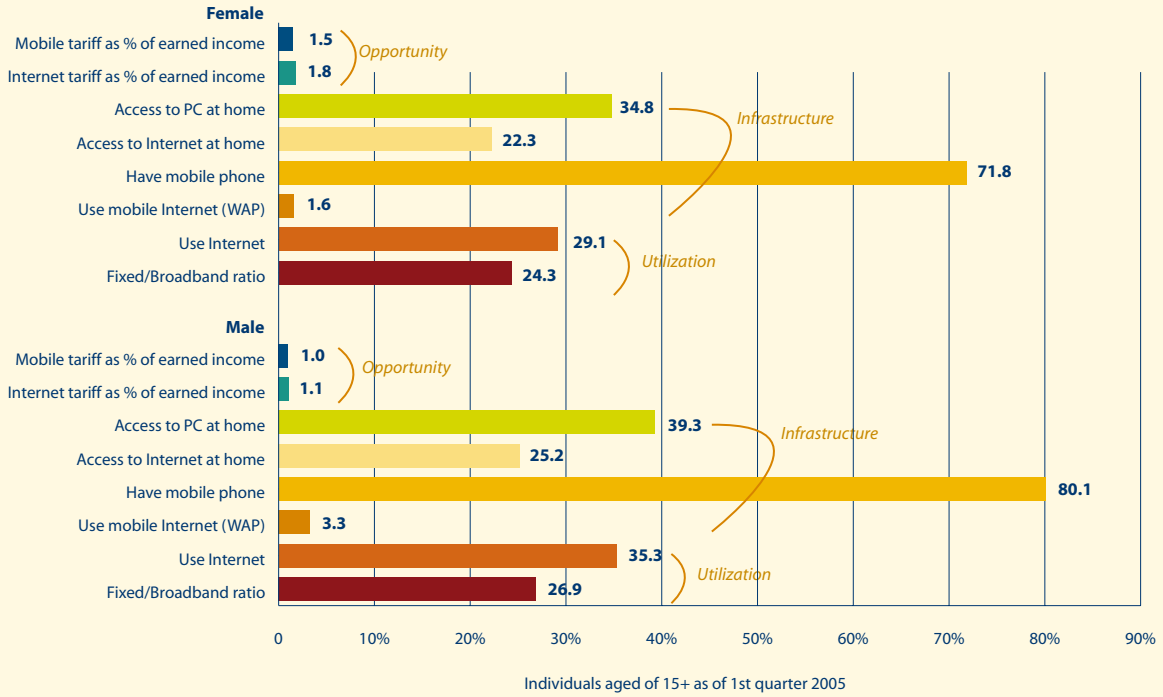
4.3.4 Monitoring national policies for digital inclusion: gender in the Czech Republic

As shown above, the DOI can be used at different geographical levels: between regions, between countries and with a country. However, the DOI can also help analyze the ICT experiences of different groups within society. Social and cultural factors impact people's interaction with ICTs as much as the economic and political factors discussed above. The levels of opportunity and utilization available to certain groups within a particular society are affected not only by income and geographical factors, but also by social variables such as age, ethnicity and gender.

The inclusion of civil society organizations representing women, youth, the disabled and indigenous populations in

Figure 4.6: A gender-disaggregated DOI

Digital opportunity disparities between men and women in the Czech Republic



Source: ITU Digital Opportunity Index, UNDP, and the Czech Statistical Office (http://hdr.undp.org/statistics/data/pdf/hdr05_table_25.pdf, www.czso.cz/eng/edicniplan.nsf/p/9603-05).

the WSIS process (amongst others) was in recognition that a truly inclusive Information Society implies the formation of ICT policies and programmes promoting access to, and use of ICTs, by all groups within society. The *UN Millennium Declaration* recognizes ICTs as tools for development, due to their potential for combating factors driving social marginalization, such as illiteracy and poverty. ICTs can improve education, health, and employment by increasing access to information.

Monitoring the success of programmes and policies that promote opportunity for specific social groups needs disaggregated ICT indicators. By examining patterns of opportunity and access based on the variables of interest—such as gender, age, income, educational level, employment status and rural/urban location—policy-makers can obtain valuable information on existing disparities among the population. Yet, despite their importance for policy-making, most countries do not collect reliable ICT statistics with this level of disaggregation. To overcome this shortcoming, the *Partnership on Measuring ICT for Development* is promoting the collection of classificatory metadata on households and individuals in NSO surveys on ICT core indicators.[25] As pointed out by the Partnership, cross-classification of these variables could provide critical information for policy purposes, but would also need larger samples and is more costly in financial and human resources.

The issue of gender disparities in digital opportunity highlights the crucial relationship between ICT statistics and policies. Although gender inequalities in access to and utilization of ICT infrastructure have been acknowledged in various international fora,[26] gender-informed ICT policies and gender-disaggregated data are still in their infancy.[27] According to UNIFEM, the United Nations Development Fund for Women, 'the urban bias in connectivity… deprives women, more than men, of the universal right to communicate' because women's responsibilities for family care limit their ability to migrate to the urban areas where ICTs are more readily available.[28] Similarly, lack of affordability of services tends to impact on women's ICT access disproportionately, as women have less discretionary income to spend on ICTs in some low-income economies and in some cultures.

