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INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) DEVELOPMENT INDICES

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ICT DEVELOPMENT INDICES

CONTENTS

LIST OF ACRONYMS

CEE	Central and Eastern Europe
CSTD	Commission on Science and Technology for Development
CU	***'Catching Up' / Falling Behind ??***
EIU	Economist Intelligence Unit
EU	European Union
FDI	Foreign Direct Investment
GA	'Getting Ahead'
GDP	Gross Domestic Product
GIT	Georgia Institute of Technology
HDI	Human Development Index (UNDP)
HDR	Human Development Report (UNDP)
HTI	High Technology Indicators (GIT)
ICTs	Information and Communication Technologies
IP	Internet Protocol
ISP	Internet Service Providers
IT	Information Technology
ITU	Information and Telecommunication Union
IX	Internet Exchange points
KU	'Keeping Up'
LAC	Latin America & Caribbean
MAE	Metropolitan Area Exchanges
MNC	Multi-National Corporation
NAPs	Network Access Points
OECD	Organisation for Economic Cooperation and Development
PC	Personal Computer
PTO	Public Telephone Operator
SSA	Sub-Saharan Africa
UNCSTD	United Nations Commission on Science and Technology for Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
WAP	Wireless Access Protocol

EXECUTIVE SUMMARY

BACKGROUND

This report has arisen out of work that was first undertaken by the United Nations Conference on Trade and Development (UNCTAD) for the Commission on Science and Technology for Development (CSTD) – ***[if you consider it to be substantially different]***.

This report was prepared by the United Nations Conference on Trade and Development (UNCTAD) for the Commission on Science and Technology for Development (CSTD).

It was first presented to the CSTD Panel Meeting in Geneva on 22 May - 24 May 2002, as part of the work programme for the inter-sessional period 2001-2003: "Technology development and capacity-building for competitiveness in a digital society".

[WHAT THIS REPORT SETS OUT TO ACHIEVE]

This report seeks to analyse and evaluate Information and Communication Technology (ICT) development using indicators of ICT diffusion across countries. It develops a conceptual framework and selects key indicators measuring development in ICTs, with a specific focus on ICTs as pervasive technologies of global impact, wide application and growing potential. This study benchmarks levels of ICT development, in existing infrastructure connectivity, as well as measures of future potential and important determinants affecting countries' abilities to absorb, adopt and make use of these new technologies.

The challenges in such a benchmarking exercise are manifold, in the selection of a representative set of indicators measuring the complex concept of technology development; in the trade-off of 'breadth versus depth' in the nature and number of these indicators; and in the integration of the results of benchmarking into policy analysis. And yet, used wisely and with caution, benchmarking can provide useful information and meaningful analysis for policy purposes. Such a cross-country analysis permits comparison between countries and monitoring of progress over time. Comparison with better-performing countries helps identify policies for further improvement and progression. Although benchmarking cannot investigate causation, it nevertheless allows more straightforward identification based on evidence of 'success stories' for closer investigation for policy conclusions. Approached with thought, benchmarking is a useful input to policy analysis in allowing more informed and insightful study into policy and ultimately, in promoting better, faster and more effective ICT development.

[WHAT THIS REPORT DOES]

In conjunction with CSTD, UNCTAD reviewed and evaluated existing work to measure ICT development from different sources, including academia, the private sector and international organizations (UNDP, UNIDO, OECD and the ITU). On the basis of this work, UNCTAD constructed a theoretical framework to approach ICT measurement, comprising indicators for connectivity, access, usage and policy.

UNCTAD benchmarked and analysed the diffusion of ICT capabilities across 160-200 countries for 1995-1002. This cross-country study compiles data and calculates ICT Development Indices for: connectivity (physical infrastructure for ICTs, in penetration rates of Internet hosts, PCs, telephone mainlines, mobile phones per capita); wider access to ICTs (literacy, GDP per capita and cost of local calls, as well as actual number of Internet users); usage of ICTs (incoming and outgoing telecoms traffic, as an alternative to Internet data traffic flows in the absence of publicly available statistics on these); and policy environment

(a wider policy framework conducive to the adoption and absorption of ICTs, which can be evaluated in terms of the presence of a domestic Internet exchange, as well as competition in the local loop, domestic long distance and ISP markets). This study analysed country and regional rankings based on these index measurements, and reviewed results over time to identify interesting trends. It further sought to evaluate the extent and evolution of the digital divide, using basic measures of hardware equipment and numbers of Internet users in each country, to determine whether and in what way the digital divide is evolving.

[CONCLUSIONS]

Classification of countries as ***'falling behind', 'keeping up' and 'getting ahead'*** on the basis of country rankings show stable rankings over time, with strong regional influences. As a generalisation, African and South Asian countries were classified as ***'falling behind'***, Latin American and transition economies as ***'keeping up'*** and OECD countries and S.E.Asian Tigers as ***'getting ahead'***. However, this masks considerable diversity in individual country experience, with Arab and 'island states' as notable successes having good connectivity despite less competitive policy measures. Strong positive correlations are observed between connectivity and access and, to a lesser extent, connectivity and competitive telecoms policy. Country rankings are stable and consistent over time, and in line with expectations based on income. Such stability is consistent with long-term time horizons required for telecommunications investment. It also implies that these Indices are based on indicators measuring central ICT development.

UNCTAD further analysed and measured the international digital divide in inequality in distributions of hardware equipment and Internet users across countries, using Gini measures of inequality. Trends in connectivity over time suggest that, despite stable country rankings, there is reducing inequality and potential convergence in the distributions of hardware across countries, yielding the intriguing result of a diminishing digital divide. Gini analysis reveals some small change in inequality, with only small, incremental reductions from highly unequal levels. Our results show that more recent technologies such as the Internet (as measured by Internet hosts and Internet users) are more unevenly distributed relative to older technologies, such as fixed line telephony. Our findings demonstrate 'leapfrogging' in mobile telephony (with lower levels of inequality, which reduce the fastest), suggesting greater potential for mobiles as more equally distributed technologies in bridging the digital divide.

However, Gini coefficients as relative measures across the whole distribution do not identify the origins of reducing inequality. UNCTAD therefore analysed relative movements in rankings to identify how countries and regions are faring in basic connectivity, to see which countries are contributing to reducing inequality, increasing inequality, or preserving the status quo. Based on a regional analysis of relative rankings, we find evidence that OECD countries are becoming more tightly bunched in the upper 'tail' of the distribution. Sub-Saharan African countries continue to occupy the lower tail of the distribution. The incremental reductions in Gini coefficient likely derive from the middle of the distribution of hardware equipment across countries. China in particular has a steady and substantial rise in relative rankings that influences the Gini coefficient strongly, since China is host to one fifth of the world's population. Taken together, it is envisaged that these relative measures of the digital divide and the insights derived from benchmarking, provide a more detailed picture of developments in the evolution in countries' ICT development.

Overall, these reductions represent only small, incremental reductions in inequality from their high levels of inequality. There is still considerable work to be done in bringing the

large majority of the world's population within reach of modern communications. And yet, the benefits of extending ICTs to the world's rural and poorer populations may be enormous. For then, truly, their voices may be heard.

1. INTRODUCTION

This report seeks to analyse and evaluate Information and Communication Technology (ICT) development using indicators of ICT diffusion across countries. It develops a conceptual framework and selects key indicators measuring development in ICTs, with a specific focus on ICTs as pervasive technologies of global impact, wide application and growing potential. This study benchmarks levels of ICT development, in extant infrastructure connectivity, as well as measures of future potential and important determinants affecting countries' abilities to absorb, adopt and make use of these new technologies.

In keeping with their complex nature and multiple applications, Information and Communication Technologies (ICTs) may be viewed in different ways. The World Bank defines ICTs as "the set of activities which facilitate by electronic means the processing, transmission and display of information" (Rodriguez & Wilson, 2000). ICTs "refer to technologies people use to share, distribute, gather information and to communicate, through computers and computer networks" (ESCAP, 2001). "ICTs are a complex and varied set of goods, applications and services used for producing, distributing, processing, transforming information – [including] telecoms, TV and radio broadcasting, hardware and software, computer services and electronic media" (Marcelle, 2000). ICTs represent a cluster of associated technologies defined by their functional usage in information access and communication, of which one embodiment is the Internet. Hargittai (1999) defines the Internet techically and functionally: "The Internet is a worldwide network of computers, but sociologically it is also important to consider it as a network of people using computers that make vast amounts of information available. Given the two [basic] services of the system – communication and information retrieval – the multitude of services allowed… is unprecedented". ICTs, represented by the Internet, deliver "at once a worldwide broadcasting capability, a mechanism for information dissemination, a medium for interaction between individuals and a marketplace for goods and services" [Kiiski & Pohjola (2001)].

ICTs have been in use for some time, for example, in voice communications technology. However, recent advances such as the Internet are breaking new ground (and introducing new divisions) in the achievements and potential they offer. Cukier (1998) notes that definition of the Internet "is very relevant to the peering debate [about the exchange of data traffic and interconnection agreements] as well as whether regulators [have] a role to play in Net matters". He points out that "the voice telecoms network is founded upon the principle of universal connectivity… The Internet, however, lacks a specific definition and it is uncertain whether the telephony model applies to it". In this view, [spread of] the Internet has unique important characteristics differentiating it from older technologies, such as telephony. This view has important implications for countries' policy approaches and the way in which they seek to encourage, monitor and regulate ICT adoption, interconnection and, ultimately, access.

It may be easier to define what ICTs are not: ICTs are not a panacea for development or replacement for real world processes. If real world processes are flawed, deficient or absent, ICTs cannot make good these flaws or make up for these deficiencies. If a government process is bureaucratic, convoluted and subject to delays, moving it online may not make it any more efficient; and instant transmission may not necessarily make it any faster. If controls over financial systems are inadequate or missing, making systems electronic will not make them effective; and may in fact make it more difficult to trace the audit trail. This emphasizes the importance of having well-thought out, well-established, clear real world processes, before moving them online. In this view, ICTs can be an effective 'AND', rather than a substitute 'OR'.

ICTs may, however, reshape, re-organize and fundamentally restructure working methods, and ultimately, the sectors in which they are used. ICTs offer generic advantages of: efficiency and productivity gains; information-sharing, storage, and communication; faster knowledge-accumulation, dissemination and application; in support of the specific purposes for which they are used. ICTs also permit new, collaborative work methods, with their potential for networking. Communication and interaction between previously isolated agents pool their individually isolated resources, knowledge and experience to build a common knowledge base that all members can draw upon. ICTs can transform work and research methods by enabling group interactions based on central reserves of shared knowledge. The evidence suggests that we still stand at the threshold of what ICTs may achieve, and that collaborative networking methods will evolve further, as people learn to communicate, interact and work in new ways. This makes ICTs a very exciting 'AND', and one that may change the equation altogether.

Despite the undoubted benefits offered by ICTs, substantial barriers to the effective use of ICTs also exist, in both developed and developing countries. These barriers must be addressed to allow realisation of ICTs' full potential. Some barriers may be endemic (e.g. the generation gap, learning processes, and gaining experience in ICTs). Developing countries face additional barriers to effective ICT usage. In the E-Commerce Report (2001), UNCTAD notes that "in developing countries, [government agencies] will have to deal with problems of telecoms infrastructure, poor computer and general literacy, lack of awareness of the Internet and regulatory inadequacy, that also hinder other applications of the Internet there". (These obstacles are not uncommon in developed countries, with the European Union seeking to address some of these challenges). Technological gaps and uneven diffusion in technology are not new – "older" innovations such as telephony and electricity are still far from evenly diffused – but what may be unprecendented is the potential size of the opportunity costs and benefits foregone by failure to participate in the new "digital society". Growth in the use of ICTs is highly uneven. There are significant disparities in access to and use of ICTs in developing countries, which risk being left behind in the digital revolution. Developing countries risk being left further behind in terms of income, equality, development, voice and presence on an increasingly digitalised world stage. They must look forward prospectively, and participate actively in building technological capabilities to suit their needs. Technology itself also has a roleto play in this. Just as technologies create them, new innovations offer ways of bridging technological divides. Connectivity can build on existing infrastructure or bypass traditional means with technologies such as wireless. The availability of free software is transforming the IT industry.

This report seeks to benchmark the extent of ICT development, as an important contribution and input to policy-making. Benchmarking is important in measuring outcomes (but not

causation) from policies, and in monitoring progress in ICT connectivity and access. Benchmarking allows comparisons between countries and indicates how well countries are doing compared to others in terms of their adaptation, mastery and development in ICTs. A standard selection of indicators against which countries are measured allows comparisons and initial policy conclusions, between countries and over time. Comparison with better-performing countries helps identify policies for further improvement and progression. Although benchmarking cannot investigate causation, it nevertheless allows more straightforward identification based on evidence of 'success stories' and 'laggards' for closer investigation, as an essential input to policy analysis.

ITU (2002) notes in its 2002 World Telecommunications Development Report that "over the last few decades, virtually every country has succeeded in improving its telecommunications sector. Thus, every country can show that its particular blend of policies has been successful. It is only by making ***international comparisons*** that it is possible to show which policies have been more successful than others… For this reason, an approach based on ***comparative rankings*** may be more meaningful than one that uses absolute growth rates". ***UNCTAD therefore uses a methodology based on relative rankings, rather than absolute scores***. Indeed, with respect to ICTs, it is unclear what the reference points for absolute scores would be. In this paper, we adopt a comparative approach based on relative country rankings to identify countries that are making progress in ICT uptake, and those which are being left behind in the digital divide.

2. THEORETICAL FRAMEWORK & LITERATURE REVIEW

In conjunction with the United Nations Commission on Science and Technology for Development (UNCSTD), UNCTAD reviewed and evaluated existing work to measure ICTs from different sources, including academia, the private sector and international organizations (UNDP, UNIDO, OECD and the ITU).

Our review of existing work carried out to date to evaluate countries' ICT capabilities reveals a consistent underlying theoretical framework of indicators of connectivity, access, policy and usage across most studies, irrespective of the viewpoint from which they are written, as illustrated in Table 1 below. UNCTAD uses this theoretical framework, shown in Table 1, to approach the measurement of ICT development and adopts this framework in the formulation of the ICT Development Indices. This section provides a brief discussion of some of the main conceptual issues arising from a review of the literature on approaches towards the measurement of ICT development.

Table 1: Theoretical Framework for Measuring ICT Development

Index	UNCTAD (2002)	Mosaic Group (1998)	Mosaic Group (1996)	McConnell International (2001, 2000)	Economist (EIU) (2001, 2000)	Harvard University	ITU
Perspective	Tech. Development	General IT	Defence	Commercial	Commercial	Sociological	Telecoms
Item measured	ICT diffusion	Global Diffusion of Internet	IT capability	E-Readiness	E-Readiness	Networked Readiness	Internet Access
1.Connectivity (physical capacity; infrastructure)	Internet hosts; Tel. Mainlines; PCs; Mobile subscribers.	Pervasiveness; Connectivity Infrastructure.		Connectivity Infrastructure pricing	Connectivity (30%) fixed & mobile, narrow band/broadband	Info Infrastructure Software & Hardware	Hosts; servers; telephones; PCs.
2. Access (wider determinants of access)	Internet users; Literacy; Average revenue; call costs.	Pervasiveness Geographical dispersion	Pervasiveness	Access	Cost of access Availability Affordability	Availability Affordability	Users; subscribers.
3. Policy environment	Competition: Local loop, long distance; Internet exchange.	Organisational infrastructure	Depth of Development	E-Leadership; E-Business Climate	Legal and Regulatory Env't (15%) Business Env't (20%)	Legal Environment: Telecom & Trade policy	ISPs; Prices; Traffic
4. Usage	Telecom traffic: incoming; outgoing.	Sectoral Absorption Sophistication of use	Sophistication of usage	Information Security	E-commerce (20%); consumer/business use; e-services (10%)	Content B2B education B2C Ecommerce;	
Additional			Proximity to Tech. Frontier	Human Capital	Social/cultural infrastructure5%	IT Sector ICT Training	
			Indigenisation		Education/literacy		

Conceptual Issues relating to ICT Indices

The theoretical model and selection of indicators determines the quality and predictive power of Indices. A good example of a comprehensive, well thought-out model embodying views on causation in Internet indices is the United Nation's Industrial Development Organization (UNIDO)'s Industrial Performance Scoreboard (2002). Conversely, the absence of, or deficiencies in, a model constrains and limits the scope of observations possible (e.g. Economic Intelligence Unit's E-Readiness indicators, which yield only limited policy insights, following the lack of a coherent theoretical framework). The selection of indicators has important consequences for the study's results and conlusions. The United Nations Development Progam (UNDP) use a broad selection of technological indicators in their Technological Achievement Index (2001). UNDP's index for agriculture and manufacturing technologies has the advantage of enabling UNDP to characterise developing countries by technological criteria relevant to developing countries' industrial achievements. Inclusion of older innovations permits longitudinal comparisons over time back to 1970.

In this study, we opt for a more narrow, focused subset of ICT indicators. This has the effect of restricting the time period (from 1995 onwards; following Hargittai (1999), who notes that usage of the Internet only really became widespread after 1993). It also has the effect of restricting our country sample, depending upon the indicator. For connectivity, 200 countries have been assessed. For more advanced data, notably on usage of ICTs, sample is restricted to mostly OECD and South Asian countries. Standardised data for several regions are not available, with individual case studies detailing usage for different countries.

Selection of indicators also describes the 'breadth versus depth' trade-off. This trade-off describes how standardised data is not available in detail for a large number of countries. Press (1999) observes that "in tracking diffusion of the Internet, one must choose a balance between breadth and depth". He concludes that with a complex concept as the Internet, "an index may be more robust than a [*single*] indicator in measuring a qualitative concept" (Press, 1999, p.5). From a practical perspective, if a wide sample coverage is sought, then basic, standardised indictors must be chosen for the index. For more detailed indicators such as usage and ICT take-up statistics, specialised data is only available for a smaller subset of countries. Furthermore, this type of data is most likely to come from country case studies, rather than the high level, standardised data we present here. In the trade-off between 'breadth versus depth', this study opts necessarily for breadth in pursuit of its cross-country benchmarking exercise.

UNCTAD (1991) distinguishes between input, output and performance-related indicators for technology indicators as a whole. However, it is becoming increasingly unclear as to what extent this distinction still applies in respect of ICT indicators. Is a Personal Computer to be viewed as an input (e.g. as a necessary piece of equipment for dial-up Internet access), as an output (e.g. in regression analysis, which has sought to explain the diffusion of PCs, as in Caselli & Coleman, 2001), or as part of the phenomenon to be studied?

The distinction between input and output indicators (e.g. UNDP, 2001) finds a parallel in similar distinctions between ex ante and ex post indicators (e.g. World Economic Forum, 2001), and determinants and performance indicators (e.g. UNIDO, 2002). It also partly relates to views of technologies, including ICTs, as sequential, in which one technology forms a basis or input to another in predefined steps. For example, UNDP (2001) justifies

including telephones and electricity per capita as indicators in its Technological Achievement Index since “they are needed to use newer technologies and are pervasive inputs to a multitude of activities”. Alternatively, views of technologies may be synergistic, in which a cluster or spectrum of technologies is necessary as simultaneous inputs to an outcome technology e.g., electricity, laser technology, digital code, PC, modem for Internet access. The question of whether inputs into the process of technology development are considered sequential, as with UNDP (2001), or synergistic, as in the 'cluster' approach of McConnell International (2001), determines the form of index adopted – See 'Index Methodology' in the next Section.

Views of sequential and synergistic technologies also partly reflect views of causation. Indices are not capable of determining or quantifying causation, for which more sophisticated statistical techniques are required. These may be conceptually embodied in the theoretical framework, e.g. the UNIDO (2002) distinguishes between 'Determinants' and indicators of 'Industrial Performance' and investigates causation by methods including cluster analysis and regressions. Indices provide a ready means of measuring a standardised predetermined set of 'symptoms', rather than their wider 'causes'. There is likely to be significant endogeneity within this model, which indices are not equipped to analyse.

Furthermore, the indigenous nature of technology is a consideration for some studies. In Porter et al (1999)'s original Capacity for Innovation Index, the highest scores in its qualitative variable were assigned to countries where "companies obtain technology by pioneering their own new products and processes", whereas countries where "companies obtain technology exclusively from foreign countries" received less credit. This method values domestic innovation as more valuable than imported technology and diminishes the value of international technology transfer (TT), despite substantial evidence to the contrary, for the potential success of these channels (notably Asian NIEs, such as Korea).
The World Economic Forum also distinguishes between domestic and foreign technology in its study of national competitiveness, on the basis that "evidence suggests that without strong domestic technological activity, heavy dependence on foreign technologies leads to limited and shallow technology transfer" (World Economic Forum, 2000). The Mosaic Group (1996) assesses 'indigenisation' in its IT Capacity Framework, defined as the national origins and staffing of technology with indigenous personnel. However, subsequently the Mosaic Group (1998) assesses worldwide diffusion of technology in its 'Global Diffusion' of the Internet framework as a stand-alone, independent package that countries can import and apply, and no longer considers the national origins of technology, R&D or human capital.

The question as to what extent it is still relevant to talk of the national origins of a global technology such as the Internet, is intriguing. The Economist Intelligence Unit notes that "the Internet is global, but local conditions matter" (EIU, 2001). "National" and cultural influences are apparent in the readiness with which consumers adopt new technology and issues of MNC operations and FDI in technology transfer. There is an important role for the state in the development of policy and the telecoms and business environment. Governments can influence access to technology (connectivity, control over access, censorship). Important policies include telecoms policy and regulation, import policy, FDI, MNCs and technology transfer, political openness/censorship, e-governance, E-Leadership, education, research, stable macro-fundamentals and the legal environment. This academic question finds its practical correlation in the adoption of national economies as the basic unit of analysis (see the next section: ICT Development Indices).

3. ICT DEVELOPMENT INDICES

The Index of ICT Diffusion is a simple arithmetic average of scores on quantitative variables (connectivity and access indices). Qualitative variables for policy indicators are also presented separately for 2001-2. The telecom usage index was also reviewed and analysed, but is not included, as it is unclear to what extent telecom traffic is representative of Internet use. These indicators represent a selective subset of the full set possible with other indicators were omitted owing to limited data availability or difficulties in their measurement.

Table 2: Construction of the ICT Development Indices

Index/Dimension	Indicators	Sources
1. Connectivity	Internet hosts per capita Number of PCs per capita Telephone mainlines per capita Cellular subscribers per capita	All data series from ITU deflated by UNSD population data and compared to World Bank data for accuracy check.
2. Access	Internet users per capita Literacy (% population) GDP per capita Cost of a local call	ITU UNSD World Bank ITU
3. Policy (*presented separately, as relates to 2001-2*).	Presence of Internet exchange Competition in local loop telecoms Competition in domestic longdistance Competition in ISP market	UNCTAD research ITU ITU ITU
Usage: Telecom Traffic (*analysed separately,but not presented, as appears unrepresentative and not clear to what extent this reflects global diffusion of ICTs and Internet*).	International incoming telecom traffic (minutes per capita) International outgoing telecom traffic (minutes per capita)	ITU ITU

Appendix 1 presents the ICT Development Indices and Index of ICT Diffusion and country rankings for 2001, 2000 and 1999 for all countries with data available. Indices and rankings for 1998 and 1995 have also been calculated and are analysed in Appendices 3 and 4.

3.1. ICT INDICATORS: 1. Connectivity

Connectivity is narrowly defined as the physical infrastructure available to a country, as distinct from broader factors determining access (e.g. literacy, cost). Connectivity represents the basic 'limiting factor' on access to and use of ICTs – without the essential physical hardware, ICT use is not possible. We defined the narrow 'connectivity' as the minimum set of measures necessary for ICT access as comprising: Internet hosts per capita; PCs per capita; telephone mainlines per capita; and mobile subscribers per capita. This excludes supporting infrastructure (such as electrical supply and transport), affordability and broadband access, which may be currently more relevant to developed countries, but is expected to become increasingly important to all countries in the future. McConnell International note that "a multitude of factors must be in place… a weakness in any one can degrade a country's ability to take advantage of the economic potential of the Internet". This view sees connectivity as a cluster of technologies with synergies, rather than precedence, between different types of physical infrastructure. This is in contrast to UNDP's sequential logic of 'old' (telephony and electricity) as opposed to 'new' innovations (hosts, PCs) and "leapfrogging" between stages with a sequential order.

1. Internet hosts per capita

Number of internet hosts has been taken as a measure of the Internet penetration of a country, and the degree of national "connectivity". Network Wizards (NW) define a host as: "A domain name that has an IP address (A) record associated with it. This would be any computer system connected to the Internet (via full or part-time, direct or dialup connections) ie. nw.com, www.nw.com". OECD (1998a) considers that "host count is the most precise available data on the presence of Internet in a country". Cross-country regression work has mainly used this variable as the most representative variable of Internet diffusion e.g. Hargittai (1999), Kiiski & Pohjola (2001), Robinson & Crenshaw (2001).

Increasing number of Internet hosts implies increased ability to handle, service and store large amounts of data. However, difficulties include:

- ambiguity/overlap in definition with Internet server functions - Hosts may include name servers, mail servers and file servers;

- measurement methods and difficulties in allocating hosts to nations:

Hosts are assumed to be in the country shown by their country code (e.g. .nl for Netherlands). However, "there is not necessarily any correlation between a host's domain name and its location. A host with a .NL domain name could easily be located in the U.S. or any other country. Hosts under domains EDU/ORG/NET/COM/INT could be located anywhere. There is no way to determine where a host is without asking its administrator" (Network Wizards). This is a major problem, giving anomalous results e.g. the top country for Internet host penetration at July 1999 was the Pacific island Niue (Minges, 2001). The Solomon Islands had no hosts according to the July 1999 Networks Wizards survey, but has been connected to the Internet since 1996. The U.S. ranks 44th in Internet penetration based on the .us code. Most hosts in US use .com, .net or domains other than .us (Minges, 2001).

A single computer may host several domain names and a single domain name might be hosted by a group of computers (Minges, 2001). These figures have been adjusted for physical location of the hosts by ISC. Data are subject to revision and there are often discrepancies between surveys. In July 1999, OECD nations owned 93% hosts (Press, 1999).

2. PCs per capita

Telephone lines and *personal computers* are key components for Internet access before 3Generation and WAP mobile access become widely available, with significant implications for ICT adoption. Current access methods include dial-up access, using a telephone line, PC and modem. PCs therefore represent an upper limit for Internet access. Caselli & Coleman (2001) use number of computer imports as a measure of "computer technology adoption".

PC estimates are available for developed countries, but measurement may not be reliable. Most ITU data are estimates of PC stocks from sales or import data. This is inaccurate for developing countries, where shipment data are scarce and significant channels for PC imports are omitted (e.g., smuggling, grey market, local assembly). Increased PC penetration rates should increase ICT connectivity. This is purely a numerical count and gives no indication of the power or quality of PCs, usage made of them, or method (e.g. shared Internet access).

3. Telephone mainlines per capita

This is a relatively reliable, basic 'limiting factor' of connectivity and representative of potential, if not actual, levels of 'dial-up' access. ITU statistics include telephone subscribers plus the number of pay phones (data from telecom authorities or operators). Increased availability of telephone mainlines should increase connectivity, assuming dial-up access is available. However, this does not give an indication of the speed, reliability or cost of the connection, which are important considerations.

It is important to be aware of the proxy variables that may be implicit in this measure. Telephone networks typically require large investments, so average national income and the public resources available play a large role in determining connectivity on a national basis. Population distribution, urban/rural dispersion and underlying geographical factors are important determinants of the extent of telephone networks e.g. Nepal and Cambodia have relatively limited mainline networks, while Turkey's is widely distributed.