Public policies and private programmes that target ICT access and financial support for women (for instance, micro-finance schemes) have already shown positive results in reducing disparities in ICT ownership and use in developing countries. A study of the Grameen experience in Bangladesh found that in the cases where women operated phone businesses, 82 per cent of the users were women; whereas with male operators, only 6.3 per cent of women were phone users.[29] Similar evidence is available for female use of mobile telephone services in Bolivia, the Dominican Republic, India and other developing countries.[30]

The DOI has been used to monitor and evaluate digital opportunity gaps over time and across countries. Figure 4.6 illustrates the use of the DOI methodology to analyze gender divides. Although few economies currently collect gender-

disaggregated statistics for all the indicators included in the DOI, the Czech Republic (CR) shows how the DOI could be used in the future for this purpose. The CR also highlights good practices in collecting disaggregated data. It collects gender statistics for mobile services and forward-looking indicators, such as broadband access at home and mobile internet access. It also reports general ICT statistics (e.g. percentage of households with PC and internet access) and gender-disaggregated data (e.g. PC and internet access at home, by gender) with the same level of disaggregation (in this case per household) and in some cases, also in absolute numbers (at the individual level).

For the gender divide in the CR, the differences between the DOI scores for men and women across the three sub-indices are not very large (0.56 for men, compared with 0.53 for women), but it nevertheless shows that women in the CR are still at a disadvantage, compared to men. Czech women face disparities in the affordability of mobile and internet services relative to their income, mobile phone ownership and utilization of internet and mobile internet services. It is likely that gender-related DOI gaps would be much greater in other countries.

Finally, from a policy perspective, the analysis of gender disparities highlights the importance of including women's groups in policy consultation and formulation, to promote gender issues within the policy agenda and improve the status of women with respect to ICTs.

4.4 Policies for Digital Opportunity

Many studies have examined the correspondence between institutional reform and the performance of the telecommunication sector. Improved performance often coincides with regulatory systems that promote competition and a clear system for recognizing property rights, although it is difficult to determine causality due to the different economic, technical, political and social variables involved.[31] The policy tools to promote digital opportunity, in both developed and developing countries, are not necessarily unique, however. Different combinations of policy instruments and institutional frameworks can result in positive outcomes.

4.4.1 Opportunity: Promoting Affordability

Availability and the affordability of ICTs are basic foundations for digital opportunity. Although disparities between high- and low-income countries (as well as high- and low-income consumers) may persist, competition, regulatory changes and innovative micro-finance programmes are making phone and internet services more affordable. The combination of affordability statistics and more complete information regarding true levels of demand would help policy-makers and industry stakeholders to better target programmes to reach non-users and reduce current obstacles to growth in services.

Box 4.1: Promoting mobile subscribership

India's Lifetime Prepaid Plans

Rapid increases in mobile subscribership have often been the result of innovative initiatives developed by operators around the globe. India is a good example. Prepaid plans allow subscribers better control over their expenses on communication services by providing them with a block of minutes or credits for outgoing phone calls for a predetermined fee. The caveat is that prepaid minutes have an expiry date, usually ranging between six months to a year after purchase, and the minutes not used within the validity period are lost. For operators, the value of validity periods lies in their potential for future revenues, by requiring subscribers to renew their cards regularly in order to avoid losing their connection to the network altogether, including their telephone numbers.

In India, operators are promoting growth in mobile subscribership by extending validity periods or eliminating them completely, in exchange for higher initial activation fees and increased consumer loyalty. In December 2005, Tata Teleservices began offering 'lifetime' prepaid plans for an initial fee of 1000 Rupees (Rs) (approximately US$22.68), an amount ten times higher than regular prepaid plans activation costs (around Rs 100 or US$2.26). New subscribers are rapidly joining the lifetime prepaid plan, despite the higher fee, attracted by the possibility of lifetime free incoming calls, no loss of prepaid minutes, and recharges that pay only for actual minutes of service. Average monthly net additions have doubled from 2.21m during the March–November 2005 period to an average of 4.46m during the December 2005–February 2006 period.

The move to lifetime prepaid plans could have mixed effects on operator revenues. Over the short-term, the large initial payment made by subscribers creates a disincentive for changing providers (churn) and increases customer loyalty. Operators improve their profitability as the number of subscribers increases. Over the long-term, it is expected that the lack of pressure on subscribers to use their minutes within a specific period of time will affect the periodicity of the revenues obtained from recharges and reduce call revenue. Pyramid Research forecasts that ARPU will decrease the average revenue per user in India will decrease to Rs. 247 (US$5.46) by 2010.

Source: Adapted from Pyramid Research, Pyramid Predictions, 4 May 2006. www.pyramidresearch.com/em_may04_india.htm?SC=PD05a.

One of the main policy objectives of low-penetration countries is to accelerate network growth and increase the number of people with access to the service. While connectivity is necessary, it is not always sufficient for the Information Society. The price of access and of use (i.e. the affordability of equipment and services, convenience of access, as well as quality of service) and the ability to use (e.g. appropriate training and language skills) also influence access.

In telecommunication services, lack of affordability may prevent people from:

- purchasing a phone or computer for mobile and internet services (including paying the necessary line rental charges for fixed-line access to the internet),
- paying initial installation costs for fixed lines; and
- making calls, or using the internet as often or for as long as they would like to, due to price concerns.

The indicators of affordability included in the Opportunity cluster of the DOI give policy-makers a useful benchmark to monitor the impact of mobile and internet tariffs on the ability of households in different income brackets to use ICT services.