4. Mobile subscribers per capita

This measure of mobile connectivity will become increasingly important in the future. Current methods of Internet access emphasise PC-based applications, with 3G and WAP less widely adopted. Inclusion of mobiles allows leapfrogging in e.g. Cambodia (ITU case study, 2002) to be counted. However, ITU notes that the Cambodian government has neglected fixed lines, which are "more important for Internet access at this time". Inclusion of both fixed and mobile telephones reflects forms of ICT access which are important both now and in the future.

2. Access

Jensen (2000) considers Internet connectivity from a more technical telecommunications perspective, noting that it "requires more than simply installing phone cables… the Internet is dependent on the telephone network ([comprising] cost of the line and cost of local and long-distance charges), availability and affordability of access equipment… and pervasiveness of telematics (mix of hard/software with human/organisational skills and knowledge transfer)". This introduces a broader definition of access and the factors determining use of ICTs, beyond narrow connectivity.

1. Number of Internet users

This is an ex post measure of the level of Internet usage achieved by a nation in realised access to the Internet. However, Nua surveys and Minges (2001) point out different survey methods and definitions of Internet 'users':

Inhabitants > awareness > ICT access > users > subscribers

Number of *subscribers* paying for Internet access is more precise than users and implies a certain degree of usage in terms of realised actual users. It is also more measurable, but may not reflect full usage as it omits free or shared access. For developing countries, subscribers may constitute 'elite' consumers and fail to include common types of usage (e.g. shared access and cybercafes).

Nua collects its data from national surveys that do not use consistent methodology, reducing their comparability. For consistency, we used ITU estimates of Internet users, weighted by population to yield Internet users per capita. ITU surveys were observed to be consistently lower than SangoNet surveys (Nua). However, to test how representative ITU surveys are, countries were scored and ranked according to Nua and ITU user estimates. Comparison of these rankings revealed relatively similar country profiles.

2. Literacy

In the absence of widely available voice protocols, text-based protocols remain the most widely used Internet applications. Language barriers and illiteracy have been identified as common obstacles to Internet access. Language has been modelled using dummy variables for English-speaking former colonies (Robinson & Crenshaw, 2001). However, the rapid growth of other languages on the Internet means that the importance of this obstacle to access is diminishing all the time. According to GlobalReach, 43% of online users and 68.4% Web content use English, down from 80% web-pages in English in the late 1990s. Literacy remains a pervasive barrier to access, particularly for developing countries. Basic literacy represents an important ex ante capability for Internet access, of which only a small subset may be realised as the proportion of Internet users. 'Depth' measures of human capital, such as tertiary education, are considered less relevant for basic Internet access. We have therefore included basic literacy in our index.

3. Cost of a local call

Prices are an important measure and determinant of access, since people will not use the Internet if they cannot afford it. In Europe, the practice of per minute billing has been considered a major obstacle to Internet adoption (Center for Democracy & Technology, 2002). Some countries may have high Internet connectivity (e.g. high telephone and PC penetration) but relatively low user levels. The most heavily used Internet access method is dial-up (U.S. Internet Council, 2000), which entails the following main charges:

1. telephone charges (line rental/call charges to PTO);

2. Internet access charges (paid to the ISP).

Internet pricing comparisons are complex (depending upon method of access, time and frequency of usage), change rapidly and are often only available for developed countries. Given data constraints for developing countries, we adopted cost of a local call as the most representative indicator of cost of access. However, issues with ***telephone charges*** include:

- local call charges: some telephone operators do not charge directly for local calls (includes operators in N. America and New Zealand) – this has been considered an integral factor in and key to the expansion of ICTs in North America (Information Society, quoted in Center for Democracy and Technology, 2002);

- operators may include a proportion of "free" local calls in subscription charges;

- charges may be fixed regardless of call duration;

- local call charges may differ depending on the time of day, day of week, or whether the call is for Internet access;

- operators may provide discounted calls to user-specified numbers.

Reduced cost of calls should facilitate the expansion of access to ICTs.

4. GDP per capita

Income is another key determinant of access and people's ability to afford hardware investment and ongoing call costs (that are often a significant proportion of the cost in accessing the Internet). $1 an hour charged by a cybercafe is unaffordable for people whose average income is $2 per day. Average national income is also a proxy variable for a country's level of development, often implicitly related to a country's level of investment and thus its connectivity and infrastructure. Kedzie (1997) notes that "economic development is a leading candidate for a compounding factor that affects both democracy and electronic communication networks simultaneously". However, in his study of democracy and interconnectivity based on simultaneous equations analysis growth in Internet nodes, "statistical test results do not support… economic development as a confounding third variable… neither democracy nor GDP proves to influence interconnectivity strongly".

3. Policy Index

The Policy Index relates to 2001-2, as this data is current and ITU gives 'realtime' data. Retrospective comparison is made with the other indices for 1995-2000. However, the stability of the rankings emerging (see section 4: Discussion of Results) give us confidence that these are valid comparisons to make.

1. Presence of Internet Exchanges

Abramson (2000) defines Internet exchange (IX) points – also called network access points (NAPs) or metropolitan area exchanges (MAEs) – as physical installations created by third parties to facilitate traffic exchange between ISPs. Telegeography defines IX as "services created to facilitate on-site interconnections between independent or third-party Internet networks". This definition can be ambiguous: ITU considers Egypt has access to the functions of an IX (ITU, 2001) but Egypt is not listed as having an IX (Telegeography).

Internet exchanges are important to permit domestic exchange of within-country traffic, without using valuable international bandwidth. Abramson (2000) notes that IX "provide focal points for local traffic exchange, enhancing local Internet infrastructure and reducing dependence on international links". Establishing an Internet exchange is an important policy decision in the allocation of resources for developing countries, keeping domestic Internet traffic within the country and saving international bandwidth for other uses.

For the majority of developing countries, Internet exchanges are nationally based i.e. one per country (e.g. Kenya IX, Indonesia IX). Some countries have multiple exchanges serving major urban centres [Capetown IX (CINX), Johannesburg IX (JINX)]. In U.S., IX operate primarily at the State level or serve major urban centres (MAE may be an appropriate name).

Our policy variable is a dichotomous variable (1 for an IX, 0 for its absence) since, for the majority of developing countries, presence of an IX is a major step. The additional benefits arising from further exchanges at the urban level may be considered marginal. The establishment of an IX may also be indicative of a proactive ICT policy outlook.

2. & 3. Competition in the local loop/domestic long distance

Competition in a country's telecoms sector is an important policy choice. Current thinking holds that monopolies may hinder rapid development and advocates liberalisation of the telecoms sector in promoting competition, lowering prices and expanding access. OECD (2001) concludes "countries that moved early to liberalise telecoms have much lower telecoms costs and a wider diffusion of ICTs than countries that were late to take action" (p.9). They recommend that countries "facilitate the diffusion of ICT, by increasing competition in telecoms and technology (p.22)… [with] policies to unbundle the local loop and improve interconnection frameworks" (p.24). The structure and policy developments in the telecoms market affect the diffusion and absorption of ICTs within a country.
Gorman & Malecki (2000) observe that "regulation and lack of telecommunication competition make it more expensive to operate through Asian and European providers

(Bond, 1997; Cukier, 1998). The high cost of infrastructure and connections in Europe makes a circuit from Washington DC to Paris, London or Stockholm cost less than direct lines (Paltridge, 1999). Although prices are dropping as competition increases, leasing capacity on many intra-European leased lines remains more expensive than trans-Atlantic routes (Paltridge, 1999)".

However, evidence from the cross-country regression studies is conflicting. Kiiski & Pohjola (2001) found that Internet access cost best explained growth in computer hosts per capita, however, competition (lack of monopoly) in telecoms markets proved insignificant. This is in sharp contrast with Hargittai (1999), who found that monopoly in the telecoms sector had a considerable negative impact on Internet connectivity in OECD countries (but not via reduced prices in access costs, which proved statistically insignificant).

Competition in the local loop describes a country's telecoms market structure and government policy towards telecoms, irrespective of whether competition actually results in reduced prices. Based on data from ITU T-Reg Unit, our index scores competition in the local loop as 1, partial competition 0.5, duopoly 0.25 and monopoly 0. It is important to be aware of the implicit value judgments inherent in this scoring system. The 'monopoly' score of 0 does not recognise the potentially beneficial effects conferred by a "benign monopoly". SingTel is widely recognised to have been an efficient, proactive incumbent in Singapore's telecoms sector, with important benefits for the adoption of ICTs in Singapore (ITU, 2001). This contrasts with Nepal Telecommunications Company in Nepal, which "was not customer-orientated in pricing, bandwidth or service" (ITU, 2000). In future work, the blunt monopoly/ competition distinction could be replaced by country analysis of actual effects in practice.

4. Competition in the ISP market

ITU defines web servers as installations that provide end-user access to the Internet, disseminate information and sell products and services (Minges, 2001). However, Cukier (1998) identifies four different types of ISP (backbone, downstream, webhosting and online service providers). Competition in a country's ISP market is important for the domestic diffusion of ICTs. Competition in Internet service provision may reduce prices and installation time, improve quality and availability of different services and customer care, thereby enhancing access.

The importance of a vibrant ISP market is illustrated by Indonesia and Egypt, each with in excess of 60 ISPs, as opposed to Cambodia and Vietnam, where a limited number of ISPs and higher market concentration arguably result in higher prices and reduced customer service (ITU case studies).

Number of ISPs in a country has been used as an indicator of market liberalisation. However, there are at least four different types of ISP [Cukier (1998)], markets may be fast-changing and there may be no legal requirement for ISPs to register. It is also necessary to distinguish between licensed ISPs and operational ISPs. This makes ISP counts inaccurate in large, liberalised markets. Number of ISPs has not been used in our index. We used ITU's T-Reg unit data to define this variable as a simple dichotomous variable (competitive scored as 1, monopoly as 0), rather than the continuous number of ISPs.

4. Usage: Telecom Traffic (omitted from the Index of ICT Diffusion)

We investigated Internet traffic data. However, this data is commercially sensitive for Internet Service Providers (ISPs), who did not respond positively to our data requests. This is consistent with OECD (1998), who note an "absence of data on Internet traffic flows between countries". Abramson (2000) notes "meaningful Internet traffic statistics do not yet exist", despite widespread use of telephone traffic data. Minges (2001) notes that "Internet traffic data are scarce. Where available, they are compiled by telecom operators, ISPs, and some government agencies. Internet average daily usage in minutes reveal wide variations in average usage times across countries".

We investigated existing data on telecom traffic as an indicator of usage. Telephone technologies form part of the ICT technological cluster. They are however mature technologies with established uses and may not be representative of usage patterns for more recent Internet technologies. Our telecom index is calculated as the average of incoming/outgoing telecoms traffic (minutes per capita population):

Telecom traffic index = (incoming traffic + outgoing traffic)/2

The results from our telecom index reveal the interesting phenomenon of 'offshore islands'. There is a small, but important, sub-category of 'island states' (such as Cayman Islands, Bahamas, Bermuda) specialised in service industries such as offshore banking/financial services, which require and are highly intensive in the use of ICTs. Renata Lebre La Rovere (1996) points out in her excellent review of Brazilian banking that "a bank's production process is particularly suited to benefit from IT diffusion, since it is organised around the storage and transfer of information". Banking particularly lends itself to automation and computerisation due to the high volume of repeat transactions involved. These economies have high PC and telephone penetration rates. However, their importance is apparent in the telecom usage statistics, where they have highest average incoming/outgoing telephone traffic. *Please see discussion of results.*

The extent to which this usage phenomenon is representative of Internet data traffic flows is questionable. Comparison of country rankings in telecom traffic with total Internet users (regardless of type of usage) reveals little similarity in country rankings. We have therefore kept this index separate and not included it in the Index of ICT Diffusion. However, current telecom traffic may demonstrate future patterns of usage of ICTs as these more recent technologies mature.

3.2. INDEX METHODOLOGY

Index Methodology

Edgeworth (1925) defines an index number as "a number [that] shows by its variations the changes in a magnitude which is not susceptible either [to] accurate measurement itself or [to] direct valuation in practice". Press (1999) observes that "in tracking diffusion of the Internet, one must choose a balance between breadth and depth" and concludes that "an index may be more robust than a [*single*] indicator in measuring a qualitative concept" (Press, 1999, p.5).

The Mosaic Group suggests that individual technologies need to be evaluated, since countries seldom exhibit uniform capabilities across the broad spectrum of ICTs. Measures of breadth and depth are needed; a dilemma which the Mosaic Group resolves by the use of Kiriat or 'wheel and spoke' diagrams [Kiriat, 1973] to reflect technology as a 'multi-faceted concept'. UNCTAD has reflected this balance between breadth and depth through use of an aggregate index with component sub-indices.

However, there are dangers inherent in the use of a disaggregated index. The Mosaic Group observes in their 'Framework Analysis' paper (1997) that "while it is tempting to derive a single index to reflect a country's IT capability, such an approach is unlikely to provide the depth of understanding needed for policy decision-making". Press (1997) explicitly warns against the dangers of averaging, or "reducing a [*multi-faceted*] capability diagram down to a single number" (i.e. area), since capability diagrams with the same total area may have very different shapes i.e. countries exhibit different profiles across the spectrum of ICT technological capabilities. Press (1999) notes further challenges for Internet indices: [they] "should be orthogonal, each measuring an independent aspect of the state of the Internet in a nation, but it is difficult to define indices that are both comprehensive and uncorrelated". Simple averaging of indicators in an index implicitly assumes equal weighting of indicators and the possibility of offset of one indicator by another (i.e. connectivity is assumed equivalent to access and policy). GIT (2000) note that an "additive model implies that strength on any one of these dimensions could compensate for weakness on another".

The question of whether inputs into the process of technology development are considered sequential, as with UNDP (2001), or synergistic, as in the 'cluster' approach of McConnell International (2001), determines the form of index adopted. A sequential concept of technological inputs implies an additive model in which factors with implied equivalence may offset each other. In other words, strength on one aspect can compensate for weakness on another (GIT 2000). This is also the perspective within which the idea of 'leapfrogging' fits in. For instance, Cambodia's lack of fixed mainlines may not matter, as its high mobile penetration rate is likely to offset this, implying 'leapfrogging' by 'skipping a step' in the sequence.

Conversely, a synergistic view of a critical mass of associated technologies essential for a country's advancement in technology implies a multiplicative model in which weakness in any one input may hinder and impede effective development on the basis of non-equivalent inputs. This is the view put forward by McConnell International (2001) in the context of the Internet, in stating that a multitude of factors must be in place to take full advantage of the

economic potential of the Internet, and that the weakness in one area can seriously obstruct the realisation of potential benefits. GIT (2000) also subscribe to a synergistic view by highlighting that all four dimensions in their model, namely national orientation, socio-economic infrastructure, technological infrastructure and productive capacity, have to be strengthened in order for a nation to enhance its technology-based export competitiveness. Despite these two differing views and methodologies, indices have usually followed simple additive averaging models. We also opt for such a model for mainly two reasons. First, our review of existing work to date indicated that results calculated using both methodologies do not differ significantly from each other. Second, the additive model is more widely used due to its relative simplicity.

In fact, determinants do not have the same or equivalent influence over IT capability. Connectivity is a limiting factor, while government policy may result in lower IT capability for a well-connected nation or different consequences for IT capability of equivalently connected nations following different policy paths (e.g. Pakistan/India: positive impact of early liberalisation of telecoms licenses for Internet growth in Pakistan, compared to slower growth under public monopoly, private monopoly and finally liberal privatisation in India).

We have used the aggregated index approach, with component indices (similar to UNDP's HDI). Countries' overall scores may be disaggregated into component indices of interest, permitting finer discernment between nations with different profiles across the spectrum of ICT capabilities. Attention should not focus on final index scores, but on scores across country profiles.

Relative or Absolute Indices

ITU (2002) notes in its 2002 World Telecommunications Development Report that "over the last few decades, virtually every country has succeeded in improving its telecommunications sector.Thus, every country can show that its particular blend of policies has been successful". In absolute scores, therefore, nearly all countries will show increases in telecommunications connectivity. ITU concludes "it is only by making ***international comparisons*** that it is possible to show which policies have been more successful than others… For this reason, an approach based on ***comparative rankings*** may be more meaningful than one that uses absolute growth rates". ITU argues that relative growth rates are more insightful for policy analysis than absolute growth rates. UNCTAD therefore uses a methodology based on relative rankings, rather than absolute scores. Using relative rankings, countries' index scores are calculated as a proportion of the maximum score achieved by any country in any one year (see next Section). This method has the advantage that reference points derive from real-world achievements realised by any country (listed in Appendix 5). However, it has the drawback that reference countries change year on year, reducing inter-year comparability. Only country rankings can be compared between years, consistent with the ITU's recommendations, rather than direct comparisons of countries' scores (since the reference points are changing).

In this paper, we adopt a comparative approach based on comparisons of relative country rankings between years to identify countries that are making progress in ICT uptake, and those which are being left behind in the digital divide.

Evidence from other studies illustrates some issues that may arise using relative indices. GIT (2000) notes that relative indexing "is a relative scaling so that an apparent 'decline' over time or low score is only relative to other countries". GIT's HTI "are *relative* indicators. Hence, a 'decline' on an indicator does not imply an actual drop, just that competing countries have advanced faster". Thus, "Germany is considerably closer to other leading nations than to the U.S. and Japan… this distancing is not due to any decline in Germany, but rather to the remarkable gains by the U.S." (GIT 2000). UNIDO (2002) also notes that: "movements in rankings are relative, not absolute. Many [countries] like Kenya are not particularly technology-intensive exporters – they move up the scale because their exports are more complex than their other measures relative to other countries in their vicinity".

These observations support the idea that in general, it is more meaningful to talk about countries' rankings, rather than a country's index score. Countries tend to group or 'bunch' together (particularly around the centre of the index distribution), where a score interval of 0.1 may be equivalent to several places in the rankings. Conversely, countries that stand out in the lead or fall behind in the tails of the distribution may have relatively large gaps between country scores, such that a significant improvement in index score is necessary to catch up leaders, or for those behind to catch other countries up. In general, it will thus be more meaningful to talk about countries' rankings, rather than their absolute index scores.

Reference Points

The question of approach in using relative versus absolute indices is closely connected to the issue of reference points. Indices with absolute scores are calculated as a proportion of fixed reference points. This has the advantage of permitting direct year on year comparability of scores (although, for the reasons cited above, the significance of a country's score depends upon its place in the index distribution), but it is unclear what these reference points should be for ICT achievements. With some indicators, maximum achievements are relatively straightforward: for example, 100% literacy rate, 100% Internet user rate. For other indicators, maximum achievements are less obvious. Mobile penetration may reach over 100% (e.g. for subscribers with more than one phone, or two SIM cards per phone). There are no established a priori ceiling limits for Internet host penetration.

The problem of an outlying 'star performer' is also illustrated in GIT's work, where the country with the maximum reference value forges ahead. "The U.S. increased [its electronics production] by $71B from 1996 to 1999. The U.S. position is so strong that even China's remarkable doubling of electronics production from $33B to $65B increases its score only from 12 to 19" (out of 100). This is partly apparent from Appendix 5, where the maximum reference values for ICT parameters are increasing at very rapid rates. The use of fixed reference values, as happened with UNDP's HDI could resolve this problem. However, with fast-changing ICT indicators, it is not evident what these fixed reference values should be (compared to life expectancy/literacy, where well-established upper ceiling values exist).

Indicator Scores Methodology

Scores are derived as an index relative to the maximum and minimum achieved in any indicator by countries:

Index score = (Value – Minimum)/(Maximum – Minimum)

Since the minimum value achieved is zero[1] for most indicators, scores amount to a percentage of maximum values:

Index score: = (Value – 0)/(Maximum – 0) = Value / Maximum

Maximum reference values are given in Appendix 5 for connectivity. Indicators for which minimum values were not zero were telecoms traffic and telephone mainlines. However, these scores were calculated as a percentage of maximum values for consistency.

Appendix 1 presents the Index of ICT Diffusion calculated on the basis of the Connectivity and Access Indices for 2001, 2000 and 1999. On the basis of these rankings, countries are classified as ***'falling behind' (FB),*** 'keeping up' (KU) and 'getting ahead' (GA) corresponding to first, second and last thirds in rankings. To analyse trends in movements between 1995-2001, segmental analysis was carried out. Appendices 3 and 4 present the results for 2001, dividing countries into these categories on the basis of rankings for study of trends over time. This permits categorical analysis of results, by income level, region or culture. It also allows analysis of the scatter of observations, with frequency given in brackets after the title.

Additive Model and Averaging

There is no a priori logic for weighting indicators in their aggregation into the index. Simple averaging of indicators in an index implicitly assumes equal weighting of indicators and the possibility of offset of one indicator by another (i.e. mobiles are assumed to have equal importance to telephones, PCs and Internet hosts; connectivity is assumed equivalent to access and policy). GIT (2000) note that an "additive model implies that strength on any one of these dimensions could compensate for weakness on another". This is consistent with a sequential view of ICTs, rather than a synergistic one (where any weakness in the cluster reduces overall technological capabilities i.e. a multiplicative model as discussed previously).

Furthermore, use of simple averages across scores results in averaging effects. GIT (2000) recognises that "a given indicator combines several scores [so] typically no country will score 100 on the resulting indicators". In general, distributions are averaged into the centre of the scoring range. Averaging effects are noted by UNIDO (2002), which recognises the possibility of "offset… at least for some countries [where] use of two benchmarks together biases the results against them in that their average capabilities appear lower".

[1] Irving Fisher (1922)'s statistically desirable property of 'reversibility' (i.e. that the index calculated forwards and the index calculated backwards should be reciprocals of each other) is not fulfilled due to use of arithmetic averages in the indices. Use of 'zero' minimum values means that this 'reversible property' yields mathematically undefined answers (reciprocals of zero). However, this does not have any significant consequences for this index.

Time Period

Hargittai (1999) notes that "the World Wide Web was invented only in 1990 and web browser in 1993, [which] significantly accelerated [the Internet's] spread both in U.S. and internationally. Significant Internet diffusion is observed worldwide only in the past few years". We therefore compiled indicators and calculated indices for 1995, 1998, 1999, 2000 and 2001. Appendix 1 presents ICT Development Indices for 2001, 2000 and 1999.
The Policy Index relates to 2001-2, since ITU's data is constantly updated. This makes comparisons with the Policy Index retrospective.

Unit of analysis

Our units of analysis are nation states, countries or territories defined by national boundaries. Technological hubs, or "centres of excellence" with extensive hinterlands [Telegeography survey, quoted in UNDP's HDR (2001)] are aggregated into national level statistics and it is important to be aware of the significant averaging effect this has on our results.
Adoption of nations and territories as our unit of analysis gives added pre-eminence to Singapore, as both a nation state and a "large city" (ITU, 2000), compared to e.g. a lower ranking for India, comprising Bangalore as a technological hub. Were New York or Bangalore to be separated out from their hinterlands, very different results would emerge. New York has more Internet hosts available to it than the whole of Sub-Saharan Africa which means that a city ranking, or ranking of nations by cities, would yield different results. Telegeography (2001)'s survey gives some indication of what a ranking by cities looks like.

Bridges.org observes that *international digital divides* have been assessed by comparisons of connectivity hardware between countries (PCs, hosts, servers, telephones), whereas *domestic digital divides* are assessed by measures of access by different groups (ethnicity, gender, age, income). The concept of disparities in access to ICTs is the same in both cases, but the level of analysis determines the choice of variables and method.
The Mosaic Group (1996) measured the 'indigenisation' of IT capability, or "involvement by nationals… in installation, use, operation, maintenance, management and adaptation of technology… performed by indigenous personnel" [Mosaic 1996]. The Mosaic Group (1998)'s later theoretical framework assesses absorption of ICT technologies as independent, stand-alone technologies. National origin of technology is not considered.

Analysis of technology along national lines measures "national differences" in the adoption and absorption of IT. However, whether such differences are national or cultural may be indeterminate (boundaries of nation states and culture may coincide, but this is not always the case). Expatriate communities are often important in promoting technological adoption in their homelands (e.g. communication needs of overseas Vietnamese; the accumulated human capital of Indian software specialists in US).

National Size Effects

GIT (2000) note that Porter et al (1999)'s Innovation Index "is normalised (per capita measures), whereas [GIT's] is not (most of the statistical components reflect national totals). HTI address national technological competitiveness without particular concern for an economy's size". However, they do not explore the consequences of this for their results.
In fact, this may introduce bias into results. UNIDO (2002) notes that "the use of a population deflator works against large countries, but remains a good way to adjust for country size". This may be particularly true for infrastructure, where a certain minimum threshold infrastructure in the network may be required, irrespective of the size of country. Further expansion of the network may benefit from economies of scale in larger countries, resulting in proportionately reduced levels of infrastructure per capita. Country size is intimately related to population dispersion and geographical dispersion of the network. It is unlikely that we will be able to correct for these effects; however, it is important to remain aware of their existence and the fact that averaging measures across per capita population may implicitly work against larger countries, lowering their relative rankings.

Data Omission Effects

The treatment of data omissions is central in determining the results of an index. In calculating the indices, final scores must be adjusted for the number of data observations and weighted, to eliminate the impact of data omissions. Failure to do so effectively 'dilutes' the final index score by the number of omissions. However, data omissions are more likely for poorer countries. This poses a problem for our results, the extent of which is unclear. For some indicators (e.g. telephone mainlines and mobiles, in the Connectivity Index), 201 countries have been covered to a reasonable extent. However, some indicators (e.g. local call costs, in the Access Index) have more limited data availability which varies from year to year. Rodriguez & Wilson (2000) note that their "results almost surely err on the side of optimism, as countries with poor or no available data are most likely to be the same countries that are being left behind by the information revolution". This caution also applies to our study. The omission of primarily poorer countries with low data availability means that absent or negligible observations are omitted. Our sample essentially comprises those countries with a degree of connectivity infrastructure in the first instance. This introduces bias from sample truncation into our findings, but it is difficult to establish the extent of this bias, or how to correct it.

4. DISCUSSION OF RESULTS

Results in this section are discussed by:

1. Income (UNDP codes of high-, middle- and low-income, others);

2. Regional groupings (UNDP codes of E. Europe and CIS, OECD, Arab states, E.Asia, S.Asia, Latin America & Caribbean, Sub-Saharan Africa, others);

3. Other regions, where geographical factors are important (e.g. 'island states').

Comparisons are also made between:

4. Connectivity and Access Indices and their relation in Appendix 3;

5. Policy and Connectivity Indices to study the impact of policy in enhancing ultimate connectivity in Appendix 4;

6. Evolution of indices over time; with particular attention paid to

7. Evolution of connectivity indicators over time, as representative of the digital divide.

as important comparisons within the ICT Development Indices. Telecoms policy is expected to impact mainly upon user numbers and cost variables in the Access Index, and less so on other variables of literacy and income, so this comparison was not analysed in detail.
Positive correlations between sub-indices in Appendix 2 are illustrated by overweight positive diagonals. Random scatters of observations would yield equal weightings across boxes. However, frequency of observations (given by the figures in brackets) illustrates a positive correlation in weightings. The high correlations in our results may suggest that we are measuring consistent indicators of central 'technological development'. However, indices do not address the question of causation. These indicators may also represent proxy variables for key drivers underlying technological development (e.g. average income and/or level of development, levels of investment). Causation cannot be determined by correlations and it is proposed to investigate causation by regression work at a later date.