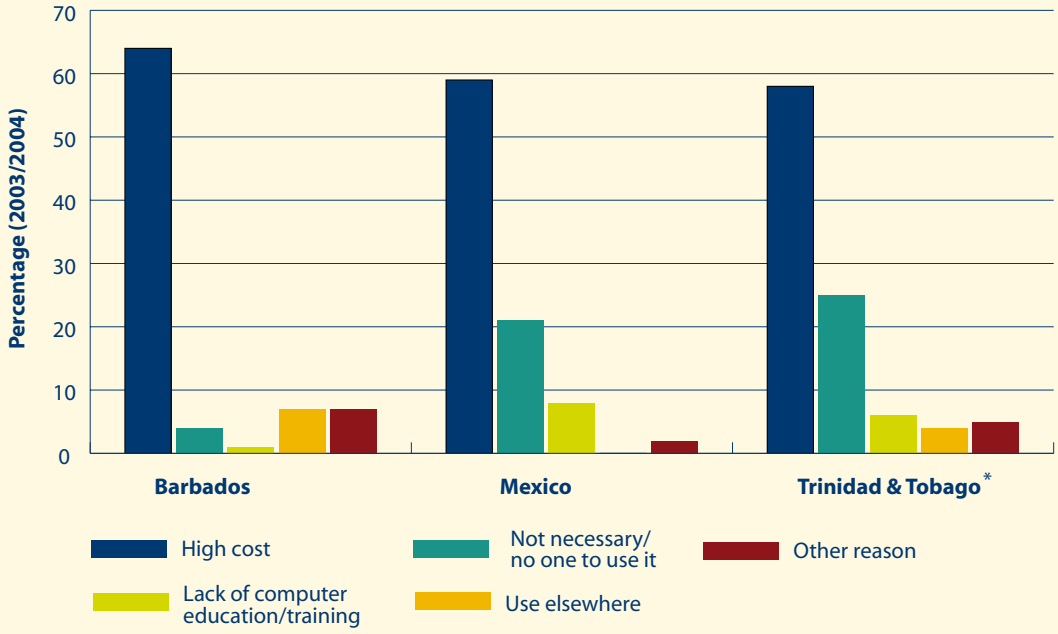
Recent demand surveys in eleven African countries[32] found similarities in user perceptions about the cost of services. While most of those interviewed considered fixed and public phone services to be affordable, the majority consistently perceived the cost of mobile calls to be high. The LIRNEasia 2005 study on low-income users (earning less than US$100 per month) in India and Sri Lanka found, for example, that 79 per cent of more than 3'000 respondents would increase their mobile use, if the cost of calls were to decrease.[33] This indicates that high prices continue to be a disincentive for use. Many users in Africa are still willing, however, to spend more of their income on mobile communications, as they are still cheaper than traveling to visit the person being called.[34] Policies focused on making mobile and Internet services affordable for disadvantaged groups (including low-income users, residents of high-cost areas and non-users) would boost not only Opportunity scores, but also Infrastructure and Utilization.

Mobile penetration has also increased greatly due to operators' marketing strategies, including discount plans and prepayment. Value-stored prepaid cards have increased the access of low-income users to phone services and given consumers more control over their expenditures. In Mexico, as in many other developing countries, pre-payment has become so popular that, by the end of 2005, about 93 per cent of the mobile phones were under prepaid calling plans.[35] Competition among mobile providers is not only reducing costs, but also resulting in innovative offers for prepaid users in many countries. Box 4.1 illustrates the case of prepaid service offers in India, while Chapter five gives further examples.

Innovation in the provision of low rate services is also reaching civil society. Micro-finance programmes, inspired in part by the Grameenphone initiative in Bangladesh, have brought small entrepreneurs into the mobile and internet markets. Resale of phone services by these small local entrepreneurs, as well as sharing schemes among relatives and neighbours, are becoming common practices among low-income users by making it more affordable to use the services.

Figure 4.7: Reasons for not owning a computer

In selected Latin American and Caribbean economies, 2004



Note: * 2003 data for Trinidad and Tobago.
Source: UN ECLAC, January 2006.

Box 4.2: Affordable ICT equipment for low-income users

Microsoft and the mobile handset industry reaching new user markets

To promote the purchase of personal computers with legal software among low-income population in developing countries, the US software company, Microsoft, has launched its FlexGo technology, a full-featured PC, with a modified operating system that allows PC owners to purchase PC usage time in small increments using prepaid cards. The 'pay-as-you-go' financing initiative is modeled on the prepaid card system for mobile phones and has shown positive results in trials in Brazil. FlexGo customers make a minimal upfront payment for the PC, equivalent to one third of its total cost, and pay the balance at their own pace through prepaid cards metering usage time. Once the balance is covered (after about 800 hours of usage time), FlexGo customers own the PC and do not need to purchase any more cards.

The potential success of FlexGo stems from its emphasis on making PC ownership affordable to low-income consumers, who would otherwise be deterred by the large initial investment. According to Microsoft, about 31 per cent of its FlexGo customers in Brazil stated that they would not have bought a PC without the pay-as-you-go offer. While traditional PC financing would result in large installments, FlexGo users pay what they can afford to, based on their income. For Microsoft and PC manufacturers, this initiative opens up new consumer markets, decreases the risk of non-payment, and reduces incentives for software piracy, a common practice in developing countries. Trials are now being extended to India, China, Russia and Mexico.

The mobile handset industry and mobile operators are also joining forces in initiatives aimed at making cellular handsets affordable to low-income subscribers in developing countries, particularly for those in Africa. In 2005, Motorola won a contract with a group of operators from developing countries to supply 6 million handsets at a cost of US$40 or less and a second contract for another 6 million for less than US$30 for 2006. Areeba, the mobile phone brand of Investcom that operates in the Middle East and Africa, estimates that the number of subscribers would double in these two regions if the cost of the handsets were to be reduced by half, from the US$60 average cost in 2004.

Source: Microsoft, 'A computer you can afford', May 2006. www.microsoft.com/presspass/features/2006/may06/05-21EmergingMarket.mspx; T. Standage, 'Connecting the next billion', The Economist: The World in 2006, March, 2006, p. 109.
Image source: Microsoft, www.microsoft.com/whdc/flexgo/payasyougo.mspx.

The analysis of DOI Opportunity data can be enhanced by demand studies to improve policy-makers' understanding of perceived affordability, consumers' willingness to spend on ICTs and their priority for telecommunications relative to other basic services, such as electricity, water and health. The Kingdom of Jordan, for example, bases its definition of affordable tariffs on income statistics for the lowest 10th percentile household group by income, to ensure that initial payments (connection of fixed lines or activation charge for mobile), monthly expenditures (fixed line rental and the monthly cost of prepaid mobile cards) and the cost of additional units of service (monthly rental for fixed and lowest prepaid card for mobile) do not exceed a percentage threshold of monthly income of these households. These income statistics are collected through interviews with household heads, with and without phones.[36]

4.4.2 Infrastructure: universal access/ service policies

Facilitating the deployment of telecommunications infrastructure and making services available to all at fair and reasonable rates is another traditional policy objective for the sector and a major goal of policies targeting the digital divide. The *Geneva Plan of Action* (para. 6) established specific connectivity targets to be achieved by the year 2015, including the connection of all villages with ICTs, all educational institutions, scientific centres, public libraries, museums and archives, health centers, as well as local and central government departments. Fulfilling these goals will need investment in infrastructure, as well as policies for service provision in underserved areas and for specific population groups.

Although universal access/service policies have been adopted in many countries, these policies are not uniform, as the goals they pursue are closely linked to the level of development of

the country and evolve over time. For instance, although the concept of universal service has been pursued as a policy goal in the United States since the early part of the 20th Century, nevertheless the goals and principles of universal service were not explicitly defined until the Telecommunications Act of 1996.[37] The evolving nature of the concept is illustrated by the discussion in many developed countries about the need to extend the breadth of services covered under universal service from basic telephony to access to broadband services by all households.

For less developed countries, universal service focuses on providing the necessary basic infrastructure and coverage for the provision of access throughout their territory. The DOI indicator of 'percentage of the population covered by mobile service' is an important measure in this regard. Although the population coverage measure in the DOI is limited to mobile services, for developed countries, it could be modified to include coverage for 3G mobile. Attracting investment to fulfill universal service goals is a primary policy objective and to this end, policy-makers have supported investment promotion measures and tax incentives. Countries follow different paths to promote network deployment. Some have included universal service obligations in incumbents' licenses, for instance, in network roll-out obligations. Others have applied competitive market mechanisms to promote deployment e.g., through reverse auctions, where the bidder tendering for the lowest level of subsidy is granted the license.

The introduction of competition has driven governments to clarify universal service goals and develop mechanisms for the financing of Universal Service Funds that are non-discriminatory, technology-neutral, and transparent. To make them compatible with a competitive environment, universal access/service policies need to be based on rules that:

- justify the need for support or subsidies in cost-benefit terms;
- identify and limit the population groups to be supported; and
- provide guidelines regarding the amount and duration of financial support.

Although ICTs are important tools in development policies, governments in low-income countries may prefer to dedicate resources to areas where they have the greatest impact on meeting basic needs of the population e.g., sanitation, clean water or electricity. Given limited resources

for telecommunication infrastructure, many developing countries have prioritized the establishment of public payphones, teleshops and telecentres as means to provide communications to communities, rather than fixed services for households, as is often the case in developed countries. Shared ICT facilities (internet cafés, libraries, digital community centres and education facilities) provide telephone and internet access to the public and represent a first step in connectivity, stimulating demand and attracting investment.

Most lower and upper middle income countries already have infrastructure accessible to a large proportion of the population. The policy focus in these countries is on increasing ownership and use of fixed, mobile and internet services and equipment; extending mobile service coverage; lifting regulatory barriers to convergence and competition; and promoting investment in advanced technologies. Universal service policies tend to focus on linking smaller communities that are underserved by commercial interests and on ensuring that low-income users can afford services. In these countries, the DOI infrastructure indicators can help evaluate progress in the adoption of ICTs. Household indicators for fixed lines, computers and internet access among these countries are especially useful. Having greater access to ICTs at work and school, ICT users often appreciate more the value of ICTs at home. Sharing internet facilities often goes on at home, among relatives and friends.

Despite users' apparent willingness to increase their telecommunication expenditures at the household level, affordability can still be a barrier, particularly for the purchase of mobile handsets and computers. Although the cost of basic mobile handsets continues to fall, perceptions among non-users/non-owners of the high cost of mobile phones remain a problem in several countries (See Figure 4.7). Market research conducted by Nokia among mobile phone users and non-users in Argentina, India, Indonesia, the Russian Federation and Ukraine shows that non-users believed that they could not afford to purchase a mobile phone and pay for its ongoing running costs afterwards.[38] Similarly, a demand survey in Nigeria on 5'600 households found that, of the 94 per cent that wanted to own a mobile handset, only 75 per cent could afford to buy a used phone (US$40) and only 70 per cent could afford the monthly charges (around US$4). These economic constraints are worse for PC ownership, which needs a much larger initial financial commitment.

Utilization of broadband and wireless services in developing countries is being promoted both by public and private initiatives. In many countries, the cost of ICT equipment remains high as a result of duties imposed on such 'luxury' imports. India and Mauritius, two countries with a fast pace of mobile and PC adoption and use, are implementing policies to reduce the level of duties on ICT equipment imports[39] Mauritius has cut its taxes on handsets, while India reduced duties to 5 per cent in 2004 and is planning to eliminate the duty altogether. Other countries, such as South Africa, promote ownership by requiring operators to provide a certain number of SIM cards and mobile payphones as part of their universal service obligations (USOs). Similarly, equipment manufacturers are implementing micro-payment initiatives to promote computer and mobile handset ownership among low-income consumers. Box 4.2 provides the examples of Microsoft's FlexGo initiative in Brazil and Motorola's efforts in Africa.