1. Income

UNDP codes were used to classify up to 171 countries into four categories of high-/middle-/low-income and 'others' for ICT Indices. To some extent, this analysis is partly dependent upon these classifications. Analysis of ICT rankings reveals that:

Table 3: Analysis of the Index of ICT Diffusion by Income

Index of ICT Diffusion	2001	2000	1999	1998	1995
High: Best Worst Average	U.S. 1 Qatar 45 18.6	U.S. 1 Bahamas 48 18.7	Norway 1 Qatar 37 17	Norway 1 Bahamas 55 18	Finland 1 Bahamas 46 17
Middle: Best Worst Average	Korea, Rep. 23 Albania 161 77	Korea, Rep. 23 Albania 176 82	Korea, Rep. 21 Eq. Guinea 144 73	Korea, Rep. 26 Gabon 142 74	Korea, Rep. 26 Egypt 154 78
Low: Best Worst Average	Armenia 62 Eritrea 171 132	Indonesia 72 Eritrea 180 137.6	Tajikistan 50 Central Af. Rep 159 126	Ukraine 66 Niger 159 128	Vietnam 61 Central Af. Rep 156 120
Others: Best Worst Average	Macao 31 Sol. Islands 167 109.4	Guam 25 Sol. Islands 174 106	Greenland 27 Vanuatu 148 84	Greenland 25 Sol. Islands 141 76	Macao 28 St Lucia 143 70

Average rankings conform to expectations. 'High' income countries consistently capture the top rankings, with an average ranking of 17-18.7. This average ranking is 55-60 places ahead of 'middle' income countries, which have a consistent average ranking between 73 and 81 over 1995-2001. 'Low' income countries show some decline in average ranking over this period, from 120 to 132 in 2001. 'Others' are too varied to yield meaningful conclusions. This pattern is apparent from the Connectivity Index for 200 countries using these categories:

Table 4: Analysis of the Connectivity Index by Income

Connectivity Index	2001	2000	1999	1998	1995
High: Best Worst Average	U.S. 1 Brunei 82 21.2	U.S. 1 Bahamas 62 22.5	U.S. 1 Bahamas 64 23.6	Finland 1 Bahamas 62 22.6	Finland 1 Qatar 57 22.5
Middle: Best Worst Average	Korea, Rep. 26 Gabon 155 86.5	Korea, Rep. 29 Djibouti 159 94.3	Korea, Rep. 28 Eq. Guinea 183 97	Korea, Rep. 28 Eq. Guinea 165 97.5	Korea, Rep. 30 Eq. Guinea 170 99.5
Low: Best Worst Average	Georgia 89 Niger 193 158.6	Ukraine 100 Congo DR 200 163.7	Ukraine 100 Guinea Bissau 201 165	Ukraine 98 Congo DR 201 165	Armenia 90 Chad 201 163
Others: Best Worst Average	Bermuda 11 Somalia 195 94.6	Bermuda 5 Afghanistan 199 85.6	Bermuda 5 Afghanistan 197 81	Bermuda 7 Afghanistan 200 81.6	Bermuda10 Yugoslavia 200 111

'High' income countries again capture the top connectivity rankings, with an average ranking of 21-23.6. This average ranking is 77 places ahead of 'middle' income countries, whose constant average ranking improves from 99.5 to 86.5 from 1995-2001. 'Low' income countries also show some improvement in average ranking over this period from 163 to 158.6. Again, 'others' is too varied a category to draw meaningful conclusions.

These results are however constrained by the broadness of these categories e.g. Djibouti, Gabon, Equatorial Guinea and Cote d'Ivoire are classified as middle-income countries, and Georgia, Ukraine and Armenia as low-income. The definitions of these categories constrains possible conclusions, so it is interesting to look at narrower regional classifications for more focused analysis.

2. Regional Groupings

UNDP codes were used to classify up to 171 countries into eight categories of E. Europe and CIS, OECD, Arab states, E.Asia, S.Asia, Latin America & Caribbean, Sub-Saharan Africa and 'others'. ICT diffusion rankings by these categories reveals:

Table 5: Analysis of the Index of ICT Diffusion by Regional Grouping

Index of ICT Diffusion	2001	2000	1999	1998	1995
1. OECD: Best Worst Average	U.S. 1 Mexico 75 22.2	U.S. 1 Mexico 73 22.7	Norway 1 Mexico 72 22	Norway 1 Mexico 71 21.5	Finland 1 Mexico 116 27
2. EE & CIS: Best Worst Average	Slovenia 27 Uzbekistan 166 94.8	Slovenia 28 Albania 176 107.6	Slovenia 30 Azerbaijan 140 71	Estonia 28 Azerbaijan 140 70	Slovenia 27 Uzbekistan 142 78
3. LAC: Best Worst Average	Bahamas 44 Belize 128 71.7	Costa Rica 46 Belize 131 77.6	Barbados 38 Dominican Rep. 120 79	Uruguay 45 Dominican Rep. 125 79.5	Guyana 41 Bolivia 146 78.6
4. E. Asia: Best Worst Average	Hong Kong 9 Cambodia 169 88.7	Hong Kong 8 Cambodia 179 89.3	Hong Kong 8 Myanmar 146 80	Hong Kong 11 Lao 156 77	Hong Kong 11 Mongolia 153 74.5
5. Arab: Best Worst Average	UAE 25 Yemen 140 88.8	UAE 26 Yemen 145 91	UAE 26 Sudan 127 80	UAE 29 Yemen 128 82	Kuwait 31 Egypt 154 89
6. S. Asia: Best Worst Average	Maldives 70 Bangladesh 148 111.6	Maldives 70 Bangladesh 154 113.3	Maldives 56 Bangladesh 133 104	Maldives 77 Sri Lanka 134 113	Maldives 86 Nepal 137 112
7.SSA: Best Worst Average	Mauritius 57 Eritrea 171 126.3	Mauritius 65 Eritrea 180 131.3	Mauritius 54 Niger 159 127	Mauritius 50 Niger 159 126.4	Mauritius 39 Central Af. Rep 156 117
Others: Best Worst Average	Israel 22 Sol. Islands 167 98.8	Israel 21 Sol. Islands 174 99.3	Israel 20 Vanuatu 148 74.4	Israel 17 Sol. Islands 141 66	Israel 19 St Vincent & G 143 62.5

Average rankings conform to expectations. OECD countries consistently capture the top rankings, with average ranking improving from 27 to 22.2 from 1995-2001. E.Europe and

CIS also improve in average ranking from 78 to 71 from 1995-1999, but decline afterwards to 94.8 in 2001. Latin American and Caribbean countries have a consistent ranking of 78.6-79 from 1995-1999, that improves to 71.7 in 2001. 'E.Asian countries' is a diverse category, encompassing Asian Tigers (e.g. best-performing Hong Kong at 11-8) and Cambodia, Lao PDR and Myanmar as countries tasked with 'catching up'. E.Asia shows some decline in average ranking over this period from 74.5 to 88.7. 'Arab' countries are similarly diverse, encompassing countries 'getting ahead' (such as UAE and Kuwait) and countries 'catching up' (Yemen and Sudan), and have roughly constant ranking over this period, with average ranking varying between 80 and 90, and 88.8 in 2001. South Asia also shows an improvement from an average of 112 in 1995 to 104 in 1999, before slipping back to 111.6 in 2001. Sub-Saharan Africa's average ranking is consistently last but stable from 117 in 1995 to 126.3 in 2001, although its best-performers of Mauritius and South Africa generally rank between 50-65. 'Others' is a varied category. These trends are again apparent from the connectivity index rankings (see also analysis of regional groupings in connectivity in the Digital Divide Section):

Table 6: Analysis of the Connectivity Index by Regional Grouping

Connectivity Index	2001	2000	1999	1998	1995
1. OECD: Best Worst Average	U.S. 1 Mexico 74 22	U.S. 1 Mexico 88 25.4	U.S. 1 Mexico 93 26.6	Finland 1 Mexico 97 27	Finland 1 Mexico 95 29
2. EE/CIS: Best Worst Average	Slovenia 25 Kyrgyz Rep. 175 90	Slovenia 28 Tajikistan 153 96.9	Slovenia 31 Tajikistan 152 99	Slovenia 36 Albania 152 95.7	Slovenia 40 Albania 158 92
3. LAC: Best Worst Average	Bahamas 49 Nicaragua 147 86.4	Barbados 59 Nicaragua 147 93.9	Barbados 57 Nicaragua 145 95	Barbados 55 Nicaragua 144 97	Barbados 51 Nicaragua 142 100
4. Arab: Best Worst Average	UAE 30 Sudan 164 103	UAE 35 Sudan 169 107.4	UAE 39 Sudan 172 109	Qatar 51 Sudan 178 108	Kuwait 44 Sudan 187 108
5. E.Asia: Best Worst Average	Hong Kong 12 Myanmar 188 106	Singapore 11 Myanmar 192 111.4	Hong Kong 12 Myanmar 184 114	Hong Kong 11 Myanmar 186 115	Hong Kong 13 Myanmar 180 113
6. S. Asia: Best Worst Average	Iran 97 Bangladesh 184 148.3	Iran 104 Bangladesh 190 153.6	Iran 101 Bangladesh 185 150	Iran 99 Bangladesh 189 150	Iran 101 Bangladesh 191 151
7.SSA: Best Worst Average	Mauritius 57 Somalia 195 156.7	Mauritius 69 Congo, DR 200 162	Mauritius 75 Guinea-Bissau 201 166	Mauritius 70 Chad 201 166	Mauritius 79 Chad 201 167
8. Others: Best Worst Average	Bermuda 11 Afghanistan 194 90.4	Bermuda 5 Afghanistan 199 83	Bermuda 5 Afghanistan 197 78.7	Bermuda 7 Afghanistan 200 79	Bermuda 5 Afghanistan 198 77.8

For 1995-2001, average connectivity rankings conform to expectations and show remarkable consistency between periods. Furthermore, the same countries are consistently best or worst in their categories, which may reflect the long timescales needed to significantly improve levels of infrastructure. OECD countries consistently capture the top rankings, with average ranking improving from 29 to 22 from 1995-2001. E.Europe and CIS show a decline in average ranking from 92 to 99 from 1995-1999, and an improvement thereafter from 99-90 (overall unchanged), while Latin American and Caribbean countries show a steady improvement in average ranking from 100 to 86.4. In terms of connectivity, Arab countries outperform E.Asian countries (the reverse is true of wider ICT access and diffusion) with average Arab connectivity of 108-103 (compared to 113-106 for E.Asia). 'Arab' countries encompass countries 'getting ahead' (UAE, Qatar and Kuwait) and Sudan as their worst-performer, although Sudan improves steadily from 187-164. E.Asian countries include best-performing Hong Kong (between 11-13) and Myanmar as the worst performing (at 180-192). South Asia has a constant average of around 150, with consistent best-performer Iran and lower-performing Bangladesh. Sub-Saharan Africa's average ranking is consistently last but shows some improvement, from 167 to 156.7 with best performers of Mauritius and South Africa generally ranking between 57-85. Chad and Guinea-Bissau are the lowest performers at 201. 'Others' is again a varied category.

3. Other Regions

Regional classifications are reflected in the above UNDP's categories of E. Europe and CIS, OECD, Arab states, E.Asia, S.Asia, Latin America & Caribbean, Sub-Saharan Africa. However, for our purposes, further interesting results emerge from the Usage Index: telecom traffic, where the importance of 'island economies' is also apparent. These are small, relatively remote but highly connected islands such as Cayman Islands and Bermuda specialised in service industries. These 'island states' score highly in connectivity, beyond what might be expected from their geography, but in line with their specialisation in ICT-intensive service sectors. The negative impact of geography is also evident e.g. in respect of Nepal and Bhutan, where mountainous terrain prevents extensive network infrastructure. These countries score poorly in their regional classification of S.Asia and the satellite technology that can help overcome such terrain is not included in our Index.

4. Connectivity and Access Indices – Appendix 3

Connectivity and Access show high correlations of 0.786 (2001), 0.764 (2000), 0.776 (1999), 0.833 (1998) and 0.686 in 1995, as shown in Appendix 2. The strong correlation of the access index (comprising users, literacy, call costs and average income) with connectivity is embodied in the Index of ICT Diffusion, as the average of these two indices.

Appendix 3 illustrates this correlation, with countries lying mainly on the positive correlation diagonal and less so on the inverse diagonal. It is expected that good connectivity provides a basic foundation for and enhances good access (GDP income is an important underlying determinant of both access and connectivity infrastructure). Good access despite poor connectivity is counter-intuitive against expectations – only one country experiences good access (Costa Rica, due to good literacy rates and low call costs) with fifteen having

adequate access despite poor connectivity. Despite their relative rarity, these countries embodied by Costa Rica illustrate the possibilities for governments to enhance access beyond narrowly defined ICT connectivity with good literacy and low call costs. Transition economies generally enjoy strong literacy and education, improving access, but with reducing connectivity moving from Central and Eastern Europe towards Central Asian republics. This contrast is observed in our rankings in Appendix 3. The absence of good connectivity may make widespread access difficult to achieve, with a large 'vicious circle' (CU Con, CU Acc), populated largely by African and Asian subcontinent countries.

5. Policy and Connectivity Indices – Appendix 4

Policy and Connectivity index scores show a reasonable correlation in Appendix 2 of 0.516 (2001), 0.4297 (2000), 0.430 (1999), 0.426 (1998) and 0.403 (1995) although this is a retrospective comparison to make, since the policy variable relates to 2001-2002. This may also explain the reducing correlation the further back in time. The positive diagonal in Appendix 4 is again overweight in country observations, as expected from these correlations.

Segmental analysis of rankings presented in Appendix 4 illustrates strong regional groupings. The 'GA Con-GA Pol' box contains primarily OECD countries, engaged in a 'virtuous circle' with competitive telecoms sectors and good infrastructure. 'GA Con-KU Pol' contains Mediterranean and some former E. European countries. 'GA Con-CU Pol' contains Arab and island states with good infrastructure, but less liberalised telecoms policies. It is important to note that for offshore islands with small populations, a competitive telecoms sector may not be appropriate, contrary to the value judgments implicit in the scores.

The 'KU Con-GA Pol' box contains mostly Latin American and some Asian countries that may have implemented competitive policies, but have yet to witness the full benefits. The middle segment 'KU Con-KU Pol' contains the bulk of Central/Eastern European countries that have been cautious about or delayed telecom sector reforms. African countries dominate the 'catching up' (CU) Connectivity column.

However, countries in the 'CU Con-GA Pol' box offer the most potential. These are countries that may have recently implemented reforms (e.g. India, in the transition from monopoly to a more liberal market structure) and are waiting to reap the benefits, or countries that have had competitive market structures for some time, but lack the resources to invest heavily in infrastructure. However, a coherent competitive policy framework is in place, so these countries may be in a position to profit from their policies in the future. These regional groups in rankings highlight different types of economies under consideration and suggest that policy recommendations must be tailored to the different types of economy.

6. Evolution over time

Comparison of Appendices 3 and 4 reveals that rankings are relatively stable year on year. Comparisons of country movements in connectivity between years demonstrate relatively little movement between boxes, although some volatility within classifications may occur. This is consistent with high correlations observed between years:

Table 7: Correlations within Indices between years

Index of ICT Diffusion	2001	2000	1999	1998	1995
2001	1	0.9918	0.9507	0.9476	0.9084
2000		1	0.9591	0.9590	0.9182
1999			1	0.9849	0.9421
1998				1	0.9553
1995					1
Connectivity Index	2001	2000	1999	1998	1995
2001	1	0.9617	0.9554	0.9483	0.9112
2000		1	0.9893	0.9798	0.9461
1999			1	0.9893	0.9579
1998				1	0.9789
1995					1
Access Index	2001	2000	1999	1998	1995
2001	1	0.9867	0.8133	0.8297	0.7057
2000		1	0.8211	0.8488	0.7167
1999			1	0.9338	0.7725
1998				1	0.8000
1995					1

These correlations are consistent with UNIDO (2002)'s "considerable stability in Industrial Performance Scoreboard rankings… supporting the argument that capability building is a slow and incremental process". These could thus reflect the long-term nature of investments and prolonged timescales involved in expansion of telephone mainline networks. It also suggests that it may be difficult to break out of a 'vicious circle', but that benefits conferred by establishing a 'virtuous circle' with competitive policies may be long-term.

Appendices 3 and 4 provide a segmental analysis of rankings for the year 2001. Only 2001 is presented, but a review of movements from 1995-2001 yields further insights. China moved up the connectivity rankings from CU to KU in 1998, following liberalisation of its telecoms sector to full competition in long-distance and partial competition in its local loop. China also experienced considerable inward investment in this period. India and Pakistan retain CU Connectivity status. "The growth of telecommunications infrastructure in south Asia has not been demand-driven, unlike that of other countries where the infrastructure has been built and services operated by private investors… but almost entirely investment-driven, dependent on priority level… from limited public resources… [In India] connectivity remains low and unevenly distributed" (Indian "Economic and Political Weekly", 1999). However, different policy paths were pursued: "In Pakistan, the private sector dominates; in India the government [was] monopoly service provider [until the end of 1998/early 1999]; in Nepal, high cost of international communications was circumvented by a country-wide Intranet". These different policy paths do not appear to have had a strongly differentiated impact on respective connectivity. (Nb. India subsequently liberalised its telecom sector, accounting for its maximum policy score of 4 in 2001-2). Reforms and subsequent benefits in connectivity are also strongly differentiated in the FUSSR. In keeping with the World Bank and EBRD studies of economies in transition, the sharp contrast between CEE and the Central Asian region is observed in our rankings. For analysis of the evolution of connectivity indicators 1995-2000 which are of particular importance due to their relation to the 'digital divide', please see the next section.

4. THE DIGITAL DIVIDE

In their review of work carried out to assess the digital divide, Bridges.org observes that the digital divide between countries has typically been assessed by counts of hardware and connectivity (such as hosts, PCs, telephones, mobiles). We can analyse the distribution of our data on these variables to investigate their evolution over time, to see whether the "uneven diffusion" of technology (UNDP) is increasing or decreasing over time. Definitions of the 'digital divide' include:

1. absolute measures: the absolute gap between the most advanced country with highest hardware concentrations and the country with the lowest;

2. relative measures: measures of whether the distribution as a whole is growing more or less convergent with time;

3. categorical measures: whether the group of 'low-income' countries is converging with (relative to) the group of 'high-income' countries.

4. convergence: relative convergence or divergence in rates of growth of hardware, Rodriguez & Wilson (2000).

UNCTAD used the first three of these methods to analyse indicators of hardware connectivity and numbers of Internet users. These are basic indicators of the digital divide, which may be defined with more sophistication as access to and use of ICTs. It may not be the amount of hardware that is most important, but ultimately, the use that is made of this hardware and overall changes in the way the economy works. However, analysis of connectivity as the basic 'limiting factor' to ICT access and of actual numbers of Internet users evaluates bottlenecks and disparity in the first stages of access to ICTs.

1. Absolute Measures

In Appendix 5 presenting basic statistics describing the indicator data populations, absolute measures of the digital divide reveals steadily increasing maxima, medians and averages across all populations over the period 1995-2000. These populations indicate rapidly increasing maximum observations as the countries in the lead continue to forge ahead as 'star performers', while in most cases, minimum observations remain at, or close to, zero. (This is explained by these observations describing per capita penetrations. Absolute gains in telecommunications sectors cited by the ITU may thus be negated by gains in populations in some developing countries). It is often this 'absolute perceived gap' that is cited in popular observations about the digital divide - the gap between the most ICT-developed economies and the least ICT- developed appears to be wide, obvious and growing.

In terms of relative disparities, the evidence is rather more mixed. The distributions of these indicator populations are highly skewed, as indicated by significant standard deviations (as a percentage of mean) and discrepancies between the median and mean (both measures of central tendency, but the mean is more influenced by outliers). Appendix 5 indicates however that skewness in these distributions of averaged indicator penetrations per capita is decreasing marginally over time. The picture is one of digital leaders forging ahead in their absolute lead; however, newcomers may be catching up in terms of relatively less skewed distributions of hardware across countries, based on average hardware penetrations across countries as the basic unit of analysis.

Such average scores are only partially representative, however. These indicators are averages of total hardware equipment divided by total population for each country. They do not take account of the relative proportion of the world's population living in each country. The Gini measure of inequality weights the distribution of hardware equipment or Internet users by the relative proportion of the world's population for each country to produce a relative weighted measure of inequality.

2. Gini Coefficients

Preliminary analysis of Gini coefficients of inequality in levels of hardware equipment across nations reveals that levels of inequality in the distribution of hardware equipment are very high at 0.7-0.9, approximately twice the average level of income inequality observed for countries (between 0.3 - 0.4). Inequality in the distribution of technology across countries is undoubtedly high and substantial. Gini coefficients further reflect the relative age of the technologies, with greater inequality observed for more recently introduced technologies, such as Internet hosts (around 0.91) and Internet users (between 0.87 and 0.73). Internet

users are more evenly distributed than either PCs or Internet hosts, emphasising that access may differ from basic connectivity to the Internet. Telephones, as the oldest technology examined, consistently have the lowest Gini coefficients of all these technologies from 0.69 to 0.57 over the period 1995-2001. Mobiles are a notable exception to the age rule, with lower Gini coefficients than expected from the relative youth of this technology, that further reduce the fastest, from 0.82 to 0.66 over the period 1995-2001. This reflects the 'leapfrogging' noted by the ITU and UNDP. The 'digital divide', as measured by hardware equipment and Internet users, is undoubtedly wide and substantial.

Table 8: Gini Coefficients (figures in brackets give numbers of countries)

Variables	2001	2000	1999	1998	1997	1996	1995
Internet hosts	0.915727 (193)	0.92052 (199)	0.91655 (200)	0.913665 (200)	0.912568 (200)	0.902182 (198)	0.910215 (199)
Internet users	0.732629 (160)	0.754422 (183)	0.809996 (195)	0.876371 (187)	0.85085 (181)	0.859376 (171)	0.870685 (136)
PCs	0.754002 (144)	0.754097 (156)	0.770972 (155)	0.76715 (148)	0.793778 (126)	0.791806 (116)	0.790808 (110)
Mobile subscribers	0.658388 (175)	0.703486 (195)	0.731545 (184)	0.775206 (197)	0.788291 (194)	0.816721 (195)	0.822235 (195)
Telephone mainlines	0.570299 (174)	0.589103 (196)	0.645535 (193)	0.66678 (200)	0.679151 (200)	0.69676 (200)	0.688234 (200)

The question of how the 'digital divide' is evolving, and whether it is growing or reducing over time is more complex. Gini analysis reveals relatively little overall change in the inequality of these distributions, with their evolution over time representing small, incremental reductions from their highly unequal levels. However, Gini coefficients as relative measures across the whole distribution do not identify exactly where contributions to reducing inequality come from. Given that Gini measures are weighted by population, countries with substantial populations, such as China and India, have greater influence in determining the Gini coefficient. It is doubtful that such contributions to reducing inequality derive from the tails of the distribution (as we saw from the absolute measures, 'best performers' are in fact increasing their lead, whilst some countries in the lower tail remain at, or close to, zero). Thus, these small reductions in inequality are coming from the centre of the distribution, but Gini coefficients only hint at a greater weighting for more populated countries – they do not tell us exactly which countries.

In the next section, we analyse relative movements in rankings to identify how countries and regions are faring in basic connectivity, to see which countries are contributing to reductions in inequality, increasing inequality, or merely preserving the status quo. Taken together, it is envisaged that these relative measures of the digital divide and the insights derived from benchmarking, provide a more detailed picture of developments in countries' ICT development.

3. Relative Movements in Country Rankings for Connectivity

Country rankings have two main characteristics: their current level and trend over time. To analyse relative movements in country rankings, connectivity rankings were divided into quartiles of 'Excellent' (1-50 places); 'Good' (51-100); 'Poor' (101-150) and 'Disadvantaged' (151-201). Trends in connectivity rankings over time were then assessed, to determine whether they were 'Improving', 'Same' or 'Declining'. In a sample of 201 countries, if 100 is taken as the median, the impact of trends in inequality on the status quo may be viewed as:

Table 9: Relative Movements in Country Rankings

Level	Trend	Impact on Inequality
Excellent *(50 countries)*	Improving	Exacerbates inequality
	Same	Preserves the status quo
	Declining	Reduces inequality
Good *(51 countries)*	Improving	Exacerbates inequality
	Same	Preserves the status quo
	Declining	Reduces inequality: trend towards median
Poor *(52 countries)*	Improving	Reduces inequality: trend towards median
	Same	Preserves the status quo
	Declining	Exacerbates inequality
Disadvantaged *(49 countries)*	Improving	Reduces inequality: trend towards median
	Same	Preserves the status quo
	Declining	Exacerbates inequality

(This is a judgemental exercise and not exact science: countries may be 'borderline' between categories, and move from one into another, accounting for the inexact numbers of countries in each category). The conclusions from such a review depend strongly on the regional classifications. UNDP classifications of regional and cultural groupings are used. Analysis of country rankings by categories reveals the following trends:

1. OECD countries

Consistent with the observations in Section 4 about regional rankings, OECD countries are consistently the best-performing countries in ICT development. OECD countries rank as having 'excellent' and 'good' connectivity and consistently capture first place (Finland, replaced by the U.S.) as maximum ranking, but with reducing minimum rankings from 95th to 74th place (Mexico). Consequently, the OECD average ranking reduces from 29 to 22 place from 1995-2001. Only three OECD countries show marginal declines in rankings (Finland, Australia and Canada) reflecting loss of first mover advantages and catch-up by other OECD countries. The standard deviation in rankings reduces correspondingly from 26 to 18, indicating a more closely-bunched grouping at the upper end of the distribution. OECD countries are effectively differentiating and separating out from the body of the distribution of country rankings, in an increasingly polarised distribution with OECD countries ahead.

2. EE and CIS

Eastern European and the Commonwealth of Independent States demonstrate polarisation within their region. Maximum ranking is improving (Slovenia rockets up the rankings, from 40th place to 25th place from 1995 to 2001). However, minimum rankings slip from 158th place in 1995 (Albania) to 175th place in 2001 (the Kyrgyz Republic). This leaves overall average ranking unchanged, between 92-90 place, but leads to a steady increase in EE and CIS standard deviation in rankings, from 18 to 40. The EE and CIS region demonstrates increasing variation and polarisation, around approximately the same mean. (It is worth noting that variation would be further increased if Poland, Hungary and the Czech Republic were to be included in the CEE region, rather than under the OECD).

3. Latin America and Caribbean

Latin American and Caribbean countries show a steady improvement in average ranking from 100 to 86.4. Barbados and Bahamas have rankings around 51-49th place from 1995-2001. The minimum ranking (Nicaragua) declines from 142 to 147th place from 1995-2001. The average ranking improves slightly from 99 to 86, while standard deviation remains the same at 25. Overall, Latin America retains a stable distribution around a slowly improving average.

4. Arab Countries

'Arab' countries encompass best-performing Qatar, Kuwait and the United Arab Emirates (UAE) whose rankings improve from 44 to 30th place, and Sudan with the lowest ICT development, although Sudan improves steadily from 187-164th place from 1995-2001. This does not impact the average ranking and standard deviation, which remain unchanged at around 108 and 41 respectively. Overall, the contribution of Arab countries is therefore to maintain the status quo, with no major contributions to reducing inequality.

5. East Asia

E.Asian countries include best-performing Hong Kong and Singapore (between 11-13) and Myanmar as the worst performing, declining from 180 to 192 from 1995-2001. This leaves the overall average unchanged at 113-111 between 1995-2001, although there is some improvement to 106 in 2001, while the standard deviation hovers around 55. From the group regional perspective, there are no major developments. However, the most remarkable individual success story in East Asia is China, which rockets up the rankings in connectivity from 136th place in 1995 to 93rd in 2001. Given that China is host to one fifth of the world's population, China's steady rise in relative ranking is likely contribute substantially to the reduction in inequality showed by the Gini coefficients.