Finally, upper-middle and high-income countries have the most advanced networks, in which the focus of universal service is on providing access to advanced wireless technologies and broadband Internet to all who want it. Developing a reliable, interconnected wireless, wireline and cable network that individuals can access anytime, anywhere, is the end goal, without forgetting about the provision of funds for special groups, such as the disabled and high cost regions. For these countries, infrastructure requirements are mostly left to market forces and the policy priority is on developing clear regulations for interconnection, inter-carrier compensation, spectrum management, and cost separation that would minimize disputes among service, application and network providers of the next generation networks (NGN). In summary, universal service policies evolve in response to countries' level of development, resources and needs. As infrastructure evolves, policy focus tends to shift from shared access (telecentre/household) to individual ubiquitous access; and from basic public telephony to increased mobile and internet access. Similarly, the policy focus on affordability becomes more targeted, shifting from making services affordable for the population as a whole, to pinpointing special groups and areas to maintain within the network. The DOI's different sub-indices can help countries track the evolution of their universal access/service goals over time.

4.4.3 Utilization: broadband and wireless technologies

One of the benefits of liberalisation is that consumers have greater choices in technologies, services and suppliers. Recent innovations have brought consumers:

- new ways to access voice services, such as mobile phones and Voice over IP;
- new ways to pay for services, including value-stored prepaid cards for mobile phones and privately-owned payphones for public use;
- faster and better technologies, such as broadband, fibre optics and digital switches; and
- A greater choice of suppliers in all ICT market sectors.

The internet is increasingly seen as just as important as having access to basic telephone service. Rapid changes in technology encourage countries to accelerate the rate at which their population adopts new technologies. Some countries track very closely the 'league tables' of worldwide broadband rankings. Developing countries are no exception. While the battle to extend basic telephony is far from over, developing countries are also seeking not to be left behind in broadband communications and the internet.

Wireless technologies, such as WiFi and WiMAX, are giving developing countries new low-cost alternatives to provide broadband access to rural and remote areas. Pakistan is a case in point. Lacking widespread broadband infrastructure until now, Wateen Telecom has announced plans to rollout the largest WiMAX network in the world so far, based on the IEEE 802.16e standard. The network is part of 'Broadband Pakistan' project to link 22 cities through broadband internet, voice, data and value-added services.[40] Moreover, with mobile

technology being the fastest-growing form of connectivity in many developing countries and equipment manufacturers looking for new markets, developing countries may adopt mobile communications as the main way of connecting to the internet, as long as services become more affordable.

Subscribers' interest in mobile internet services is already growing in developing countries. The 2005 Mobinet study on global mobile usage reports an upward trend in the percentage of multimedia phone users in Latin America browsing the internet or using mobile e-mail at least once a month on their phones, which jumped from 32 per cent in 2004 to 64 per cent in 2005.[41] According to Siemens' projections, based on the current growth rate of mobile subscriptions and internet users, the convergence of mobile and internet is expected to result in 50 per cent of internet access occurring mainly over mobile devices.[42]

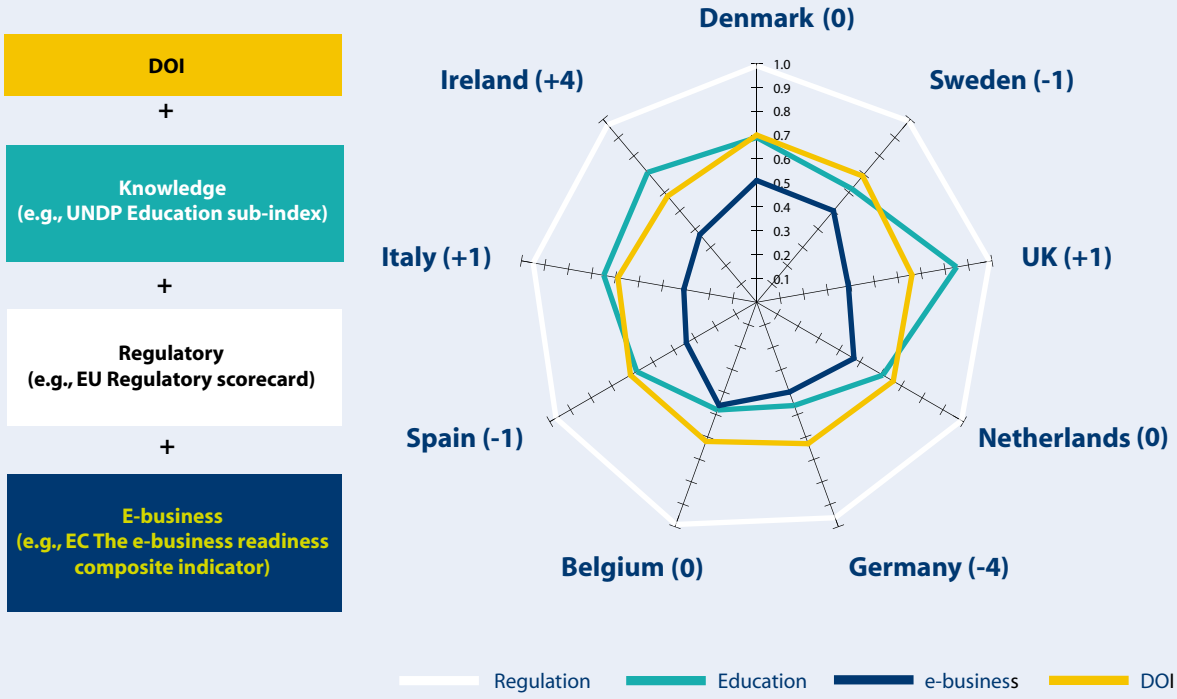
4.5 Complementing the DOI

The previous sections have showed how the DOI methodology can help benchmark international, regional and national performance, using a core set of ICT indicators. But, as discussed above, the telecommunication environment is subject to multiple cultural, economic and political factors. The modular structure of the DOI, based on the sequential clusters of Opportunity, Infrastructure, and Utilization, can be adapted to analysis of particular policy needs. The three DOI clusters can be complemented by social and regulatory indicators, as well as by technology indicators for other sectors influencing the ICT environment (such as government or business).

Regulation influences the structure, performance, and behavior of the telecommunication sector. However, it is difficult to measure the regulatory environment. The European Telecommunications Regulatory Scorecard is an attempt to combine various aspects of the regulatory situation in a country into a numerical score.[43] The Regulatory Scorecard evaluates the impact of a country's regulatory framework on investment and employment in the ICT sector, two variables closely related to the deployment of ICT infrastructure in a country. With respect to social factors, the UNDP's Human Development Index provides useful national and sub-national statistics on poverty and knowledge (adult literacy rate and combined primary, secondary, and tertiary gross enrolment ratio).[44] These social indicators (disaggregated by gender and income groups) can be combined with the DOI

Figure 4.8: Extending the DOI

How the DOI's modular structure can be adapted to include other indices



Note: The number in parentheses reflects the difference in the original DOI rank and the revised rank by including the new components.

Source: Minges, Michael (2006) 'The Digital Opportunity Index', presentation made at ITU/LBS conference 'Digital Transformations in the Information Society', Geneva, 1-2 June 2006, available at: www.itu.int/osg/spu/dtis/documents/presentations/minges.ppt.

Figure 4.9: Examples of matrices for policy evaluation

DOI Score	Opportunity	Infrastructure	Utilization
High			
Medium			
Low			

Coverage \ Affordability	Low	High
Low		
High		

Source: ITU/KADO: see Cho, Cheung-Moon (2006) 'Application of the DOI for policy development', presentation made at ITU/LBS conference 'Digital Transformations in the Information Society', Geneva, 1-2 June 2006, available at: www.itu.int/osg/spu/dtis/documents/presentations/cho.ppt.

to provide useful insights into the impact of education and poverty reduction efforts on closing population divides.

Other indices can also extend the DOI by providing greater detail on the impact of ICTs in other sectors of the economy, such as business or government. The e-business readiness composite indicator, developed for the European Commission, evaluates the availability and use of ICTs in the business sector.[45] It builds on many of the Partnership indicators used for measuring ICTs in enterprises such as the percentage of business with Internet access. The UN Division for Public Administration and Development Management compiles an annual e-government index measuring the development and sophistication of publicly accessible government websites around the world.[46] Figure 4.8 compares selected European economies, and shows how DOI scores could be modified by the inclusion of additional indices and indicators. Although the Regulatory Scorecard and the e-business readiness indices are not as extensive in country coverage, they are useful templates for methodologies and indicators that could be used by other regions.

4.6 Next steps: developing a policy matrix

This chapter has demonstrated the value of the DOI as a tool for assessing ICT policy outcomes at different levels. Through its categories of Opportunity, Infrastructure, and Utilization, the DOI can identify specific areas where performance can be improved (for example, using the policy instruments shown in Table 4.1). The database of DOI statistics for 180 economies and the 2000-2005 time-series for the 40 largest economies offer a solid statistical basis from which the feedback between ICT statistics into policy recommendations can be established.

One next step could be to develop a policy matrix that would classify countries as high/medium/low, based on their scores for the three DOI sub-indices, its eleven indicators, and/or other variables of interest (such as gross national income, population, area size, and social factors, such as education). Once classified, the relationship between performance and the policy framework of countries within a single group could be analyzed. This would allow the identification of patterns of performance linked to specific policy tools, as well as of policies that have been successful in addressing the particular needs of each respective group. Countries could also be classified according to their performance on interrelated indicators, such as affordability and coverage, to make policy recommendations. Figure 4.9 gives examples of potential matrices. Finally, the DOI statistics could be used as a frame of reference to evaluate progress made towards specific goals, such as the *Geneva Plan of Action* for 2015, or targets set at the regional or national level for closing the digital divide.

In accordance with the multi-stakeholder approach on which the WSIS process was based, ITU plans to develop a policy tool-kit for the DOI through a collaborative process, with the participation and input of other partners including governments, other international organisations, business and civil society representatives.

4.7 Conclusions

Data collection and analysis are essential to address the impact of policies and business strategies on ICT development. The eleven indicators included in the Digital Opportunity Index cover core areas to be monitored in order to track changes in the magnitude of the digital divide. The value of the DOI as a policy instrument lies in its flexibility to be applied on the evaluation of performance across and within countries and on its modular structure that facilitates the integration of other indices of interest. The links between policy and performance could be used to develop a policy tool-kit that countries may use to compare their performance with similar countries around the world and to learn from their policy experiences.

Endnotes

1 *Tunis Agenda*, WSIS-05/TUNIS/DOC/6(Rev.1)-E, 18 November 2005.

2 Institutional reform consists of a set of transformations in patterns of interaction and activity, which in the area of telecommunications may include changes in one or more of the following three components: (a) regulation, ranging from the revision of existing laws and regulations in telecommunication, trade, and foreign investment, to the establishment of new legislation and regulatory agencies, to partial or complete elimination of some regulations (deregulation); (b) the internal organization of the incumbent telecommunication operator, and (c) the degree of competition in the market. See R. Samarajiva, 'The role of competition in institutional reform of telecommunications: Lessons from Sri Lanka'. *Telecommunications Policy*, 24(8/9), 2000, pp.699-717.

3 J. Bauer, Governing the networks of the information society. Working Paper 01-04, Quello Center for Telecommunication Management and Law, May 20, 2004.

4 See ITU (2005) 'Hong Kong, China: ICT Data Collection Case Study', available at: www.itu.int/osg/spu/ni/digitalbridges/docs/HKG_CS_final.pdf.

5 See ITU (2005) 'Australia: ICT data collection case study', available at: www.itu.int/ITU-D/ict/cs/australia/material/AUS_CS.pdf.