6. South Asia

South Asia demonstrates no real change overall and essentially preserves the status quo. The best maximum ranking varies between 101 and 97 (Iran) from 1995 to 2001, and the lowest between 191 and 194 (Bangladesh). This leaves overall average ranking preserved at 151-148, while standard deviation remains the same around 30. India, the most populous country with one sixth of the world's population, shows a slight improvement in ranking from 158 to 151 between 1995-2001. This may reinforce the reductions in Gini coefficient, representing a small reduction in inequality, but it seems likely that overall, the South Asian region does not contribute towards any major changes in overall inequality.

7. Sub-Saharan Africa

Africa demonstrates a wide variation in performance, between best-performing Mauritius, which improves from 79th place to 57th place from 1995-2001, and the bulk of Sub-Saharan African countries at the lower end of the distribution, including Chad, Guinea-Bissau, Congo and Somalia which occupy last place. The overall average ranking shows a small improvement in rankings, from 167 to 157, while standard deviation in rankings increases to reflect the growing variation from 28 to 32. Overall, there is thus an increasing deviation about a minimally improving average. However, African countries remain clustered towards the bottom of the distribution, so the overall contribution of Sub-Saharan Africa is to maintain the status quo, with no major contributions to reducing inequality.

6. CONCLUSIONS & WAY FORWARD

There are different aspects to 'multi-faceted' technology clusters, and ICTs may be defined and measured from several perspectives. Measurement across multiple aspects is necessary, to give rounded country profiles across the spectrum of ICT capabilities. Based on a review of previous work, we chose the aspects of connectivity, access, usage and policy as key components in the measurement of ICT development across countries. We measured technological profiles using a disaggregated index of ICT Diffusion, with component indices for connectivity, access and policy in the ICT Development Indices.

There is a trade-off of 'breadth versus depth' of indicators in such a cross-country analysis of as many countries as possible. It is difficult to achieve depth and complexity in indicators using standardised, cross-country indicators for broad comparability across many countries. The qualitative policy index contains an implicit value judgment in favour of competition in the telecoms sector, which does not allow for 'benign monopolies' or small economies where economies of scale may be appropriate. The policy index is, however, correlated with connectivity, which implies beneficial effects to telecoms liberalisation in terms of improved connectivity.

These different aspects are related, with strong positive correlations observed between connectivity and access and, to a lesser extent, competitive telecoms policy and connectivity.

This suggests that we are measuring central measures of 'technological development', although causation cannot be addressed with benchmarking indices – for example, we may be implicitly measuring proxy variables of income and/or development. Benchmarking provides useful information and meaningful analysis for policy purposes. Our cross-country analysis allows comparison between countries and monitoring of progress over time. It further allows straightforward identification based on evidence of 'success stories' for closer investigation for policy conclusions. Approached with thought, benchmarking is a useful input to policy analysis in allowing more informed and insightful study into policy and ultimately, in promoting better, faster and more effective ICT development.

Classification of countries as 'catching up', 'keeping up' and 'getting ahead' on the basis of rankings in the ICT Development Indices show consistent rankings over time, with high correlations and stable rankings (illustrative of these high correlations) between periods. This may reflect the long-term nature of infrastructure investments and policy reforms. Strong regional influences are apparent. As a broad generalisation, African and South Asian countries are classified as 'catching up', Latin American and transition economies as 'keeping up', and OECD countries and some South East Asian Tigers as 'getting ahead'. However, this masks considerable diversity with individual success stories such as Costa Rica and China, and the notable successes achieved in connectivity by Arab and 'island states', despite less competitive telecom policies. For island states, this may arise however, from their geographical situation and specialisation in service industries.

Trends in connectivity over time suggest stable country rankings from 1995 to 2001 and potential convergence in distributions of hardware, yielding the intriguing result of a diminishing digital divide, as defined narrowly by hardware measures. A review of the the digital divide and its evolution, as defined by hardware measures, has been carried out in terms of both absolute measures, Gini coefficients and an analysis of movements in country rankings. Taken together, this review suggests small, incremental reductions in inequality in the distributions of hardware and Internet users across countries, yielding the intriguing result of a diminishing digital divide. Our results show that more recent technologies such as the Internet are more unevenly distributed relative to older technologies, such as fixed line telephony. Our findings also demonstrate 'leapfrogging' in mobile telephony (with lower levels of inequality, which reduce the fastest), suggesting greater potential for mobiles as more equally distributed technologies in bridging the digital divide. Using a regional analysis of relative rankings, we reviewed levels of and trends in connectivity for different regions. Our results show that the 'tails' of the distributions are becoming more polarised, with OECD countries differentiating out from the body of the distribution of countries, and becoming increasingly more tightly bunched at the head of the distribution. Conversely, Sub-Saharan African remain grouped in the lower end of the distribution. These incremental reductions in Gini coefficients derive from the middle of the distribution, and China in particular, which accounts for a fifth of the world's population and shows a steady and substantial rise up the rankings.

It would be interesting to compare our indices and the changes in rankings therein with other indices (e.g. UNIDO's Infrastructure Index, McConnell International's and EIU's connectivity rankings). In future work, the challenging question of causation could be addressed to forge a link between the trends in outcomes observed and underlying policy by using more sophisticated statistical techniques. Regression work should include consideration of economies' sectoral composition, as reflected in the technological structure of exports and FDI as important determinants of and influences on countries' uptake and absorption of ICTs.

7. APPENDICES

The following appendices are presented:

1. Appendix 1 – ICT Development Indices for 2001, 2000 and 1999 (by country and by ranking);

2. Appendix 2 – Correlations of component indices;

3. Appendix 3 – Comparison of Connectivity/Access Indices for 2001;

4. Appendix 4 – Comparison of Connectivity/Policy Indices for 2001;

5. Appendix 5 – Digital Divide work;

6. Appendix 6 – Connectivity Index (2001, 2000 and 1999).

Appendix 1 presents ICT Development Indices and the Index of ICT Diffusion calculated as discussed above, in the section on Index Methodology for 2001, 2000 and 1999.

Appendix 2 presents correlation tables for the three main component indices (Connectivity, Access and Policy Indices) calculated using the correlation function in Excel for the four years 1995, 1998, 1999, 2000 and 2001.

Appendices 3 and 4 compare Connectivity/Access Indices and Connectivity/Policy Indices for 2001 by categorising them as 'catching up' (CU), 'keeping up' (KU) and 'getting ahead' (GA). For connectivity, countries were divided into thirds, with the first third (1-67) classified as GA, second third (68-124) classified as KU and the last third (125-201) as CU. For access, countries were also divided into thirds, with the first third (1-53) classified as GA, second third (54-106) classified as KU and the last third (107-156) as CU. For policy, thirds closely corresponded to scores, so first third includes policy scores in excess of 0.5, the second third 0.5>/ x >0 and last third scores of zero. This allows the segmental classification and analysis of Connectivity with Access Index and Connectivity with Policy Index.

Appendix 5 presents exploratory data analysis for base data populations of Internet hosts, PCs, telephones and mobiles to present a preliminary analysis of the digital divide.

Appendix 6 provides a separate listing of the Connectivity Index, for 2001, 2000 and 1999.

7. Appendix 1: ICT Development Indices (2001)

COUNTRY	2001 CONNECTIVITY	2001 ACCESS	2001-2 POLICY	2001 ICT DIFFUSION
Afghanistan	0.0005	..	0.1667	..
Albania	0.0500	0.0161	0.5000	0.033066658
Algeria	0.0209	0.2248	0.0000	0.122837535
American Samoa	0.0321	..	0.0000	..
Andorra	0.2675	..	0.0000	..
Angola	0.0038	0.0110	0.6250	0.007400343
Antigua and Barbuda	0.3567	..	0.1667	
Argentina	0.1382	0.4221	1.0000	0.280129439
Armenia	0.0446	0.4959	0.2500	0.270259284
Aruba	0.3153	..	0.0000	..
Australia	0.5814	0.6396	1.0000	0.610462268
Austria	0.4904	0.6728	1.0000	0.581640716
Azerbaijan	0.0664	0.0094	0.1667	0.037865117
Bahamas	0.2171	0.4701	0.0000	0.343632715
Bahrain	0.2560	0.6660	0.0000	0.461000488
Bangladesh	0.0027	0.1399	0.0833	0.071297108
Barbados	0.0754	0.6007	0.0000	0.338087047
Belarus	0.1106	0.0714	0.3333	0.090978728
Belgium	0.4717	0.6444	0.8750	0.558049134
Belize	0.1325	0.0975	0.0000	0.114972247
Benin	0.0083	0.1280	0.0000	0.068150287
Bermuda	0.5614	..	0.0000	..
Bhutan	0.0029	0.1591	0.0000	0.080999773
Bolivia	0.0475	0.4419	0.2500	0.244698065
Bosnia and	0.0618	0.0207	0.2500	0.041264407
Botswana	0.0841	0.4252	0.2500	0.254646597
Brazil	0.1352	0.4706	0.7500	0.302877114
Brunei Darussalam	0.0950	0.6903	0.0000	0.392647369
Bulgaria	0.2092	0.3755	0.5000	0.29235306
Burkina Faso	0.0036	0.0791	0.2500	0.041374387
Burundi	0.0022	0.1613	0.6667	0.081746558
Cambodia	0.0056	0.0034	0.3750	0.004493064
Cameroon	0.0087	0.3939	0.0000	0.201302836
Canada	0.4385	0.7179	1.0000	0.578170681
Cape Verde	0.0782	0.2667	0.2500	0.172483465
Cayman Islands	0.0362	..	0.0000	..
Central African Rep.	0.0022	0.1556	0.0000	0.078917352
Chad	0.0017	0.1816	0.0000	0.09164793
Chile	0.1944	0.4532	1.0000	0.323813524
China	0.0759	0.3026	0.8750	0.189220187
Colombia	0.0847	0.3350	1.0000	0.209830044
Comoros	0.0056	0.2583	0.0000	0.131974466
Congo	0.0159	0.4154	0.6667	0.215660292
Congo (Democratic	0.0011	..	0.7500	..
Costa Rica	0.1538	0.5274	0.0000	0.34057669
Cote d'Ivoire	0.0190	0.1633	0.2500	0.091152173
Croatia	0.2368	0.5379	0.5000	0.387370568
Cuba	0.0224	0.4877	0.2500	0.255070121
Cyprus	0.3447	0.6219	0.5000	0.48328467
Czech Republic	0.3844	0.4525	1.0000	0.418420835

COUNTRY	2001 CONNECTIVITY	2001 ACCESS	2001-2 POLICY	2001 ICT DIFFUSION
Denmark	0.6203	0.7859	1.0000	0.703105322
Djibouti	0.0099	0.1793	0.0000	0.094609149
Dominica	0.1721	..	0.0000	..
Dominican Rep.	0.0889	0.3091	0.7500	0.19896696
Ecuador	0.0558	0.3273	0.1250	0.191539414
Egypt	0.0433	0.3895	0.2500	0.216381019
El Salvador	0.0671	0.4197	0.7500	0.243382443
Equatorial Guinea	0.0144	0.4164	0.0000	0.21541592
Eritrea	0.0031	0.0038	0.2500	0.003456059
Estonia	0.3217	0.5113	0.7500	0.41651666
Ethiopia	0.0019	0.1310	0.0000	0.066449659
Faroe Islands	0.0929	..	0.0000	..
Fiji	0.0795	0.4493	0.0000	0.264381982
Finland	0.6402	0.7220	1.0000	0.681065837
France	0.4596	0.6296	1.0000	0.544591168
French Guiana	..	..	0.0000	..
French Polynesia	0.1861	0.2460	0.0000	0.216058916
Gabon	0.0096	0.4020	0.3750	0.205804468
Gambia	0.0208	0.1289	0.2500	0.074802833
Georgia	0.0817	0.0102	0.7500	0.045955985
Germany	0.4995	0.6874	1.0000	0.593480312
Ghana	0.0074	0.2365	0.5000	0.121954517
Gibraltar	..	..	0.0000	..
Greece	0.3817	0.4692	1.0000	0.425445318
Greenland	0.3172	0.5042	0.0000	0.410678569
Grenada	0.1715	0.0885	0.0000	0.130016424
Guadelope	..	..	0.0000	..
Guam	..	0.9950	0.0000	..
Guatemala	0.0485	0.3616	0.5000	0.205047156
Guinea	0.0042	0.1405	0.2500	0.072344169
Guinea-Bissau	0.0037	0.1264	0.7500	0.065044672
Guyana	0.0548	0.3939	0.0000	0.224367984
Honduras	0.0274	0.5036	0.0000	0.265523508
Hongkong	0.5556	0.7826	1.0000	0.66911458
Hungary	0.2858	0.4917	0.5000	0.388732272
Iceland	0.7065	0.9138	1.0000	0.810114573
India	0.0134	0.1937	1.0000	0.10351466
Indonesia	0.0211	0.4592	0.5000	0.240136052
Iran (Islamic Rep. of)	0.0701	0.2704	0.0000	0.170240055
Iraq	0.0107	..	0.0000	..
Ireland	0.5018	0.6393	1.0000	0.570576017
Israel	0.4790	0.5796	0.5000	0.529289132
Italy	0.4370	0.6056	1.0000	0.5213067
Jamaica	0.1449	0.3294	0.2500	0.237133091
Japan	0.4918	0.8396	1.0000	0.665655189
Jordan	0.0883	0.3335	0.2500	0.210880945
Kazakhstan	0.0194	..	0.6667	..
Kenya	0.0092	0.2837	0.6250	0.146437143
Kiribati	0.0195	0.0233	0.0000	0.021368796
Korea, Dem. Rep.	0.0276	..	0.0000	..
Korea (Rep. of)	0.4023	0.6522	0.8750	0.527257657
Kuwait	0.1850	0.6555	0.1667	0.420259543
Kyrgyzstan	0.0040	..	0.3750	..

COUNTRY	2001 CONNECTIVITY	2001 ACCESS	2001-2 POLICY	2001 ICT DIFFUSION
Latvia	0.2216	0.3904	0.5000	0.306005956
Lebanon	0.0479	0.4856	0.0000	0.266724449
Lesotho	0.0082	0.2847	0.0000	0.146458491
Liberia	0.0010	0.2652	0.0000	0.133137566
Libya	0.0455	0.4027	0.0000	0.224073714
Liechtenstein	0.2909	..	0.0000	..
Lithuania	0.1871	0.4821	0.2500	0.334596136
Luxembourg	0.7028	0.7754	1.0000	0.739124756
Macau	0.2934	0.6274	0.0000	0.460417848
Macedonia, FYR	0.1372	0.3527	0.2500	0.244990376
Madagascar	0.0043	0.0045	0.7500	0.004383419
Malawi	0.0030	0.2020	0.7500	0.102499833
Malaysia	0.1949	0.5627	0.6250	0.37876599
Maldives	0.0493	0.4531	0.0000	0.251210599
Mali	0.0027	0.1362	0.5000	0.069431727
Malta	0.3470	0.6423	0.5000	0.494686344
Marshall Islands	0.0523	0.0345	0.0000	0.04340254
Martinique	..	..	0.0000	..
Mauritania	0.0080	0.1373	0.3333	0.072625314
Mauritius	0.1856	0.3752	0.0000	0.28041522
Mexico	0.1230	0.3655	0.7500	0.244251098
Micronesia (Fed.	0.0345	..	0.0000	..
Moldova	0.0638	0.3391	0.2500	0.20141817
Mongolia	0.0385	0.0158	0.5000	0.027162433
Morocco	0.0564	0.1784	0.2500	0.11741058
Mozambique	0.0052	0.2173	0.2500	0.111234232
Myanmar	0.0022	0.4251	0.0000	0.21365745
Namibia	0.0491	0.3009	0.2500	0.17501665
Nepal	0.0051	0.3452	0.2500	0.175167267
Netherlands	0.6528	0.6731	0.7500	0.662953275
Netherlands Antilles	0.2106	..	0.0000	..
New Caledonia	0.0577	..	0.0000	..
New Zealand	0.5281	0.6810	0.8750	0.604538239
Nicaragua	0.0157	0.3255	0.2500	0.170634801
Niger	0.0008	0.0552	0.6667	0.027999867
Nigeria	0.0047	0.3242	0.7500	0.164460937
Norway	0.6690	0.8838	1.0000	0.776393593
Oman	0.0711	0.3930	0.0000	0.232065713
Pakistan	0.0097	0.3517	0.8750	0.180705636
Panama	0.1117	0.5007	0.5000	0.306185889
Paraguay	0.0726	0.4368	0.2500	0.254720915
Peru	0.0565	0.4711	1.0000	0.263810316
Philippines	0.0555	0.5027	1.0000	0.279069106
Poland	0.1927	0.4129	0.8750	0.302756919
Portugal	0.3908	0.5603	1.0000	0.475541941
Puerto Rico	0.2310	0.5795	0.0000	0.405294354
Qatar	0.2315	0.4552	0.0000	0.343337767
Romania	0.1113	0.3609	0.5000	0.236102424
Russia	0.1012	0.3578	0.5000	0.22947641
Rwanda	0.0039	0.3909	0.0000	0.197424446
Samoa	0.0482	0.0310	0.0000	0.039630734
Sao Tome and	0.0205	0.0503	0.0000	0.035393645
Saudi Arabia	0.1011	0.3953	0.5000	0.248199984

COUNTRY	2001 CONNECTIVITY	2001 ACCESS	2001-2 POLICY	2001 ICT DIFFUSION
Seychelles	0.2737	0.1704	0.0000	0.222053146
Sierra Leone	0.0039	0.1219	0.5000	0.062903588
Singapore	0.5491	0.6617	1.0000	0.605399974
Slovak Republic	0.2511	0.5661	0.5000	0.408642678
Slovenia	0.4298	0.5501	0.2500	0.489971049
Solomon Islands	0.0247	0.0103	0.0000	0.017500514
Somalia	0.0000	..	0.6667	..
South Africa	0.1168	0.3397	0.3333	0.228270209
Spain	0.3700	0.5243	1.0000	0.44716507
Sri Lanka	0.0251	0.4494	0.5000	0.237257064
Saint Kitts and Nevis	0.1683	..	0.0000	..
Saint Lucia	0.1238	..	0.0000	..
St. Vincent & the	0.0916	..	0.0000	..
Sudan	0.0063	0.1937	0.7500	0.099977804
Suriname	0.1378	0.4950	0.5000	0.316396106
Swaziland	0.0379	0.4251	0.2500	0.231484438
Sweden	0.6918	0.7847	1.0000	0.73828085
Switzerland	0.5857	0.7909	1.0000	0.688307363
Syria	0.0402	0.2564	0.0000	0.148293031
Taiwan, China	..	..	1.0000	..
Tajikistan	0.0138	0.3315	0.0000	0.172642523
Tanzania	0.0056	0.2561	0.2500	0.130824524
Thailand	0.0683	0.3619	0.6250	0.215103892
Togo	0.0168	0.1974	0.2500	0.107076493
Trinidad and Tobago	0.1432	0.4138	0.2500	0.278488098
Tunisia	0.0512	0.2729	0.2500	0.162011465
Turkey	0.1713	0.3245	0.2500	0.247935095
Turkmenistan	0.0456	0.0121	0.3333	0.028825513
Uganda	0.0054	0.2266	0.5000	0.115994873
Ukraine	0.0810	0.3409	0.0833	0.210987261
United Arab Emirates	0.3786	0.6247	0.2500	0.501655426
United Kingdom	0.5396	0.7131	1.0000	0.626315848
United States	0.8005	0.8462	1.0000	0.823370778
Uruguay	0.1776	0.4312	0.1250	0.304377226
Uzbekistan	0.0256	0.0107	0.1667	0.018103136
Vanuatu	0.0147	0.1765	0.0000	0.095633432
Venezuela	0.1207	0.4346	0.7500	0.277639578
Viet Nam	0.0189	0.3156	0.2500	0.167252298
Virgin Islands (U.S.)	0.0543	..	0.0000	..
Yemen	0.0090	0.1575	0.2500	0.083246802
Yugoslavia	0.1243	..	0.6667	..
Zambia	0.0075	0.2633	0.2500	0.135412716
Zimbabwe	0.0174	0.3183	0.7500	0.167861436

2001 Index of ICT Diffusion by Ranking

RANKING	COUNTRY	2000 CONNEC	2000 ACCESS	2001-2 POLICY	2000 ICT DIFFUSION
1	United States	0.8005	0.8462	1.0000	0.8234
2	Iceland	0.7065	0.9138	1.0000	0.8101
3	Norway	0.6690	0.8838	1.0000	0.7764
4	Luxembourg	0.7028	0.7754	1.0000	0.7391
5	Sweden	0.6918	0.7847	1.0000	0.7383
6	Denmark	0.6203	0.7859	1.0000	0.7031
7	Switzerland	0.5857	0.7909	1.0000	0.6883
8	Finland	0.6402	0.7220	1.0000	0.6811
9	Hongkong	0.5556	0.7826	1.0000	0.6691
10	Japan	0.4918	0.8396	1.0000	0.6657
11	Netherlands	0.6528	0.6731	0.7500	0.6630
12	United Kingdom	0.5396	0.7131	1.0000	0.6263
13	Australia	0.5814	0.6396	1.0000	0.6105
14	Singapore	0.5491	0.6617	1.0000	0.6054
15	New Zealand	0.5281	0.6810	0.8750	0.6045
16	Germany	0.4995	0.6874	1.0000	0.5935
17	Austria	0.4904	0.6728	1.0000	0.5816
18	Canada	0.4385	0.7179	1.0000	0.5782
19	Ireland	0.5018	0.6393	1.0000	0.5706
20	Belgium	0.4717	0.6444	0.8750	0.5580
21	France	0.4596	0.6296	1.0000	0.5446
22	Israel	0.4790	0.5796	0.5000	0.5293
23	Korea (Rep. of)	0.4023	0.6522	0.8750	0.5273
24	Italy	0.4370	0.6056	1.0000	0.5213
25	United Arab Emira	0.3786	0.6247	0.2500	0.5017
26	Malta	0.3470	0.6423	0.5000	0.4947
27	Slovenia	0.4298	0.5501	0.2500	0.4900
28	Cyprus	0.3447	0.6219	0.5000	0.4833
29	Portugal	0.3908	0.5603	1.0000	0.4755
30	Bahrain	0.2560	0.6660	0.0000	0.4610
31	Macau	0.2934	0.6274	0.0000	0.4604
32	Spain	0.3700	0.5243	1.0000	0.4472
33	Greece	0.3817	0.4692	1.0000	0.4254
34	Kuwait	0.1850	0.6555	0.1667	0.4203
35	Czech Republic	0.3844	0.4525	1.0000	0.4184
36	Estonia	0.3217	0.5113	0.7500	0.4165
37	Greenland	0.3172	0.5042	0.0000	0.4107
38	Slovak Republic	0.2511	0.5661	0.5000	0.4086
39	Puerto Rico	0.2310	0.5795	0.0000	0.4053
40	Brunei Darussalar	0.0950	0.6903	0.0000	0.3926
41	Hungary	0.2858	0.4917	0.5000	0.3887
42	Croatia	0.2368	0.5379	0.5000	0.3874
43	Malaysia	0.1949	0.5627	0.6250	0.3788
44	Bahamas	0.2171	0.4701	0.0000	0.3436
45	Qatar	0.2315	0.4552	0.0000	0.3433
46	Costa Rica	0.1538	0.5274	0.0000	0.3406
47	Barbados	0.0754	0.6007	0.0000	0.3381
48	Lithuania	0.1871	0.4821	0.2500	0.3346
49	Chile	0.1944	0.4532	1.0000	0.3238
50	Suriname	0.1378	0.4950	0.5000	0.3164
51	Panama	0.1117	0.5007	0.5000	0.3062
52	Latvia	0.2216	0.3904	0.5000	0.3060
53	Uruguay	0.1776	0.4312	0.1250	0.3044
54	Brazil	0.1352	0.4706	0.7500	0.3029
55	Poland	0.1927	0.4129	0.8750	0.3028
56	Bulgaria	0.2092	0.3755	0.5000	0.2924
57	Mauritius	0.1856	0.3752	0.0000	0.2804
58	Argentina	0.1382	0.4221	1.0000	0.2801
59	Philippines	0.0555	0.5027	1.0000	0.2791
60	Trinidad and Tobago	0.1432	0.4138	0.2500	0.2785
61	Venezuela	0.1207	0.4346	0.7500	0.2776
62	Armenia	0.0446	0.4959	0.2500	0.2703
63	Lebanon	0.0479	0.4856	0.0000	0.2667
64	Honduras	0.0274	0.5036	0.0000	0.2655
65	Fiji	0.0795	0.4493	0.0000	0.2644
66	Peru	0.0565	0.4711	1.0000	0.2638
67	Cuba	0.0224	0.4877	0.2500	0.2551
68	Paraguay	0.0726	0.4368	0.2500	0.2547
69	Botswana	0.0841	0.4252	0.2500	0.2546
70	Maldives	0.0493	0.4531	0.0000	0.2512
71	Saudi Arabia	0.1011	0.3953	0.5000	0.2482
72	Turkey	0.1713	0.3245	0.2500	0.2479
73	Macedonia, FYR	0.1372	0.3527	0.2500	0.2450
74	Bolivia	0.0475	0.4419	0.2500	0.2447
75	Mexico	0.1230	0.3655	0.7500	0.2443
76	El Salvador	0.0671	0.4197	0.7500	0.2434
77	Indonesia	0.0211	0.4592	0.5000	0.2401
78	Sri Lanka	0.0251	0.4494	0.5000	0.2373
79	Jamaica	0.1449	0.3294	0.2500	0.2371
80	Romania	0.1113	0.3609	0.5000	0.2361
81	Oman	0.0711	0.3930	0.0000	0.2321
82	Swaziland	0.0379	0.4251	0.2500	0.2315
83	Russia	0.1012	0.3578	0.5000	0.2295
84	South Africa	0.1168	0.3397	0.3333	0.2283
85	Guyana	0.0548	0.3939	0.0000	0.2244
86	Libya	0.0455	0.4027	0.0000	0.2241
87	Seychelles	0.2737	0.1704	0.0000	0.2221
88	Egypt	0.0433	0.3895	0.2500	0.2164
89	French Polynesia	0.1861	0.2460	0.0000	0.2161
90	Congo	0.0159	0.4154	0.6667	0.2157
91	Equatorial Guinea	0.0144	0.4164	0.0000	0.2154
92	Thailand	0.0683	0.3619	0.6250	0.2151
93	Myanmar	0.0022	0.4251	0.0000	0.2137
94	Ukraine	0.0810	0.3409	0.0833	0.2110
95	Jordan	0.0883	0.3335	0.2500	0.2109
96	Colombia	0.0847	0.3350	1.0000	0.2098
97	Gabon	0.0096	0.4020	0.3750	0.2058
98	Guatemala	0.0485	0.3616	0.5000	0.2050
99	Moldova	0.0638	0.3391	0.2500	0.2014
100	Cameroon	0.0087	0.3939	0.0000	0.2013
101	Dominican Rep.	0.0889	0.3091	0.7500	0.1990
102	Rwanda	0.0039	0.3909	0.0000	0.1974
103	Ecuador	0.0558	0.3273	0.1250	0.1915
104	China	0.0759	0.3026	0.8750	0.1892
105	Pakistan	0.0097	0.3517	0.8750	0.1807
106	Nepal	0.0051	0.3452	0.2500	0.1752
107	Namibia	0.0491	0.3009	0.2500	0.1750
108	Tajikistan	0.0138	0.3315	0.0000	0.1726
109	Cape Verde	0.0782	0.2667	0.2500	0.1725
110	Nicaragua	0.0157	0.3255	0.2500	0.1706
111	Iran (Islamic Rep. of)	0.0701	0.2704	0.0000	0.1702
112	Zimbabwe	0.0174	0.3183	0.7500	0.1679
113	Viet Nam	0.0189	0.3156	0.2500	0.1673
114	Nigeria	0.0047	0.3242	0.7500	0.1645
115	Tunisia	0.0512	0.2729	0.2500	0.1620
116	Syria	0.0402	0.2564	0.0000	0.1483
117	Lesotho	0.0082	0.2847	0.0000	0.1465
118	Kenya	0.0092	0.2837	0.6250	0.1464
119	Zambia	0.0075	0.2633	0.2500	0.1354
120	Liberia	0.0010	0.2652	0.0000	0.1331
121	Comoros	0.0056	0.2583	0.0000	0.1320
122	Tanzania	0.0056	0.2561	0.2500	0.1308
123	Grenada	0.1715	0.0885	0.0000	0.1300
124	Algeria	0.0209	0.2248	0.0000	0.1228
125	Ghana	0.0074	0.2365	0.5000	0.1220
126	Morocco	0.0564	0.1784	0.2500	0.1174
127	Uganda	0.0054	0.2266	0.5000	0.1160
128	Belize	0.1325	0.0975	0.0000	0.1150
129	Mozambique	0.0052	0.2173	0.2500	0.1112
130	Lao P.D.R.	0.0053	0.2101	0.0000	0.1077
131	Togo	0.0168	0.1974	0.2500	0.1071
132	India	0.0134	0.1937	1.0000	0.1035
133	Malawi	0.0030	0.2020	0.7500	0.1025
134	Sudan	0.0063	0.1937	0.7500	0.1000
135	Vanuatu	0.0147	0.1765	0.0000	0.0956
136	Djibouti	0.0099	0.1793	0.0000	0.0946
137	Chad	0.0017	0.1816	0.0000	0.0916
138	Cote d'Ivoire	0.0190	0.1633	0.2500	0.0912
139	Belarus	0.1106	0.0714	0.3333	0.0910
140	Yemen	0.0090	0.1575	0.2500	0.0832
141	Senegal	0.0330	0.1319	0.2500	0.0825
142	Burundi	0.0022	0.1613	0.6667	0.0817
143	Bhutan	0.0029	0.1591	0.0000	0.0810
144	Central African Re	0.0022	0.1556	0.0000	0.0789
145	Gambia	0.0208	0.1289	0.2500	0.0748
146	Mauritania	0.0080	0.1373	0.3333	0.0726
147	Guinea	0.0042	0.1405	0.2500	0.0723
148	Bangladesh	0.0027	0.1399	0.0833	0.0713
149	Mali	0.0027	0.1362	0.5000	0.0694
150	Benin	0.0083	0.1280	0.0000	0.0682
151	Ethiopia	0.0019	0.1310	0.0000	0.0664
152	Guinea-Bissau	0.0037	0.1264	0.7500	0.0650
153	Sierra Leone	0.0039	0.1219	0.5000	0.0629
154	Georgia	0.0817	0.0102	0.7500	0.0460
155	Marshall Islands	0.0523	0.0345	0.0000	0.0434
156	Burkina Faso	0.0036	0.0791	0.2500	0.0414
157	Bosnia and Herze	0.0618	0.0207	0.2500	0.0413
158	Samoa	0.0482	0.0310	0.0000	0.0396
159	Azerbaijan	0.0664	0.0094	0.1667	0.0379
160	Sao Tome and Pri	0.0205	0.0503	0.0000	0.0354
161	Albania	0.0500	0.0161	0.5000	0.0331
162	Turkmenistan	0.0456	0.0121	0.3333	0.0288
163	Niger	0.0008	0.0552	0.6667	0.0280
164	Mongolia	0.0385	0.0158	0.5000	0.0272
165	Kiribati	0.0195	0.0233	0.0000	0.0214
166	Uzbekistan	0.0256	0.0107	0.1667	0.0181
167	Solomon Islands	0.0247	0.0103	0.0000	0.0175
168	Angola	0.0038	0.0110	0.6250	0.0074
169	Cambodia	0.0056	0.0034	0.3750	0.0045
170	Madagascar	0.0043	0.0045	0.7500	0.0044
171	Eritrea	0.0031	0.0038	0.2500	0.0035