6 For more detail see ITU, *Building Digital Bridges*, Chapter 3, Geneva, 2005.

7 For more information on ECLAC ICT measurement efforts see www.cepal.org/socinfo/default.asp?idioma=IN.

8 LIRNEasia and the Telecom Regulatory Authority of India are coordinating this initiative. The project includes the implementation of a multi-component study that will focus on the standardization of ICT indicators and the collection of data for six South Asian countries (India, Indonesia, Pakistan, Philippines, Sri Lanka and Thailand). The coordinators expect that the results of this study will lead to the adoption of the regional set of indicators by South Asian regulatory authorities and NSOs and later on expand to other Asian countries. See www.lirneasia.net/2006/05/report-on-workshop-on-ict-indicators-new-delhi.

9 'African mobile market to grow to 186 mln subscribers – study', *Telecompaper*, 9 May 2006, at www.telecompaper.com/news.

10 'African mobile market to grow to 186 mln subscribers – study', *Telecompaper*, 9 May 2006, at www.telecompaper.com/news.

11 ITU data, cited in L. Waverman, M. Meschi, & M. Fuss, 'The impact of telecoms on economic growth in developing countries', *Africa: The impact of mobile phones*. The Vodaphone Policy Paper Series, No. 2, at www.vodafone.com/assets/files/en/GPP%20SIM%20paper.pdf.

12 The actual number of Internet users in Africa is probably higher due to the prevalence of shared accounts and computers and the use of community centres for connectivity to the Internet.

13 'Africa is coming online!', *eMarketer*, 10 May 2006.

14 According to AfricaOnline, Kenya increased its number of Internet users from 500,000 to 1.5 million in one year. 'Africa is coming online!', *eMarketer*, 10 May 2006.

15 R. Ngowi, 'Official: Africa charges more for net use', *Yahoo News*, May 17, 2006. http://news.yahoo.com/s/ap/20060517/ap_on_hi_te/africa_Internet.

16 F. Seye Sylla, *ICT as an Instrument for Participation: The Regional Perspective from Africa, Examples of the Internet use at the Grassroots Level*, United Nations Division for the Advancement of Women (DAW), Expert Group Meeting on 'Information and communication technologies and their impact on and use as an instrument for the advancement and empowerment of women', Seoul, Republic of Korea, 11-14 November, 2002.

17 E. Burns, *Web usage climbs in Africa*, 3 May 2006, www.clickz.com/experts/contact_author/index.php/68343_3603526, with data from AllAfrica Global Media www.allafrica.com and CIA World Factbook, 2006.

18 Senegal has a 45Mbps Internet circuit to France via the new Atlantis-2 cable and is planning to become a regional hub linking its Internet backbone to Mauritania and Mali. Pyramid Research, 'Senegal Gears up for competition', *Pyramid Analysis*, March 2005. www.pyramidresearch.com/pa_mar_05_sen.htm.

19 Based on 2005 estimates, Brazil's GDP is calculated at US$1,576,728, while its per capita income is estimated at US$8,584 (68th worldwide). *World Factbook*.

20 Instituto Brasileiro de Geografia e Estatistica (IBGE), www.receita.fazenda.gov.br/principal/Ingles/SistemaTributarioBR/BrazilianTaxSystem/basicaspects.htm.

21 R. Paes de Barros, R. Henriques and R. Mendonça, *A Estabilidade Inaceitável: Desigualdade e Pobreza no Brasil*, IPEA, 2001. http://integracao.fgvsp.br/BancoPesquisa/pesquisas_n5_2001.htm.

22 For example, seven per cent of households in the North and Northeast regions had access to computers in 2004, compared to 22 per cent in the Southeast. By the same token, 27 per cent of the households in the Northeast had fixed telephones, compared to 62 per cent in the Southeast.

23 Universal access/service policies are set in place to address these internal disparities, justified by network externality, equity and development rationales. Network externality arguments justify subsidizing universal service because adding individuals that would otherwise not subscribe to the network increases the value of the network for each of its users. As the number of subscribers that can be reached through the network increases so does the value of the network. Equity rationales emphasize the redistributive role of universal service policies that facilitate access to underserved populations or regions to the network. Finally, development rationales focus on the importance of communications infrastructure for commerce and its effect on growth and development. Access to communications infrastructure allows participation in the economic life of a country. E. Rosenberg, L. Perez-Chavolla & J. Liu, *Commissioner Primer: Universal Service*. NRRI, 2006.

24 See for example, Pyramid Research, 'Fixed mobile convergence: How Brasil Telecom leverages position to offer innovative converged services', *Analyst Insight*, October 14, 2005.

[25] The Partnership proposed the collection of metadata variables for households and individuals. For households, the Partnership suggested to collected as a minimum, the size (number of members) and composition of the household, that is, if it included children under 16. For individuals, the minimum classificatory variables proposed by the Partnership are: Age, gender, highest education level received, employment status and occupation. For more detail see *Partnership on Measuring ICT for Development*, *Core ICT Indicators*, UN, 2005. www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators.pdf.

[26] For instance, the United Nations Conference of Women, regional conferences on Gender and Communication Policy of the World Association for Christian Communication (WACC), and the two phases of WSIS.

[27] N. Hafkin, *Gender Issues in ICT Policy in Developing Countries: An Overview*, United Nations Division for the Advancement of Women (DAW), Expert Group Meeting on 'Information and communication technologies and their impact on and use as an instrument for the advancement and empowerment of women'. Seoul, Republic of Korea, 11-14 November 2002, p.4. www.un.org/womenwatch/daw/egm/ict2002/reports/Paper-NHafkin.PDF.

[28] UNIFEM and United Nations University Institute for New Technologies (UNU/TECH). *Gender and Telecommunications: An Agenda for Policy*, 2000. www.unifem.undp.org/pap_itu.htm.