7. Appendix 1: ICT Development Indices (2000)

COUNTRY	2000 CONNECTIVITY	2000 ACCESS	2001-2 POLICY	2000 ICT DIFFUSION
Afghanistan	0.0005	..	0.1667	..
Albania	0.0199	0.0148	0.5000	0.0173
Algeria	0.0197	0.2248	0.0000	0.1222
American Samoa	0.1474	..	0.0000	..
Andorra	0.2824	0.4139	0.0000	0.3481
Angola	0.0026	0.0097	0.6250	0.0061
Antigua and Barbuda	0.3631	0.1885	0.1667	0.2758
Argentina	0.1386	0.4210	1.0000	0.2798
Armenia	0.0434	0.3379	0.2500	0.1907
Aruba	0.2039	..	0.0000	..
Australia	0.5653	0.6486	1.0000	0.6069
Austria	0.5493	0.6620	1.0000	0.6056
Azerbaijan	0.0589	0.0084	0.1667	0.0337
Bahamas	0.1804	0.4676	0.0000	0.3240
Bahrain	0.2396	0.5972	0.0000	0.4184
Bangladesh	0.0022	0.1398	0.0833	0.0710
Barbados	0.1964	0.4212	0.0000	0.3088
Belarus	0.1006	0.0562	0.3333	0.0784
Belgium	0.4747	0.6352	0.8750	0.5549
Belize	0.1260	0.0963	0.0000	0.1112
Benin	0.0057	0.1275	0.0000	0.0666
Bermuda	0.6670	..	0.0000	..
Bhutan	0.0028	0.1589	0.0000	0.0809
Bolivia	0.0470	0.3026	0.2500	0.1748
Bosnia and Herzegovina	0.0505	0.0211	0.2500	0.0358
Botswana	0.0859	0.2924	0.2500	0.1892
Brazil	0.1189	0.4661	0.7500	0.2925
Brunei Darussalam	0.2013	0.6906	0.0000	0.4460
Bulgaria	0.1503	0.3685	0.5000	0.2594
Burkina Faso	0.0025	0.0788	0.2500	0.0407
Burundi	0.0022	0.1613	0.6667	0.0818
Cambodia	0.0043	0.0032	0.3750	0.0038
Cameroon	0.0064	0.3940	0.0000	0.2002
Canada	0.5134	0.7373	1.0000	0.6254
Cape Verde	0.0661	0.2639	0.2500	0.1650
Cayman Islands	0.4682	..	0.0000	..
Central African Rep.	0.0018	0.1556	0.0000	0.0787
Chad	0.0012	0.1816	0.0000	0.0914
Chile	0.1720	0.4488	1.0000	0.3104
China	0.0592	0.2997	0.8750	0.1795
Colombia	0.0802	0.3336	1.0000	0.2069
Comoros	0.0046	0.2579	0.0000	0.1313
Congo	0.0109	0.4154	0.6667	0.2132
Congo (Democratic	0.0003	..	0.7500	..
Costa Rica	0.1443	0.5173	0.0000	0.3308
Cote d'Ivoire	0.0158	0.1626	0.2500	0.0892
Croatia	0.2081	0.3884	0.5000	0.2983
Cuba	0.0169	0.4845	0.2500	0.2507
Cyprus	0.3341	0.6123	0.5000	0.4732
Czech Republic	0.3033	0.4437	1.0000	0.3735

COUNTRY	2000 CONNECTIVITY	2000 ACCESS	2001-2 POLICY	2000 ICT DIFFUSION
Denmark	0.6412	0.7726	1.0000	0.7069
Djibouti	0.0088	0.1781	0.0000	0.0935
Dominica	0.1298	0.1155	0.0000	0.1227
Dominican Republic	0.0754	0.3091	0.7500	0.1922
Ecuador	0.0489	0.3230	0.1250	0.1859
Egypt, Arab Rep.	0.0336	0.3891	0.2500	0.2114
El Salvador	0.0688	0.2842	0.7500	0.1765
Equatorial Guinea	0.0090	0.4163	0.0000	0.2126
Eritrea	0.0030	0.0031	0.2500	0.0030
Estonia	0.3235	0.5169	0.7500	0.4202
Ethiopia	0.0015	0.1309	0.0000	0.0662
Faeroe Islands	0.3899	..	0.0000	..
Fiji	0.0752	0.4488	0.0000	0.2620
Finland	0.6416	0.7208	1.0000	0.6812
France	0.4608	0.5825	1.0000	0.5216
French Guiana	0.1913	..	0.0000	..
French Polynesia	0.1597	0.2508	0.0000	0.2052
Gabon	0.0437	0.2747	0.3750	0.1592
Gambia, The	0.0134	0.1275	0.2500	0.0704
Georgia	0.0676	0.0104	0.7500	0.0390
Germany	0.5223	0.6736	1.0000	0.5980
Ghana	0.0068	0.2364	0.5000	0.1216
Gibraltar	0.5830	..	0.0000	..
Greece	0.3619	0.4580	1.0000	0.4100
Greenland	0.3405	0.5092	0.0000	0.4249
Grenada	0.1625	0.0851	0.0000	0.1238
Guadelope	0.2915	..	0.0000	..
Guam	0.0030	0.9950	0.0000	0.4990
Guatemala	0.0450	0.3583	0.5000	0.2017
Guinea	0.0040	0.1402	0.2500	0.0721
Guinea-Bissau	0.0034	0.1262	0.7500	0.0648
Guyana	0.0394	0.3719	0.0000	0.2057
Honduras	0.0251	0.3803	0.0000	0.2027
Hong Kong, China	0.5869	0.7796	1.0000	0.6832
Hungary	0.2488	0.4676	0.5000	0.3582
Iceland	0.7293	0.9138	1.0000	0.8215
India	0.0119	0.1934	1.0000	0.1027
Indonesia	0.0184	0.4564	0.5000	0.2374
Iran, Islamic Rep.	0.0662	0.2696	0.0000	0.1679
Iraq	0.0107	..	0.0000	..
Ireland	0.5031	0.6415	1.0000	0.5723
Israel	0.5079	0.5792	0.5000	0.5436
Italy	0.4544	0.5989	1.0000	0.5267
Jamaica	0.1201	0.3281	0.2500	0.2241
Japan	0.4957	0.7830	1.0000	0.6394
Jordan	0.0730	0.3276	0.2500	0.2003
Kazakhstan	0.0470	0.0184	0.6667	0.0327
Kenya	0.0065	0.2796	0.6250	0.1430
Kiribati	0.0207	0.0211	0.0000	0.0209
Dem. People's Rep. of	0.0270	..	0.0000	..
Korea, Rep.	0.4147	0.6288	0.8750	0.5217
Kuwait	0.2039	0.6501	0.1667	0.4270
Kyrgyz Republic	0.0296	0.0118	0.3750	0.0207

COUNTRY	2000 CONNECTIVITY	2000 ACCESS	2001-2 POLICY	2000 ICT DIFFUSION
Latvia	0.2041	0.3907	0.5000	0.2974
Lebanon	0.1421	0.3713	0.0000	0.2567
Lesotho	0.0085	0.2846	0.0000	0.1465
Liberia	0.0011	0.2651	0.0000	0.1331
Libya	0.0448	0.4016	0.0000	0.2232
Liechtenstein	0.5580	..	0.0000	..
Lithuania	0.1652	0.4829	0.2500	0.3240
Luxembourg	0.6506	0.7935	1.0000	0.7221
Macao, China	0.2783	0.5772	0.0000	0.4278
Macedonia, FYR	0.1156	0.3499	0.2500	0.2328
Madagascar	0.0032	0.0045	0.7500	0.0038
Malawi	0.0029	0.2019	0.7500	0.1024
Malaysia	0.1775	0.5410	0.6250	0.3592
Maldives	0.0403	0.4496	0.0000	0.2450
Mali	0.0017	0.1359	0.5000	0.0688
Malta	0.3405	0.5687	0.5000	0.4546
Marshall Islands	0.0517	0.0350	0.0000	0.0433
Martinique	0.2597	..	0.0000	..
Mauritania	0.0070	0.1371	0.3333	0.0720
Mauritius	0.1628	0.3518	0.0000	0.2573
Mexico	0.1092	0.3639	0.7500	0.2366
Micronesia (Fed. States	0.0331	0.0489	0.0000	0.0410
Moldova	0.0542	0.3391	0.2500	0.1966
Mongolia	0.0371	0.0144	0.5000	0.0258
Morocco	0.0429	0.1758	0.2500	0.1093
Mozambique	0.0036	0.2173	0.2500	0.1104
Myanmar	0.0021	0.4251	0.0000	0.2136
Namibia	0.0485	0.2983	0.2500	0.1734
Nepal	0.0047	0.3452	0.2500	0.1749
Netherlands	0.6481	0.6493	0.7500	0.6487
Netherlands Antilles	0.2039	..	0.0000	..
New Caledonia	0.1846	0.2591	0.0000	0.2218
New Zealand	0.5527	0.6688	0.8750	0.6107
Nicaragua	0.0183	0.2225	0.2500	0.1204
Niger	0.0008	0.0549	0.6667	0.0278
Nigeria	0.0042	0.2171	0.7500	0.1107
Norway	0.7445	0.8672	1.0000	0.8059
Oman	0.0595	0.3895	0.0000	0.2245
Pakistan	0.0086	0.3508	0.8750	0.1797
Panama	0.1071	0.3512	0.5000	0.2292
Paraguay	0.0677	0.4360	0.2500	0.2519
Peru	0.0523	0.4701	1.0000	0.2612
Philippines	0.0467	0.5018	1.0000	0.2743
Poland	0.1706	0.4057	0.8750	0.2881
Portugal	0.3787	0.5260	1.0000	0.4523
Puerto Rico	0.2206	0.5549	0.0000	0.3878
Qatar	0.2182	0.4491	0.0000	0.3336
Romania	0.0981	0.3592	0.5000	0.2287
Russian Federation	0.0883	0.3553	0.5000	0.2218
Rwanda	0.0030	0.3903	0.0000	0.1967
Samoa	0.0376	0.0227	0.0000	0.0301
Sao Tome and Principe	0.0189	0.0432	0.0000	0.0310
Saudi Arabia	0.0893	0.3932	0.5000	0.2413

COUNTRY	2000 CONNECTIVITY	2000 ACCESS	2001-2 POLICY	2000 ICT DIFFUSION
Seychelles	0.2265	0.1527	0.0000	0.1896
Sierra Leone	0.0028	0.1218	0.5000	0.0623
Singapore	0.5985	0.6515	1.0000	0.6250
Slovak Republic	0.2171	0.4746	0.5000	0.3459
Slovenia	0.4314	0.4884	0.2500	0.4599
Solomon Islands	0.0259	0.0109	0.0000	0.0184
Somalia	0.0022	..	0.6667	..
South Africa	0.1229	0.3368	0.3333	0.2298
Spain	0.3861	0.5101	1.0000	0.4481
Sri Lanka	0.0215	0.4493	0.5000	0.2354
St. Kitts and Nevis	0.2454	..	0.0000	..
St. Lucia	0.1614	..	0.0000	..
St. Vincent & the	0.1132	0.0601	0.0000	0.0867
Sudan	0.0050	0.1933	0.7500	0.0992
Suriname	0.1071	0.4933	0.5000	0.3002
Swaziland	0.0289	0.4242	0.2500	0.2265
Sweden	0.7143	0.7879	1.0000	0.7511
Switzerland	0.6560	0.7601	1.0000	0.7081
Syrian Arab Republic	0.0356	0.2556	0.0000	0.1456
Taiwan, China	..	..	1.0000	..
Tajikistan	0.0132	0.3315	0.0000	0.1724
Tanzania	0.0042	0.2539	0.2500	0.1291
Thailand	0.0508	0.3555	0.6250	0.2031
Togo	0.0129	0.1971	0.2500	0.1050
Trinidad and Tobago	0.1272	0.4122	0.2500	0.2697
Tunisia	0.0417	0.2674	0.2500	0.1546
Turkey	0.1689	0.3234	0.2500	0.2462
Turkmenistan	0.0292	0.0119	0.3333	0.0206
Uganda	0.0044	0.2264	0.5000	0.1154
Ukraine	0.0711	0.3390	0.0833	0.2051
United Arab Emirates	0.3614	0.6144	0.2500	0.4879
United Kingdom	0.5662	0.6871	1.0000	0.6266
United States	0.8073	0.8486	1.0000	0.8279
Uruguay	0.1779	0.4354	0.1250	0.3067
Uzbekistan	0.0251	0.0104	0.1667	0.0178
Vanuatu	0.0143	0.1747	0.0000	0.0945
Venezuela	0.1202	0.4319	0.7500	0.2760
Viet Nam	0.0160	0.3146	0.2500	0.1653
Virgin Islands (U.S.)	0.3326	..	0.0000	..
Yemen	0.0066	0.1575	0.2500	0.0820
Yugoslavia	0.1124	..	0.6667	..
Zambia	0.0082	0.2632	0.2500	0.1357
Zimbabwe	0.0189	0.3167	0.7500	0.1678

2000 Index of ICT Diffusion by Ranking

RANKING	COUNTRY	2000 CONNEC	2000 ACCESS	2001-2 POLICY	2000 ICT DIFFUSION
1	United States	0.8073	0.8486	1.0000	0.8279
2	Iceland	0.7293	0.9138	1.0000	0.8215
3	Norway	0.7445	0.8672	1.0000	0.8059
4	Sweden	0.7143	0.7879	1.0000	0.7511
5	Luxembourg	0.6506	0.7935	1.0000	0.7221
6	Switzerland	0.6560	0.7601	1.0000	0.7081
7	Denmark	0.6412	0.7726	1.0000	0.7069
8	Hong Kong, China	0.5869	0.7796	1.0000	0.6832
9	Finland	0.6416	0.7208	1.0000	0.6812
10	Netherlands	0.6481	0.6493	0.7500	0.6487
11	Japan	0.4957	0.7830	1.0000	0.6394
12	United Kingdom	0.5662	0.6871	1.0000	0.6266
13	Canada	0.5134	0.7373	1.0000	0.6254
14	Singapore	0.5985	0.6515	1.0000	0.6250
15	New Zealand	0.5527	0.6688	0.8750	0.6107
16	Australia	0.5653	0.6486	1.0000	0.6069
17	Austria	0.5493	0.6620	1.0000	0.6056
18	Germany	0.5223	0.6736	1.0000	0.5980
19	Ireland	0.5031	0.6415	1.0000	0.5723
20	Belgium	0.4747	0.6352	0.8750	0.5549
21	Israel	0.5079	0.5792	0.5000	0.5436
22	Italy	0.4544	0.5989	1.0000	0.5267
23	Korea, Rep.	0.4147	0.6288	0.8750	0.5217
24	France	0.4608	0.5825	1.0000	0.5216
25	Guam	0.0030	0.9950	0.0000	0.4990
26	United Arab Emira	0.3614	0.6144	0.2500	0.4879
27	Cyprus	0.3341	0.6123	0.5000	0.4732
28	Slovenia	0.4314	0.4884	0.2500	0.4599
29	Malta	0.3405	0.5687	0.5000	0.4546
30	Portugal	0.3787	0.5260	1.0000	0.4523
31	Spain	0.3861	0.5101	1.0000	0.4481
32	Brunei Darussalar	0.2013	0.6906	0.0000	0.4460
33	Macao, China	0.2783	0.5772	0.0000	0.4278
34	Kuwait	0.2039	0.6501	0.1667	0.4270
35	Greenland	0.3405	0.5092	0.0000	0.4249
36	Estonia	0.3235	0.5169	0.7500	0.4202
37	Bahrain	0.2396	0.5972	0.0000	0.4184
38	Greece	0.3619	0.4580	1.0000	0.4100
39	Puerto Rico	0.2206	0.5549	0.0000	0.3878
40	Czech Republic	0.3033	0.4437	1.0000	0.3735
41	Malaysia	0.1775	0.5410	0.6250	0.3592
42	Hungary	0.2488	0.4676	0.5000	0.3582
43	Andorra	0.2824	0.4139	0.0000	0.3481
44	Slovak Republic	0.2171	0.4746	0.5000	0.3459
45	Qatar	0.2182	0.4491	0.0000	0.3336
46	Costa Rica	0.1443	0.5173	0.0000	0.3308
47	Lithuania	0.1652	0.4829	0.2500	0.3240
48	Bahamas	0.1804	0.4676	0.0000	0.3240
49	Chile	0.1720	0.4488	1.0000	0.3104
50	Barbados	0.1964	0.4212	0.0000	0.3088
51	Uruguay	0.1779	0.4354	0.1250	0.3067
52	Suriname	0.1071	0.4933	0.5000	0.3002
53	Croatia	0.2081	0.3884	0.5000	0.2983
54	Latvia	0.2041	0.3907	0.5000	0.2974
55	Brazil	0.1189	0.4661	0.7500	0.2925
56	Poland	0.1706	0.4057	0.8750	0.2881
57	Argentina	0.1386	0.4210	1.0000	0.2798
58	Venezuela	0.1202	0.4319	0.7500	0.2760
59	Antigua and Barbu	0.3631	0.1885	0.1667	0.2758
60	Philippines	0.0467	0.5018	1.0000	0.2743
61	Trinidad and Tobago	0.1272	0.4122	0.2500	0.2697
62	Fiji	0.0752	0.4488	0.0000	0.2620
63	Peru	0.0523	0.4701	1.0000	0.2612
64	Bulgaria	0.1503	0.3685	0.5000	0.2594
65	Mauritius	0.1628	0.3518	0.0000	0.2573
66	Lebanon	0.1421	0.3713	0.0000	0.2567
67	Paraguay	0.0677	0.4360	0.2500	0.2519
68	Cuba	0.0169	0.4845	0.2500	0.2507
69	Turkey	0.1689	0.3234	0.2500	0.2462
70	Maldives	0.0403	0.4496	0.0000	0.2450
71	Saudi Arabia	0.0893	0.3932	0.5000	0.2413
72	Indonesia	0.0184	0.4564	0.5000	0.2374
73	Mexico	0.1092	0.3639	0.7500	0.2366
74	Sri Lanka	0.0215	0.4493	0.5000	0.2354
75	Macedonia, FYR	0.1156	0.3499	0.2500	0.2328
76	South Africa	0.1229	0.3368	0.3333	0.2298
77	Panama	0.1071	0.3512	0.5000	0.2292
78	Romania	0.0981	0.3592	0.5000	0.2287
79	Swaziland	0.0289	0.4242	0.2500	0.2265
80	Oman	0.0595	0.3895	0.0000	0.2245
81	Jamaica	0.1201	0.3281	0.2500	0.2241
82	Libya	0.0448	0.4016	0.0000	0.2232
83	New Caledonia	0.1846	0.2591	0.0000	0.2218
84	Russian Federation	0.0883	0.3553	0.5000	0.2218
85	Myanmar	0.0021	0.4251	0.0000	0.2136
86	Congo	0.0109	0.4154	0.6667	0.2132
87	Equatorial Guinea	0.0090	0.4163	0.0000	0.2126
88	Egypt, Arab Rep.	0.0336	0.3891	0.2500	0.2114
89	Colombia	0.0802	0.3336	1.0000	0.2069
90	Guyana	0.0394	0.3719	0.0000	0.2057
91	French Polynesia	0.1597	0.2508	0.0000	0.2052
92	Ukraine	0.0711	0.3390	0.0833	0.2051
93	Thailand	0.0508	0.3555	0.6250	0.2031
94	Honduras	0.0251	0.3803	0.0000	0.2027
95	Guatemala	0.0450	0.3583	0.5000	0.2017
96	Jordan	0.0730	0.3276	0.2500	0.2003
97	Cameroon	0.0064	0.3940	0.0000	0.2002
98	Rwanda	0.0030	0.3903	0.0000	0.1967
99	Moldova	0.0542	0.3391	0.2500	0.1966
100	Dominican Republic	0.0754	0.3091	0.7500	0.1922
101	Armenia	0.0434	0.3379	0.2500	0.1907
102	Seychelles	0.2265	0.1527	0.0000	0.1896
103	Botswana	0.0859	0.2924	0.2500	0.1892
104	Ecuador	0.0489	0.3230	0.1250	0.1859
105	Pakistan	0.0086	0.3508	0.8750	0.1797
106	China	0.0592	0.2997	0.8750	0.1795
107	El Salvador	0.0688	0.2842	0.7500	0.1765
108	Nepal	0.0047	0.3452	0.2500	0.1749
109	Bolivia	0.0470	0.3026	0.2500	0.1748
110	Namibia	0.0485	0.2983	0.2500	0.1734
111	Tajikistan	0.0132	0.3315	0.0000	0.1724
112	Iran, Islamic Rep.	0.0662	0.2696	0.0000	0.1679
113	Zimbabwe	0.0189	0.3167	0.7500	0.1678
114	Viet Nam	0.0160	0.3146	0.2500	0.1653
115	Cape Verde	0.0661	0.2639	0.2500	0.1650
116	Gabon	0.0437	0.2747	0.3750	0.1592
117	Tunisia	0.0417	0.2674	0.2500	0.1546
118	Lesotho	0.0085	0.2846	0.0000	0.1465
119	Syrian Arab Republic	0.0356	0.2556	0.0000	0.1456
120	Kenya	0.0065	0.2796	0.6250	0.1430
121	Zambia	0.0082	0.2632	0.2500	0.1357
122	Liberia	0.0011	0.2651	0.0000	0.1331
123	Comoros	0.0046	0.2579	0.0000	0.1313
124	Tanzania	0.0042	0.2539	0.2500	0.1291
125	Grenada	0.1625	0.0851	0.0000	0.1238
126	Dominica	0.1298	0.1155	0.0000	0.1227
127	Algeria	0.0197	0.2248	0.0000	0.1222
128	Ghana	0.0068	0.2364	0.5000	0.1216
129	Nicaragua	0.0183	0.2225	0.2500	0.1204
130	Uganda	0.0044	0.2264	0.5000	0.1154
131	Belize	0.1260	0.0963	0.0000	0.1112
132	Nigeria	0.0042	0.2171	0.7500	0.1107
133	Mozambique	0.0036	0.2173	0.2500	0.1104
134	Morocco	0.0429	0.1758	0.2500	0.1093
135	Lao PDR	0.0040	0.2098	0.0000	0.1069
136	Togo	0.0129	0.1971	0.2500	0.1050
137	India	0.0119	0.1934	1.0000	0.1027
138	Malawi	0.0029	0.2019	0.7500	0.1024
139	Sudan	0.0050	0.1933	0.7500	0.0992
140	Vanuatu	0.0143	0.1747	0.0000	0.0945
141	Djibouti	0.0088	0.1781	0.0000	0.0935
142	Chad	0.0012	0.1816	0.0000	0.0914
143	Cote d'Ivoire	0.0158	0.1626	0.2500	0.0892
144	St. Vincent and th	0.1132	0.0601	0.0000	0.0867
145	Yemen	0.0066	0.1575	0.2500	0.0820
146	Burundi	0.0022	0.1613	0.6667	0.0818
147	Bhutan	0.0028	0.1589	0.0000	0.0809
148	Central African Re	0.0018	0.1556	0.0000	0.0787
149	Belarus	0.1006	0.0562	0.3333	0.0784
150	Senegal	0.0220	0.1293	0.2500	0.0756
151	Guinea	0.0040	0.1402	0.2500	0.0721
152	Mauritania	0.0070	0.1371	0.3333	0.0720
153	Bangladesh	0.0022	0.1398	0.0833	0.0710
154	Gambia, The	0.0134	0.1275	0.2500	0.0704
155	Mali	0.0017	0.1359	0.5000	0.0688
156	Benin	0.0057	0.1275	0.0000	0.0666
157	Ethiopia	0.0015	0.1309	0.0000	0.0662
158	Guinea-Bissau	0.0034	0.1262	0.7500	0.0648
159	Sierra Leone	0.0028	0.1218	0.5000	0.0623
160	Marshall Islands	0.0517	0.0350	0.0000	0.0433
161	Micronesia (Fed. S	0.0331	0.0489	0.0000	0.0410
162	Burkina Faso	0.0025	0.0788	0.2500	0.0407
163	Georgia	0.0676	0.0104	0.7500	0.0390
164	Bosnia and Herze	0.0505	0.0211	0.2500	0.0358
165	Azerbaijan	0.0589	0.0084	0.1667	0.0337
166	Kazakhstan	0.0470	0.0184	0.6667	0.0327
167	Sao Tome and Pri	0.0189	0.0432	0.0000	0.0310
168	Samoa	0.0376	0.0227	0.0000	0.0301
169	Niger	0.0008	0.0549	0.6667	0.0278
170	Mongolia	0.0371	0.0144	0.5000	0.0258
171	Kiribati	0.0207	0.0211	0.0000	0.0209
172	Kyrgyz Republic	0.0296	0.0118	0.3750	0.0207
173	Turkmenistan	0.0292	0.0119	0.3333	0.0206
174	Solomon Islands	0.0259	0.0109	0.0000	0.0184
175	Uzbekistan	0.0251	0.0104	0.1667	0.0178
176	Albania	0.0199	0.0148	0.5000	0.0173
177	Angola	0.0026	0.0097	0.6250	0.0061
178	Madagascar	0.0032	0.0045	0.7500	0.0038
179	Cambodia	0.0043	0.0032	0.3750	0.0038
180	Eritrea	0.0030	0.0031	0.2500	0.0030

7. Appendix 1: ICT Development Indices (1999)

COUNTRY	1999 CONNECTIVITY	1999 ACCESS	2001-2 POLICY	1999 ICT DIFFUSION
Afghanistan	0.0005	..	0.1667	..
Albania	0.0152	0.4687	0.5000	0.2420
Algeria	0.0191	0.4412	0.0000	0.2301
American Samoa	0.1053	..	0.0000	..
Andorra	0.3142	..	0.0000	..
Angola	0.0027	0.3239	0.6250	0.1633
Antigua and Barbuda	0.2634	0.4164	0.1667	0.3399
Argentina	0.1334	0.5230	1.0000	0.3282
Armenia	0.0495	0.5895	0.2500	0.3195
Aruba	0.2142	..	0.0000	..
Australia	0.5670	0.7067	1.0000	0.6368
Austria	0.5094	0.6295	1.0000	0.5694
Azerbaijan	0.0485	0.2728	0.1667	0.1607
Bahamas, The	0.1706	..	0.0000	..
Bahrain	0.2302	0.6184	0.0000	0.4243
Bangladesh	0.0019	0.3452	0.0833	0.1736
Barbados	0.2072	0.5943	0.0000	0.4008
Belarus	0.1011	0.5370	0.3333	0.3191
Belgium	0.4652	0.6248	0.8750	0.5450
Belize	0.1139	0.5002	0.0000	0.3070
Benin	0.0015	0.1383	0.0000	0.0699
Bermuda	0.7095	..	0.0000	..
Bhutan	0.0063	..	0.0000	..
Bolivia	0.0441	0.4338	0.2500	0.2389
Bosnia and Herzegovina	0.0453	..	0.2500	..
Botswana	0.0708	0.4744	0.2500	0.2726
Brazil	0.0992	0.4974	0.7500	0.2983
Brunei	0.1870	0.6845	0.0000	0.4358
Bulgaria	0.1327	0.5377	0.5000	0.3352
Burkina Faso	0.0019	0.2664	0.2500	0.1342
Burundi	0.0012	0.1610	0.6667	0.0811
Cambodia	0.0038	0.3443	0.3750	0.1741
Cameroon	0.0043	0.4156	0.0000	0.2099
Canada	0.5290	0.7600	1.0000	0.6445
Cape Verde	0.0535	0.4449	0.2500	0.2492
Cayman Islands	0.4434	..	0.0000	..
Central African Republic	0.0019	0.1204	0.0000	0.0612
Chad	0.0010	0.2742	0.0000	0.1376
Chile	0.1547	0.5119	1.0000	0.3333
China	0.0443	0.4779	0.8750	0.2611
Colombia	0.0831	0.5041	1.0000	0.2936
Comoros	0.0043	0.3236	0.0000	0.1639
Congo, Dem. Rep.	0.0002	..	0.7500	..
Congo, Rep.	0.0052	0.2708	0.6667	0.1380
Costa Rica	0.1261	0.5477	0.0000	0.3369
Cote d'Ivoire	0.0133	0.3433	0.2500	0.1783
Croatia	0.1669	0.4114	0.5000	0.2891
Cuba	0.0164	0.5948	0.2500	0.3056
Cyprus	0.3524	0.6504	0.5000	0.5014
Czech Republic	0.2496	0.5294	1.0000	0.3895

COUNTRY	1999 CONNECTIVITY	1999 ACCESS	2001-2 POLICY	1999 ICT DIFFUSION
Denmark	0.6801	0.7193	1.0000	0.6997
Djibouti	0.0092	0.4135	0.0000	0.2114
Dominica	0.1599	..	0.0000	..
Dominican Republic	0.0656	0.3221	0.7500	0.1939
Ecuador	0.0486	0.4930	0.1250	0.2708
Egypt, Arab Rep.	0.0303	0.3975	0.2500	0.2139
El Salvador	0.0543	0.4429	0.7500	0.2486
Equatorial Guinea	0.0022	0.3111	0.0000	0.1567
Eritrea	0.0028	0.3766	0.2500	0.1897
Estonia	0.3064	0.5831	0.7500	0.4447
Ethiopia	0.0013	0.3368	0.0000	0.1691
Faeroe Islands	0.3653	..	0.0000	..
Fiji	0.0659	0.4826	0.0000	0.2743
Finland	0.7079	0.7164	1.0000	0.7122
France	0.4686	0.6186	1.0000	0.5436
French Guiana	0.1986	..	0.0000	..
French Polynesia	0.1434	0.3184	0.0000	0.2309
Gabon	0.0162	..	0.3750	..
Gambia, The	0.0123	0.1933	0.2500	0.1028
Georgia	0.0581	..	0.7500	..
Germany	0.4561	0.6626	1.0000	0.5593
Ghana	0.0051	0.4008	0.5000	0.2029
Gibraltar	0.4049	..	0.0000	..
Greece	0.3349	0.5843	1.0000	0.4596
Greenland	0.3709	0.5911	0.0000	0.4810
Grenada	0.1589	0.4030	0.0000	0.2809
Guadelope	0.3114	..	0.0000	..
Guam	0.2520	..	0.0000	..
Guatemala	0.0329	0.4028	0.5000	0.2178
Guinea	0.0046	0.2793	0.2500	0.1420
Guinea-Bissau	0.0000	0.1317	0.7500	0.0659
Guyana	0.0371	0.5174	0.0000	0.2772
Honduras	0.0225	0.4189	0.0000	0.2207
Hong Kong, China	0.5811	0.7311	1.0000	0.6561
Hungary	0.2235	0.5250	0.5000	0.3743
Iceland	0.7582	0.8554	1.0000	0.8068
India	0.0101	0.4005	1.0000	0.2053
Indonesia	0.0171	0.4740	0.5000	0.2456
Iran, Islamic Rep.	0.0668	0.4670	0.0000	0.2669
Iraq	0.0117	..	0.0000	..
Ireland	0.4864	0.6464	1.0000	0.5664
Israel	0.4723	0.6338	0.5000	0.5530
Italy	0.4389	0.6032	1.0000	0.5211
Jamaica	0.0988	0.3302	0.2500	0.2145
Japan	0.5043	0.6032	1.0000	0.5538
Jordan	0.0444	0.4973	0.2500	0.2709
Kazakhstan	0.0440	..	0.6667	..
Kenya	0.0054	0.4394	0.6250	0.2224
Kiribati	0.0201	..	0.0000	..
Korea, Dem. Rep.	0.0271	..	0.0000	..
Korea, Rep.	0.4259	0.6783	0.8750	0.5521
Kuwait	0.1972	0.6397	0.1667	0.4184
Kyrgyz Republic	0.0316	..	0.3750	..
Lao PDR	0.0041	0.3719	0.0000	0.1880

COUNTRY	1999 CONNECTIVITY	1999 ACCESS	2001-2 POLICY	1999 ICT DIFFUSION
Latvia	0.1817	0.4987	0.5000	0.3402
Lebanon	0.1521	0.6059	0.0000	0.3790
Lesotho	0.0001	0.4631	0.0000	0.2316
Liberia	0.0009	..	0.0000	..
Libya	0.0586	..	0.0000	..
Liechtenstein	0.5712	..	0.0000	..
Lithuania	0.1599	0.5193	0.2500	0.3396
Luxembourg	0.6224	0.7626	1.0000	0.6925
Macao, China	0.2646	0.5214	0.0000	0.3930
Macedonia, FYR	0.1050	0.3726	0.2500	0.2388
Madagascar	0.0026	0.3827	0.7500	0.1926
Malawi	0.0023	0.3862	0.7500	0.1943
Malaysia	0.1496	0.5580	0.6250	0.3538
Maldives	0.0371	0.6189	0.0000	0.3280
Mali	0.0010	0.1391	0.5000	0.0700
Malta	0.2966	0.6036	0.5000	0.4501
Marshall Islands	0.0512	..	0.0000	..
Martinique	0.2903	..	0.0000	..
Mauritania	0.0154	0.3240	0.3333	0.1697
Mauritius	0.1463	0.5201	0.0000	0.3332
Mexico	0.0906	0.4672	0.7500	0.2789
Micronesia, Fed. Sts.	0.0065	..	0.0000	..
Moldova	0.0430	0.5061	0.2500	0.2746
Mongolia	0.0216	0.4127	0.5000	0.2171
Morocco	0.0254	0.3491	0.2500	0.1873
Mozambique	0.0028	0.3165	0.2500	0.1597
Myanmar	0.0022	0.2883	0.0000	0.1453
Namibia	0.0413	0.4610	0.2500	0.2511
Nepal	0.0047	0.3537	0.2500	0.1792
Netherlands	0.6004	0.6616	0.7500	0.6310
Netherlands Antilles	0.2158	..	0.0000	..
New Caledonia	0.1567	0.3108	0.0000	0.2338
New Zealand	0.5486	0.6979	0.8750	0.6233
Nicaragua	0.0166	0.3940	0.2500	0.2053
Niger	0.0004	0.0570	0.6667	0.0287
Nigeria	0.0037	0.2159	0.7500	0.1098
Norway	0.7972	0.8321	1.0000	0.8147
Oman	0.0590	..	0.0000	..
Pakistan	0.0094	0.3631	0.8750	0.1862
Panama	0.0962	0.3613	0.5000	0.2287
Paraguay	0.0956	0.4734	0.2500	0.2845
Peru	0.0524	0.4719	1.0000	0.2622
Philippines	0.0347	0.5182	1.0000	0.2765
Poland	0.1526	0.5373	0.8750	0.3450
Portugal	0.3592	0.5591	1.0000	0.4592
Puerto Rico	0.2374	..	0.0000	..
Qatar	0.2067	0.6293	0.0000	0.4180
Romania	0.0872	0.3902	0.5000	0.2387
Russian Federation	0.0844	0.5420	0.5000	0.3132
Rwanda	0.0015	0.3992	0.0000	0.2003
Samoa	0.0244	0.4599	0.0000	0.2422
Sao Tome and Principe	0.0180	..	0.0000	..
Saudi Arabia	0.0846	0.5053	0.5000	0.2950
Senegal	0.0165	0.2883	0.2500	0.1524

COUNTRY	1999 CONNECTIVITY	1999 ACCESS	2001-2 POLICY	1999 ICT DIFFUSION
Seychelles	0.2127	..	0.0000	..
Sierra Leone	0.0015	0.3163	0.5000	0.1589
Singapore	0.5659	0.7032	1.0000	0.6345
Slovak Republic	0.2164	0.5508	0.5000	0.3836
Slovenia	0.3690	0.5338	0.2500	0.4514
Solomon Islands	0.0278	0.2891	0.0000	0.1584
Somalia	0.0006	..	0.6667	..
South Africa	0.1169	0.4975	0.3333	0.3072
Spain	0.3132	0.5856	1.0000	0.4494
Sri Lanka	0.0186	0.4784	0.5000	0.2485
St. Kitts and Nevis	0.2351	..	0.0000	..
St. Lucia	0.2079	..	0.0000	..
St. Vincent and G.	0.1143	0.3286	0.0000	0.2215
Sudan	0.0041	0.3634	0.7500	0.1837
Suriname	0.0879	..	0.5000	..
Swaziland	0.0213	0.4471	0.2500	0.2342
Sweden	0.7204	0.5736	1.0000	0.6470
Switzerland	0.6487	0.7045	1.0000	0.6766
Syrian Arab Republic	0.0363	0.4573	0.0000	0.2468
Taiwan	0.6359	..	1.0000	..
Tajikistan	0.0136	0.6605	0.0000	0.3371
Tanzania	0.0031	0.3983	0.2500	0.2007
Thailand	0.0514	0.4936	0.6250	0.2725
Togo	0.0130	0.3537	0.2500	0.1834
Trinidad and Tobago	0.1064	0.3899	0.2500	0.2481
Tunisia	0.0362	0.4506	0.2500	0.2434
Turkey	0.1469	0.4625	0.2500	0.3047
Turkmenistan	0.0324	..	0.3333	..
Uganda	0.0029	0.3445	0.5000	0.1737
Ukraine	0.0684	0.5185	0.0833	0.2934
United Arab Emirates	0.3119	0.6799	0.2500	0.4959
United Kingdom	0.5311	0.6276	1.0000	0.5793
United States	0.8140	0.8083	1.0000	0.8112
Uruguay	0.1752	0.5036	0.1250	0.3394
Uzbekistan	0.0264	0.3126	0.1667	0.1695
Vanuatu	0.0136	0.2630	0.0000	0.1383
Venezuela, RB	0.1144	0.4814	0.7500	0.2979
Vietnam	0.0139	0.4578	0.2500	0.2359
Virgin Islands (U.S.)	0.3410	..	0.0000	..
Yemen, Rep.	0.0063	0.3628	0.2500	0.1845
Yugoslavia, Former	0.0962	..	0.6667	..
Zambia	0.0070	0.4221	0.2500	0.2145
Zimbabwe	0.0177	0.3167	0.7500	0.1672

1999 Index of ICT Diffusion by Ranking

RANKING	COUNTRY	1999 CONNEC	1999 ACCESS	2001-2 POLICY	1999 ICT DIFFUSION
1	Norway	0.7972	0.8321	1.0000	0.8147
2	United States	0.8140	0.8083	1.0000	0.8112
3	Iceland	0.7582	0.8554	1.0000	0.8068
4	Finland	0.7079	0.7164	1.0000	0.7122
5	Denmark	0.6801	0.7193	1.0000	0.6997
6	Luxembourg	0.6224	0.7626	1.0000	0.6925
7	Switzerland	0.6487	0.7045	1.0000	0.6766
8	Hong Kong, China	0.5811	0.7311	1.0000	0.6561
9	Sweden	0.7204	0.5736	1.0000	0.6470
10	Canada	0.5290	0.7600	1.0000	0.6445
11	Australia	0.5670	0.7067	1.0000	0.6368
12	Singapore	0.5659	0.7032	1.0000	0.6345
13	Netherlands	0.6004	0.6616	0.7500	0.6310
14	New Zealand	0.5486	0.6979	0.8750	0.6233
15	United Kingdom	0.5311	0.6276	1.0000	0.5793
16	Austria	0.5094	0.6295	1.0000	0.5694
17	Ireland	0.4864	0.6464	1.0000	0.5664
18	Germany	0.4561	0.6626	1.0000	0.5593
19	Japan	0.5043	0.6032	1.0000	0.5538
20	Israel	0.4723	0.6338	0.5000	0.5530
21	Korea, Rep.	0.4259	0.6783	0.8750	0.5521
22	Belgium	0.4652	0.6248	0.8750	0.5450
23	France	0.4686	0.6186	1.0000	0.5436
24	Italy	0.4389	0.6032	1.0000	0.5211
25	Cyprus	0.3524	0.6504	0.5000	0.5014
26	United Arab Emirates	0.3119	0.6799	0.2500	0.4959
27	Greenland	0.3709	0.5911	0.0000	0.4810
28	Greece	0.3349	0.5843	1.0000	0.4596
29	Portugal	0.3592	0.5591	1.0000	0.4592
30	Slovenia	0.3690	0.5338	0.2500	0.4514
31	Malta	0.2966	0.6036	0.5000	0.4501
32	Spain	0.3132	0.5856	1.0000	0.4494
33	Estonia	0.3064	0.5831	0.7500	0.4447
34	Brunei	0.1870	0.6845	0.0000	0.4358
35	Bahrain	0.2302	0.6184	0.0000	0.4243
36	Kuwait	0.1972	0.6397	0.1667	0.4184
37	Qatar	0.2067	0.6293	0.0000	0.4180
38	Barbados	0.2072	0.5943	0.0000	0.4008
39	Macao, China	0.2646	0.5214	0.0000	0.3930
40	Czech Republic	0.2496	0.5294	1.0000	0.3895
41	Slovak Republic	0.2164	0.5508	0.5000	0.3836
42	Lebanon	0.1521	0.6059	0.0000	0.3790
43	Hungary	0.2235	0.5250	0.5000	0.3743
44	Malaysia	0.1496	0.5580	0.6250	0.3538
45	Poland	0.1526	0.5373	0.8750	0.3450
46	Latvia	0.1817	0.4987	0.5000	0.3402
47	Antigua and Barbuda	0.2634	0.4164	0.1667	0.3399
48	Lithuania	0.1599	0.5193	0.2500	0.3396
49	Uruguay	0.1752	0.5036	0.1250	0.3394
50	Tajikistan	0.0136	0.6605	0.0000	0.3371
51	Costa Rica	0.1261	0.5477	0.0000	0.3369
52	Bulgaria	0.1327	0.5377	0.5000	0.3352
53	Chile	0.1547	0.5119	1.0000	0.3333
54	Mauritius	0.1463	0.5201	0.0000	0.3332
55	Argentina	0.1334	0.5230	1.0000	0.3282
56	Maldives	0.0371	0.6189	0.0000	0.3280
57	Armenia	0.0495	0.5895	0.2500	0.3195
58	Belarus	0.1011	0.5370	0.3333	0.3191
59	Russian Federation	0.0844	0.5420	0.5000	0.3132
60	South Africa	0.1169	0.4975	0.3333	0.3072
61	Belize	0.1139	0.5002	0.0000	0.3070
62	Cuba	0.0164	0.5948	0.2500	0.3056
63	Turkey	0.1469	0.4625	0.2500	0.3047
64	Brazil	0.0992	0.4974	0.7500	0.2983
65	Venezuela, RB	0.1144	0.4814	0.7500	0.2979
66	Saudi Arabia	0.0846	0.5053	0.5000	0.2950
67	Colombia	0.0831	0.5041	1.0000	0.2936
68	Ukraine	0.0684	0.5185	0.0833	0.2934
69	Croatia	0.1669	0.4114	0.5000	0.2891
70	Paraguay	0.0956	0.4734	0.2500	0.2845
71	Grenada	0.1589	0.4030	0.0000	0.2809
72	Mexico	0.0906	0.4672	0.7500	0.2789
73	Guyana	0.0371	0.5174	0.0000	0.2772
74	Philippines	0.0347	0.5182	1.0000	0.2765
75	Moldova	0.0430	0.5061	0.2500	0.2746
76	Fiji	0.0659	0.4826	0.0000	0.2743
77	Botswana	0.0708	0.4744	0.2500	0.2726
78	Thailand	0.0514	0.4936	0.6250	0.2725
79	Jordan	0.0444	0.4973	0.2500	0.2709
80	Ecuador	0.0486	0.4930	0.1250	0.2708
81	Iran, Islamic Rep.	0.0668	0.4670	0.0000	0.2669
82	Peru	0.0524	0.4719	1.0000	0.2622
83	China	0.0443	0.4779	0.8750	0.2611
84	Namibia	0.0413	0.4610	0.2500	0.2511
85	Cape Verde	0.0535	0.4449	0.2500	0.2492
86	El Salvador	0.0543	0.4429	0.7500	0.2486
87	Sri Lanka	0.0186	0.4784	0.5000	0.2485
88	Trinidad and Tobago	0.1064	0.3899	0.2500	0.2481
89	Syrian Arab Republic	0.0363	0.4573	0.0000	0.2468
90	Indonesia	0.0171	0.4740	0.5000	0.2456
91	Tunisia	0.0362	0.4506	0.2500	0.2434
92	Samoa	0.0244	0.4599	0.0000	0.2422
93	Albania	0.0152	0.4687	0.5000	0.2420
94	Bolivia	0.0441	0.4338	0.2500	0.2389
95	Macedonia, FYR	0.1050	0.3726	0.2500	0.2388
96	Romania	0.0872	0.3902	0.5000	0.2387
97	Vietnam	0.0139	0.4578	0.2500	0.2359
98	Swaziland	0.0213	0.4471	0.2500	0.2342
99	New Caledonia	0.1567	0.3108	0.0000	0.2338
100	Lesotho	0.0001	0.4631	0.0000	0.2316
101	French Polynesia	0.1434	0.3184	0.0000	0.2309
102	Algeria	0.0191	0.4412	0.0000	0.2301
103	Panama	0.0962	0.3613	0.5000	0.2287
104	Kenya	0.0054	0.4394	0.6250	0.2224
105	St. Vincent and G.	0.1143	0.3286	0.0000	0.2215
106	Honduras	0.0225	0.4189	0.0000	0.2207
107	Guatemala	0.0329	0.4028	0.5000	0.2178
108	Mongolia	0.0216	0.4127	0.5000	0.2171
109	Zambia	0.0070	0.4221	0.2500	0.2145
110	Jamaica	0.0988	0.3302	0.2500	0.2145
111	Egypt, Arab Rep.	0.0303	0.3975	0.2500	0.2139
112	Djibouti	0.0092	0.4135	0.0000	0.2114
113	Cameroon	0.0043	0.4156	0.0000	0.2099
114	Nicaragua	0.0166	0.3940	0.2500	0.2053
115	India	0.0101	0.4005	1.0000	0.2053
116	Ghana	0.0051	0.4008	0.5000	0.2029
117	Tanzania	0.0031	0.3983	0.2500	0.2007
118	Rwanda	0.0015	0.3992	0.0000	0.2003
119	Malawi	0.0023	0.3862	0.7500	0.1943
120	Dominican Republic	0.0656	0.3221	0.7500	0.1939
121	Madagascar	0.0026	0.3827	0.7500	0.1926
122	Eritrea	0.0028	0.3766	0.2500	0.1897
123	Lao PDR	0.0041	0.3719	0.0000	0.1880
124	Morocco	0.0254	0.3491	0.2500	0.1873
125	Pakistan	0.0094	0.3631	0.8750	0.1862
126	Yemen, Rep.	0.0063	0.3628	0.2500	0.1845
127	Sudan	0.0041	0.3634	0.7500	0.1837
128	Togo	0.0130	0.3537	0.2500	0.1834
129	Nepal	0.0047	0.3537	0.2500	0.1792
130	Cote d'Ivoire	0.0133	0.3433	0.2500	0.1783
131	Cambodia	0.0038	0.3443	0.3750	0.1741
132	Uganda	0.0029	0.3445	0.5000	0.1737
133	Bangladesh	0.0019	0.3452	0.0833	0.1736
134	Mauritania	0.0154	0.3240	0.3333	0.1697
135	Uzbekistan	0.0264	0.3126	0.1667	0.1695
136	Ethiopia	0.0013	0.3368	0.0000	0.1691
137	Zimbabwe	0.0177	0.3167	0.7500	0.1672
138	Comoros	0.0043	0.3236	0.0000	0.1639
139	Angola	0.0027	0.3239	0.6250	0.1633
140	Azerbaijan	0.0485	0.2728	0.1667	0.1607
141	Mozambique	0.0028	0.3165	0.2500	0.1597
142	Sierra Leone	0.0015	0.3163	0.5000	0.1589
143	Solomon Islands	0.0278	0.2891	0.0000	0.1584
144	Equatorial Guinea	0.0022	0.3111	0.0000	0.1567
145	Senegal	0.0165	0.2883	0.2500	0.1524
146	Myanmar	0.0022	0.2883	0.0000	0.1453
147	Guinea	0.0046	0.2793	0.2500	0.1420
148	Vanuatu	0.0136	0.2630	0.0000	0.1383
149	Congo, Rep.	0.0052	0.2708	0.6667	0.1380
150	Chad	0.0010	0.2742	0.0000	0.1376
151	Burkina Faso	0.0019	0.2664	0.2500	0.1342
152	Nigeria	0.0037	0.2159	0.7500	0.1098
153	Gambia, The	0.0123	0.1933	0.2500	0.1028
154	Burundi	0.0012	0.1610	0.6667	0.0811
155	Mali	0.0010	0.1391	0.5000	0.0700
156	Benin	0.0015	0.1383	0.0000	0.0699
157	Guinea-Bissau	0.0000	0.1317	0.7500	0.0659
158	Central African Republic	0.0019	0.1204	0.0000	0.0612
159	Niger	0.0004	0.0570	0.6667	0.0287

7. Appendix 2: Correlations of component Indices

2001	Connectivity	Access	Policy
Connectivity	1	0.7846	0.5163
Access		1	0.4247
Policy			1
2000	Connectivity	Access	Policy
Connectivity	1	0.7639	0.4297
Access		1	0.4426
Policy			1
1999	Connectivity	Access	Policy
Connectivity	1	0.7757	0.4297
Access		1	0.3971
Policy			1
1998	Connectivity	Access	Policy
Connectivity	1	0.83326	0.4258
Access		1	0.4558
Policy			1
1995	Connectivity	Access	Policy
Connectivity	1	0.6863	0.4031
Access		1	0.3744
Policy			1

7. Appendix 3: Comparison of Connectivity/Access Indices

2001 CONNECTIVITY VERSUS ACCESS PLOT OF RANKINGS

CU CON – GA ACC (3)	**KU CON – GA ACC (9)**	**GA CON – GA ACC (45)**
Honduras, Cuba, Indonesia.	Suriname, Brazil, Panama, Brunei, Barbados, Peru, Philippines, Lebanon, Armenia.	US, Iceland, Luxembourg, Sweden, Norway, Netherlands, Finland, Denmark, Switzerland, Australia, HK, Singapore, U.K., New Zealand, Ireland, Germany, Japan, Austria, Israel, Belgium, France, Canada, Italy, Slovenia, Korea, Portugal, Greece, UAE, Spain, Malta, Cyprus, Estonia, Greenland, Macao, Hungary, Bahrain, Slovak Rep., Croatia, Puerto Rico, Bahamas, Malaysia, Lithuania, Kuwait, Costa Rica.
CU CON – KU ACC (16)	**KU CON – KU ACC (31)**	**GA CON – KU ACC (10)**
Sri Lanka, Vietnam, Zimbabwe, Congo, Nicaragua, Eq. Guinea, Tajikistan, Pakistan, Gabon, Kenya, Cameroon, Lesotho, Nepal, Nigeria, Rwanda, Myanmar.	Trinidad & Tobago, Argentina, Macedonia, Mexico, Venezuela, S. Africa, Romania, Russia, Saudi Arabia, Dominican Rep., Jordan, Colombia, Botswana, Ukraine, Fiji, China, Paraguay, Oman, Thailand, El Salvador, Moldova, Ecuador, Guyana, Tunisia, Maldives, Namibia, Guatemala, Bolivia, Libya, Egypt, Swaziland.	Czech Republic, Qatar, Latvia, Bulgaria, Chile, Poland, Mauritius, Uruguay, Turkey, Jamaica. Brazil, , Brunei, New Caledonia, Liberia. Honduras, , Panama, Gabon, Armenia, Nigeria,
CU CON – CU ACC (40)	**KU CON – CU ACC (15)**	**GA CON – CU ACC (3)**
Uzbekistan, Solomon Isls, Algeria, Gambia, Sao Tome, Kiribati, Ivory Coast, Togo, Vanuatu, India, Djibouti, Yemen, Benin, Mauritania, Zambia, Ghana, Sudan, Comoros, Cambodia, Tanzania, Uganda, Laos PDR, Mozambique, Madagascar, Guinea, Sierra Leone, Angola, Guinea-B, Burkina Faso, Eritrea, Malawi, Bhutan, Bangladesh, Mali, CAR, Burundi, Ethiopia, Chad, Liberia Niger.	Belize, Belarus, Georgia, Cape Verde, Iran, Azerbaijan, Bosnia, Morocco, Marshall Islands, Albania, Samoa, Turkmenistan, Syria, Mongolia, Senegal.	Seychelles, French Polynesia, Grenada.