[29] N. Hafkin and N. Taggart, *Gender, information technology and developing countries: An analytical study*, Washington, D.C., Academy for Educational Development, 2001. As cited in Sonia N. Jorge, The Economics of ICT: Challenges and Practical Strategies of ICT use for Women's Economic Empowerment, United Nations Division for the Advancement of Women (DAW), Expert Group Meeting on 'Information and communication technologies and their impact on and use as an instrument for the advancement and empowerment of women'. Seoul, Republic of Korea, 11-14 November 2002, p. 1. www.un.org/womenwatch/daw/egm/ict2002/reports/Paper%20by%20Sonia%20Jorge.pdf.

[30] S. N. Jorge, *The Economics of ICT: Challenges and Practical Strategies of ICT use for Women's Economic Empowerment,* United Nations Division for the Advancement of Women (DAW), Expert Group Meeting on 'Information and communication technologies and their impact on and use as an instrument for the advancement and empowerment of women'. Seoul, Republic of Korea, 11-14 November 2002, p. 2. www.un.org/womenwatch/daw/egm/ict2002/reports/Paper%20by%20Sonia%20Jorge.pdf.

[31] J. Bauer, *Governing the networks of the information society: Prospects and limits of policy in a complex technical system*. Working Paper 01-04. Quello Center for Telecommunication Management and Law, 2004.

[32] See A. Gillwald, S. Esselaar, L. Adam, J. Chuma, G. Frempong, I. Kaggwa, S. Masupe, S. Mulavu, B. Mutagahywa, F. Mwenda, I. Ngalinda, A. Nsengiyumva, O. N. Nzepa, J. Ongora; S: Sebusang; A. Stavrou; C. Stork; R. Tankeu; F. F. Tusubira; & K, Woldekidan, *Towards an African e-Index: Household and individual ICT access across 10 African countries.* LINK Centre, Johannesburg, South Africa, 2005. Intelcon & shekels, *Nigerian demand study,* 2005. Study conducted for the NCC as part of a World Bank funded contract. Cited in C. Milne, *Telecoms demand: Measures for improving affordability in developing countries*. IDRC, infoDev, Lirne.net, January 2006.

[33] LIRNEasia, *Telecom use on a shoestring: The use of cost-saving strategies by the financially constrained*, 2005. www.lirneasia.net/projects/completed-projects/strategies-of-the-poor-telephone-usage.

[34] L. Waverman, M. Meschi, & M. Fuss, 'The impact of telecoms on economic growth in developing countries', *Africa: The impact of mobile phones*. The Vodaphone Policy Paper Series, No. 2. www.vodafone.com/assets/files/en/GPP%20SIM%20paper.pdf.

[35] According to COFETEL, as of 4Q 2005, Mexico had 43,873 prepaid subscribers and 3'268 under the post-paid modality. With the economic recession affecting Mexico's finances, mobile subscribers began migrating from post-paid plans to prepaid plans in early 2002. Telcel, the incumbent's wireless affiliate (now part of America Movil), lost 19 per cent of post-paid subscribers in the first quarter of 2002, compared to the same quarter in 2001, while the number of prepaid subscribers increased 56 per cent (A. García, 'Crecen clientes de Telefónica de México', *Reforma*, 13 May 2002).

[36] TRC Jordan, *Draft regime on the universal service obligation, consultation paper,* 2005. Cited in C. Milne, Telecoms demand: Measures for improving affordability in developing countries. IDRC, infoDev, Lirne.net, January 2006.

[37] The Communications Act of 1934 created the Federal Communications Commission (FCC) with the purpose of 'regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all the people of the United States, without discrimination on the basis of race, color, religion, national origin, or sex, a rapid, efficient, nationwide, and worldwide wire and radio communication service with adequate facilities at reasonable charges …'. In contrast, the Telecommunications Act of 1996 aimed to 'promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies.' E. Rosenberg, L. Perez-Chavolla & J. Liu, *Commissioner Primer: Universal Service*, NRRI, Columbus, Ohio, 2006, p. 2.

[38] Nokia, 'New insights into non-users point to new potential', New Horizons, 3rd Quarter, 2005. Cited in C. Milne, *Telecoms demand: Measures for improving affordability in developing countries*. IDRC, infoDev, Lirne.net, January 2006.

[39] Mauritius ranks second in mobile digital opportunity, after Seychelles, among African countries included in the DOI. It ranks first in mobile opportunity and use within the continent, due in part to its high ratio of mobile Internet subscribers relative to other African countries. It also ranks first in percentage of households with computers. As for India, the number of mobile cellular subscribers has increased more than two thousand per cent between 2000 and 2005, growing from 3.5 million in 2000 to 75.9 million in 2005.

[40] D. Meyer, 'Pakistan plans largest mobile WiMAX rollout', *c|net News.com*, 23 May, 2006; S. McClelland, 'WiMax World Europe: Motorola WiMax wins Pakistan's Wateen', *Telecommunications Online*, 23 May, 2006, www.telecommagazine.com/search/article.asp?HH_ID=AR_2081&SearchWord=.

[41] A.T. Kearney & University of Cambridge, 'Mobinet 2005: Raising the stakes', 2006, www.atkearney.com/main.taf?p=5,3,1,121,1.

[42] Siemens, *The Internet and UMTS*, www.siemens.com.vn/Marketplaces/IaC/mobile-net-facts-intertrend.htm.

[43] Jones Day / ECTA, 2004 Regulatory Telecommunications Scorecard, www.jonesday.com/pubs/pubs_detail.aspx?pubID=S1187

[44] http://hdr.undp.org.

[45] http://ec.europa.eu/enterprise/ict/policy/ebi/eur21294en.pdf.

[46] www.unpan.org/egovernment5.asp.