7. Appendix 4: Comparison of Policy/Connectivity Indices

2001 CONNECTIVITY VERSUS POLICY PLOT OF RANKINGS

CU CON – GA POL (16)	**KU CON – GA POL (13)**	**GA CON – GA POL (31)**
Kazakhstan, Zimbabwe, Congo Rep., India, Pakistan, Kenya, Sudan, Nigeria, Madagascar, Angola, Guinea-Bissau, Malawi, Burundi, Congo DR, Niger, Somalia.	Argentina, Brazil, Yugoslavia, Mexico, Venezuela, Dominican Rep., Colombia, Georgia, China, Thailand, El Salvador, Peru, Philippines.	US, Iceland, Luxembourg, Sweden, Norway, Netherlands, Finland, Denmark, Switzerland, Australia, Hong Kong, Singapore, United Kingdom, New Zealand, Ireland, Germany, Japan, Austria, Belgium, France, Canada, Italy, Korea, Portugal, Czech Republic, Greece, Spain, Estonia, Malaysia, Chile, Poland.
CU CON – KU POL (27)	**KU CON – KU POL (30)**	**GA CON – KU POL (16)**
Uzbekistan, Sri Lanka, Cuba, Indonesia, Gambia, Cote d'Ivoire, Vietnam, Togo, Nicaragua, Gabon, Yemen, Mauritania, Zambia, Ghana, Cambodia, Tanzania, Uganda, Mozambique, Nepal, Guinea, Kyrgyz Republic, Sierra Leone, Burkina Faso, Eritrea, Bangladesh, Mali, Afghanistan.	Trinidad and Tobago, Suriname, Macedonia, South Africa, Panama, Romania, Belarus, Russian Federation, Saudi Arabia, Jordan, Botswana, Ukraine, Cape Verde, Paraguay, Azerbaijan, Moldova, Bosnia and Herzegovina, Morocco, Ecuador, Tunisia, Albania, Namibia, Guatemala, Bolivia, Turkmenistan, Armenia, Egypt, Mongolia, Swaziland, Senegal.	Israel, Slovenia, UAE, Antigua and Barbuda, Malta, Cyprus, Hungary, Slovak Republic, Croatia, Latvia, Bulgaria, Lithuania, Kuwait, Uruguay, Turkey, Jamaica.
CU CON – CU POL (23)	**KU CON – CU POL (20)**	**GA CON – CU POL (18)**
Korea DR, Honduras, Solomon Islands, Algeria, Sao Tome, Kiribati, Vanuatu, Eq. Guinea, Tajikistan, Iraq, Djibouti, Cameroon, Benin, Lesotho, Comoros, Lao PDR, Rwanda, Bhutan, CAR, Myanmar, Ethiopia, Chad, Liberia.	Belize, St. Lucia, Brunei, Faeroe Islands, St Vincent, Fiji, Barbados, Oman, Iran, New Caldeonia, Guyana, Virgin Islands, Marshall Islands, Maldives, Samoa, Lebanon, Libya, Syria, Cayman Islands, American Samoa.	Bermuda, Greenland, Aruba, Macau, Lichtenstein, Seychelles, Andorra, Bahrain, Qatar, Puerto Rico, Bahamas, Netherlands Antilles, French Polynesia, Mauritius, Dominica, Grenada, St. Kitts, Costa Rica.

7. Appendix 5: Digital Divide work

According to Bridges.org, the international digital divide has typically been assessed by counts of hardware and connectivity (hosts, PCs, telephones, mobiles). We can analyse the distribution of these variables to investigate their evolution over time, to see whether "uneven diffusion" (UNDP) is in fact increasing or decreasing over time:

Table A – Summary Statistics

Measure	Hosts	PCs	Telephones	Mobiles
1995 values Maximum	422	328	737	227
Minimum	0	0	0.7	0
Median	0.042	17.24	93.8	1.34
Average	15.80	59.92	178.45	20.25
Med/av %	*0.26%*	*28.8%*	*0.75%*	*6.6%*
Std.deviation	50.17	85.27	194.79	39.90
SD/av	*3.17*	*1.42*	*1.09*	*1.97*
Skewness	4.949	1.629	1.006	2.873
Kurtosis	29.627	1.509	-0.211	9.453
1998 values Maximum	1,098	447	840	572
Minimum	0	0	0.4	0
Median	1.79	26.85	108.5	15.28
Average	57.48	83.23	204.61	70.36
Med/av %	*3.1%*	*32.2%*	*53%*	*21.7%*
Std.deviation	153.54	116.48	213.09	110.99
SD/av	*2.68*	*1.398*	*1.04*	*1.58*
Skewness	4.220	1.659	0.9346	2.068
Kurtosis	20.466	1.663	-0.2823	4.180

1999 values Maximum	1,896	503	857	651
Minimum	0	0.38	0.3	0
Median	3.24	33.82	128.1	35.27
Average	83.37	93.41	218.44	116.96
Med/av %	*3.88%*	*36.2%*	*58.6%*	*30.2%*
Std.deviation	224.64	126.52	219.69	162.35
SD/av	*2.69*	*1.35*	*1.01*	*1.39*
Skewness	4.541	1.644	0.904	1.602
Kurtosis	26.036	1.689	-0.280	1.706
2000 values Maximum	2,845	568	915.5	794
Minimum	0	0.95	0.4	0
Median	4.57	39.9	114.6	53.6
Average	111.35	106.54	213.4	166.56
Med/av %	*4.1%*	*37.5%*	*57.7%*	*32.2%*
Std.deviation	301.27	144.37	224.91	222.88
SD/av	*2.71*	*1.36*	*1.05*	*1.338*
Skewness	5.2393	1.6363	1.0764	1.4358
Kurtosis	37.19	1.6697	0.2524	0.8855
2001 values Maximum	3,714	623	888.6	977.8
Minimum	0	0.53	0.4	0
Median	5.48	34.7	112.4	75.7
Average	146.95	99.36	206.5	210.7
Med/av %	*3.73%*	*34.9%*	*54.4%*	*35.9%*
Std.deviation	396.61	142.91	216.15	265.96
SD/av	*2.70*	*1.44*	*1.05*	*1.26*
Skewness	5.3373	1.9281	1.0337	1.2645
Kurtosis	37.7662	2.9673	0.1004	0.2833

Table B – Evolution over time of statistics on average per capita variable distributions

Maximum	**2001**	**2000**	**1999**	**1998**	**1995**
Hosts	3,714	2,845	1,896	1,098	422
PCs	623	568	503	447	328
Telephones	888.6	915.5	857	840	737
Mobiles	977.77	794	651	572	227
Median/av%					
Hosts	3.73%	4.1%	3.88%	3.1%	0.26%
PCs	34.9%	37.5%	36.2%	32.2%	28.8%
Telephones	54.4%	53.7%	58.6%	53%	0.75%
Mobiles	35.9%	32.2%	30.2%	21.7%	6.6%
SD/average					
Hosts	2.7	2.71	2.69	2.68	3.17
PCs	1.44	1.36	1.35	1.398	1.42
Telephones	1.05	1.05	1.01	1.04	1.09
Mobiles	1.26	1.338	1.39	1.58	1.97
Skewness					
Hosts	5.3373	5.2393	4.541	4.220	4.929
PCs	1.9281	1.6363	1.644	1.659	1.629
Telephones	1.0337	1.0764	0.904	0.9346	1.006
Mobiles	1.2645	1.4358	1.602	2.068	2.873

Table C – Summary Statistics of Connectivity Index

Measure	2001	2000	1999	1998	1995
Maximum	0.8005 (U.S.)	0.8073 (U.S.)	0.814 (U.S.)	0.8131 (Fin)	0.8368(Fin)
Minimum	1.18x10-6 (Somalia)	0.00027 (Congo DR)	3.37x10-5 (Guinea-Bissau)	0.00028 (Congo DR)	0.000362 (Chad)
Median	0.0683	0.0699	0.0668	0.0570	0.0472
Average	0.1532	0.1630	0.1599	0.1465	0.1245
Med/av %	*44.6%*	*42.9%*	*41.8%*	*38.9%*	*37.9%*
Std.deviation	0.1888	0.199	0.1996	0.1896	0.1741
SD/average	*1.23*	*1.22*	*1.25*	*1.29*	*1.40*
Skewness	1.484	1.412	1.488	1.675	2.003
Kurtosis	1.276	0.979	1.335	2.236	3.841

7. Appendix 6: Connectivity Index (2001)

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Afghanistan	0.0000	..	0.0015	0.0000	0.0005
Albania	0.0002	0.0153	0.0707	0.1138	0.0500
Algeria	0.0001	0.0115	0.0686	0.0033	0.0209
American Samoa	0.0321	..	..	..	0.0321
Andorra	0.0960	..	0.4390	..	0.2675
Angola	0.0000	0.0020	0.0067	0.0065	0.0038
Antigua and Barbuda	0.0325	..	0.6447	0.3930	0.3567
Argentina	0.0334	0.0857	0.2434	0.1903	0.1382
Armenia	0.0017	0.0127	0.1572	0.0067	0.0446
Aruba	0.0239	..	0.4014	0.5207	0.3153
Australia	0.3186	0.8306	0.5854	0.5907	0.5814
Austria	0.1087	..	0.5310	0.8316	0.4904
Azerbaijan	0.0004	..	0.1203	0.0783	0.0664
Bahamas	0.0002	..	0.4502	0.2009	0.2171
Bahrain	0.0071	0.2465	0.3002	0.4701	0.2560
Bangladesh	0.0000	0.0029	0.0041	0.0038	0.0027
Barbados	0.0013	0.1496	..	..	0.0754
Belarus	0.0009	..	0.3170	0.0139	0.1106
Belgium	0.0923	..	0.5564	0.7663	0.4717
Belize	0.0039	0.2295	0.1717	0.1248	0.1325
Benin	0.0002	0.0027	0.0104	0.0198	0.0083
Bermuda	0.2193	0.8112	1.0000	0.2152	0.5614
Bhutan	0.0014	0.0030	0.0074	0.0000	0.0029
Bolivia	0.0005	0.0321	0.0680	0.0893	0.0475
Bosnia and Herzegovina	0.0022	..	0.1246	0.0587	0.0618
Botswana	0.0022	0.0672	..	0.1829	0.0841
Brazil	0.0257	0.1005	0.2441	0.1704	0.1352
Brunei Darussalam	0.0700	0.1200	..	..	0.0950
Bulgaria	0.0092	..	0.4169	0.2015	0.2092
Burkina Faso	0.0002	0.0023	0.0055	0.0065	0.0036
Burundi	0.0000	..	0.0035	0.0031	0.0022
Cambodia	0.0001	0.0024	0.0028	0.0170	0.0056
Cameroon	0.0001	0.0063	0.0075	0.0209	0.0087
Canada	0.2509	..	0.7373	0.3272	0.4385
Cape Verde	0.0002	..	0.1607	0.0738	0.0782
Cayman Islands	0.0362	..	..	..	0.0362
Central African Rep.	0.0000	0.0030	0.0030	0.0030	0.0022
Chad	0.0000	0.0024	0.0015	0.0028	0.0017
Chile	0.0215	0.1356	0.2706	0.3501	0.1944
China	0.0002	0.0313	0.1568	0.1153	0.0759
Colombia	0.0036	0.0676	0.1919	0.0755	0.0847
Comoros	0.0000	0.0088	0.0137	0.0000	0.0056
Congo	0.0000	0.0062	0.0080	0.0493	0.0159
Congo (Democratic Republic of the)	0.0000	..	0.0004	0.0029	0.0011
Costa Rica	0.0056	0.2734	0.2586	0.0774	0.1538
Cote d'Ivoire	0.0005	0.0098	0.0202	0.0456	0.0190
Croatia	0.0127	0.1380	0.4110	0.3856	0.2368
Cuba	0.0002	0.0314	0.0573	0.0007	0.0224
Cyprus	0.0071	0.3455	0.6193	0.4067	0.3447

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Czech Republic	0.0566		0.4218	0.6747	0.3844
Denmark	0.2833	..	0.8193	0.7583	0.6203
Djibouti	0.0000	0.0175	0.0174	0.0048	0.0099
Dominica	0.0085	0.1367	0.3711	..	0.1721
Dominican Rep.	0.0132	..	0.1243	0.1290	0.0889
Ecuador	0.0007	0.0374	0.1167	0.0682	0.0558
Egypt	0.0001	0.0233	0.1083	0.0414	0.0433
El Salvador	0.0002	0.0351	0.1052	0.1279	0.0671
Equatorial Guinea	0.0000	0.0086	0.0165	0.0327	0.0144
Eritrea	0.0000	0.0029	0.0094	0.0000	0.0031
Estonia	0.0998	0.2917	0.4116	0.4838	0.3217
Ethiopia	0.0000	0.0019	0.0054	0.0004	0.0019
Faroe Islands	0.0929	..	..	..	0.0929
Fiji	0.0022	0.0976	0.1237	0.0945	0.0795
Finland	0.4612	0.6824	0.6183	0.7987	0.6402
France	0.0357	0.5404	0.6442	0.6179	0.4596
French Polynesia	0.0196	..	0.2497	0.2890	0.1861
Gabon	0.0001	0.0191	..	..	0.0096
Gambia	0.0002	0.0204	0.0295	0.0329	0.0208
Georgia	0.0011	..	0.1864	0.0576	0.0817
Germany	0.0797	..	0.7175	0.7014	0.4995
Ghana	0.0000	0.0057	0.0138	0.0100	0.0074
Greece	0.0363	0.1300	0.5941	0.7665	0.3817
Greenland	0.1235	..	0.5239	0.3042	0.3172
Grenada	0.0003	0.2227	0.3931	0.0700	0.1715
Guatemala	0.0015	0.0206	0.0728	0.0992	0.0485
Guinea	0.0001	0.0062	0.0035	0.0069	0.0042
Guinea-Bissau	0.0002	..	0.0110	0.0000	0.0037
Guyana	0.0001	0.0484	0.1179	0.0529	0.0548
Honduras	0.0001	0.0195	0.0530	0.0370	0.0274
Hongkong	0.1500	0.6000	0.6347	0.8378	0.5556
Hungary	0.0455	0.1620	0.4233	0.5124	0.2858
Iceland	0.5231	0.6850	0.7621	0.8556	0.7065
India	0.0002	0.0094	0.0381	0.0057	0.0134
Indonesia	0.0006	0.0171	0.0415	0.0252	0.0211
Iran (Islamic Rep. of)	0.0001	0.1013	0.1578	0.0213	0.0701
Iraq	0.0000	..	0.0322	0.0000	0.0107
Ireland	0.0898	0.6272	0.5449	0.7455	0.5018
Israel	0.0627	0.4164	0.5652	0.8716	0.4790
Italy	0.0319	0.3157	0.5344	0.8661	0.4370
Jamaica	0.0015	0.0804	0.2220	0.2755	0.1449
Japan	0.1505	0.5601	0.6717	0.5847	0.4918
Jordan	0.0012	0.0541	0.1471	0.1510	0.0883
Kazakhstan	0.0018	..	..	0.0370	0.0194
Kenya	0.0002	0.0090	0.0113	0.0163	0.0092
Kiribati	0.0007	0.0382	..	..	0.0195
Korea, Dem. Rep.	..	..	0.0552	0.0000	0.0276
Korea (Rep. of)	0.0252	0.4095	0.5433	0.6311	0.4023
Kuwait	0.0047	0.2119	0.2697	0.2538	0.1850
Kyrgyzstan	0.0025	..		0.0055	0.0040
Lao P.D.R.	0.0001	0.0048	0.0110	0.0056	0.0053
Latvia	0.0280	0.2404	0.3390	0.2792	0.2216
Lebanon	0.0054	0.0904	..	..	0.0479

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Liberia	0.0000	..	0.0025	0.0007	0.0010
Libya	0.0000	..	0.1269	0.0095	0.0455
Liechtenstein	0.2909	..	..	..	0.2909
Lithuania	0.0257	0.1132	0.3513	0.2584	0.1871
Luxembourg	0.0850	0.8355	0.8907	1.0000	0.7028
Macau	0.0011	0.2864	0.4426	0.4434	0.2934
Macedonia, FYR	0.0034	..	0.2966	0.1117	0.1372
Madagascar	0.0000	0.0039	0.0040	0.0092	0.0043
Malawi	0.0000	0.0018	0.0053	0.0049	0.0030
Malaysia	0.0088	0.2129	0.2356	0.3221	0.1949
Maldives	0.0000	0.0321	0.1022	0.0629	0.0493
Mali	0.0000	0.0019	0.0048	0.0040	0.0027
Malta	0.0600	0.3690	0.5968	0.3623	0.3470
Marshall Islands	0.0002	0.1085	0.0909	0.0097	0.0523
Mauritania	0.0001	0.0158	..	..	0.0080
Mauritius	0.0072	0.1784	0.2949	0.2621	0.1856
Mexico	0.0246	0.1104	0.1517	0.2052	0.1230
Micronesia (Fed. States of)	0.0140	..	0.0894	0.0000	0.0345
Moldova	0.0011	0.0262	0.1776	0.0501	0.0638
Mongolia	0.0002	0.0220	0.0541	0.0779	0.0385
Morocco	0.0002	0.0211	0.0441	0.1604	0.0564
Mozambique	0.0000	0.0060	0.0054	0.0093	0.0052
Myanmar	0.0000	0.0018	0.0065	0.0003	0.0022
Namibia	0.0070	0.0584	0.0739	0.0572	0.0491
Nepal	0.0002	0.0054	0.0142	0.0007	0.0051
Netherlands	0.4449	0.6958	0.7065	0.7640	0.6528
Netherlands Antilles	0.0015	..	0.4198	..	0.2106
New Caledonia	0.0577	..	..	..	0.0577
New Zealand	0.2887	0.6327	0.5419	0.6491	0.5281
Nicaragua	0.0011	0.0154	..	0.0306	0.0157
Niger	0.0000	0.0009	0.0022	0.0002	0.0008
Nigeria	0.0000	0.0110	0.0048	0.0029	0.0047
Norway	0.1831	0.8232	0.8180	0.8516	0.6690
Oman	0.0048	0.0521	0.1010	0.1266	0.0711
Pakistan	0.0002	0.0066	0.0264	0.0056	0.0097
Panama	0.0073	0.0609	0.1669	0.2117	0.1117
Paraguay	0.0013	0.0228	0.0577	0.2087	0.0726
Peru	0.0014	0.0770	0.0872	0.0606	0.0565
Philippines	0.0011	0.0354	0.0452	0.1401	0.0555
Poland	0.0342	0.1374	0.3326	0.2664	0.1927
Portugal	0.0662	0.1937	0.4901	0.8132	0.3908
Puerto Rico	0.0011	..	0.3786	0.3134	0.2310
Qatar	0.0006	0.2794	0.3278	0.3181	0.2315
Romania	0.0056	0.0574	0.2058	0.1763	0.1113
Russia	0.0066	0.0811	0.2777	0.0393	0.1012
Rwanda	0.0004	..	0.0030	0.0084	0.0039
Saint Kitts and Nevis	0.0002	0.3364	..	..	0.1683
Saint Lucia	0.0003	0.2472	..	..	0.1238
Samoa	0.0906	0.0121	0.0708	0.0193	0.0482
Sao Tome and Principe	0.0178	..	0.0437	0.0000	0.0205
Saudi Arabia	0.0015	0.1069	0.1730	0.1230	0.1011
Senegal	..	0.0299	0.0276	0.0414	0.0330
Seychelles	0.0087	0.2367	0.2954	0.5539	0.2737

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Singapore	0.1298	0.8212	0.5338	0.7117	0.5491
Slovak Republic	0.0362	0.2378	0.3242	0.4065	0.2511
Slovenia	0.0401	0.4450	0.4533	0.7808	0.4298
Solomon Islands	0.0023	0.0764	0.0180	0.0021	0.0247
Somalia	0.0000	..	..	..	0.0000
South Africa	0.0147	0.1100	0.1277	0.2148	0.1168
Spain	0.0363	0.2736	0.4913	0.6788	0.3700
Sri Lanka	0.0003	0.0126	0.0488	0.0385	0.0251
St. Vincent and the Grenadines	0.0001	0.1832	..	..	0.0916
Sudan	0.0000	0.0058	0.0160	0.0034	0.0063
Suriname	0.0004	..	0.2078	0.2052	0.1378
Swaziland	0.0033	..	0.0384	0.0720	0.0379
Sweden	0.2241	0.9092	0.8390	0.7951	0.6918
Switzerland	0.1981	..	0.8136	0.7455	0.5857
Syria	0.0000	0.0261	0.1225	0.0123	0.0402
Taiwan, China	..	..	..	..	..
Tajikistan	0.0001	..	0.0409	0.0003	0.0138
Tanzania	0.0001	0.0054	0.0046	0.0121	0.0056
Thailand	0.0030	0.0429	0.1057	0.1214	0.0683
Togo	0.0001	0.0345	0.0116	0.0209	0.0168
Trinidad and Tobago	0.0142	0.1112	0.2699	0.1773	0.1432
Tunisia	0.0001	0.0386	0.1243	0.0416	0.0512
Turkey	0.0042	0.0641	0.3145	0.3024	0.1713
Turkmenistan	0.0009	..	0.0902	..	0.0456
Uganda	0.0000	0.0047	0.0030	0.0137	0.0054
Ukraine	0.0032	0.0301	0.2445	0.0463	0.0810
United Arab Emirates	0.0777	0.2543	0.4466	0.7359	0.3786
United Kingdom	0.1009	0.5935	0.6561	0.8078	0.5396
United States	1.0000	1.0000	0.7478	0.4543	0.8005
Uruguay	0.0568	0.1768	0.3184	0.1582	0.1776
Uzbekistan	0.0000	..	0.0741	0.0025	0.0256
Vanuatu	0.0048	..	0.0377	0.0018	0.0147
Venezuela	0.0025	0.0848	0.1260	0.2695	0.1207
Viet Nam	0.0000	0.0162	0.0434	0.0162	0.0189
Virgin Islands (U.S.)	0.0543	..	..	..	0.0543
Yemen	0.0000	0.0031	0.0249	0.0081	0.0090
Yugoslavia	0.0040	0.0381	0.2610	0.1939	0.1243
Zambia	0.0003	0.0113	0.0090	0.0094	0.0075
Zimbabwe	0.0007	0.0206	0.0222	0.0262	0.0174

7. Appendix 6: Connectivity Index (2000)

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Afghanistan	0.0000	..	0.0015	0.0000	0.0005
Albania	0.0002	0.0140	0.0532	0.0120	0.0199
Algeria	0.0000	0.0116	0.0635	0.0036	0.0197
American Samoa	0.0639	..	0.2309	..	0.1474
Andorra	0.0675	..	0.4348	0.3449	0.2824
Angola	0.0000	0.0020	0.0058	0.0025	0.0026
Antigua and Barbuda	0.0170	..	0.6451	0.4272	0.3631
Argentina	0.0257	0.0903	0.2329	0.2057	0.1386
Armenia	0.0025	0.0116	0.1538	0.0058	0.0434
Aruba	0.0101	..	0.4138	0.1878	0.2039
Australia	0.2968	0.8273	0.5736	0.5634	0.5653
Austria	0.2102	0.4942	0.5182	0.9745	0.5493
Azerbaijan	0.0007	..	0.1088	0.0673	0.0589
Bahamas	0.0003	..	0.4106	0.1305	0.1804
Bahrain	0.0003	0.2612	0.2919	0.4050	0.2396
Bangladesh	0.0000	0.0026	0.0037	0.0026	0.0022
Barbados	0.0013	0.1447	0.5057	0.1340	0.1964
Belarus	0.0007	..	0.2951	0.0061	0.1006
Belgium	0.1030	0.6007	0.5394	0.6556	0.4747
Belize	0.0046	0.2332	0.1726	0.0935	0.1260
Benin	0.0000	0.0028	0.0090	0.0111	0.0057
Bermuda	0.1898	0.8382	0.9728	..	0.6670
Bhutan	0.0013	0.0030	0.0070	0.0000	0.0028
Bolivia	0.0006	0.0296	0.0661	0.0917	0.0470
Bosnia and Herzegovina	0.0020	..	0.1123	0.0373	0.0505
Botswana	0.0054	0.0685	0.1065	0.1634	0.0859
Brazil	0.0181	0.0877	0.1982	0.1714	0.1189
Brunei Darussalam	0.0496	0.1232	0.2678	0.3644	0.2013
Bulgaria	0.0081	0.0800	0.3960	0.1169	0.1503
Burkina Faso	0.0001	0.0023	0.0050	0.0028	0.0025
Burundi	0.0000	..	0.0034	0.0032	0.0022
Cambodia	0.0001	0.0020	0.0026	0.0125	0.0043
Cameroon	0.0001	0.0059	0.0070	0.0125	0.0064
Canada	0.2702	0.6864	0.7388	0.3583	0.5134
Cape Verde	0.0002	..	0.1398	0.0582	0.0661
Cayman Islands	0.0520	..	1.0000	0.3524	0.4682
Central African Rep.	0.0000	0.0028	0.0028	0.0017	0.0018
Chad	0.0000	0.0025	0.0014	0.0009	0.0012
Chile	0.0173	0.1457	0.2433	0.2816	0.1720
China	0.0002	0.0284	0.1241	0.0842	0.0592
Colombia	0.0039	0.0627	0.1866	0.0675	0.0802
Comoros	0.0002	0.0075	0.0108	0.0000	0.0046
Congo	0.0000	0.0064	0.0080	0.0292	0.0109
Congo (Democratic Republic of the)	0.0000	..	0.0004	0.0004	0.0003
Costa Rica	0.0064	0.2623	0.2440	0.0642	0.1443
Cote d'Ivoire	0.0001	0.0099	0.0180	0.0354	0.0158
Croatia	0.0125	0.1365	0.4040	0.2795	0.2081
Cuba	0.0002	0.0188	0.0477	0.0007	0.0169
Cyprus	0.0359	0.3367	0.6133	0.3508	0.3341
Czech Republic	0.0545	0.2141	0.4117	0.5328	0.3033

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Denmark	0.2207	0.7605	0.7874	0.7962	0.6412
Djibouti	0.0000	0.0181	0.0168	0.0005	0.0088
Dominica	0.0093	0.1371	0.3514	0.0214	0.1298
Dominican Republic	0.0033	..	0.1167	0.1061	0.0754
Ecuador	0.0001	0.0383	0.1093	0.0480	0.0489
Egypt, Arab Rep.	0.0001	0.0207	0.0882	0.0252	0.0336
El Salvador	0.0003	0.0336	0.0992	0.1419	0.0688
Equatorial Guinea	0.0000	0.0077	0.0146	0.0138	0.0090
Eritrea	0.0000	0.0030	0.0091	0.0000	0.0030
Estonia	0.1032	0.2777	0.4098	0.5034	0.3235
Ethiopia	0.0000	0.0017	0.0040	0.0004	0.0015
Faeroe Islands	0.1179	..	0.5895	0.4623	0.3899
Fiji	0.0024	0.0973	0.1160	0.0851	0.0752
Finland	0.3598	0.6973	0.6015	0.9079	0.6416
France	0.0666	0.5322	0.6267	0.6176	0.4608
French Guiana	0.0028	0.2669	..	0.3044	0.1913
French Polynesia	0.0227	..	0.2411	0.2153	0.1597
Gabon	0.0001	0.0172	0.0346	0.1228	0.0437
Gambia, The	0.0000	0.0203	0.0279	0.0054	0.0134
Georgia	0.0012	..	0.1572	0.0444	0.0676
Germany	0.0875	0.5929	0.6688	0.7401	0.5223
Ghana	0.0000	0.0055	0.0134	0.0085	0.0068
Gibraltar	0.1383	0.9921	0.9384	0.2632	0.5830
Greece	0.0366	0.1244	0.5826	0.7041	0.3619
Greenland	0.1551	..	0.5087	0.3579	0.3405
Grenada	0.0001	0.2258	0.3663	0.0579	0.1625
Guadelope	0.0047	0.3700	..	0.4999	0.2915
Guam	0.0030	..	..	..	0.0030
Guatemala	0.0017	0.0201	0.0651	0.0933	0.0450
Guinea	0.0001	0.0063	0.0033	0.0065	0.0040
Guinea-Bissau	0.0001	..	0.0101	0.0000	0.0034
Guyana	0.0003	0.0509	0.0982	0.0083	0.0394
Honduras	0.0001	0.0192	0.0509	0.0305	0.0251
Hong Kong, China	0.1173	0.6052	0.6251	1.0000	0.5869
Hungary	0.0368	0.1535	0.4162	0.3887	0.2488
Iceland	0.5022	0.6929	0.7504	0.9717	0.7293
India	0.0001	0.0080	0.0351	0.0045	0.0119
Indonesia	0.0004	0.0174	0.0342	0.0217	0.0184
Iran, Islamic Rep.	0.0001	0.1001	0.1473	0.0172	0.0662
Iraq	0.0000	..	0.0321	0.0000	0.0107
Ireland	0.1022	0.6291	0.4567	0.8245	0.5031
Israel	0.1049	0.4631	0.5463	0.9173	0.5079
Italy	0.0623	0.3150	0.5156	0.9247	0.4544
Jamaica	0.0020	0.0819	0.2170	0.1794	0.1201
Japan	0.1284	0.5537	0.6389	0.6617	0.4957
Jordan	0.0006	0.0537	0.1378	0.0997	0.0730
Kazakhstan	0.0016	..	0.1239	0.0154	0.0470
Kenya	0.0005	0.0086	0.0115	0.0052	0.0065
Kiribati	0.0010	0.0318	0.0442	0.0060	0.0207
Dem. People's Rep. of Korea	..	..	0.0540	0.0000	0.0270
Korea, Rep.	0.0000	0.4236	0.5125	0.7225	0.4147
Kuwait	0.0062	0.2297	0.2665	0.3131	0.2039
Kyrgyz Republic	0.0029	..	0.0835	0.0023	0.0296

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Latvia	0.0289	0.2471	0.3315	0.2088	0.2041
Lebanon	0.0000	0.0880	0.2129	0.2676	0.1421
Lesotho	0.0002	..	0.0119	0.0134	0.0085
Liberia	0.0000	..	0.0025	0.0006	0.0011
Libya	0.0000	..	0.1249	0.0095	0.0448
Liechtenstein	0.4334	..	0.6717	0.5688	0.5580
Lithuania	0.0169	0.1142	0.3510	0.1785	0.1652
Luxembourg	0.0951	0.8055	0.8277	0.8743	0.6506
Macao, China	0.0014	0.2772	0.4347	0.3998	0.2783
Macedonia, FYR	0.0027	..	0.2724	0.0717	0.1156
Madagascar	0.0001	0.0039	0.0038	0.0050	0.0032
Malawi	0.0000	0.0019	0.0043	0.0055	0.0029
Malaysia	0.0108	0.1900	0.2278	0.2812	0.1775
Maldives	0.0032	0.0333	0.0917	0.0331	0.0403
Mali	0.0000	0.0020	0.0038	0.0012	0.0017
Malta	0.0595	0.3609	0.5720	0.3696	0.3405
Marshall Islands	0.0001	0.1101	0.0854	0.0110	0.0517
Martinique	0.0032	0.2294	0.2738	0.5324	0.2597
Mauritania	0.0002	0.0165	0.0078	0.0034	0.0070
Mauritius	0.0099	0.1818	0.2642	0.1952	0.1628
Mexico	0.0199	0.1014	0.1362	0.1793	0.1092
Micronesia (Fed. States of)	0.0135	..	0.0859	0.0000	0.0331
Moldova	0.0014	0.0260	0.1485	0.0408	0.0542
Mongolia	0.0002	0.0208	0.0507	0.0769	0.0371
Morocco	0.0002	0.0206	0.0521	0.0987	0.0429
Mozambique	0.0000	0.0058	0.0051	0.0035	0.0036
Myanmar	0.0000	0.0019	0.0061	0.0004	0.0021
Namibia	0.0065	0.0601	0.0685	0.0588	0.0485
Nepal	0.0002	0.0053	0.0127	0.0006	0.0047
Netherlands	0.3598	0.6986	0.6802	0.8538	0.6481
Netherlands Antilles	0.0018	..	0.4059	..	0.2039
New Caledonia	0.0029	..	0.2588	0.2922	0.1846
New Zealand	0.3211	0.6426	0.5277	0.7193	0.5527
Nicaragua	0.0010	0.0156	0.0342	0.0224	0.0183
Niger	0.0001	0.0008	0.0020	0.0002	0.0008
Nigeria	0.0000	0.0116	0.0047	0.0003	0.0042
Norway	0.3561	0.8660	0.8070	0.9490	0.7445
Oman	0.0040	0.0554	0.0970	0.0815	0.0595
Pakistan	0.0002	0.0073	0.0236	0.0031	0.0086
Panama	0.0186	0.0647	0.1641	0.1810	0.1071
Paraguay	0.0008	0.0224	0.0595	0.1881	0.0677
Peru	0.0015	0.0720	0.0731	0.0625	0.0523
Philippines	0.0009	0.0344	0.0442	0.1074	0.0467
Poland	0.0309	0.1217	0.3097	0.2201	0.1706
Portugal	0.0218	0.1844	0.4704	0.8380	0.3787
Puerto Rico	0.0014	..	0.3625	0.2980	0.2206
Qatar	0.0140	0.2800	0.3095	0.2692	0.2182
Romania	0.0065	0.0559	0.1898	0.1403	0.0981
Russian Federation	0.0079	0.0762	0.2408	0.0282	0.0883
Rwanda	0.0002	..	0.0025	0.0065	0.0030
Samoa	0.0557	0.0122	0.0587	0.0238	0.0376
Sao Tome and Principe	0.0200	..	0.0366	0.0000	0.0189
Saudi Arabia	0.0006	0.1124	0.1592	0.0852	0.0893

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Seychelles	0.0004	0.2407	0.2585	0.4066	0.2265
Sierra Leone	0.0002	..	0.0047	0.0034	0.0028
Singapore	0.1538	0.8498	0.5292	0.8610	0.5985
Slovak Republic	0.0247	0.2411	0.3436	0.2589	0.2171
Slovenia	0.0387	0.4850	0.4316	0.7701	0.4314
Solomon Islands	0.0029	0.0786	0.0188	0.0032	0.0259
Somalia	0.0000	..	0.0044	..	0.0022
South Africa	0.0152	0.1097	0.1251	0.2416	0.1229
Spain	0.0401	0.2557	0.4681	0.7805	0.3861
Sri Lanka	0.0004	0.0125	0.0443	0.0286	0.0215
St. Kitts and Nevis	0.0004	0.3201	0.6221	0.0393	0.2454
St. Lucia	0.0008	0.2619	0.3614	0.0213	0.1614
St. Vincent and the Grenadines	0.0001	0.1864	0.2402	0.0262	0.1132
Sudan	0.0000	0.0057	0.0136	0.0009	0.0050
Suriname	0.0001	..	0.1972	0.1239	0.1071
Swaziland	0.0037	..	0.0380	0.0449	0.0289
Sweden	0.2368	0.8953	0.8179	0.9071	0.7143
Switzerland	0.1287	0.8832	0.7975	0.8146	0.6560
Syrian Arab Republic	0.0000	0.0272	0.1130	0.0023	0.0356
Taiwan, China	..	..	..	..	..
Tajikistan	0.0002	..	0.0392	0.0002	0.0132
Tanzania	0.0001	0.0050	0.0054	0.0065	0.0042
Thailand	0.0036	0.0412	0.0972	0.0613	0.0508
Togo	0.0001	0.0272	0.0103	0.0139	0.0129
Trinidad and Tobago	0.0179	0.1087	0.2524	0.1296	0.1272
Tunisia	0.0000	0.0407	0.1103	0.0159	0.0417
Turkey	0.0037	0.0660	0.3014	0.3047	0.1689
Turkmenistan	0.0009	..	0.0840	0.0025	0.0292
Uganda	0.0000	0.0045	0.0029	0.0102	0.0044
Ukraine	0.0025	0.0316	0.2296	0.0208	0.0711
United Arab Emirates	0.0580	0.2700	0.4276	0.6901	0.3614
United Kingdom	0.0993	0.5978	0.6467	0.9210	0.5662
United States	1.0000	1.0000	0.7425	0.4868	0.8073
Uruguay	0.0570	0.1845	0.3041	0.1661	0.1779
Uzbekistan	0.0000	..	0.0727	0.0027	0.0251
Vanuatu	0.0037	..	0.0369	0.0023	0.0143
Venezuela	0.0023	0.0801	0.1146	0.2838	0.1202
Viet Nam	0.0000	0.0158	0.0355	0.0127	0.0160
Virgin Islands (U.S.)	0.0099	..	0.6233	0.3645	0.3326
Yemen	0.0000	0.0034	0.0206	0.0022	0.0066
Yugoslavia	0.0050	0.0400	0.2491	0.1556	0.1124
Zambia	0.0003	0.0118	0.0087	0.0119	0.0082
Zimbabwe	0.0008	0.0223	0.0216	0.0308	0.0189

7. Appendix 6: Connectivity Index (1999)

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Afghanistan	0.0000	..	0.0015	0.0000	0.0005
Albania	0.0004	0.0127	0.0425	0.0054	0.0152
Algeria	0.0000	0.0120	0.0605	0.0037	0.0191
American Samoa	0.0134	..	0.2467	0.0558	0.1053
Andorra	0.0364	..	0.5219	0.3844	0.3142
Angola	0.0000	0.0019	0.0062	0.0029	0.0027
Antigua and Barbuda	0.0184	..	0.5700	0.2019	0.2634
Argentina	0.0205	0.0924	0.2346	0.1861	0.1334
Armenia	0.0032	0.0105	0.1811	0.0033	0.0495
Aruba	0.0192	..	0.4339	0.1896	0.2142
Australia	0.3037	0.8299	0.6072	0.5271	0.5670
Austria	0.1713	0.5166	0.5510	0.7986	0.5094
Azerbaijan	0.0004	..	0.1106	0.0346	0.0485
Bahamas, The	0.0001	..	0.4304	0.0813	0.1706
Bahrain	0.0094	0.2948	0.2900	0.3266	0.2302
Bangladesh	0.0001	0.0019	0.0040	0.0017	0.0019
Barbados	0.0013	0.1567	0.4981	0.1728	0.2072
Belarus	0.0005	..	0.2995	0.0035	0.1011
Belgium	0.1749	0.6220	0.5860	0.4781	0.4652
Belize	0.0066	0.2244	0.1815	0.0429	0.1139
Benin	0.0000	0.0029	..	..	0.0015
Bermuda	0.2382	0.8902	1.0000	..	0.7095
Bhutan	0.0014	0.0029	0.0209	0.0000	0.0063
Bolivia	0.0006	0.0244	0.0720	0.0793	0.0441
Bosnia and Herzegovina	0.0031	..	0.1118	0.0210	0.0453
Botswana	0.0077	0.0652	0.0896	0.1208	0.0708
Brazil	0.0140	0.0721	0.1735	0.1372	0.0992
Brunei	0.0229	0.1236	0.2867	0.3149	0.1870
Bulgaria	0.0105	0.0544	0.3992	0.0668	0.1327
Burkina Faso	0.0001	0.0021	0.0047	0.0007	0.0019
Burundi	0.0000	..	0.0033	0.0002	0.0012
Cambodia	0.0001	0.0020	0.0026	0.0107	0.0038
Cameroon	0.0000	0.0055	0.0075	..	0.0043
Canada	0.2888	0.7175	0.7634	0.3462	0.5290
Cape Verde	0.0000	..	0.1308	0.0297	0.0535
Cayman Islands	0.0620	..	0.9189	0.3495	0.4434
Central African Republic	0.0000	0.0027	0.0031	0.0018	0.0019
Chad	0.0000	0.0026	0.0015	0.0000	0.0010
Chile	0.0141	0.1324	0.2414	0.2311	0.1547
China	0.0003	0.0244	0.1001	0.0526	0.0443
Colombia	0.0052	0.0673	0.1869	0.0729	0.0831
Comoros	0.0003	0.0058	0.0112	0.0000	0.0043
Congo, Dem. Rep.	0.0000	..	0.0003	..	0.0002
Congo, Rep.	0.0000	0.0068	0.0089	..	0.0052
Costa Rica	0.0100	0.2023	0.2380	0.0541	0.1261
Cote d'Ivoire	0.0002	0.0101	0.0175	0.0252	0.0133
Croatia	0.0165	0.1282	0.4256	0.0973	0.1669
Cuba	0.0001	0.0196	0.0453	0.0007	0.0164
Cyprus	0.0422	0.3327	0.7351	0.2996	0.3524
Czech Republic	0.0627	0.2127	0.4326	0.2902	0.2496

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Denmark	0.3363	0.8248	0.7986	0.7607	0.6801
Djibouti	0.0003	0.0194	0.0163	0.0007	0.0092
Dominica	0.0135	0.1408	0.3252	..	0.1599
Dominican Republic	0.0042	..	0.1144	0.0783	0.0656
Ecuador	0.0008	0.0401	0.1062	0.0474	0.0486
Egypt, Arab Rep.	0.0002	0.0224	0.0875	0.0111	0.0303
El Salvador	0.0008	0.0323	0.0887	0.0954	0.0543
Equatorial Guinea	0.0000	0.0045	..	..	0.0022
Eritrea	0.0000	..	0.0085	0.0000	0.0028
Estonia	0.1125	0.2750	0.4168	0.4212	0.3064
Ethiopia	0.0000	0.0015	0.0036	0.0002	0.0013
Faeroe Islands	0.0835	..	0.6499	0.3624	0.3653
Fiji	0.0024	0.0989	0.1179	0.0446	0.0659
Finland	0.4716	0.7164	0.6437	1.0000	0.7079
France	0.1102	0.5283	0.6786	0.5574	0.4686
French Guiana	0.0041	0.2872	0.3297	0.1735	0.1986
French Polynesia	0.0199	..	0.2638	0.1466	0.1434
Gabon	0.0000	0.0166	0.0370	0.0114	0.0162
Gambia, The	0.0000	0.0157	0.0268	0.0064	0.0123
Georgia	0.0009	..	0.1435	0.0298	0.0581
Germany	0.1051	0.5916	0.6885	0.4392	0.4561
Ghana	0.0000	0.0053	0.0093	0.0057	0.0051
Gibraltar	0.1000	0.3735	0.9355	0.2104	0.4049
Greece	0.0374	0.1202	0.6160	0.5659	0.3349
Greenland	0.2100	..	0.5329	0.3699	0.3709
Grenada	0.0002	0.2347	0.3676	0.0331	0.1589
Guadelope	0.0068	0.3986	0.5213	0.3188	0.3114
Guam	0.0041	..	0.5505	0.2012	0.2520
Guatemala	0.0008	0.0197	0.0642	0.0468	0.0329
Guinea	0.0000	0.0066	0.0069	0.0048	0.0046
Guinea-Bissau	0.0001	..	..	0.0000	0.0000
Guyana	0.0001	0.0551	0.0873	0.0057	0.0371
Honduras	0.0001	0.0191	0.0516	0.0193	0.0225
Hong Kong, China	0.0899	0.5899	0.6715	0.9733	0.5811
Hungary	0.0630	0.1489	0.4327	0.2495	0.2235
Iceland	0.5686	0.7178	0.7901	0.9564	0.7582
India	0.0001	0.0066	0.0309	0.0029	0.0101
Indonesia	0.0005	0.0180	0.0338	0.0162	0.0171
Iran, Islamic Rep.	0.0000	0.1005	0.1556	0.0109	0.0668
Iraq	0.0000	..	0.0350	0.0000	0.0117
Ireland	0.0896	0.6237	0.5573	0.6752	0.4864
Israel	0.1334	0.4577	0.5498	0.7481	0.4723
Italy	0.0276	0.3803	0.5392	0.8084	0.4389
Jamaica	0.0008	0.0856	0.2220	0.0868	0.0988
Japan	0.1096	0.5693	0.6504	0.6881	0.5043
Jordan	0.0007	0.0374	0.1017	0.0380	0.0444
Kazakhstan	0.0012	..	0.1261	0.0047	0.0440
Kenya	0.0001	0.0083	0.0120	0.0012	0.0054
Kiribati	0.0027	0.0243	0.0497	0.0038	0.0201
Korea, Dem. Rep.	0.0000	..	0.0541	..	0.0271
Korea, Rep.	0.0524	0.3651	0.5107	0.7755	0.4259
Kuwait	0.0116	0.2476	0.2802	0.2492	0.1972
Kyrgyz Republic	0.0016	..	0.0925	0.0008	0.0316
Lao PDR					

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Latvia	0.0409	0.1633	0.3497	0.1729	0.1817
Lebanon	0.0073	0.0868	0.2343	0.2800	0.1521
Lesotho	0.0001	..	..	..	0.0001
Liberia	0.0000	..	0.0026	0.0000	0.0009
Libya	0.0000	..	0.1172	..	0.0586
Liechtenstein	0.5508	..	0.7107	0.4521	0.5712
Lithuania	0.0202	0.1182	0.3634	0.1377	0.1599
Luxembourg	0.1175	0.7836	0.8450	0.7436	0.6224
Macao, China	0.0019	0.2714	0.4759	0.3092	0.2646
Macedonia, FYR	0.0058	..	0.2729	0.0362	0.1050
Madagascar	0.0001	0.0038	0.0037	..	0.0026
Malawi	0.0000	0.0018	0.0044	0.0031	0.0023
Malaysia	0.0143	0.1369	0.2367	0.2106	0.1496
Maldives	0.0043	0.0352	0.0929	0.0159	0.0371
Mali	0.0000	0.0020	..	..	0.0010
Malta	0.0816	0.3589	0.5975	0.1486	0.2966
Marshall Islands	0.0002	0.1183	0.0727	0.0135	0.0512
Martinique	0.0046	0.2348	0.5112	0.4108	0.2903
Mauritania	0.0001	0.0539	0.0075	0.0000	0.0154
Mauritius	0.0038	0.1899	0.2554	0.1361	0.1463
Mexico	0.0219	0.0878	0.1309	0.1219	0.0906
Micronesia, Fed. Sts.	0.0130	..	..	0.0000	0.0065
Moldova	0.0016	0.0162	0.1478	0.0064	0.0430
Mongolia	0.0001	0.0190	0.0460	0.0211	0.0216
Morocco	0.0004	0.0203	0.0615	0.0196	0.0254
Mozambique	0.0000	0.0055	0.0047	0.0010	0.0028
Myanmar	0.0000	0.0021	0.0064	0.0004	0.0022
Namibia	0.0062	0.0577	0.0744	0.0267	0.0413
Nepal	0.0001	0.0053	0.0132	0.0004	0.0047
Netherlands	0.3203	0.7178	0.7078	0.6557	0.6004
Netherlands Antilles	0.0024	..	0.4292	..	0.2158
New Caledonia	0.0039	..	0.2810	0.1853	0.1567
New Zealand	0.3814	0.6634	0.5783	0.5715	0.5486
Nicaragua	0.0011	0.0161	0.0355	0.0137	0.0166
Niger	0.0000	0.0008	..	..	0.0004
Nigeria	0.0000	0.0126	0.0019	0.0003	0.0037
Norway	0.5203	0.8941	0.8272	0.9471	0.7972
Oman	0.0015	0.0526	0.1044	0.0775	0.0590
Pakistan	0.0002	0.0084	0.0258	0.0031	0.0094
Panama	0.0023	0.0637	0.1916	0.1272	0.0962
Paraguay	0.0016	0.0223	0.0583	0.3001	0.0956
Peru	0.0019	0.0709	0.0752	0.0617	0.0524
Philippines	0.0009	0.0338	0.0453	0.0590	0.0347
Poland	0.0234	0.1236	0.3063	0.1572	0.1526
Portugal	0.0410	0.1850	0.4935	0.7174	0.3592
Puerto Rico	0.0018	..	0.3882	0.3223	0.2374
Qatar	0.0003	0.2865	0.3067	0.2332	0.2067
Romania	0.0085	0.0531	0.1947	0.0926	0.0872
Russian Federation	0.0033	0.0748	0.2452	0.0144	0.0844
Rwanda	0.0002	..	0.0020	0.0024	0.0015
Samoa	0.0002	0.0126	0.0559	0.0291	0.0244
Sao Tome and Principe	0.0174	..	0.0366	0.0000	0.0180
Saudi Arabia	0.0008	0.1215	0.1510	0.0654	0.0846
Senegal					

COUNTRY	Hosts	PC	Tel	Mobile	Connectivity
Seychelles	0.0001	0.2505	0.2848	0.3155	0.2127
Sierra Leone	0.0001	..	0.0044	0.0000	0.0015
Singapore	0.1995	0.8629	0.5622	0.6389	0.5659
Slovak Republic	0.0291	0.2175	0.3577	0.2613	0.2164
Slovenia	0.0624	0.4995	0.4409	0.4733	0.3690
Solomon Islands	0.0026	0.0828	0.0219	0.0039	0.0278
Somalia	0.0000	..	0.0017	0.0000	0.0006
South Africa	0.0207	0.1116	0.1461	0.1892	0.1169
Spain	0.0621	0.2393	0.4782	0.4733	0.3132
Sri Lanka	0.0003	0.0111	0.0420	0.0210	0.0186
St. Kitts and Nevis	0.0011	0.3079	0.6038	0.0277	0.2351
St. Lucia	0.0005	0.2858	0.3374	..	0.2079
St. Vincent and G.	0.0000	0.1944	0.2436	0.0194	0.1143
Sudan	0.0001	0.0056	0.0101	0.0007	0.0041
Suriname	0.0000	..	0.1989	0.0647	0.0879
Swaziland	0.0038	..	0.0364	0.0236	0.0213
Sweden	0.3116	0.8989	0.7752	0.8959	0.7204
Switzerland	0.1984	0.9153	0.8264	0.6546	0.6487
Syrian Arab Republic	0.0000	0.0290	0.1158	0.0004	0.0363
Taiwan	..	..	0.6359	..	0.6359
Tajikistan	0.0002	..	0.0406	0.0002	0.0136
Tanzania	0.0000	0.0046	0.0052	0.0023	0.0031
Thailand	0.0034	0.0443	0.1000	0.0579	0.0514
Togo	0.0001	0.0363	0.0098	0.0059	0.0130
Trinidad and Tobago	0.0199	0.1080	0.2516	0.0461	0.1064
Tunisia	0.0000	0.0308	0.1048	0.0091	0.0362
Turkey	0.0063	0.0666	0.3248	0.1898	0.1469
Turkmenistan	0.0005	..	0.0954	0.0013	0.0324
Uganda	0.0000	0.0048	0.0030	0.0038	0.0029
Ukraine	0.0031	0.0318	0.2319	0.0066	0.0684
United Arab Emirates	0.0406	0.2332	0.4743	0.4994	0.3119
United Kingdom	0.1547	0.6040	0.6617	0.7040	0.5311
United States	1.0000	1.0000	0.7850	0.4710	0.8140
Uruguay	0.0404	0.1981	0.3157	0.1465	0.1752
Uzbekistan	0.0000	..	0.0766	0.0025	0.0264
Vanuatu	0.0041	..	0.0344	0.0024	0.0136
Venezuela, RB	0.0032	0.0839	0.1254	0.2451	0.1144
Vietnam	0.0000	0.0181	0.0311	0.0065	0.0139
Virgin Islands (U.S.)	0.0263	..	0.6556	..	0.3410
Yemen, Rep.	0.0000	0.0034	0.0194	0.0024	0.0063
Yugoslavia, Former	0.0053	0.0414	0.2501	0.0880	0.0962
Zambia	0.0003	0.0127	0.0107	0.0042	0.0070
Zimbabwe	0.0009	0.0241	0.0241	0.0215	0.0177

Data Appendix

Variable Sources and Definitions:

1. **Internet Hosts**: Internet hosts are the number of computers with active Internet Protocol addresses connected to the Internet, per 10,000 people. Source: ITU.

2. **Personal Computers**: Personal computers are the estimated number of computers designed to be used by a single individual, per 1,000 people. Source: ITU.

3. **Telephone Mainlines**: Telephone mainlines are the estimated number of telephone mainlines, per 1,000 people. Source: ITU.

4. **Mobile Phones**: Mobile phones are the number of mobile phone subscribers, per 1,000 people. Source: ITU and UNSD population estimates.

5. **Internet Users**: Number of Internet users per 1,000 people. Source: ITU.

6. **Literacy**: Literacy rate calculated as the inverse of the illiteracy rate. Source: World Bank and UNCTAD.

7. **GDP per capita**: Gross Domestic Product per capita. Source: World Bank.

8. **Cost of a Local Call**: Estimated cost of a 3 minute local call in US dollars. Source: ITU.

9. **Telecom Traffic Outgoing**: Estimated number of minutes outgoing traffic. Source: ITU.

10. **Telecom Traffic Incoming**: Estimated number of minutes incoming traffic. Source: ITU.

11. **Internet Exchange**: Presence of an Internet Exchange (IX) point, defined by Telegeography as "services created to facilitate on-site interconnections between independent or third-party Internet networks ". Source: Telegeography.

12. **Competition in Local Loop**: full/partial competition, duopoly, monopoly. Source: ITU.

13. **Competition in Long-distance**: full/partial competition, duopoly, or monopoly. Source: ITU.

14. **Competition in ISP market**: whether the ISP market may be described by full/partial competition, duopoly, or monopoly. Source: ITU.

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